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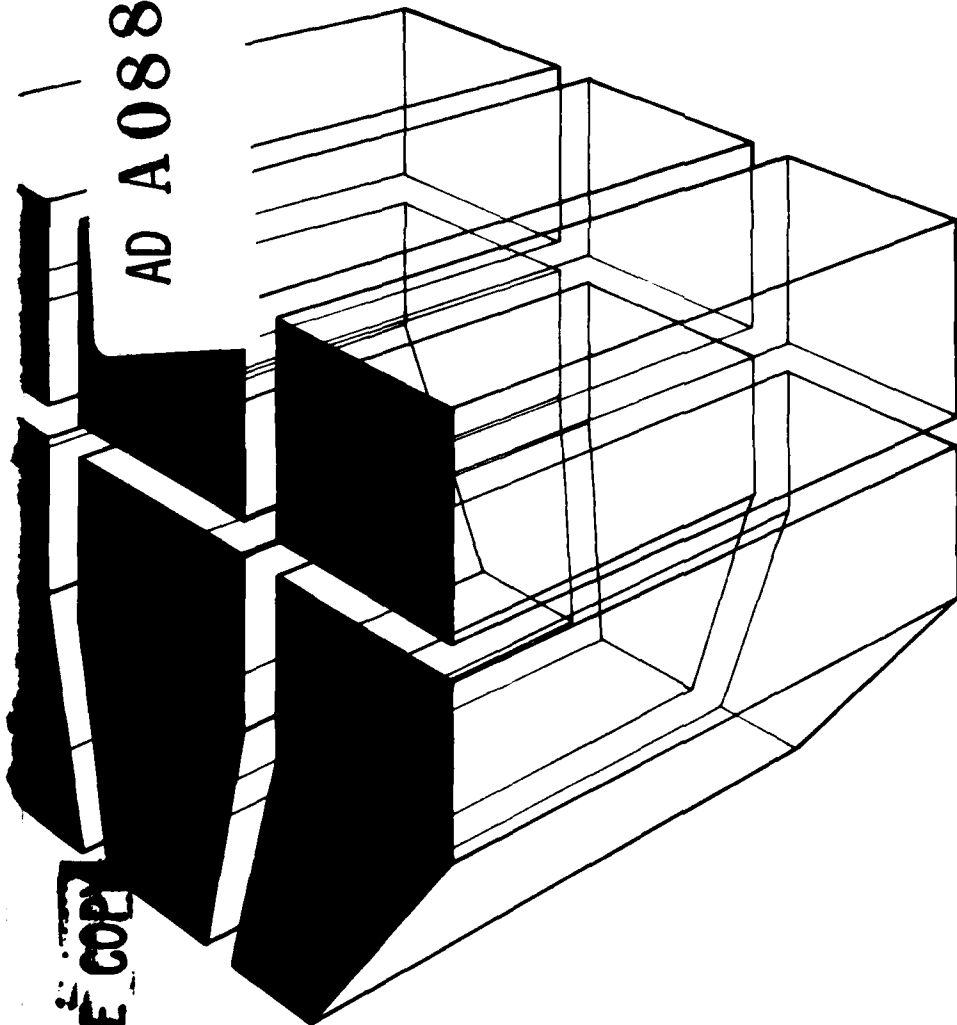
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ECOLOGICAL BASELINE—
FORT HOOD, TEXAS

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by
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report presents ecological baseline information on the biota of Fort Hood, TX. Surveys were conducted in fall 1978 and spring 1979 on the terrestrial and aquatic flora and fauna for the purpose of helping Fort Hood personnel more accurately determine the environmental impacts of their military training and related activities. Representative terrestrial communities were surveyed for vertebrates (mammals, birds, reptiles, and amphibians) and vegetation. Representative aquatic communities were sampled for periphyton, phytoplankton, zooplankton, macrophytes, macroinvertebrates, and fish. Data		

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gathered are in the form of species lists, species composition, density, and/or relative abundance.

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EXECUTIVE SUMMARY

Fort Hood Military Reservation encompasses approximately 87 800 ha (339 square miles; 217,000 acres) in Bell and Coryell Counties in central Texas. The major activity on the reservation is the training of the Armored Corps and its support units.

This report presents the results of ecological investigations on the reservation in late summer and early fall 1978 and spring 1979. The major purpose of the studies was to describe baseline ecological conditions of Fort Hood to determine the environmental impacts of Fort Hood activities.

Major components of the terrestrial and aquatic ecosystems were systematically sampled and analyzed. Studies of the terrestrial ecosystems included the delineation and characterization of vegetational communities. This included quantification of vegetational components of representative communities and preparation of floristic species lists. In addition, representative communities were characterized according to their wildlife components. This included preparation of species lists for all terrestrial vertebrates and bird and mammal censuses in representative habitats. Representative aquatic communities were sampled for periphyton, phytoplankton, zooplankton, macrophytes, macroinvertebrates, and fish. Each aquatic system was characterized by species composition, density, and/or relative abundance.

The reservation lies in the southern portion of the "Cross Timbers and Prairies Vegetation Area," a region encompassing most of 29 counties in North Central Texas. The reservation is geographically near two other major vegetational areas: the Blackland Prairie immediately to the east, and the Edwards Plateau about 80 km to the southwest.

The reservation is about 38 percent grassland and savanna, 57 percent woodland and scrub, and 5 percent built-up land. The woody vegetation of the reservation is primarily Ashe juniper (Juniperus ashei), live oak (Quercus fusiformis), and Texas oak (Q. texana). The grassland of the reservation includes elements of tall grass prairie, which is characteristic of the higher rainfall areas of the Blackland Prairie to the east, and the more important short-grass grasslands to the west.

Floristic surveys of Fort Hood revealed 380 species or varieties of plants representing 81 families. Two species deserve particular attention: the big-tooth maple (Acer grandidentatum), and the white dog-tooth violet (Erythronium albidum). Big-tooth maple occurs in several disjunct populations in the Owl Creek Mountain area of eastern Fort Hood. This species, having a mass range from northern Mexico to Wyoming, normally occurs in the trans-pecos area. Besides the Fort Hood populations, the nearest known natural stand is in western Bandera County, 240 km southwest of the reservation. The white dog-tooth violet population, in eastern Fort Hood, appears to be on the extreme western limits of its natural range, which extends from northeast Texas to Minnesota, Ontario, and Georgia. The disjunct populations of big-tooth maple and white dog-tooth violet do not represent threatened or endangered species.

Like the vegetation, the wildlife is typical of the Edwards Plateau. Qualitative and quantitative field surveys at Fort Hood revealed 28 species of amphibians and reptiles, 128 species of birds, and 20 species of mammals. The most notable bird species observed were the Roseate Spoonbill (Ajaia ajaja), the Osprey (Pandion haliaetus), and the Peregrine Falcon (Falco peregrinus). The spoonbill is a normal coastal species and a late summer or fall straggler in north central Texas. The Peregrine Falcon and Osprey are endangered species which are rarely observed as migrants in the Fort Hood area.

Riparian woodland provides the best habitat for bird species diversity. Species diversity was lowest in the grazed grassland census area. Densities of birds were greatest in riparian woodland, followed by mixed woodland, juniper woodland, and grassland. The bird encountered over the widest portion of the survey area during the road-cruise censuses was the Cardinal (Cardinalis cardinalis).

Common mammal species observed on the reservation included the raccoon (Procyon lotor), white-tailed deer (Odocoileus virginianus), and black-tailed jack rabbit (Lepus californicus). Trapping indicated that the deer mouse (Peromyscus maniculatus) was the most common small mammal in the fall, and the Texas mouse (Peromyscus attwateri) and White-ankled mouse (Peromyscus pectoralis) were most common in the spring.

Several species of mammals and birds are hunted on the reservation, and therefore represent an important recreational and economic resource. These include white-tailed deer, squirrels, rabbits, furbearers, Bobwhite, Mourning Dove, Turkey, and waterfowl.

Several species of endangered, threatened, or peripheral wildlife species may live on the reservation; however, only the migratory Peregrine Falcon was observed during the field surveys. One species, the Golden-cheeked Warbler, although not observed during the surveys, is considered endangered by the Texas Organization for Endangered Species (TOES) because of its breeding requirements. Its breeding range is restricted to suitable mature juniper habitats in Central Texas. The Army has protected much of the Golden-cheeked's habitat at Fort Hood from disturbance by limiting activities in several designated areas. The Osprey is considered endangered by TOES. This species was seen several times near Belton Lake, and Army activity does not appear to affect it.

Aquatic communities at Fort Hood were similar to those in other areas of Central Texas. Most of the stations sampled, other than those in Belton Lake, exhibited variable communities in terms of species compositions and densities. This was often the case in intermittent stream environments, where fluctuations in water level create pools or where floods drastically reduce resident populations and may considerably alter the physical habitat. During the fall field surveys, most of the streams were not flowing, due to dry weather in the area, thus creating a series of pools or ponds. Species assemblages included both open water and littoral forms as would be expected in an area exhibiting a variety of available habitats (littoral, profundal, limnetic) and a diversity of food sources (phytoplankton, detritus, organic matter). The spring sampling showed the effects on resident populations and diversity caused by habitat changes effected by the spring floods.

The results of the phytoplankton and periphyton fall and spring surveys showed that most, if not all, of the areas examined were dominated by taxa tolerant of a wide range of physiochemical conditions, including nutrient and organic loading. This situation was pronounced in lower Clear Creek (Station A) during the fall near a number of enrichment sources. Generally, however, these communities (and the densities observed) were typical of those commonly observed in the calcareous streams of central Texas. Phytoplankton densities were lower in the spring; however, the diversity of the diatoms increased due to scouring of the substrate by the spring rains.

Similar results were obtained in the zooplankton sampling program. Except possibly at Station D (Reese Creek), the results of the phytoplankton, periphyton, and zooplankton surveys did not indicate any effects resulting directly from siltation. On the other hand, the indications of moderate, widespread enrichment observed may have been due, at least in part, to nutrients entering the streams along with soil particles. Zooplankton densities were generally lower in the spring.

Belton Lake had rather distinct phytoplankton and zooplankton assemblages during both surveys. This is the normal condition, considering the vast difference in habitat between the reservoir and its tributary streams and the lack of significant recent freshwater input.

Based on phytoplankton and zooplankton data collected from 7 to 11 May 1979, flood events at Fort Hood in spring 1979 appeared to have the greatest impact on the Leon River. Slower-moving pool-like habitats, like those at Lower Cowhouse Creek and Belton Lake, appeared to be less affected by floods than some of the intermittent creeks where currents were faster and more scouring of substrates was likely to occur.

The macroinvertebrate survey showed that most stations were dominated by oligochaetes and dipterans. While this is often the case in enriched situations, these groups are also usually dominant in soft-sediment habitats. Doubtless, both conditions contributed to the large numbers and widespread occurrence of these organisms. The highest densities of oligochaetes, particularly tubificids which are characteristic of organically enriched habitats, were found at stations in Table Rock, House, and Cowhouse Creeks. All of these stations were characterized by thick layers of silty sediments over the original rocky stream beds. Densities were lower at most stations in the spring, although the silty substrate at Station J supported a more abundant oligochaete population, and total densities were higher at this station. Although dipterans were still an important group in terms of abundance, they were considerably less abundant and diverse in benthic samples than they were in the fall. However, quantitative and qualitative analyses of samples indicated that the numbers of taxa observed were not excessively low, nor were individual species densities high enough to indicate a heavily polluted situation.

The results of both fish collections, in the streams sampled and in Belton Lake, do not indicate any conditions that would be considered unusual in the types of habitat sampled. Members of the families Cyprinidae (minnows) and Centrarchidae (sunfishes) were the most commonly collected. The largest numbers of species were collected at lower Cowhouse Creek, mid Table Rock Creek, and lower Clear Creek. No species considered threatened or endangered

by the state or by the U.S. Department of the Interior are known to occur in the general area. Generally, the number of individuals was lower in the spring, which would be expected after the spring floods.

FOREWORD

This work was performed by the Environmental Division (EN) of the U.S. Army Construction Engineering Research Laboratory (CERL) for Fort Hood, TX, under IAO 319-79, dated 2 March 1979. The Fort Hood project monitor is CPT David Palmer, Environmental Programs Officer.

Esey Huston and Associates, Inc. collected the spring aquatic data and all the fall data. The University of Oklahoma Biological Survey collected spring vegetation data.

Dr. R. K. Jain is Chief of EN. COL L. J. Circeo is Commander and Director of CERL, and Dr. L. R. Shaffer is Technical Director.

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ECOLOGICAL BASELINE --
FORT HOOD, TEXAS

1 INTRODUCTION

Background

Fort Hood Military Reservation encompasses approximately 87 800 ha (339 sq mi; 217,000 acres) in Bell and Coryell Counties in central Texas (Figure 1). The major activity on the post is training of the Armored Corps and its support units. Facilities are available for field training, weapons firing, housing and support for personnel living on the post, and other required support activities. Industrial activities include motor vehicle repair, small arms repair, and electrical shops.

During late summer and early fall of 1978 and late spring and early summer of 1979, Espey Huston and Associates, Inc. and CERL conducted ecological investigations at Fort Hood Military Reservation. Data from these investigations produced baseline ecological data that would be helpful in determining the environmental impacts resulting from current Fort Hood activities (i.e., for use in the Overall Mission Environmental Impact Statement). The studies were designed to represent the entire reservation with particular emphasis on characteristic habitats of the various species studied. The results should also be valuable for evaluating the impacts of future Fort Hood activities; for example, the impacts of a future activity in a certain area of the reservation can be evaluated by referring to maps to determine affected habitats and by referring to appropriate habitat characterizations to determine their biotic components. Results of the first survey conducted in fall 1978 were documented in a report entitled Ecological Baseline Report, Fort Hood, Texas. This report adds the ecological data collected in spring of 1979.

Purpose

The purpose of this study is to provide ecological data for determining present and predicting future impacts of military activities on Fort Hood's environment.

Approach

Data for this study were collected through field surveys which gathered information on both terrestrial and aquatic biological communities. The surveys were initially conducted during fall of 1978 and then repeated during spring of 1979 to fill the void caused by normal seasonal occurrence of some types of biota. Terrestrial mammals, birds, reptiles, amphibians, and vegetation were surveyed, as well as periphyton, phytoplankton, zooplankton, macrophytes, macroinvertebrates, and fish. The Appendix of this report provides a detailed discussion of the types of data gathered and the methodology used in the survey.

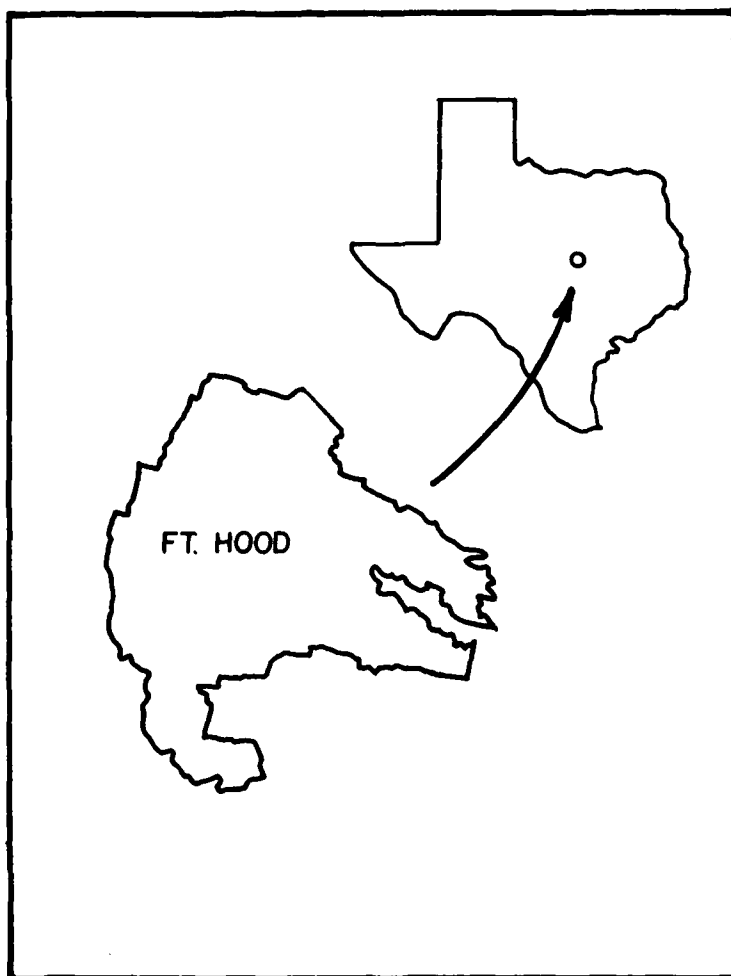


Figure 1. Location map.

Outline of Report

Chapters 2, 3, 4 present data on vegetation, wildlife, and aquatic communities; each chapter contains characterizations of representative habitats and discussions of representative and important species (i.e., recreationally important, commercially important, and threatened or endangered) for each habitat type. This material characterizes the various habitats and evaluates the importance and significance of each. Chapter 5 discusses ecologically sensitive areas and provides general conclusions. The Appendix presents methodologies used in the various surveys.

2 VEGETATION

General

Fort Hood Military Reservation lies in the "Cross Timbers and Prairies Vegetational Area," a region encompassing most of 29 counties in North Central Texas.¹ The reservation, situated in the southern portion of the area, is geographically near two other major vegetational areas: the Blackland Prairie immediately to the east, and the Edwards Plateau about 80 km to the southwest.

The woody vegetation of the reservation is most closely related to that of the eastern Edwards Plateau, as shown by the predominance of Ashe juniper (*Juniperus ashei*), live oak (*Quercus fusiformis*), Texas oak (*Q. texana*), cedar elm (*Ulmus crassifolia*), Texas ash (*Fraxinus texensis*), and Texas persimmon (*Diospyros texana*). Conversely, the two predominant tree species of the cross timbers -- post oak (*Quercus stellata*) and blackjack oak (*Q. marilandica*) -- are of minor importance on the reservation. A western tree species -- big-tooth maple (*Acer grandidentatum*) -- is undoubtedly the most interesting plant species on the reservation. This is a Rocky Mountain species which occurs east of the Pecos in only two other known areas: one in southwestern Oklahoma, and one which includes three counties on the southeastern Edwards Plateau.

The grassland of the reservation includes elements of tallgrass prairie, and is characteristic of the higher rainfall areas of the Blackland Prairie to the east, and of the more important mid- and short-grass grasslands to the west. Frequent fires, vehicular traffic, and overgrazing have eliminated much of the perennial grass cover over much of the area. At the time of the field survey, the apparent dominants over the majority of the grassland acreage were the broomweeds (*Xanthocephalum texanum* and *X. dracunculoides*), short, bushy, yellow-flowered annual forbs which increase enormously in response to overgrazing.²

The reservation is about 38 percent grassland and savanna, 57 percent woodland and scrub, and 5 percent developed land. Open grassland is most extensive where the general topography is level to gently rolling. Conversely, woodland predominates on escarpments, stream terraces, and in other areas where the terrain is rough and broken. This pattern is a natural consequence of occasional grass fires, which originate primarily from live artillery fire in the 12 222-ha (30,200 acres; 47.2 sq mi) impact area near the center of the reservation. As pointed out by Wells,³ grasslands are maintained in areas of smooth terrain where hot, wind-blown fires are unimpeded by topographic obstacles, whereas woodlands are often restricted to rough terrain where fires burn more slowly, if at all.

- 1 F. W. Gould, Texas Plants -- A Checklist and Ecological Summary (Texas A & M Univ., Texas Agric. Exp. Sta., College Station, 1975).
- 2 D. Correll and M. Johnston, Manual of the Vascular Plants of Texas (Texas Research Foundation, Renner, 1970).
- 3 P. V. Wells, "Scarp Woodlands, Transported Grassland Soils, and Concept of Grassland Climate in the Great Plains Region," Science, No. 148, pp 246-249.

Fire is a significant ecological factor in shaping the reservation's vegetational structure. Two other exogenous factors are important: (1) the off-road military traffic, including both tracked and wheeled vehicles, which causes extensive mechanical disturbance to the soil and vegetation, and (2) grazing by domestic cattle.

The following sections describe the reservation's vegetation in more detail. The information includes a discussion of the plant species observed on the reservation, a generalized vegetation map, a description of the major plant communities, and a discussion of important plant species.

Plant Species Inventory

The purpose of the floral survey was to list the vascular plant species that were flowering (or otherwise identifiable) at the time of the survey (11-15 September and 19-24 September 1978, and 22-27 May 1979). The floral survey was performed in conjunction with the vegetational survey (described in the following section) and was concentrated in 17 stands selected as being representative of the reservation. cursory surveys were also made throughout the reservation. Nomenclature used in this inventory follows Correll and Johnston.⁴

One of the most common and conspicuous species at the Fort Hood Military Reservation was the Ashe juniper (Juniperus ashei). Because of its conspicuousness and dominance in central and west Texas, numerous common names have been applied to it, including rock cedar, post cedar, Mexican juniper, mountain cedar, and Ashe juniper. The common name Ashe juniper will be used in this report.

Table 1 gives the plant inventory taken from the survey; species are identified according to common name, scientific name, growth form, and their occurrence in upland woodlands, lowland woodlands, grasslands, and wetlands. The list includes 380 taxa (species and varieties) and 81 families. This compares with almost 5000 taxa and 166 families known to occur in Texas.⁵ The largest families in the list are the sunflower family (56 taxa compared with 628 for Texas); the grass family (47 of the 672 known for Texas); the legume family (33 of 281 known for Texas); and the spurges (14 of 141 in the state). Beaty⁶ has compiled a list of 584 plant taxa for central and western Bell County. The spring, early summer, and late fall inventories should produce a number of plant taxa on the reservation approaching Beaty's number.

⁴ D. Correll and M. Johnston, Manual of the Vascular Plants of Texas (Texas Research Foundation, Renner, 1970).

⁵ F. W. Gould, Texas Plants -- A Checklist and Ecological Summary (Texas A & M Univ., Texas Agric. Exp. Sta., College Station, 1975).

⁶ H. E. Beaty, A Checklist of Flora and Fauna in Central and West Bell County, Texas, unpublished manuscript (3414 Forest Trail, Temple, TX, 1978a).

Plant Communities

Figure 2 is a generalized map of the vegetation at Fort Hood Reservation. The mapped categories represent the four major distinctions that can be made with respect to the vegetation of the reservation: coniferous (Ashe juniper) woodland, mixed (Ashe juniper-oak) woodland, deciduous (primarily oak) woodland, and grassland and savanna. In Figure 2, the three categories of predominantly woody vegetation are further subdivided into two canopy cover classes of less than 50 percent cover and greater than 50 percent cover. For purposes of characterizing the major categories in terms of structure and species composition, a number of representative stands were visited and sampled. Figure 3 shows the locations of the stands. Sampling methods (described in detail in the Appendix) involved both qualitative observation and objective, quantitative sampling using the point-centered quarter method of Cottam and Curtis.⁷ This method allows the determination of density (number per unit area), basal area (size), and frequency (spatial distribution) of trees. From these measurements, an overall "importance percentage" can be calculated for each species as a means of indicating its relative importance in the stand. The following paragraphs describe vegetation observed at each stand. The stands are grouped under coniferous woodland, mixed woodland, and deciduous woodland. Quantitative data were collected at stands 2, 4, 8, 10, 12, and 13. Other stands are described qualitatively.

The most extensive category of woody vegetation is mixed woodland, which generally has a predominance of Ashe juniper, as well as important components of live oak, Texas oak, or both. In some small upland areas, Ashe juniper is the only significant species, while in some lowland areas, it is virtually excluded by oaks and other broadleaf deciduous trees. Some variation is present in the grassland category, which includes both open grassland and parkland (savanna). The latter consists of trees or shrubs widely scattered in a matrix of grasses and forbs.

Coniferous Woodland

The only coniferous tree species found on the reservation is Ashe juniper, the most common species on the reservation and the main component of most vegetation; however, it seldom occurs alone.

Stand 1 (Ashe juniper) occurred on rolling topography and light-colored, clayey soil. The area was grazed and had been impacted by military vehicles. Ashe juniper trees, which formed most of the woody cover, were mostly 3 to 5 m high and often had low branching trunks. Other woody vegetation in the stand included flameleaf sumac (*Rhus lanceolata*), Texas ash, and live oak. Grasses and broomweeds surrounded the patches of woody vegetation.

Mixed Woodland

A disjunct population of white dog-tooth violets is associated with the mixed woodland. The white dog-tooth violet population in the eastern part of Fort Hood (Figure 3), appears to be on the extreme western limits of its

⁷ G. Cottam and J. T. Curtis, 1956, "The Use of Distance Measures in Phytosociological Sampling," *Ecol.* 37:450-460.

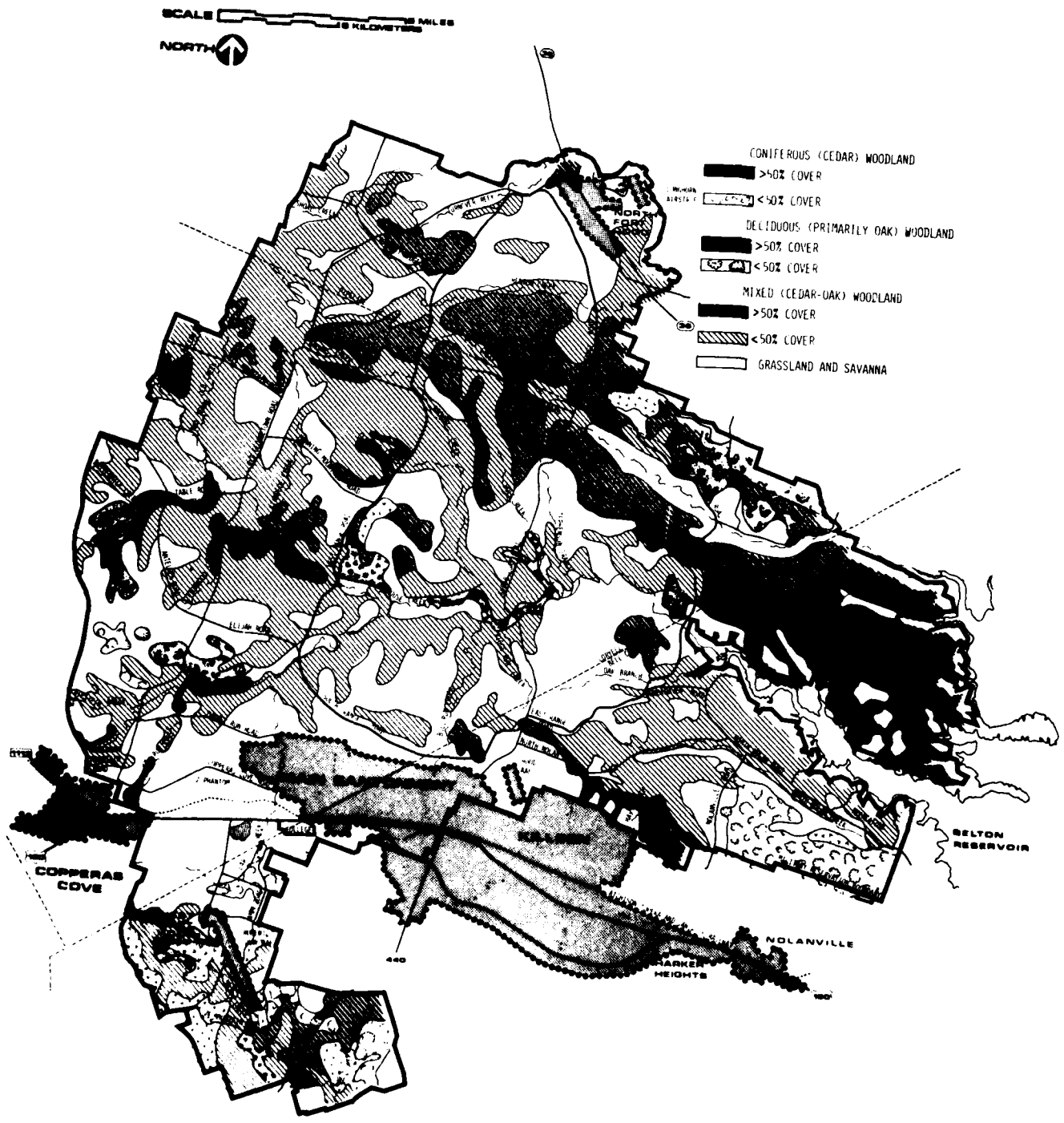


Figure 2. Vegetation map.

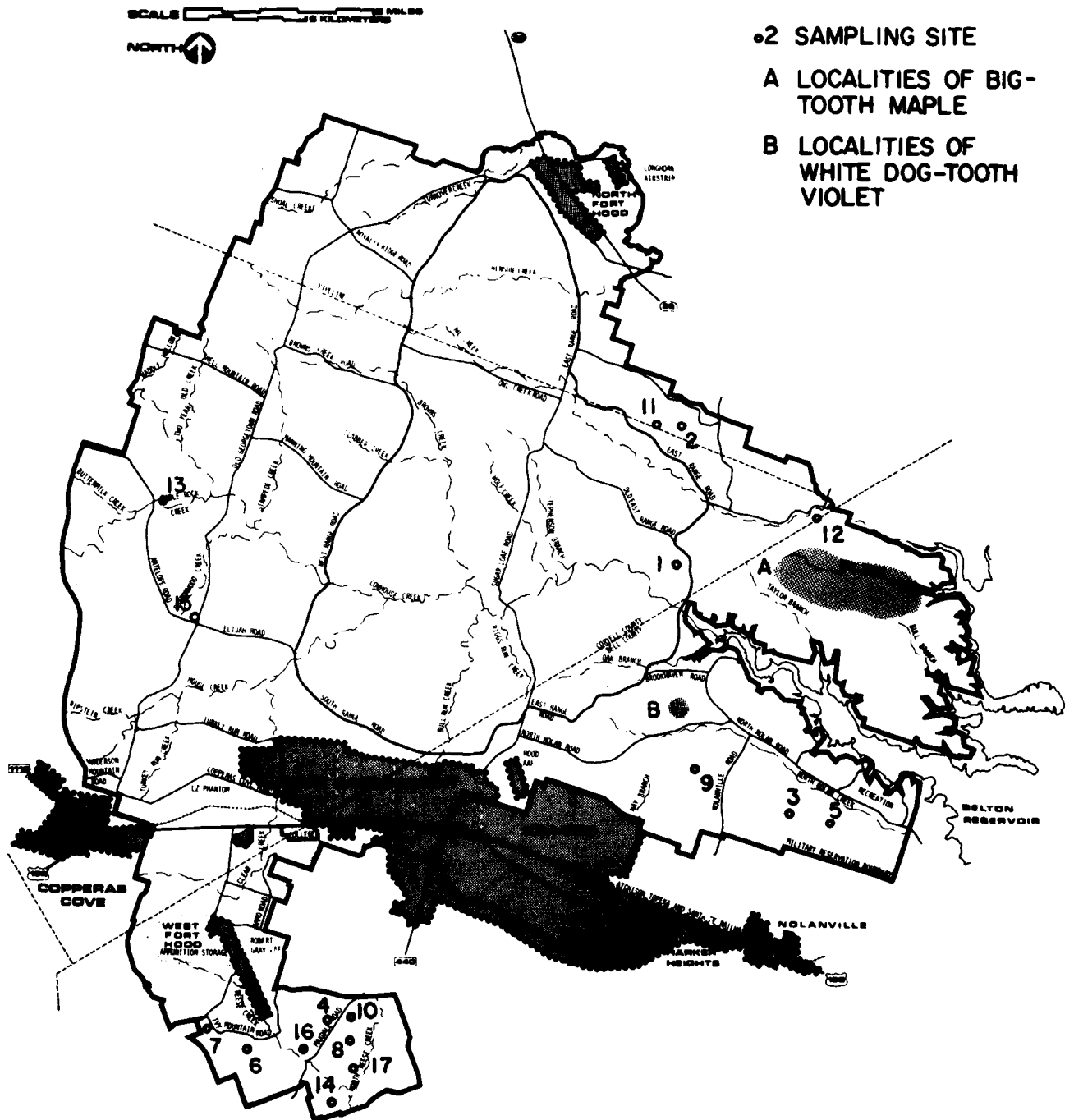


Figure 3. Vegetation sampling sites.

natural range, which extends from northeast Texas to Minnesota, Ontario, and Georgia.⁸ The population is concentrated in a 15-ha area within the Oak Branch of Cowhouse Creek drainage system.⁹

Six stands dominated by Ashe juniper and oaks were examined.

Stand 2 (Ashe juniper/live oak) occurred on a 25 percent west-facing slope of rocky and sandy soil. The dominant trees were Ashe juniper and live oak (Table 2). Other woody species present were cedar elm (Ulmus crassifolia), Texas oak, and netleaf hackberry (Celtis reticulata). The total stand density was about 1800 trees per ha, and the total basal area was about 90 m²/ha. The undergrowth, which was very dense, was composed of saplings of the canopy tree species, as well as understory trees, shrubs, and vines. Understory species were redbud (Cercis canadensis), possum-haw (Ilex decidua), Mexican buckeye (Ungnadia speciosa), and Texas persimmon (Diospyros texana). Vines included greenbrier (Smilax bona-nox) and white honeysuckle (Lonicera albiflora). Generally, the stand was disturbed, consisting of dense clumps of trees in a matrix of grasses. Common ground cover species in this stand included hairy grama (Bouteloua hirsuta), blue grama (Bouteloua gracilis), ruellia (Ruellia humilis), and painted euphorbia (Euphorbia cyathophora).

Stand 3 (Ashe juniper/live oak) occurred on level to gently rolling topography with rocky, light-colored clayey soils. The predominant tree species were Ashe juniper and live oak. Other species included Texas ash, blackjack oak, elbow-bush (Forestiera pubescens), and mustang grape (Vitis mustangensis). The trees were about 5 m high and scattered in a field of mostly broomweeds. Other ground cover species included blue grama and hairy grama.

Stand 4 (Ashe juniper/Texas oak) occurred on a 10 percent, northeast-facing slope, in an upland area of generally rolling topography. The soil was a rocky, tight, light-colored clay. The vegetation consisted of dense patches and thickets of woody vegetation scattered in a matrix of low-growing herbaceous vegetation. The dominant trees were 5-m-high Ashe junipers and Texas oaks (Table 3). Other important trees included live oak, cedar elm, buckthorn (Bumelia lanuginosa), and netleaf hackberry. The density was about 400 trees per ha, and the basal area was about 7 m²/ha. Common understory trees and shrubs of this stand included redbud, fragrant sumac (Rhus aromatica), poison ivy (R. toxicodendron), and flameleaf sumac. Common ground cover species in this stand included buffalo grass (Buchloe dactyloides), Texas grama (Bouteloua rigidiseta), hairy grama, and broomweeds.

Stand 5 (live oak/Ashe juniper) occurred atop a small mesa in a hilly, boulder-strewn area. The soil was a tight, rocky clay. The area was grazed and heavily impacted by vehicles. The dominant woody species present were 5- to 8-m live oaks and Ashe junipers. Also present were Texas ash, Texas oak, and blackjack oak. The predominant ground cover consisted of broomweeds,

⁸ D. Correll and M. Johnston, Manual of the Vascular Plants of Texas (Texas Research Foundation, Renner, 1970).

⁹ D. Riskind, 1978, personal communication, Texas Parks and Wildlife Department, Austin.

prairie-tea (Croton monanthogynus), and Lindheimer muhly (Muhlenbergia lindheimeri).

Stand 6 (live oak-Ashe juniper) occurred in a rolling gullied area on a 10 to 15 percent north-facing slope. The soil was rocky clay, fairly tight, and light in color. Dominant woody species were live oak and Ashe juniper. A few scattered mesquites (Prosopis glandulosa) were present. Most of the area was covered with short-grass vegetation. Over a large area, the following herbaceous species were important community constituents: bermuda grass (Cynodon dactylon), little bluestem (Schizachyrium scoparium), broomweeds, buffalo grass, hairy grama, sideoats grama (B. curtipendula), seep muhly (Muhlenbergia reverchonii), and Indian grass (Sorghastrum avenaceum).

Stand 7 (live oak-Ashe juniper) occurred on rolling topography on a rocky clay soil. The dominant tree species were live oak and Ashe juniper. The rest of the area was covered by the short-grass vegetation type, consisting of hairy grama, sideoats grama, buffalo grass, silver bluestem (Bothriochloa saccharoides), little bluestem, and broomweeds.

Deciduous Woodland

Broadleaved trees (predominantly oaks) occurred in lowlands and on protected slopes and ridges. Ashe juniper occurred in these stands but was not a dominant.

A disjunct population of big-tooth maple is associated with this vegetation type. This species, which occurs in several stands in the Owl Creek Mountain area of eastern Fort Hood (Figure 3), is a trans-Pecos species with a mass range from northern Mexico to Wyoming.¹⁰ Disjunct populations occur in canyons of the Edwards Plateau and in the Wichita Mountains of southwestern Oklahoma. The nearest known natural stand of big-tooth maple is in western Bandera County, 240 km southwest of Fort Hood.¹¹

Stand 8 (live oak) occurred on a 10 percent, north-facing slope in an area of rolling topography. The soil was a rocky, chalky clay. The stand was dominated by 6-m-high live oaks (Table 4). Less important species were cedar elm, Texas oak, Ashe juniper, and netleaf hackberry. The total stand density was about 340 trees per ha, and the total basal area was about 13 m²/ha. There were no extensive patches of trees in this vegetation type. The trees were located in long sinuous lines surrounded by short grasses. The woody understory consisting of elbow-bush and possum-haw was not extensive and tended to be disturbed. The herbaceous cover included hairy grama, Texas grama, and prairie-tea. Several Ashe junipers had been cut and removed.

Stand 9 (post oak) occurred on nearly level topography in a light-colored, tight, clayey soil. The stand was dominated by 5 to 7 m post oaks, which tended to occur singly or in small clumps and sinuous rows. The stand had been grazed and heavily impacted by vehicles in the past. Other trees,

¹⁰ D. Correll and M. Johnston, Manual of the Vascular Plants of Texas (Texas Research Foundation, Renner, 1970).

¹¹ D. Riskind, personal communication, Texas Parks and Wildlife Department, Austin (1978).

much less abundant than post oak, included buckthorn, netleaf hackberry, and Ashe juniper. The trees covered about 25 percent of the ground. Greenbrier and flameleaf sumac were common. The predominant herb was broomweed, followed by silver bluestem, prairie three-awn (Aristida oligantha), and Lindheimer muhly.

Stand 10 (cedar elm) occurred in a nearly level bottomland area with loose, sandy soils. The stand was dominated by cedar elms 5 to 10 m high (Table 5). Other tree species were Texas oak, netleaf hackberry, live oak, slippery elm (Ulmus rubra), red mulberry (Morus rubra), Mexican plum (Prunus americana), and pecan (Carya illinoensis). The stand was relatively undisturbed. Shrubs and vines found in this stand included supple-jack (Berchemia scandens), buttonbush (Cephalanthus occidentalis), elbow-bush, and greenbrier. The total density of the stand was about 470 trees per ha and the total basal area was about 29 m²/ha.

Stand 11 (Texas ash-cedar elm) was a riparian stand on a tight, clayey soil. The stand was dominated by Texas ash and cedar elm, ranging from 5 to 12 m tall. Ashe juniper was third in importance, followed by Texas oak, netleaf hackberry, buckthorn, and possum-haw. The stand was not heavily disturbed.

Stand 12 (chinkapin oak/big-tooth maple) occurred on a 40 percent north-northwest-facing slope. Soils were shallow and rocky, with little humus. The dominants of the stand were chinkapin oak (Quercus muhlenbergii) and big-tooth maple (Table 6). Other trees included Texas oak, Texas ash, black walnut (Juglans nigra), and Ashe juniper. Total density was about 760 trees per ha, and basal area was about 27 m²/ha. Common shrubs in this stand were southern blackhaw (Viburnum rufidulum), Indian-cherry (Rhamnus caroliniana), and rough-leaved dogwood (Cornus drummondii). There was very little ground cover in this stand, but purple cliff brake fern (Pellaea atropurpurea) occurred in drainage areas.

Texas ash, big-tooth maple, and Texas oak were found mainly in clumps as stump sprouts from cut trees. The smaller Ashe junipers growing under deciduous canopy cover had dead branches and were drying out as they were overtopped by other trees. A number of impressively large trees, including Ashe junipers and black walnuts, occurred in the stand. These larger trees were apparently present before the area was invaded by the current dominants. Ashe junipers (cedar) grow much more rapidly than other species so there is no species that can overtop them. Juniper seeds, carried by birds, germinate under the hardwoods and will eventually crowd out the oaks, maples and ash trees. The dead branches evidenced in this survey occurred from a lack of water. The hardwoods which have a more developed root system can sustain periods of drought much longer than immature junipers. The normal course on all sites is that the junipers are site invaders and as many as 100 immature cedars germinate under hardwoods and eventually remove enough soil moisture and nutrients to kill the hardwood. This process can be observed throughout the installation.

The ridge and mesa above the stand were dominated by large Ashe junipers and Texas oaks. Shrubs common in this area included eve's necklace (Sophora affinis), Mexican buckeye, bastard oak (Quercus sinuata var. breviloba), and evergreen sumac (Rhus virens).

The lowland forest along the stream below the stand was composed of netleaf hackberry, cedar elm, big-tooth maple, chinkapin oak, Texas ash, Ashe juniper, and pecan. Common shrubs in this stand included American beautybush (Callicarpa americana) and Indian-cherry.

This stand was generally less disturbed than other stands examined. However, on the surrounding ridges and mesas, large amounts of Ashe juniper had been cut and removed. There was also a motorcycle trail in part of this stand.

Stand 13 (pecan/elm/hackberry) occurred on loose sandy soil in a floodplain. The area had been grazed and heavily impacted by vehicles. Predominant species in the stand were pecan, cedar elm, and netleaf hackberry (Table 7). Other trees were bur oak (Quercus macrocarpa), buckthorn, Texas oak, and American elm (Ulmus americana). The total density of the stand was about 300 trees per ha, and the total basal area was about 29 m²/ha.

The understory of the stand was best developed in the narrow draws leading to the stream along which the stand was located. Most of the understory has been eliminated under the larger trees by vehicular traffic.

Stand 14 (pecan/ash/sycamore) occurred in a rocky, clay soil along a stream. In and along the stream the most important trees were pecan, Texas ash, sycamore (Platanus occidentalis), Texas oak, and cedar elm. The main trees in the uplands near the stream were live oak and cedar elm, with only a few Ashe juniper present. Shrubs included Texas persimmon, elbow-brush, rough-leaved dogwood, and possumhaw. Common herbs along the stream were panicked tickclover (Desmodium paniculatum), canela (Pluchea purpurascens), and mist-flower (Eupatorium coelestinum).

Grassland and Savanna

Grassland on the reservation has been strongly influenced by frequent burning and/or overgrazing. The grasslands species composition ranges from tall grass prairie, which occurs in isolated fragments, to the commonly seen short and mid-grasses, to weedy annuals, which are also common. Ashe junipers were frequently scattered widely throughout the grasslands.

Stand 15 (bluestem/grama) was a mid-grass stand occurring on level terrain on tight, rocky, clay soils. The stand was grazed and heavily impacted by vehicles. Predominant species included little bluestem, hairy grama, sideoats grama, seep muhly, prairie-tea, broomweeds, and ragweed (Ambrosia artemisiifolia).

Stand 16 (bluestem/grama) occurred on similar terrain and soils. It had virtually the same species composition and the same physiognomy as Stand 15.

Stand 17 (grama/Ashe juniper) occurred on rolling, rocky topography with tight, clayey soils. The main woody species was Ashe juniper 2 to 5 m high. These trees formed about 2 percent of the total cover. Most of the cover was formed by grassland species, particularly sideoats grama, broomweeds, triple-awn (Aristida sp.), little bluestem, snow-on-the-prairie (Euphorbia bicolor), blue grama, and hairy grama.

Important Species

A species is considered important if one or more of the following criteria applies: (1) the species is commercially or recreationally valuable, (2) the species is threatened or endangered, (3) the species affects the well-being of some important species within criteria (1) or (2), or (4) the species is critical to the structure and function of the ecological system.

Threatened and Endangered Species

Ten plant species cited by the University of Texas Rare Plant Study Center as rare or endangered are known from previous collections from Bell and Coryell Counties (see Table 8). None of the species has been proposed for Federal protection under the Endangered Species Act of 1973.¹² No Federally protected species, or species proposed for protection, is known from collections in either of the two counties, according to collection information available from the Rare Plant Study Center and from the herbaria of the University of Texas, Southern Methodist University, and Texas A&M University.

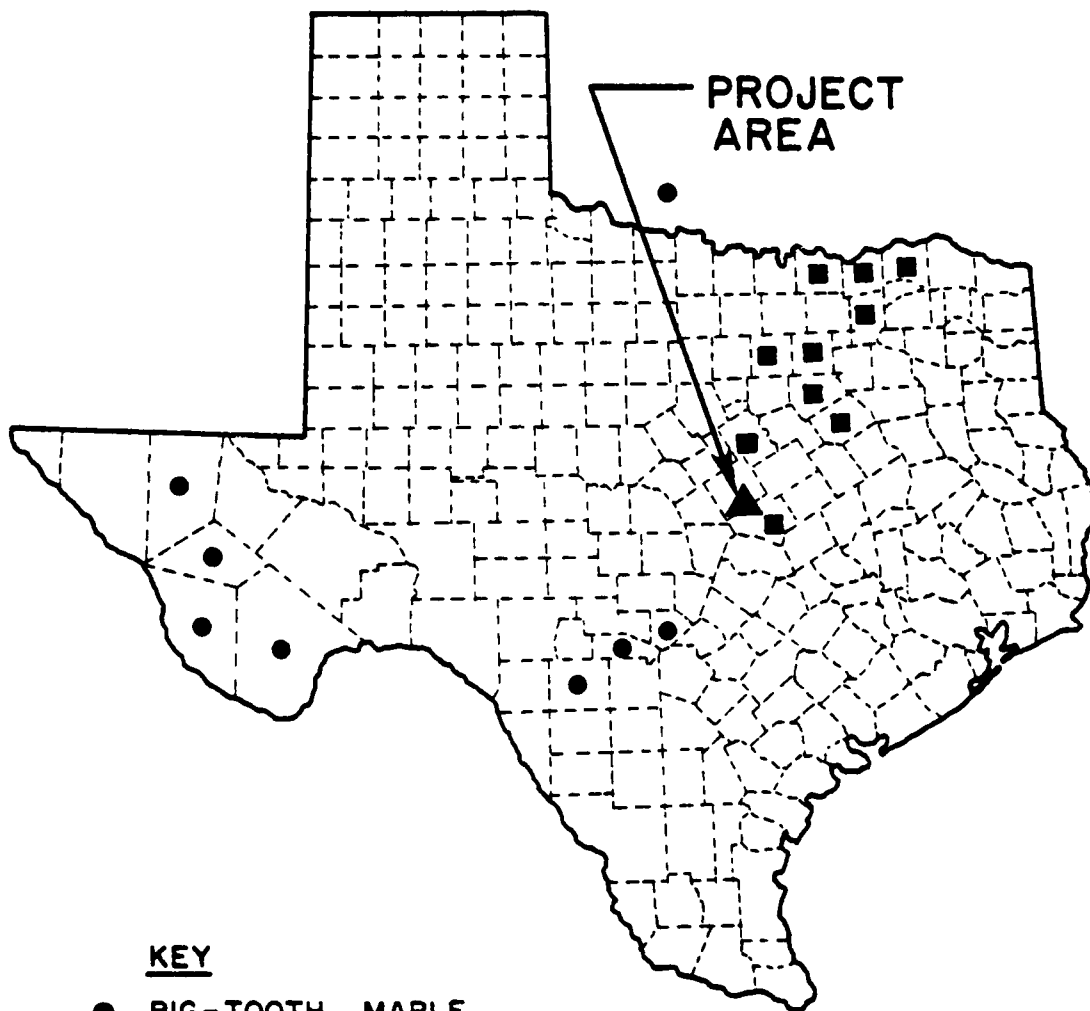
Most of the 10 species flower in the spring and are therefore unlikely to be encountered or identifiable at other times of the year. The three exceptions are the southern marsh fern (*Thelypteris palustris* var. *halenana*), and the two shrubs -- spicebush (*Lindera benzoin*) and Texas almond (*Prunus minutiflora*) -- all of which would probably be identifiable during most of the growing season. Habitats that are probably capable of supporting all the species collectively do occur on the reservation.

The disjunct populations of big-tooth maple and white dog-tooth violet (Figure 4) occurring at Fort Hood do not represent threatened or endangered species. However, both populations represent significant ecological resources which could be destroyed if precautions are not taken. Riskind¹³ has informed the administrators of Fort Hood of the location and importance of the populations on the reservation.

The Hedgehey Cactus (*Echinocereus* sp.) has been observed on Fort Hood. Due to the brief period of flowering for this genus, the individual species were not identifiable. Presently, the Federal Government recognizes as endangered three species from Texas: Black Lace Cactus (*Echinocereus reichenbachii* var. *albertii*), Lloyd's Hedgehog Cactus (*Echinocereus lloydii*), and Davis' Green Pitaya (*Echinocereus viridiflorus* var. *davisii*). A survey of Fort Hood should be conducted to determine these species' status.

¹² U.S. Department of Interior, Endangered and Threatened Wildlife and Plants, Fed. Reg. 41:47181 (U.S. Fish and Wildlife Service, 1976).

¹³ D. Riskind, personal communication, Texas Parks and Wildlife Department, Austin (1978).



KEY

- BIG-TOOTH MAPLE
(ACER GRANDIDENTATUM)
- WHITE DOG-TOOTH VIOLET
(ERYTHRONIUM ALBIDUM)

Figure 4. Distribution of big-tooth maple and white dog-tooth violet.

Commercially Important Species

The reservation is not a source of commercially important crops or wild plant species. However, grazing rights to reservation grasslands are leased to cattle ranchers in the region. In this respect, the native forage grasses could be considered commercially important. In addition, Fort Hood administrators have an agreement with a local concern (Nolan Valley Cedar Company), whereby marketable Ashe juniper (cedar) may be harvested in exchange for clearing the woody vegetation from selected old fields.

Ashe juniper vigorously invades grazing lands and reduces their livestock carrying capacity.¹⁴ The elimination of Ashe juniper thus probably increases the carrying capacity and, correspondingly, the lease value of the reservations' grazing lands. However, the removal of Ashe juniper may reduce the amount of available nesting habitat for the Golden-cheeked Warbler, an important bird endemic to the Edwards Plateau region.

Other Important Species

Dominant species are, by definition, critical to the structure and function of the ecological system and therefore qualify as important species. The dominant species of the reservation include a number of trees and a few herbs. Removal of these species would radically alter the structure and biological productivity of the ecosystem.

Plant species important for browse and forage materials for wildlife at Fort Hood include supple-jack, post oak, American beautybush, possum-haw, greenbrier (Smilax spp.), black dalea (Dalea frutescens), and elbow-bush. Of special importance to deer are oak mast (Quercus spp.).¹⁵

¹⁴ J. Davis, personal communication, Bell County Extension Agent (1978); L. Allen, personal communication, District Conservationist, USDA Soil Conservation Service, Coryell County, Texas (1978).

¹⁵ G. B. Alexander, Performance Report, Northeast Texas Game Management Survey (Texas Parks and Wildlife Department, 1976); G. H. Lowery, Louisiana Birds (Louisiana State Univ. Press, Baton Rouge, 1974); D. Correll and M. Johnston, Manual of the Vascular Plants of Texas (Texas Research Foundation, Renner, 1970).

Table 1
Plant Species Observed--Fort Hood

Common Name*	Family/Scientific Name	Growth Form	Upland Woodland	Lowland Woodland	Grasslands	Wetlands
ACANTHUS FAMILY	ACANTHACEAE					
Ruellia	<u>Ruellia humilis</u> var. <u>expansa</u>	herb	X	X	X	
	<u>Ruellia humilis</u> var. <u>longiflora</u>	herb			X	
	<u>Dyschoriste linearis</u>	herb			X	
MAPLE FAMILY	ACERACEAE					
Bigtooth Maple	<u>Acer grandidentatum</u>	tree	XO			
Box Elder	<u>Acer negundo</u>	tree		X		
WATER PLANTAIN FAMILY	ALISMITACEAE					
	<u>Sagittaria platyphyllis</u>	herb				X
AMARANTH FAMILY	AMARANTHACEAE					
Prostrate Pigweed	<u>Amaranthus blitoides</u>	herb			X	
	<u>Amaranthus palmeri</u>	herb			X	
AMARYLLIS FAMILY	AMARYLLIDACEAE					
Cebollita	<u>Cooperia drummondii</u>	herb	XO		X	
SUMAC FAMILY	ANACARDIACEAE					
Fragrant Sumac	<u>Rhus aromatica</u>	shrub	XO			
Flameleaf Sumac	<u>Rhus lanceolata</u>	shrub	XO	0	XO	
Poison Ivy	<u>Rhus toxicodendron</u>	vine	XO	XO	XO	
Evergreen Sumac	<u>Rhus virens</u>	shrub	XO			
DOGBANE FAMILY	APOCYNACEAE					
Blue Star	<u>Amsonia longiflora</u>	herb			0	
HOLLY FAMILY	AQUIFOLIACEAE					
Possum-Haw	<u>Ilex decidua</u>	shrub	XO	XO		
MILKWEED FAMILY	ASCLEPIADACEAE					
Hierba de Zizotes	<u>Asclepias ocotheroides</u>	herb			X	
	<u>Asclepias verticillata</u>	herb			X	
	<u>Cynanchum barbigerum</u>	vine	X			
	<u>Matelea biflora</u>	vine	X		0	
Milkweed	<u>Asclepias asperula</u>	herb	0		0	
Angle Pod	<u>Matelea biflora</u>	herb	0		0	
Climbing Milkweed	<u>Matelea gonocarpa</u>	vine	0		0	

X = Observed in Fall 1978
0 = Observed in Spring 1979

*For an explanation of terminology in table headings, see the appendix.

Table 1 (Cont'd)

Common Name	Family/Scientific Name	Growth Form	Upland Woodland	Lowland Woodland	Grasslands	Wetlands
SUNFLOWER FAMILY	ASTERACEAE					
Short Ragweed	<u>Ambrosia artemisiifolia</u>	herb		X	X	
Giant Ragweed	<u>Ambrosia trifida</u>	herb		X		X
White Sage	<u>Artemisia ludoviciana</u>	herb		X	X	
	<u>Aster ericoidea</u>	herb			X	
	<u>Aster patens</u>	herb			X	
	<u>Aster pratensis</u>	herb			X	
Roosevelt Weed	<u>Baccharis neglecta</u>	shrub		X0		
Smooth Beggarticks	<u>Bidens laevis</u>	herb				X
	<u>Brickellia sp.</u>	herb	X			
Horse-Weed	<u>Conyza canadensis</u>	herb		X	X	X
Verba de Tago	<u>Eclipta alba</u>	herb		X		X
Mist-Flower	<u>Eupatorium coelestinum</u>	herb		X		X
	<u>Eupatorium serotinum</u>	herb		X		
	<u>Grindellia lanceolata</u>	herb			X	
Gumweed	<u>Helenium amarum</u>	herb			X	
Bitterweed	<u>Helianthus annuus</u>	herb	X		X	
Common Sunflower	<u>Helianthus annuus</u>	herb			X	
Maximilian Sunflower	<u>Helianthus maximiliani</u>	herb			X	
Grey Goldaster	<u>Heterotheca caccacens</u>	herb			X	
Chalkhill	<u>Hymenopappus tenuifolius</u>	herb			X	
Bitterweed	<u>Hymenoxys scaposa</u>	herb	0	0	X0	
	<u>Iva angustifolia</u>	herb		X	X	X
Kuhnia	<u>Kuhnia eupatorioides</u>	herb			X	
	<u>Liatris mucronata</u>	herb			X	
Texas Skeleton Plant	<u>Lygodesmia texana</u>	herb			X	
Blackfort	<u>Melampodium leucanthum</u> var. <u>leucanthum</u>	herb	0		X0	
	<u>Palafoxia callosa</u>	herb	X	X	X	
False Ragweed	<u>Parthenium hysterophorus</u>	herb		X		
Crownseed Pectis	<u>Pectis angustifolia</u>	herb	X			
Canela	<u>Pluchea purpurascens</u>	herb		X		
Mexican Hat	<u>Ratibida columnaris</u>	herb		X	X	
White Rosinweed	<u>Silphium albidiflorum</u>	herb			X	
Awnless Bush Sunflower	<u>Simsia calva</u>	herb	X			
	<u>Solidago altissima</u>	herb			X	
	<u>Solidago gigantea</u>	herb		X		
	<u>Solidago nemoralis</u>	herb			X	

Table 1 (Cont'd)

Common Name	Family/Scientific Name	Growth Form	Upland Woodland	Lowland Woodland	Grasslands	Wetlands
Greenthread	<u>Thelesperma filifolium</u>	herb	0	0	X	
Slender Greenthread	<u>Thelesperma simplicifolium</u>	herb	X		X	
Compen Daisy	<u>Verbesina encelioides</u>	herb	X	X		
Frostweed	<u>Verbesina virginica</u>	herb		X		
Western Ironweed	<u>Vernonia balowinii</u>	herb			X	
Woolly Ironweed	<u>Vernonia lindheimeri</u>	herb		X		
	<u>Xanthium strumarium</u>	herb				
Common Broomweed	<u>Xanthocephalum dracunculoides</u>	herb			X	
Texas Broomweed	<u>Xanthocephalum texanum</u>	herb			X	
Hairy Least Daisy	<u>Chaetopappa bellidifolia</u>	herb	0		0	
Engelmann Daisy	<u>Engelmannia pinnatifida</u>	herb		0		
Philadelphus Fleabane	<u>Erigeron philadelphicus</u>	herb				
Rabbit-Tobacco	<u>Evax verna</u>	herb	0	0	0	
Old Plainsman	<u>Hymenopappus scabiosaeus</u>	herb			0	
Bitterweed	<u>Hymenoxys linearifolia</u>	herb		0	0	
Dwarf Dandelion	<u>Krigia occidentalis</u>	herb	0			
Blazing-Star	<u>Liatris elegans</u>	herb	0			
Texas Yellow Star	<u>Lindheimeri texana</u>	herb	0	0	0	
False Dandelion	<u>Pyrropappus multicaulis</u>	herb	0	0	0	
Groundsel	<u>Senecio imparipinnatus</u>	herb	0		0	
Achicoria Dulce	<u>Sonchus asper</u>	herb		0		
BARBERRY FAMILY	BARBERTIDACEAE					
Algeratis	<u>Berberis trifoliolata</u>	shrub	0			
BORAGE FAMILY	BORAGINACEAE					
	<u>Heliotropium tenellum</u>	herb	X		X	
	<u>Onosmodium bejarriense</u>	herb	0		0	
	<u>Lithospermum incisum</u>	herb				
Puccoon	CACTACEAE					
	<u>Echinocereus sp.</u>	shrub	X		X	
Hedgehog Cactus	<u>Opuntia sp.</u>	shrub	X	X	X	
Prickly Pear Cactus	<u>Coryphantha missouriensis</u>	shrub	0			
Pincushion Cactus	<u>Coryphantha sulcata</u>	shrub	0			
Mound Cory	<u>Echinocereus reichenbachii</u>	shrub	0			
Lace Echinocereus	<u>Opuntia lindheimeri</u>	shrub	0			
Texas Prickly Pear	<u>Opuntia phaeacantha</u>	shrub	0		0	
Brownsipine Prickly Pear		shrub				

Table 1 (Cont'd)

Common Name	Family/Scientific Name	Growth Form	Upland Woodland	Lowland Woodland	Grass-lands	Wetlands
BLUEBELL FAMILY	CAMPANULACEAE					
Cardinal Flower	<u>Lobelia cardinalis</u>	herb	0		0	X
Venus Looking-Glass	<u>Specularia biflora</u>	herb				
CAPER FAMILY	CAPPARIDACEAE					
Clammy-Need	<u>Polanisia dodecandra</u>	herb			X	
HONEYSUCKLE FAMILY	CAPRIFOLIACEAE					
White Honeysuckle	<u>Lonicera albiflora</u>	shrub	X			
Southern Black Haw	<u>Viburnum rufidulum</u>	shrub	X	X0		
PINK FAMILY	CARYOPHYLLACEAE					
Hilly Sandwort	<u>Arenaria benthamii</u>	herb				
Sleepy Catchfly	<u>Silene antirrhina</u>	herb				
GOOSEFOOT FAMILY	CHENOPODIACEAE					
Mexican Tea	<u>Chenopodium ambrosioides</u>	herb			X	
SPIDERWORT FAMILY	COMMELINACEAE					
False Day Flower	<u>Commelinantia anomala</u>	herb		0	0	
Spider Lily	<u>Tradescantia hirsutiflora</u>	herb				
MORNING GLORY FAMILY	CONVOLVULACEAE					
Bindweed	<u>Convolvulus equitans</u>	vine		X	X	
Dodder	<u>Cuscuta glabrior</u> var. <u>glabrior</u>	vine			X	
Morning Glory	<u>Ipomoea trichocarpa</u> var. <u>torreyana</u>	vine				
Bindweed	<u>Convolvulus equitans</u>	herb	0	0	0	
Ojo De Vibora	<u>Evolvulus nuttallianus</u>	herb	0			
DOGWOOD FAMILY	EVOLVULACEAE					
Rough-leaf Dogwood	<u>Cornus drummondii</u>	shrub	X0	X0		X
ORPINE FAMILY	CRASSULACEAE					
Yellow Stonecrop	<u>Sedum nuttallianum</u>	herb	0			
Texas Stonecrop	<u>Sedum pulchellum</u>	herb	0			
MUSTARD FAMILY	CRUCIFERAE					
Paniclesillo	<u>Rorippa sessiliflora</u>	herb		X		
Whitloe-Grass	<u>Capsella bursa-pastoris</u>	herb	0			
Peppergrass	<u>Draba platycarpa</u>	herb	0		0	
Lax Bladderpod	<u>Lepidium densiflorum</u>	herb	0	0	0	
	<u>Lesquerella gracilis</u>	herb	0		0	
	<u>Myagrum perfoliatum</u>	herb	0		0	
Virginia Sibara	<u>Sibara virginica</u>	herb	0		0	
GOURD FAMILY	CUCURBITACEAE					
Buffalo-Gourd	<u>Cucurbita foetidissima</u>	herb			X	
Globe Berry	<u>Ibervillea lindheimeri</u>	vine	0			

Table 1 (Cont'd)

Common Name	Family/Scientific Name	Growth Form	Upland Woodland	Lowland Woodland	Grasslands	Wetlands
CYPRESS FAMILY	CUPRESSACEAE					
Rock Cedar	<u>Juniperus ashei</u>	tree	X0			
SEDGE FAMILY	CYPERACEAE					
	<u>Cyperus odoratus</u>	herb				X
	<u>Eleocharis sp.</u>	herb				X
Western Umbrella Sedge	<u>Fuirena simplex</u>	herb				X
Littletooth Sedge	<u>Carex microdonta</u>	herb		0		
Muhlenberg Sedge	<u>Carex muhlenbergii</u>	herb		0		
Cedar Sedge	<u>Carex planostachys</u>	herb	0	0		
Spikerush	<u>Eleocharis montevidensis</u>	herb		0		
EBONY FAMILY	EBENACEAE					
Texas Persimmon	<u>Diospyros texana</u>	shrub	X0			
Common Persimmon	<u>Diospyros virginiana</u>	tree	X			
SPURGE FAMILY	EUPHORBIACEAE					
Lindheimer Copperleaf	<u>Acalypha lindheimeri</u>	herb			0X	
Hophornbeam Copperleaf	<u>Acalypha ostryaefolia</u>	herb		X		
Bull Mistle	<u>Cnidocolus texanus</u>	herb			X	
Prairie-Tea	<u>Croton monanthogynus</u>	herb	X		X	
Texas Croton	<u>Croton texensis</u>	herb			X	
Snow-On-The-Prairie	<u>Euphorbia bicolor</u>	herb			X	
	<u>Euphorbia cyathophora</u>	herb	X		X	
	<u>Euphorbia dentata</u>	herb		X	X	
	<u>Euphorbia missurica</u>	herb			X	
	<u>Euphorbia nutans</u>	herb		X	X	
Eychane	<u>Euphorbia serpens</u>	herb			X	
Hierba de la Colondrina	<u>Phyllanthus polygonoides</u>	herb	0		X0	
Knotweed Leafflower	<u>Stillingia texana</u>	herb			X	
	<u>Tragia ramosa</u>	herb	0		X0	
Texas Queen's Delight	<u>Argythamnia simulans</u>	herb	0			
Plateau Wild Mercury	<u>Euphorbia spathulata</u>	herb	0		0	
Marty-Fruited Spurge	<u>Euphorbia spp</u>	herb	0		0	
Spurge	<u>Tragia betonicifolia</u>	herb	0		0	
Noseburn						

Table 1 (Cont'd)

Common Name	Family/Scientific Name	Growth Form	Upland Woodland	Lowland Woodland	Grasslands	Wetlands
BEECH FAMILY	FAGACEAE					
Live Oak	<u>Quercus fusiformis</u>	tree	X0	X0		
Bur Oak	<u>Quercus macrocarpa</u>	tree	X0	X0		
Blackjack Oak	<u>Quercus marilandica</u>	tree		X		
Chinkapin Oak	<u>Quercus muehlenbergii</u>	tree	X0			
Bastard Oak	<u>Quercus sinuata</u> var. <u>breviloba</u>	tree	X0			
Post Oak	<u>Quercus stellata</u>	tree	X0			
Texas Red Oak	<u>Quercus texana</u>	tree	X0			
GENTAIN FAMILY	GENTIANACEAE					
Mountain Pink	<u>Centaurium beyrichii</u>	herb			X	
Lira de San Pedro	<u>Eustoma grandiflorum</u>	herb			X	
GERANIUM FAMILY	GERANIACEAE					
Cranebill	<u>Geranium carolinianum</u>	herb	0		0	
Alfilerillo	<u>Erodium cicutarium</u>	herb	0		0	
Stork's-Bill	<u>Erodium texanum</u>	herb	0		0	
IRIS FAMILY	IRIDACEAE					
Swordleaf Blue-Eyegrass	<u>Sisyrinchium ensigerum</u>	herb	0		0	
WALNUT FAMILY	JUGLANDACEAE					
Arizona Walnut	<u>Juglans major</u>	tree	X0	0		
Black Walnut	<u>Juglans nigra</u>	tree		X0		
CRAMERIA FAMILY	KRAMERIACEAE					
Crameria	<u>Krameria lanceolata</u>	herb			X	
MINT FAMILY	LABIATAE					
	<u>Hedeoma drummondii</u>	herb			X	
	<u>Lycopus americanus</u>	herb				X
Common Horehound	<u>Marrubium vulgare</u>	herb		X		
Lemon Beebalm	<u>Monarda citriodora</u>	herb			X	
Blue Sage	<u>Salvia azurea</u> var. <u>grandiflora</u>	herb		X		
Mealy Sage	<u>Salvia farinacea</u>	herb			X	
Texas Sage	<u>Salvia texana</u>	herb	0		X0	
	<u>Scutellaria wrightii</u>	herb	0		X0	
American Germander	<u>Teucrium canadense</u>	herb				X
Mock Pennyroyal	<u>Hedeoma acinoideis</u>	herb	0		0	
Mejorana	<u>Salvia coccinea</u>	herb				
Drummond's Skullcap	<u>Scutellaria drummondii</u>	herb	0	0		
Shade Betony	<u>Stachys crenata</u>	herb	0		0	

Table 1 (Cont'd)

Common Name	Family/Scientific Name	Growth Form	Upland Woodland	Lowland Woodland	Grasslands	Wetlands
LEGUME FAMILY						
Bastard Indigo	<u>Acacia schaffneri</u>	shrub			X	
Partridge Pea	<u>Amorpha fruticosa</u>	shrub			X	X
Two-Leaved Senna	<u>Cassia fasciculata</u>	herb			X	
Redbud	<u>Cassia roemeriana</u>	herb	X0		X0	
Black Dalea	<u>Cercis canadensis</u>	tree	X			
Hall Dalea	<u>Dalea frutescens</u>	shrub				
Illinois Bundleflower	<u>Dalea hallii</u>	herb			X	
Velvet Bundleflower	<u>Desmanthus illinoensis</u>	herb			X	
Panicled Tickclover	<u>Desmanthus velutinus</u>	herb			X	
Kidney Wood	<u>Desmodium paniculatum</u>	herb		X		
Honey Locust	<u>Eysenhardtia texana</u>	shrub	X			
Western Indigo	<u>Gleditsia triacanthos</u>	tree		X		
Prairie Clover	<u>Indigofera miniata</u> var. <u>leptosepala</u>	herb			X	
Slender Bush Clover	<u>Lespedeza violacea</u>	herb			X	
Retama	<u>Lespedeza virginica</u>	herb	X			
Roundhead Prairieclover	<u>Parkinsonia aculeata</u>	tree			X	
Honey Mesquite	<u>Petalostemum multiflorum</u>	herb			X	
Scurfy Pea	<u>Prosopis glandulosa</u>	tree	0		X0	
Bequilla	<u>Psoralea tenuiflora</u>	herb			X	
Bog-Pod	<u>Sesbania macrocarpa</u>	herb				X
Eve's Necklace	<u>Sesbania vesicaria</u>	herb				X
Mescal-Bean	<u>Sophora affinis</u>	shrub	X			
Nuttall Milk-Vetch	<u>Sophora secundiflora</u>	shrub	X			
Wright Milk-Vetch	<u>Astragalus nuttallianus</u>	herb	0		0	
Texas Bluebonnet	<u>Astragalus wrightii</u>	herb		0		
Pink Mimosa	<u>Lupinus texensis</u>	herb	0		0	
Scurfpea	<u>Mimosa borealis</u>	shrub	0			
Stemless Scurfpea	<u>Psoralea late stipulata</u>	herb			0	
Catclaw Sensitive Brier	<u>Psoralea scaposa</u>	herb	0		0	
Texas Mountain Laurel	<u>Schrankia roemeriana</u>	herb	0		0	
Carolina Clover	<u>Sophora secundiflora</u>	shrub	0			
Leavenworth Vetch	<u>Trifolium carolinianum</u>	herb	0		0	
DUCKWEED FAMILY	<u>Vicia leavenworthii</u>	herb				
Duckweed	LEMNACEAE <u>Lemna</u> sp.	herb				X

Table 1 (Cont'd)

Common Name	Family/Scientific Name	Growth Form	Upland Woodland	Lowland Woodland	Grasslands	Wetlands
LILY FAMILY	LILIACEAE					
White Dog-Tooth Violet	<u>Erythronium albidum</u>	herb	X			
Crow-Poison	<u>Nothoscordum bivalve</u>	herb			X	
Cat-Brier	<u>Smilax bona-nox</u>	vine	X	X		
Twisted-Leaf Yucca	<u>Yucca rupicola</u>	shrub	X			
Wild Garlic	<u>Allium canadense</u>	herb	0			
Wild Onion	<u>Allium drummondii</u>	herb	0	0		
False Garlic	<u>Nothoscordum bivalve</u>	herb	0		0	
Bear Grass	<u>Nolina texana</u>	shrub	0			
Cat-brier	<u>Smilax bona-nox</u>	vine	0	0		
FLAX FAMILY	LINACEAE					
Rock Flax	<u>Linum rupestre</u>	herb			X	
Stiffstem Flax	<u>Linum rigidum</u>	herb			0	
STICK-LEAF FAMILY	LOASACEAE					
Stick-Leaf	<u>Mentzelia oligosperma</u>	herb			X	
LOGANIA FAMILY	LOGANIACEAE					
	<u>Cynoctonum mitreola</u>	herb				X
MALLOW FAMILY	MALVACEAE					
Pelotazo	<u>Abutilon incanum</u>	herb		X		
Spreading Sida	<u>Sida filicaulis</u>	herb				
Finger Poppy-Mallow	<u>Callirhoe digitata</u>	herb	0		X	
UNICORN-PLANT FAMILY	MARTYNIACEAE					
Unicorn-Plant	<u>Proboscidea louisianica</u>	herb		X		
MAHOGANY FAMILY	MELIACEAE					
Chinaberry-Tree	<u>Melia azedarach</u>	tree	X0	X0		
MOONSEED FAMILY	MENISPERMACEAE					
Red-berrifed Moonseed	<u>Cocculus carolinus</u>	vine	X	X		
MULBERRY FAMILY	MORACEAE					
Osage Orange	<u>Maclura pomifera</u>	tree	X	X		
Red Mulberry	<u>Morus rubra</u>	tree	X	X0		
Common Fig	<u>Ficus carica</u>	shrub	X			
WATER-NYMPH FAMILY	NAJADACEAE					
Common Water-Nymph	<u>Najas guadalupensis</u>	herb				X
FOUR O'CLOCK FAMILY	NYCTAGINACEAE					
Linear-Leaf Four-O'Clock	<u>Mirabilis linearis</u>	herb			X	
OLIVE FAMILY	OLEACEAE					
Elbow-Bush	<u>Foreatiera pubescens</u>	shrub	X	X		
Texas Ash	<u>Fraxinus texensis</u>	tree	X0	X0		

Table 1 (Cont'd)

Common Name	Family/Scientific Name	Growth Form	Upland Woodland	Lowland Woodland	Grasslands	Wetlands
EVENING PRIMROSE FAMILY	ONAGRACEAE					
Yellow Evening Primrose	<u>Calylophus drummondianus</u>	herb	0		X0	
Wild Honeysuckle	<u>Gaura suffulta</u>	herb			X	X
	<u>Ludwigia octovalvis</u> subsp. <u>octovalvis</u>	herb				X
Missouri Primrose	<u>Oenothera jamesii</u>	herb				
Showy Primrose (Amopola Del Campo)	<u>Oenothera missouriensis</u>	herb	0	0	X0	
	<u>Oenothera spectiosa</u>	herb			X0	
Scarlet Gaura	<u>Stenosiphon linifolius</u>	herb			X	
Lizard-Tail	<u>Gaura coccinea</u>	herb	0	0	0	
Cut-Leaved Primrose	<u>Gaura parviflora</u>	herb			0	
Stemless Primrose	<u>Oenothera grandis</u>	herb	0		0	
WOOD-SORREL FAMILY	<u>Oenothera triloba</u>	herb			0	
OXALIDACEAE						
Yellow Wood-Sorrel (Jocoyote)	<u>Oxalis dillenii</u>	herb		X0	0	
	<u>Oxalis drummondii</u>	herb			X	
POPPY FAMILY	PAPAVERACEAE					
	<u>Argemone polyanthemus</u>	herb			X	
PASSION-FLOWER FAMILY	PASSIFLORACEAE					
Passion-Flower	<u>Passiflora lutea</u>	vine		X		
POKEWEEED FAMILY	PHYTOLACCACEAE					
Pigeon-Berry	<u>Rivina humilis</u>	herb		X		
PLANTAIN FAMILY	PLANTAGINACEAE					
Red-Seeded Plantain	<u>Plantago rhodosperma</u>	herb		X	X	
Woolly Plantain	<u>Plantago patagonica</u>	herb	0		0	
Pale-Seeded Plantain	<u>Plantago virginica</u>	herb	0			
PLANE-TREE FAMILY	PLATANACEAE					
Sycamore	<u>Platanus occidentalis</u>	tree		X		X
GRASS FAMILY	POACEAE					
Broomsedge	<u>Andropogon virginicus</u>	herb			X	X
Prairie Three-Awn	<u>Aristida oligantha</u>	herb			X	X
Giant Reed	<u>Arundo donax</u>	herb			X	X
King Ranch Bluestem	<u>Botriochloa ischaemum</u> var. <u>songarica</u>	herb			X	X
Silver Bluestem	<u>Bothriochloa saccharoides</u>	herb			X0	
Side-Oats Grama	<u>Bouteloua curtipendula</u>	herb			X	
Blue Grama	<u>Bouteloua gracilis</u>	herb			X	
Hairy Grama	<u>Bouteloua hirsuta</u>	herb			X	

Table 1 (Cont'd)

Common Name	Family/Scientific Name	Growth Form	Upland Woodland	Lowland Woodland	Grass-lands	Wetlands
Texas Grama	<u>Bouteloua rigidiseta</u>	herb	0		X0	
Red Grama	<u>Bouteloua trifida</u>	herb			X0	
Japanese Chess	<u>Bromus japonicus</u>	herb			X	
Buffalo Grass	<u>Buchloe dactyloides</u>	herb	X0	X	X0	
Grassbur	<u>Cenchrus incertus</u>	herb			X	
Inland Sea Oats	<u>Chasmanthium latifolium</u>	herb		X		
Windmill Grass	<u>Chloris verticillata</u>	herb			X	
Bermuda Grass	<u>Cynodon dactylon</u>	herb		X	X	
Northern Crabgrass	<u>Digitaria sanguinalis</u>	herb		X	X	
Barnyard Grass	<u>Echinochloa crusgalli</u>	herb			X	
Canada Wild-Rye	<u>Elymus canadensis</u>	herb		X		X
	<u>Eragrostia barrelieri</u>	herb	X		X	
	<u>Erioneuron pilosum</u>	herb			X	
Texas Cupgrass	<u>Eriochloa sericea</u>	herb			X	
Lindheimer Muhly	<u>Muhlenbergia lindheimeri</u>	herb			X	
Seep Muhly	<u>Muhlenbergia reverchoni</u>	herb			X	
	<u>Panicum texanum</u>	herb			X	
Switchgrass	<u>Panicum virgatum</u>	herb		X		X
Dallis-Grass	<u>Paspalum dilatatum</u>	herb		X		
Little Bluestem	<u>Schizachyrium scoparium</u>	herb		X		
Green Bristlegrass	<u>Setaria viridis</u>	herb			X	
Indian Grass	<u>Sorghastrum avenaceum</u>	herb			X	X
Johnson Grass	<u>Sorghum halepense</u>	herb			X	X
Tall Dropseed	<u>Sporobolus asper</u>	herb			X	
Sand Dropseed	<u>Sporobolus cryptandrus</u>	herb			X	
Purple Threawn	<u>Aristida purpurea</u>	herb				X
Rescuegrass	<u>Bromus unioloides</u>	herb	0		0	
Windmillgrass	<u>Chloris andropogonoides</u>	herb	0	0	0	
Fluffgrass	<u>Erioneuron pulchellum</u>	herb	0	0	0	
Little Barley	<u>Hordeum pusillum</u>	herb	0		0	
Fall Witchgrass	<u>Leptoloma cognatum</u>	herb	0		0	
Hall Panicum	<u>Panicum hallii</u>	herb	0		0	
Scribner's Panicum	<u>Panicum oligosanthos</u>	herb	0		0	
Carolina Canarygrass	<u>Phalaris caroliniana</u>	herb	0		0	
Texas Bluegrass	<u>Poa arachnifera</u>	herb	0		0	
Annual Bluegrass	<u>Poa annua</u>	herb	0		0	
Texas Wintergrass	<u>Stipa leucotricha</u>	herb	0		0	
Prairie Trisetum	<u>Trisetum interruptum</u>	herb	0		0	
Six-Needs Fescue	<u>Vulpia octoflora</u>	herb	0		0	

Table 1 (Cont'd)

Common Name	Family/Scientific Name	Growth Form	Upland Woodland	Lowland Woodland	Grasslands	Wetlands
PHLOX FAMILY	<u>Polemoniaceae</u>				X	
Texas Plume	<u>Ipomopsis rubra</u>	herb				
MILKWORT FAMILY	<u>Polygalaceae</u>				X0	
White Milkwort	<u>Polygala alba</u>	herb	0		0	
Rock Milkwort	<u>Polygala tweedyi</u>	herb				
KNOTWEED FAMILY	<u>Polygonaceae</u>				X	
Knotweed	<u>Eriogonum longifolium</u>	herb				X
Pale Dock	<u>Persicaria densiflora</u>	herb				X
TRUE FERN FAMILY	<u>Rumex altissimus</u>	herb		0		
Culantrillo	<u>Polyodiaceae</u>					
Little Ebony Spleenwort	<u>Adiantum capillus-veneria</u>	herb				X
Purple Cliff Brake	<u>Asplenium resiliens</u>	herb				X
Southern Shield Fern	<u>Pellaea stropurpurea</u>	herb	X			X
PRIMROSE FAMILY	<u>Thelypteris kunthii</u>	herb				
	<u>Primulaceae</u>					
	<u>Samolus parviflorus</u>	herb				X
CROWFOOT FAMILY	<u>Ranunculaceae</u>					
Leather Flower	<u>Clematis pitcheri</u>	vine		X		
Carolina Anemone	<u>Anemone caroliniana</u>	herb			0	
Tenpetal Anemone	<u>Anemone heterophylla</u>	herb			0	
Large Buttercup	<u>Ranunculus macranthus</u>	herb				
BUCKHORN FAMILY	<u>Rhamnaceae</u>					
Supple-Jack	<u>Berchemia scandens</u>	vine	X			
Redroot	<u>Ceanothus herbaceus</u>	shrub	X0			
Indian Cherry	<u>Rhamnus caroliniana</u>	tree	X0			
ROSEFAMILY	<u>Rosaceae</u>					
Cockspur Hawthorne	<u>Crataegus crus-galli</u>	tree	X			
White Avens	<u>Geum canadense</u>	herb	X		0	
Mexican Plum	<u>Prunus mexicana</u>	tree	X0			
Southern Dewberry	<u>Rubus trivialis</u>	shrub	X0		X	
Japanese Rose	<u>Rosa multiflora</u>	shrub			0	
MADDER FAMILY	<u>Rubiaceae</u>					
Common Buttonbush	<u>Cephalanthus occidentalis</u>	shrub	X			
Prairie Bluets	<u>Galium circaezans</u>	herb				X
Catchweed Bedstraw	<u>Hedyotis nigricans</u>	herb				
Southwestern Bedstraw	<u>Galium aparine</u>	herb	0			
	<u>Galium virgatum</u>	herb	0			

Table 1 (Cont'd)

Common Name	Family/Scientific Name	Growth Form	Upland Woodland	Lowland Woodland	Grasslands	Wetlands
CITRUS FAMILY	RUTACEAE					
Wafer-Ash	<i>Ptelea trifoliata</i>	shrub	XO			
Tickle-Tongue	<i>Zanthoxylum hirsutum</i>	shrub	XO			
Dutchman's Breeches	<i>Thamnosma texana</i>	herb			0	
WILLOW FAMILY	SALICACEAE					
Plains Cottonwood	<i>Populus sargentii</i>	tree	X	X		
Black Willow	<i>Salix nigra</i>	tree		XO		
Cottonwood	<i>Populus deltoides</i>	tree		0		X
SOAP-BERRY FAMILY	SAPINDACEAE					
Jaboncillo	<i>Sapindus saponaria</i> var. <i>drummondii</i>	tree		X		
Mexican Buckeye	<i>Ungnadia speciosa</i>	shrub	X	X		
SAPODILLA FAMILY	SAPOTACEAE					
Buckthorn	<i>Bumelia lanuginosa</i>	tree	XO	XO		
FIGMORT FAMILY	SCROPHULARIACEAE					
Prairie Agalinis	<i>Agalinis heterophylla</i>	herb			X	
Disc Water-Hyssop	<i>Bacopa rotundifolia</i>	herb				X
Narrow-Leaf Leucospora	<i>Leucospora multifida</i>	herb		X		
	<i>Mecardonia vandellioides</i>	herb		X		
	<i>Verbascum thapsus</i>	herb		X		X
Common Mullein	<i>Castilleja purpurea</i>	herb	0		0	
Prairie Paintbrush	<i>Penstemon cobei</i>	herb	0		0	
Cobaea Beardtongue	<i>Veronica peregrina</i>	herb			0	
Purslane Speedwell	SIMARUBACEAE					
QUASSIA FAMILY	AILANTHACEAE					
Tree-of-Heaven	<i>Ailanthus altissima</i>	tree		X		
NIGHTSHADE FAMILY	SOLANACEAE					
Indianapple	<i>Datura wrightii</i>	herb	X			
Field Groundcherry	<i>Physalis viscosa</i>	herb	0	XO	0	
Western Horse Nettle	<i>Solanum dimidiatum</i>	herb	0		XO	
Silver Leaf Nightshade	<i>Solanum elaeagnifolium</i>	herb			X	
Buffalo Bur	<i>Solanum rostratum</i>	herb		X	X	
Hairy False-Nightshade	<i>Chamaesaracha conioides</i>	herb			0	
CAT-TAIL FAMILY	TYPHACEAE					
Common Cat-Tail	<i>Typha latifolia</i>	herb				X

Table 1 (Cont'd)

Common Name	Family/Scientific Name	Growth Form	Upland Woodland	Lowland Woodland	Grasslands	Wetlands
ELM FAMILY	ULMACEAE					
Netleaf Hackberry	<u>Celtis reticulata</u>	tree	X0	X0	X	
American Elm	<u>Ulmus americana</u>	tree	X0	X0	X	
Cedar Elm	<u>Ulmus crassifolia</u>	tree	X0	X0	X	
Slippery Elm	<u>Ulmus rubra</u>	tree	X	X		
Sugarberry	<u>Celtis laevigata</u>	tree	0	0		
PARSLEY FAMILY	UMBELLIFERAE					
Leavenworth Eryngo	<u>Eryngium leavenworthii</u>	herb			X	
	<u>Hydrocotyle verticillata</u>	herb				X
	<u>var. verticillata</u>	herb				
	<u>Chaerophyllum tainturieri</u>	herb	0	0	0	
NETTLE FAMILY	URTICACEAE					
Hairyfruit Chervil	<u>Parietaria pensylvanica</u>	herb	0			
Pennsylvania Pellitory	VALERIANACEAE					
VALERIAN FAMILY	VALERIANACEAE					
Corn Salad	<u>Valerianaella amarella</u>	herb	0		0	
VERVAIN FAMILY	VERBENACEAE					
American Beautybush	<u>Calliandra americana</u>	shrub		X		
	<u>Lantana scorta</u>	shrub		X		
Texas Frog-Fruit	<u>Phyla incisa</u>	herb	0		X0	
Dakota Vervain	<u>Verbena bipinnatifida</u>	herb	0		X0	
Gray Vervain	<u>Verbena canescens var. roemeriana</u>	herb			X	
Texas Vervain	<u>Verbena halei</u>	herb		X	X	
Common Chaste-Tree	<u>Vitex agnus-castus</u>	shrub		X		
New Mexico Vervain	<u>Verbena neomexicana</u>	herb			0	
Pink Vervain	<u>Verbena pumila</u>	herb	0		0	
Harsh Vervain	<u>Verbena scabra</u>	herb			0	
MISTLETOE FAMILY	VISCACEAE					
Injerto	<u>Phoradendron tomentosum</u>	shrub		X		
	<u>subsp. tomentosum</u>					
GRAPE FAMILY	VITACEAE					
Pepper-Vine	<u>Amelopsis arborea</u>	vine	X	X0		
Possum-Grape	<u>Cissus incisa</u>	vine	X	0		
Virginia Creeper	<u>Parthenocissus quinquefolia</u>	vine	X0	X0		
Spanish Grape	<u>Vitis berlandieri</u>	vine	X0	X0		
Mustang Grape	<u>Vitis mustangensis</u>	vine	X	X		

Table 2
 Structure of Ashe Juniper-Live Oak Woodland (Stand 2) -- Fort Hood

Species*	Count	Mean Basal Area (cm ²)	Density (stems/ha)	% Relative Density	Total Basal Area (dm ² /ha)	% Relative Basal Area	% Frequency	% Relative Frequency	% Importance
Netleaf hackberry	1	392	45.3	2.5	177.7	1.9	10.0	4.0	2.8
Ashe Juniper	18	454	815.3	45.0	3704.7	40.1	90.0	36.0	40.4
Live oak	13	530	588.9	32.5	3116.4	33.8	90.0	36.0	34.1
Texas oak	2	554	90.6	5.0	501.6	5.4	20.0	8.0	6.1
Cedar elm	6	637	271.8	15.0	1731.5	18.8	40.0	16.0	16.6
Total	40		1811.9	100.0	9231.9	100.0	250.0	100.0	100.0

*For an explanation of terminology in table headings, see the appendix.

Table 3
 Structure of Ashe Juniper-Texas Oak Woodland (Stand 4) -- Fort Hood

Species*	Count	Mean Basal Area (cm ²)	Density (stems/ha)	% Relative Density	Total Area (dm ² /ha)	% Relative Basal Area	% Frequency	% Relative Frequency	% Importance
Woolly buckthorn	1	170	6.6	1.7	11.2	1.6	6.7	3.1	2.1
Netleaf hackberry	1	81	6.6	1.7	5.3	0.8	6.7	3.1	1.9
Ashe juniper	26	160	172.8	43.3	276.1	39.7	80.0	37.5	40.2
Live oak	7	330	46.5	11.7	153.3	22.0	33.0	15.6	16.4
Texas oak	22	128	146.2	36.7	187.5	26.9	73.3	34.4	32.7
Cedar elm	3	312	19.9	5.0	62.2	8.9	13.3	6.3	6.7
Total	60		398.6	100.1	695.6	99.1	213.0	100.0	100.0

*For an explanation of terminology in table headings, see the appendix.

Table 4
Structure of Live Oak Woodland (Stand 8) -- Fort Hood

Species*	Count	Mean Basal Area (cm ²)	Density (stems/ha)	% Relative Density	Total Basal Area (dm ² /ha)	% Relative Basal Area	% Frequency	% Relative Frequency	% Importance
Netleaf hackberry	1	142	8.4	2.5	11.5	0.9	10.0	11.1	4.8
Ashe juniper	1	159	8.4	2.5	13.3	1.0	10.0	11.1	4.9
Live oak	35	396	293.8	87.5	1164.5	89.9	50.0	55.6	77.7
Texas oak	1	170	8.4	2.5	14.3	1.1	10.0	11.1	4.9
Cedar elm	2	544	16.8	5.0	91.5	7.1	10.0	11.1	7.7
Total	40	335.8	335.8	100.0	1295.1	100.0	90.0	100.0	100.0

*For an explanation of terminology in table headings, see the appendix.

Table 5
Structure of Cedar Elm Woodland (Stand 10) -- Fort Hood

Species*	Count	Mean Basal Area (cm ²)	Density (stems/ha)	% Relative Density	Total Basal Area (dm ² /ha)	% Relative Basal Area	% Frequency	% Relative Frequency	% Importance
Pecan	1	117	11.7	2.5	13.7	0.5	10.0	4.2	2.4
Netleaf hackberry	5	509	58.4	12.5	297.1	10.2	40.0	16.7	13.7
Red mulberry	1	214	11.7	2.5	24.9	0.9	10.0	4.2	2.5
Mexican plum	1	207	11.7	2.5	24.2	0.8	10.0	4.2	2.5
Live Oak	2	2210	23.4	5.0	516.0	17.8	20.0	8.3	10.4
Texas oak	7	289	81.7	17.5	236.1	8.1	40.0	16.7	14.1
Cedar elm	22	617	256.8	55.0	1584.1	54.6	100.0	41.7	50.4
Slippery elm	1	1753	11.7	2.5	204.5	7.1	10.0	4.2	4.6
Total	40		467.1	100.0	2900.6	100.0	240.0	100.2	100.6

*For an explanation of terminology in table headings, see the appendix.

Table 6
Structure of Oak-Maple Woodland (Stand 12) -- Fort Hood

Species*	Count	Mean Basal Area (cm ²)	Density (stems/ha)	% Relative Density	Total Basal Area (dm ² /ha)	% Relative Basal Area	% Frequency	% Relative Frequency	% Importance
Big-tooth maple	19	187	242.3	31.7	453	16.6	73.3	26.8	25.0
Texas ash	10	185	127.7	16.7	236	8.6	53.3	19.5	14.9
Ashe juniper	5	225	63.4	8.3	143	5.2	26.7	9.8	7.8
Black walnut	2	2351	25.2	3.3	593	21.7	13.3	4.7	10.0
Chinkapin oak	14	520	178.1	23.3	928	34.0	60.0	22.0	26.4
Texas oak	10	293	127.7	16.7	375	13.7	46.7	17.1	15.8
Total	60		764.4	100.0	2728	99.8	273.3	99.9	99.9

*For an explanation of terminology in table headings, see the appendix.

Table 7
Structure of Pecan-Elm-Hackberry Woodland (Stand 13) -- Fort Hood

Species*	Count	Mean Basal Area (cm ²)	Density (stems/ha)	% Relative Density	Total Basal Area (dm ² /ha)	% Basal Area	% Relative Frequency	% Relative Importance
Woolly blackthorn	1	358	7.5	2.5	27	0.9	10	4.0
Pecan	18	1301	134.1	45.0	1762	59.7	90	36.0
Netleaf hackberry	8	813	60.2	20.0	489	16.6	50	20.0
Bur oak	2	572	15.0	5.0	84	2.9	20	8.0
Texas oak	1	506	7.5	2.5	38	1.3	10	4.0
American elm	1	81	7.5	2.5	6	0.2	10	4.0
Cedar elm	9	798	67.7	22.5	540	18.3	60	24.0
Total	40		299.5	100.0	2946	99.9	250	100.0

*for an explanation of terminology in table headings, see the appendix.

Table 8
Rare or Endangered Plants

Scientific Name (Common Name)*	Habitat	Flowering Time	Status	Distribution	
				Texas	North America
<u>Arabis petiolaris</u> (Rock cress)	Open woods, rocky knolls, wooded bluffs	April to May	1-D	Central Texas	Endemic to Texas
<u>Carex oligocarpa</u> ¹ (Few-Seed sedge)	Wooded calcareous slopes	April to May	2/3- F(A)	Travis County Kendall County	From Ontario & N.E. U.S., W. to Mich., Ia., Mo. & Okla., S. to Ala., Ky., Ark. & Tex. Central Okla. S. to S. Cen. Tex.
<u>Dyssodia tagetoides</u> (Marigold dogweed)	Dry soils	June to August	1-D(A)	N. Central Tex. S. to Bexar & Fayette Counties	Central Okla. S. to S. Cen. Tex.
<u>Lespedeza violacea</u> (Prairie clover)	Dry soils	July to August	2-E(A)	N. Central Tex.	Most of the N.E. & Cen. U.S.
<u>Lindera benzoin</u> (Spicebush)	Rich wooded slopes rock areas along streams	March to April	1-C(A)	Edwards Plateau	S.E. Va., S. to Fla. & Tex. W. to Ohio, Mich., Mo. & Okla.
<u>Lomatium daucifolium</u> (Prairie Lomatium)	Rocky slopes, bluffs, ravines	March to April	2-C(A)	N. blackland prairies & plains country	Texas N. to S.D.
<u>Poa arachnifera</u> (Texas bluegrass)	Relatively undis- turbed prairies	May to June	2-E(A)	Plains country, N. Cen. Tex. & Edwards Plateau	Kan., Okla., Tex., intro- duced Gulf States
<u>Prunus minutiflora</u> (Texas almond)	Limestone slopes, sandy brushy plains	March to April	1-B	Edwards Plateau Rio Grande Plains	Endemic to Tex.
<u>Senecio glabellus</u> (Butterweed)	Sandy soil	Spring	2-E(A)	E. Tex. (Gregg & San Augustine Counties)	S.E. U.S. N. to N.C., Ill. & Mo., W. to Kan., Okla. and Tex.
<u>Thelypteris palustris</u> var. <u>haleana</u> (Southern marsh fern)	Open sandy bogs, swamps, meadows, open low woods along streams	Fall	1-C(A)	Jefferson County Waller County Colorado County	Fla. to La., & E. Tex. N. to Pa.

¹Texas specimens differ from those of main distribution range

Source: Rare Plant Study Center (1974) and Correll & Johnston (1970)

Comments:

- 1 - scarce, endangered in Texas
- 2 - very rare, acutely endangered in Texas
- 3 - presumed extinct, with no records since 1930 in Texas
- A - distributed broadly but regionally in North America and extending into Texas
- B - distributed over several of the vegetational areas of Texas
- C - distributed in two of the vegetational areas of Texas
- D - distribution limited to 4 to 8 counties in one vegetational area
- E - distribution limited to 1 to 3 counties in one vegetational area
- F - known only from one or a few populations; explicit information occasionally provided

*For an explanation of terminology in table headings, see the appendix.

3 TERRESTRIAL WILDLIFE

The wildlife, like the vegetation of the Fort Hood Military Reservation, is typical of the Edwards Plateau and bordering areas described by Blair.¹⁶ In fact, Blair includes Fort Hood in the northeastern portion of the Balconian Biotic Province, which includes the Edwards Plateau (Figure 5).

The terrestrial vertebrate fauna of the Balconian Biotic Province contain a unique mixture of species from the Austroriparian, Tamaulipan, Chihuahuan, and Kansan Biotic Provinces. It also contains six endemic species of neotenic salamanders that have evolved in the subterranean waterways and springs of the Edwards Plateau, and one avian species whose breeding range lies almost entirely within the Balconian Biotic Province. Blair considered the Edwards Plateau as a separate biotic province because of its unique aggregate vertebrate fauna, the unique vegetational aspect of the region, and the fact that it is a discrete physiographic unit.

The topography of the eastern part of this province, which includes Fort Hood, is generally rugged because several rivers and their tributaries dissect the limestone. Limestone outcrops are characteristic of the stream canyons, and limestone fragments occur at the surface over most of the area. The climate of the eastern portion of the Balconian has been classified as dry sub-humid and mesothermal.¹⁷ Blair characterizes it as an area of intermediate ecological conditions between eastern forests and western deserts.

Wildlife Habitats

The Fort Hood area can be divided into several major wildlife habitats. The first division is between aquatic and terrestrial areas. Terrestrial areas are further divided into characteristic units which coincide closely with the major vegetational communities. Edges or ecotones between forested and non-forested areas and between the different types of forested areas cause a blending of species typical of the pure habitats. Many wildlife species actually prefer these ecotones (particularly those between forested and non-forested areas). This is true to some extent for recreationally important species, such as the white-tailed deer (*Odocoileus virginianus*), eastern cottontail (*Sylvilagus floridanus*), and Bobwhite (*Colinus virginianus*). These transition zones are preferred not only for the diversity of available food materials but also for the usually dense cover provided by the characteristic overlap of vegetational communities. Conspicuous in all habitat types are areas of physical disturbances (i.e., motorcycle trails, tank trails, burned areas). Four major wildlife habitat types were encountered in the Fort Hood area. The following sections briefly characterize these habitat types, along with lists of their characteristic faunal components. Also included is a short discussion of urban wildlife.

¹⁶ W. F. Blair, "The Biotic Provinces of Texas," Tex. J. Sci., Vol 2 (1950), pp 93-117.

¹⁷ C. W. Thornthwaite, "An Approach Toward a Rational Classification of Climate," Geogr. Rev., Vol 38 (1948), pp 55-94.

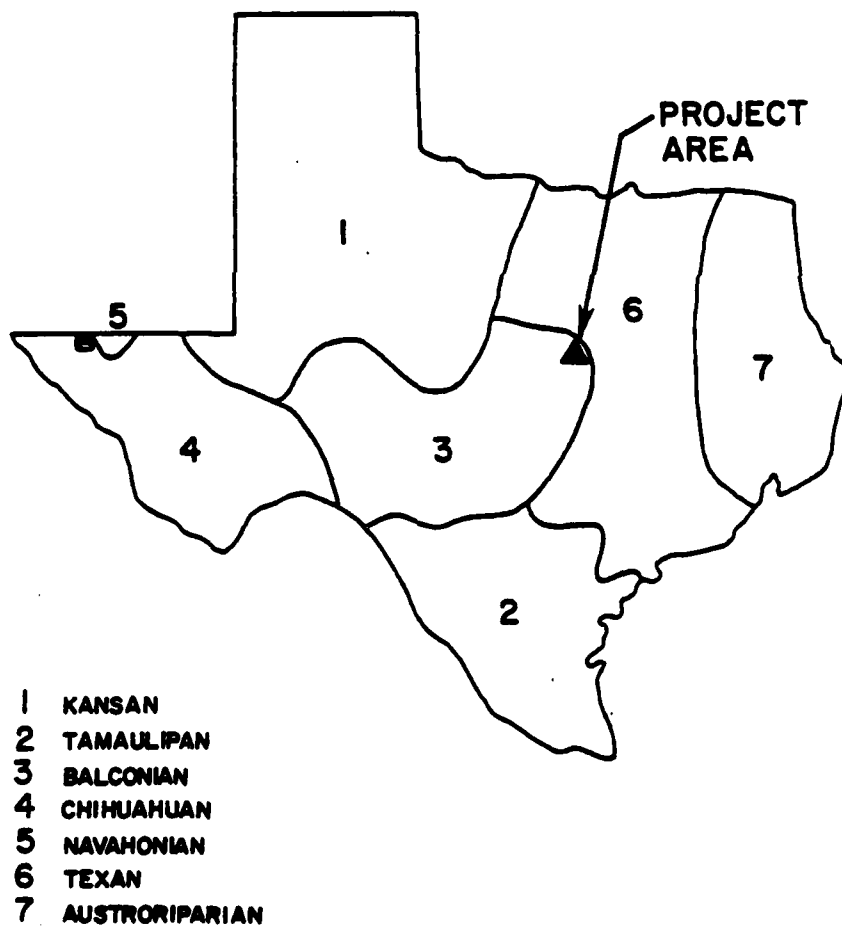


Figure 5. Biotic provinces of Texas.

Upland Woodland

The most characteristic vegetational association (and thus wildlife habitat) of the Balconian Biotic Province is a scrub forest composed of species of juniper and oaks, and other less dominant species.¹⁸ This habitat predominates in the Fort Hood area. The physical appearance of this forest varies, depending to some extent on the amount of physical disturbance which has occurred in any given area. It also varies according to the relative abundance of the dominant species. Rather distinct subdivisions can be recognized between areas having a high density of Ashe juniper (*Juniperus ashei*) as opposed to areas having mostly deciduous species. Areas with high densities of large old juniper are essential as nesting habitat for the Golden-cheeked Warbler (*Dendroica chrysoparia*), a species whose entire breeding range is restricted to such suitable forests in Central Texas.

Vertebrate species, exclusive of fish, which are characteristic of this habitat are presented below. Those which are more characteristic of the juniper-dominated areas are marked with an asterisk.

Southern Prairie Lizard	Nine-banded Armadillo
Texas Spiny Lizard	Mourning Dove
Broad-banded Copperhead	Cardinal
Western Diamondback Rattlesnake	Bewick's Wren
Texas Patchnose Snake	Tufted Titmouse
Eastern Blackneck Garter Snake*	Black-capped Vireo*
Gray Fox	Golden-cheeked Warbler*
Bobcat	Rufous-crowned Sparrow
Eastern Woodrat	Painted Bunting
Deer Mouse	Ladder-backed Woodpecker
Texas Mouse	Brown Towhee
White-ankled Mouse	White-tailed Deer

Deciduous (Riparian) Woodland

Along the stream bottoms, canyons, and other more mesic areas are riparian forests composed mostly of live oaks, elms, hackberries, pecans, and in certain areas a Rocky Mountain species of maple. These riparian situations provide avenues for extending many Austroriparian species into the Fort Hood region. They are also prime habitat for game species such as the fox squirrel (*Sciurus niger*) and turkey (*Meleagris gallopavo*). Species typical of this habitat include:

Gray Treefrog	Carolina Wren
Four-lined Skink	White-eyed Vireo
Broad-banded Copperhead	Black-and-white Warbler
Virginia Opossum	Summer Tanager
Raccoon	Cardinal
White-tailed Deer	Eastern Wood Pewee
Fox Squirrel	Barred Owl
Deer Mouse	Screech Owl

¹⁸ W. F. Blair, "The Biotic Provinces of Texas," Tex. J. Sci. Vol 2 (1950), pp 93-117.

Turkey
Yellow-billed Cuckoo
Scissor-tailed Flycatcher

Downy Woodpecker

Grasslands, Rangelands, and Other Open Areas

This habitat category includes open areas in which trees are either few in number or entirely absent. Ground cover varies from sparse to heavy. Species composition and densities of the herbaceous plants indicate that many areas are overgrazed to some extent by cattle. Although grazing is allowed over most of Fort Hood, it is excluded from some enclosures, including a number of fenced wildlife food plots, as well as areas such as Gray's Airfield in West Fort Hood. These areas provide better food and cover for wildlife than most of the grazed or disturbed rangeland. Species which inhabit open areas include:

Ornate Box Turtle
Texas Horned Lizard
Spotted Whiptail
Western Coachwhip
Wheat Plains Narrowmouth Toad
Couch's Spadefoot
Eastern Green Toad
Coyote
Fulvous Harvest Mouse
Hispid Cotton Rat
Texas Mouse
Black-tailed Jackrabbit
Eastern Cottontail
Nine-banded Armadillo

Turkey Vulture
Bobwhite
Red-tailed Hawk
American Kestrel
Mourning Dove
Common Nighthawk
Scissor-tailed Flycatcher
Mockingbird
Loggerhead Shrike
Eastern Meadowlark
Lark Sparrow
Field Sparrow

Springs, Streams, Ponds, Reservoirs, and Other Aquatic Habitats

This habitat category includes Belton Lake, Leon River, Cowhouse Creek, other streams and their tributaries, and numerous ponds and springs scattered over Fort Hood. Streams are mostly intermittent and seasonal; however, portions of many contain water in the form of pools throughout most of the year when the streams are not actually flowing. Ponds, streams, and other aquatic habitats are not only important to resident wildlife, such as aquatic turtles, snakes, frogs, shorebirds, and other species, but also as a source of moisture for species in the surrounding habitats, particularly during extended dry periods. They provide essential breeding habitat for several amphibian species. Migrating and wintering waterfowl also frequent these habitats. Vertebrate species (exclusive of fishes) typical of this habitat are:

Red-eared Turtle
Diamondback Water Snake
Blotched Water Snake
Redstripe Ribbon Snake
Red-spotted Toad
Eastern Green Toad
Spotted Chorus Frog
Cricket Frog
Bullfrog

Nutria
Beaver
Pied-billed Grebe
Great Blue Heron
Great Egret
Green-winged Teal
Blue-winged Teal
Spotted Sandpiper
Western Sandpiper

Plains Leopard Frog
Rio Grande Leopard Frog
Raccoon
Northern Shoveler

Belted Kingfisher
American Widgeon
Lesser Scaup

Urban Areas

Urban areas at the Fort Hood Military Reservation include North Fort Hood, West Fort Hood, and the Main Cantonment Area. Although species diversity of the urban zones may be low in comparison to natural habitats, the densities of some species are often relatively high. The avifauna of urban areas may, in fact, have higher densities than adjacent native habitats, although the species diversity is much lower.¹⁹ The quality of urban areas as wildlife habitat depends on many factors, including the types and densities of plant species and the types of structures present. Species adapted to urban environments at Fort Hood include:

Woodhouse's Toad
Texas Brown Snake
Big Brown Bat
Raccoon
House Mouse
Black Rat
Norway Rat
Starling
House Sparrow

Rock Dove
Common Nighthawk
Chimney Swift
Purple Martin
Blue Jay
Mockingbird
Common Grackle

Wildlife Species

Quantitative and/or qualitative surveys of amphibians, reptiles, birds, and mammals were conducted during August and September 1978 and April and May 1979. An initial 2-day reconnaissance (9 to 10 August) was followed by fall wildlife surveys between 21 and 25 August and from 28 August to 1 September; an additional fall reconnaissance was made on 9 and 10 September. Spring surveys were conducted between 11 April and 3 May 1979. Seven sites were quantitatively sampled for terrestrial vertebrates (Figure 6); the Appendix describes the sampling methods used.

Amphibians and Reptiles

Table 9 lists amphibian and reptile species whose geographic range includes the Fort Hood area, their general habitat preference, and the species observed during the field surveys. Of the 79 potentially occurring species, 28 (35 percent) were actually observed. Species with eastern affinities which were observed were the Blanchard's cricket frog (*Acris crepitans*), gray treefrog (*Hyla versicolor* or *H. chrysoscelis*), and bullfrog (*Rana catesbeiana*). Other species observed which are characteristic of the Galconian Biotic Province, most of which have western affinities, include the Texas greater earless lizard (*Cophosaurus texanus*), collared lizard (*Crotophytus collaris*), spotted

¹⁹ C. W. Sexton, personal communication, Department of Zoology, University of Texas, Austin (1978).

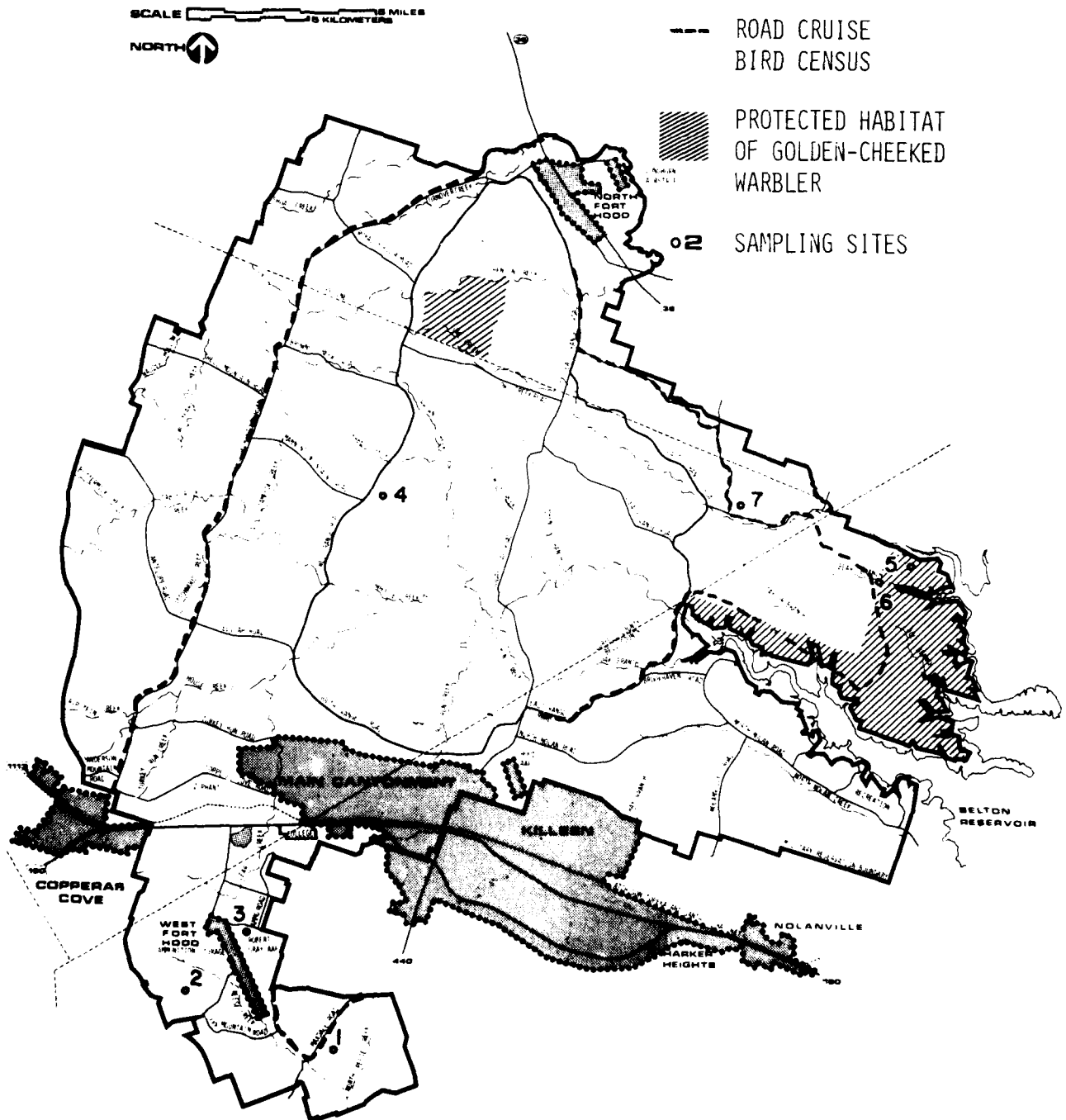


Figure 6. Wildlife sampling sites.

whiptail (Cnemidophorus gularis), great plains ground snake (Sonora episcopa), western diamondback rattlesnake (Crotalus atrox), green toad (Bufo debilis), red-spotted toad (Bufo punctatus), and great plains narrowmouth toad (Gastrophyne olivaceus). Species observed which have southern affinities include the Texas spiny lizard (Sceloporus olivaceus), four-lined skink (Eumeces tetragrammus), Rio Grande leopard frog (Rana berlandieri), and Texas patchnose snake (Salvadora grahamiae).

On 30 August 1978, researchers observed ponds containing singing green toads, red-spotted toads, spotted chorus frogs, great plains narrowmouth toads, Rio Grande leopard frogs, and Blanchard's cricket frogs. Recent rains had apparently created conditions conducive to breeding in these species.

The eastern black-necked garter snake (Thamnophis cyrtopsis) was not previously reported for Bell County by Raun and Gehlbach²⁰ or by Beaty;²¹ however, Potter²² reported that he had observed the species in the Fort Hood area. The single specimen observed in this survey was collected in a "cedar brake" north of Belton Lake.

Birds

Table 10 lists the avian species whose geographic ranges include the Fort Hood Military Reservation, their probable seasonal occurrence, their habitat preference, and the relative abundance of the species actually observed during the field surveys. Eighty species of birds were observed during the fall census, despite the fact that most were either in molt, not singing, or migrating silently through the area. The spring survey added an additional 47 species to the list of birds observed. The most notable species observed were the Roseate Spoonbill (Ajaia ajaja), the Osprey (Pandion haliaetus), and the Peregrine Falcon (Falco peregrinus). An immature Roseate Spoonbill was observed feeding and roosting at a drainage pond north of the Main Cantonment Area on 28, 29, and 30 August and on 9 September 1978. This normally coastal species is a late summer and fall straggler in north central Texas and has been taken four times in Oklahoma and once in Kansas.²³ It is possible that recent tropical storms in the Gulf of Mexico caused the young bird to stray from its normal range. Post-breeding wandering is common in this species, particularly among first- and second-year birds. Beaty²⁴ reported other recent observations of the species in the area. The Peregrine Falcon is an endangered species which is a rarely observed migrant in the Fort Hood area.

²⁰ G. Raun and F. R. Gehlbach, "Amphibians and Reptiles in Texas," Dallas Mus. of Nat. Hist., Bulletin 2 (1972).

²¹ H. E. Beaty, A Checklist of Flora and Fauna in Central and West Bell County, Texas, unpublished manuscript (3414 Forest Trail, Temple, TX, 1978a).

²² F. Potter, personal communication, Texas Parks and Wildlife Department, Austin (1978).

²³ G. M. Sutton, Oklahoma Birds (Univ. of Oklahoma Press, Norman, 1967); H. C. Oberholser, The Bird Life of Texas, Vol. 1 and 2 (University of Texas Press, 1974).

²⁴ H. E. Beaty, A Checklist of Flora and Fauna in Central and West Bell County, Texas, unpublished manuscript (3414 Forest Trail, Temple, TX, 1978a).

Beaty²⁵ reported one in 1976 in an area a few miles from Fort Hood. The single bird observed in this survey was seen perched in a dead tree in the Owl Creek Mountains, north of Belton Lake. In woodland habitats, the Peregrine feeds mainly on small and medium-sized birds such as goatsuckers, jays, woodpeckers, and blackbirds, while in open grassland habitats, it feeds on meadowlarks and sparrows.²⁶ The Osprey, which is an endangered species (see Table 21, p 87), was an adult individual seen several times in the vicinity of Bear Creek near Belton Lake.

An analysis of the Emlen transect bird census data (Tables 11 through 15) indicated species richness (Whittaker's species diversity/richness index) to be the greatest in the riparian woodland ($d=4.04$, Station 6) and lowest in the grazed grassland ($d=1.31$, Station 1). Intermediate were the deciduous/juniper woodland ($d=2.37$, Station 2) and the juniper woodland ($d=2.20$, Station 5). These results were expected, since species diversity tends to increase in relation to the habitat's complexity. The vertical aspect of a forest (particularly a tall riparian forest), provides a number of ecological niches which are lacking in open grassland habitats. The species richness in the burned mixed deciduous/juniper woodland ($d=1.37$, Station 4) was much lower than that of the undisturbed mixed woodland and only slightly higher than that of the grazed grassland.

The Whittaker's species diversity/richness index was not calculated for the spring data. This index requires that a study area of specific size be thoroughly searched and that all species within that area (within reasonable searching time constraints) be identified. Data for Emlen's transit bird census method are not gathered from an area of specific size, since each species has its own survey area strip width (see Table 11). Therefore, these data are not presented since they would lend credence to using those methods concurrently.

The estimated fall densities of small birds based on transect results, was 823 per 100 ha in riparian woodland, 210 per 100 ha in mixed woodland, 298 per 100 ha in juniper woodland, and 93 per 100 ha in grazed grassland (Tables 11 through 15). Density in the disturbed woodland was 305 per 100 ha; however, one species, the Cardinal (*Cardinalis cardinalis*), accounted for about two-thirds of the total density (Table 15). Overall, the estimated fall densities of birds in the Fort Hood area were low in comparison to estimated densities in other habitats in central and south Texas. The low density estimates could be due in part to the general inactivity of some species and to the irregularity of the daily activity patterns of others at the time of year in which the censuses were conducted.

The estimated spring densities were considerably higher than the fall densities in all habitats except the disturbed woodland. Lower densities cannot be caused by avian seasonal or daily inactivity patterns, since the Emlen transect census method, when used properly, must count all birds within the strip designated by the field personnel. Low fall densities may have been caused by the reduced availability of food, since the survey was conducted

²⁵ H. E. Beaty, personal communication, Temple, Texas (1978b).

²⁶ H. C. Oberholser, The Bird Life of Texas, Vol. 1 and 2 (University of Texas Press, 1974).

toward the end of an extreme drought. The higher, more normal densities were due to the winter and spring moisture reviving the area. Densities were higher in the undisturbed woodlands, particularly those with good oak populations. Juniperus sp. and other coniferous species do not provide as much edible vegetation as oaks; therefore, populations like those at Fort Hood can be expected to be lower. Grasslands are only a single stratum and can easily be less productive for bird life, and when there is grazing, a reduction in bird populations is expected; however, just the fact that the woodlands were disturbed may account for the lower populations.

Tables 16 and 17 present the results of the road-cruise censuses. The Cardinal was the most widespread, abundant species observed during the fall and spring cruises on both the east and west sides. Other widespread species on the east side were the Mourning Dove, Carolina Chickadee, and Mockingbird. In the fall, the Lark Sparrow and Tufted Titmouse were noted, and the Eastern Meadowlark, Field Sparrow, and Brown-headed Cowbird were observed in the spring. Other widespread species on the west side were the Carolina Chickadee, Turkey Vulture, and Mockingbird in the fall, and the Tufted Titmouse, Eastern Meadowlark, Lark Sparrow, Killdeer, Mourning Dove, and Redwinged Blackbird in the spring. The most abundant birds on the east side were the Cardinal, Carolina Chickadee, Mourning Dove, and Turkey Vulture in the fall and the Cardinal, Mourning Dove, Mockingbird, Lark Sparrow, Tufted Titmouse, and Eastern Meadowlark in the spring. The most abundant birds on the west side were the Cardinal, Carolina Chickadee, and Turkey Vulture in the fall, and the Cardinal, Mockingbird, Eastern Meadowlark, Lark Sparrow, Mourning Dove, and Redwinged Blackbird in the spring.

Mammals

Table 18 lists mammals whose known geographic range includes the Fort Hood area, the habitats in which they generally occur, and the species observed at Fort Hood. Common species observed during general reconnaissance included the raccoon (Procyon lotor), white-tailed deer, and black-tailed jack rabbit (Lepus californicus) during the fall, and the raccoon, white-tailed deer, and eastern cottontail in the spring. Raccoon tracks were common in upland woodland as well as in the riparian areas, which they normally prefer. White-tailed deer were observed in a variety of habitats, although none were observed in strictly grassland areas. Black-tailed jack rabbits were observed mainly in open areas; much of Fort Hood provides good habitat for this species, which prefers overgrazed rangeland to thickly vegetated grasslands.

Figure 6 shows the small mammal trapping locations, and Table 19 gives the trapping results. The deer mouse (Peromyscus maniculatus) was by far the most common (90 percent of 102 total catches) of the four species captured during the fall survey. It was abundant in both juniper woodland (Station 5) and mixed woodland (Station 2). The deer mouse was the only species captured in the riparian woodland (Station 6), disturbed woodland (Station 4), grazed grassland (Station 1), and the food plot (Station 7), although its numbers were much lower in these habitats than in the woodland habitats. The deer mouse, captured at only rare intervals during the spring survey, made up less than 2 percent of the total catch. Second in abundance during the fall survey was the hispid cotton rat (Sigmodon hispidus) which made up about 6 percent of the catch. This species was most common in the ungrazed grassland (Station 3); however, one individual was taken in mixed woodland. The eastern wood rat

(Neotoma floridana) composed about 3 percent of the catch and was collected in mixed and juniper woodland. Neither the cotton rat nor the wood rat were taken during the spring survey. The two golden harvest mice (Reithrodontomys fulvescens) captured were taken in the ungrazed grassland during the fall survey and in the riparian woodland during the spring.

The Texas Mouse (Peromyscus attwateri), the most common small mammal taken during the spring survey, prefers the mixed deciduous-juniper woodland and disturbed woodland. It was also found in relatively low numbers in the juniper woodlands and ungrazed grassland. The most abundant small mammal observed during the spring survey was the White-ankled Mouse (Peromyscus pectoralis). It was taken in similar numbers in the same habitat as the Texas Mouse, except that it was also found in the grazed grassland. The Merriam Pocket Mouse (Perognathus flavus) was taken in small, but significant numbers in the disturbed woodlands. This mouse is normally a desert dweller and has apparently become resident in the disturbed woodlands, where training has created an "artificial" desert. Other small mammals taken during the spring survey were the Plains Harvest Mouse (Reithrodontomys montanus), the Northern Pygmy Mouse (Baiomys taylori), and an immature Eastern Cottontail (Sylvilagus floridanus), but their numbers were so small (one each) that they could not be used as indicators. One curious development during the analysis of the small mammal trapping data was the discrepancy between the numbers of Deer Mice observed (90 percent of the fall small mammal population, and less than 2 percent of the spring population), and the presence of the Texas Mouse and White-ankled Mouse in the spring census, but not in the fall. This is very unusual and is difficult to explain biologically.

The habitats showing the highest fall small mammal populations, as indicated by trapping, were the juniper woodland (20.4 percent success) and mixed woodland (18.1 percent success). Trapping in the disturbed woodland was considerably less productive (4.7 percent). Ungrazed grassland showed 5.8 percent trapping success as opposed to only 0.4 percent in the grazed grassland. The low trapping success (1.0 percent) in the riparian woodland was somewhat unexpected; however, it may have been due in part to periodic flooding of the low areas sampled.

All areas showed a low trapping success rate in the spring census. This is a fairly common occurrence resulting from the climatic conditions. The trapping success rate in undisturbed juniper woodland was almost twice as high as in any other habitat, but this is not statistically significant.

Table 20 gives the results of the 64-km nocturnal road-cruise census. The white-tailed deer, raccoon, and black-tailed jack rabbit were the most common species seen during the fall cruise. Only one eastern cottontail was observed during the night census. The spring nocturnal road-cruise census showed similar results, except that the high recordings of the Black-Tailed Jack Rabbit were replaced by similarly high recordings of the Eastern Cottontail. It is significant that no coyotes (Canis latrans) were observed either during the quantitative road census or during any other nighttime road hunts. Considering the lack of observations of this species, it seems unlikely that Fort Hood harbors an unusually high coyote population. Support for this statement is provided by the fact that during a 1-year period from 1 March

1977 to 1 March 1978, two trappers caught only 19 coyotes in 2080 manhours of predator control on the reservation.²⁷

A 64-km diurnal road-cruise census conducted by the Fort Hood Fish and Wildlife Section in the fall of 1977 counted 0.76 white-tailed deer per km, 0.28 black-tailed jack rabbits per km, and 0.25 eastern cottontails per km.

Important Species

Chapter 2 provides a detailed definition of important species.

Recreationally or Commercially Important Species

Several species of mammals and birds are hunted on the Fort Hood Military Reservation, and therefore represent an important recreational and economic resource. According to Fort Hood records, the estimated hunter days for deer, quail, turkey, and waterfowl in 1974 were 21,470.

The white-tailed deer is the most important big game mammal in Texas.²⁸ It requires forested stands containing good shrub layers which provide food and cover. Edge situations are often favored for browsing. Twigs of shrubs and trees, acorns, and various herbs and grasses make up the majority of the deer's diet; however, food habits may vary somewhat regionally and seasonally. White-tailed deer populations at Fort Hood are relatively high and have been estimated as follows: 1975 -- one deer per 3.87 ha; 1976 -- one deer per 5.77 ha; 1977 -- one deer per 8.32 ha.²⁹ A 64-km daytime game census conducted by Fort Hood's Fish and Wildlife Section showed an average of 0.76 deer observed per km in 1977. The nocturnal road-cruise census conducted in the present studies resulted in observations of about 0.11 deer per km in the fall and 0.36 deer per km in the spring. Deer harvest during the 1977-1978 season at Fort Hood was 881.³⁰ This is down from 1495 in 1976 and 2602 in 1975; however, a downward trend in annual deer harvest is evident statewide.³¹

The fox squirrel is an important small game mammal over much of the state, particularly to the east. Oak mast provides the bulk of the diet for this species, which inhabits woodlands, groves, and savanna. At the Fort Hood Military Reservation, the fox squirrel predominantly inhabits riparian-type forests. By 1974, 360 artificial squirrel nests had been placed in hardwood trees at Fort Hood to increase the breeding potential of this species.

²⁷ Fort Hood Fish and Wildlife Section, Fort Hood, Texas, personal communication (1978).

²⁸ W. B. Davis, The Mammals of Texas, Bulletin 41 (Texas Parks and Wildlife Department, Austin, 1974).

²⁹ Fort Hood Fish and Wildlife Section, Fort Hood, Texas, personal communication (1978).

³⁰ C. L. Knight, Deer and Turkey Kill by Area 1977-1978 (Fish and Wildlife Section, Fort Hood, Texas, 1978).

³¹ Texas Parks and Wildlife Department, Job No. 4: Big Game Harvest Regulations (White-Tailed Deer Harvest Surveys), Federal Aid Project No. W-109-R-1 (Texas Parks and Wildlife Department, 1978a).

Although quantitative estimates of squirrel populations are lacking, field observations during the current surveys suggest that squirrel densities are low to moderate over most of the reservation.

The eastern cottontail and the black-tailed jack rabbit, although not strictly defined as game animals, are hunted throughout their ranges in Texas. Eastern cottontails occur in a variety of habitats, including open areas and woodlands; however, they tend to be most abundant along edges. Early morning road-cruise game censuses on Fort Hood have observed 0.25 cottontails per km in 1977, 0.66 per km in 1976, and 0.76 per km in 1975.³² The nighttime road-cruise census during the current studies indicated only 0.02 per km in the fall and 0.16 per km in the spring. The numbers of black-tailed jack rabbits observed by Fort Hood Fish and Wildlife Section biologists during game censuses were 0.42 per km in 1975, 0.40 per km in 1976, and 0.28 per km in 1977.³³ During the night census of this study, 0.11 jack rabbits per km were observed in the fall and 0.02 per km in the spring.

Furbearers (e.g., raccoon, opossum, gray fox, coyote, striped skunk, bobcat, and others) are of some economic and recreational importance in Texas. On a statewide basis, furbearers harvested during the 1976-1977 season had an estimated value in excess of \$16.2 million.³⁴ The raccoon was the most commonly observed furbearer during this study. Other furbearers observed included the gray fox, striped skunk, and opossum. Fort Hood Fish and Wildlife Section trappers captured 19 coyotes and 1 bobcat between 1 March 1977 and 1 March 1978; these numbers are low, considering the time period and number of man-hours (2080) expended in the trapping efforts.

The Bobwhite is an important game bird over much of Texas. It prefers open areas and edges which provide grasses and herbs for food, and dense, low woody, and herbaceous vegetation for cover. Bobwhite appear to be fairly common in such habitats at Fort Hood. The Fort Hood Fish and Wildlife Section road census data showed fall populations of 0.25 Bobwhite per km in 1977; data from the present studies showed 0.20 per km on the west side, and 0.05 per km on the east side. Results of the spring cruise showed Bobwhite 0.24 per km on the west side, 0.12 per km on the east side. The fall density, based on the Emlen transect in grazed grassland, was 39.6 Bobwhite per 100 ha. Spring transects showed Bobwhite in all areas except disturbed woodlands and the deciduous-juniper woodland.

The Mourning Dove is the most widespread and abundant gamebird in Texas. Doves seem to prefer semi-open country and edges, but are also common in heavily wooded areas and extensively cultivated prairies. They typically nest in wooded vegetation and feed in more open areas. The Mourning Dove was among the most common species observed during the present surveys. Census data from the 29 August 1978 road cruise in mixed-woodland showed 0.75 doves per km on the east side and 0.22 per km on the west side. A 1977 census by the Fort Hood Fish and Wildlife

³² Fort Hood Fish and Wildlife Section, Fort Hood, Texas, personal communication (1978).

³³ Fort Hood Fish and Wildlife Section.

³⁴ Texas Parks and Wildlife Department, Job No. 13: Evaluation of the Annual Fur Harvest, Federal Aid Project No. W-103-R-7 (Texas Parks and Wildlife Department, 1978b).

Section showed 0.65 doves per km. These figures approach the statewide average of 0.85 per km between 1966 and 1977.

The Turkey is an important game bird in certain areas of Texas where it has been reintroduced. Turkeys prefer to nest in woody vegetation which is at least 45 cm high. They feed on acorns, fruits, and seeds. The Turkey population, estimated to be 1430 at Fort Hood during 1977, is most commonly found in riparian woodland. During the present study, 11 Turkeys were seen during the road-cruise census on the west side of Fort Hood.

Several species of waterfowl are likely to use suitable aquatic habitats on Fort Hood during the proper seasons. While most individuals migrate to areas further south, some (e.g., Blue-winged Teal, Mallard, and Green-winged Teal) often take up winter residence in the area. Table 10 lists species which might be expected in the area.

Threatened and Endangered Species

Several species considered to be endangered, threatened, or peripheral by the Texas Organization for Endangered Species, the Texas Parks and Wildlife Department, and/or the U.S. Department of the Interior may be found in the Fort Hood region. Table 21 lists these species and their status.

Of the 12 species listed, only two are considered endangered by the U.S. Department of the Interior: the Bald Eagle (*Haliaeetus leucocephalus*) and the Peregrine Falcon. The Peregrine Falcon, which was observed during the present studies, breeds in the North American tundra and generally winters in Central and South America; it is a rare migrant through the Fort Hood area. The single Peregrine observed during the fall survey probably used the reservation as a temporary resting place and may have preyed to some extent on small birds and rodents of the area. Beaty³⁵ reported a sighting of this species in 1976 in the Fort Hood area. Decline of this species has been attributed to the buildup of chlorinated hydrocarbon pesticides in the environment.³⁶

The Bald Eagle is generally found in coastal areas or around large inland bodies of water. Belton Lake provides suitable habitat in the Fort Hood area. Between 1971 and 1976, nine Bald Eagle sightings were reported from Bell County (all in 1972 and 1973), and none were reported from Coryell County.³⁷ Although the species once bred over most of the state, its Texas breeding range is now restricted mainly to coastal areas.³⁸ It should be considered a rare, but possible, winter resident in the Fort Hood area.

³⁵ H. E. Beaty, personal communication, Temple, Texas (1978b).

³⁶ J. J. Hickey and D. W. Anderson, "Chlorinated Hydrocarbons and Eggshell Changes in Raptorial and Fish-Eating Birds," *Sci.*, No. 162 (1968), pp 271-273.

³⁷ Texas Parks and Wildlife Department, Job No. 30: Bald Eagle-Osprey Survey, Federal Aid Project No. W-103-R-6 (Texas Parks and Wildlife Department, 1976).

³⁸ H. C. Oberholser The Bird Life of Texas, Vol. 1 and 2 (University of Texas Press, 1974).

In addition to the Peregrine Falcon and Bald Eagle, the Texas Parks and Wildlife Department³⁹ considers a subspecies of the Least Tern (*Sterna albi-frons athallossos*) to be endangered. This bird may migrate through the Fort Hood area; however, breeding is highly unlikely, since the southern limits of its believed breeding range lie just north of Fort Hood.⁴⁰ In addition, suitable nesting habitats (sandy flats or bars along rivers) are not present at Fort Hood.

A species of special concern is the Golden-cheeked Warbler, which TOES considers to be endangered. This species has a breeding range restricted to suitable mature (more than 50 years old) Ashe juniper habitats in central Texas.⁴¹ Urbanization and clearing of old juniper stands for posts are suspected reasons for the endangered status of this species. Fort Hood has significant areas of good Golden-cheeked Warbler habitat; however, the actual distribution of the species at Fort Hood could not be determined in this study, since it is a spring and early summer resident. Much of its habitat has been protected from disturbance by a U.S. Army agreement to limit activities in designated areas during the breeding season, as well as to prevent commercial cutting of juniper in the Golden-cheeked Warbler's habitat at all times. Figure 6 indicates these protected areas; care should be taken to prevent unauthorized activities in these habitats. Pulich states that Fort Hood can probably support one pair of Golden-cheeked Warblers per 20 ha.

The Osprey (*Pandion haliaetus*) is another endangered species (according to TOES) which may be found in the Fort Hood area. This fish-eating hawk is found along sea coasts, rivers, and lakes. Recent breeding records for Texas are extremely sparse; however, wintering and migrating individuals may occasionally use Belton Lake for feeding. Between 1971 and 1976, 39 Osprey sightings were reported in Bell County, while none were reported in Coryell County.⁴² One was seen on several occasions during the spring survey near Belton Lake.

The Roseate Spoonbill (peripheral, according to TOES) is a predominantly coastal species. Some individuals (particularly first- and second-year birds) may wander northward after the breeding season.⁴³ An immature of this species was observed feeding and roosting in a shallow pond just north of the Main

³⁹ Texas Parks and Wildlife Department, Regulations for Taking, Possessing, Transporting, Exporting, Processing, Selling or Offering for Sale, or Shipping Endangered Species, 127.30.09.001-006 as amended July 1977 (Texas Parks and Wildlife Department, 1977).

⁴⁰ H. C. Oberholser, The Bird Life of Texas, Vol. 1 and 2 (University of Texas Press, 1974).

⁴¹ W. M. Pulich, The Golden-Cheeked Warbler (Texas Parks and Wildlife Department, Austin, 1976).

⁴² Texas Parks and Wildlife Department, Job No. 30: Bald Eagle-Osprey Survey, Federal Aid Project No. W-103-R-6 (Texas Parks and Wildlife Department, 1976).

⁴³ H. C. Oberholser, The Bird Life of Texas, Vol. 1 and 2 (University of Texas Press, 1974).

Cantonment Area on several days during the field surveys. Beaty⁴⁴ reported other recent sightings of the species in the same general area. This species probably occurs only irregularly at Fort Hood and should not be considered a seasonal resident. Other irregularly or doubtfully occurring species in the Fort Hood area are the White-faced Ibis (Plegadis chihi) (threatened according to TOES) and the Fulvous Whistling Duck (Dendrocygna bicolor) (endangered according to TOES).

TOES considers the Prairie Falcon (Falco mexicanus) and the Merlin (Falco columbarius) to be threatened. The Prairie Falcon is a bird of the prairies, plains, and deserts, in contrast to the coast-, woods-, and mountain-seeking Peregrine Falcon.⁴⁵ Oberholser states that the Prairie Falcon is "uncommon to scarce in the western third (of Texas); increasingly rare and irregular eastward to 96th meridian and upper coast." It is highly unlikely that it will use the Fort Hood area to a large extent, although its occurrence there would not be totally unexpected. The Merlin is found in woodland openings and edges of lakes, rivers, ponds, and marshes.⁴⁶ It may occur as a rare migrant or winter resident at Fort Hood.

The only mammal considered to be endangered or threatened which might be observed at Fort Hood is the mountain lion (Felis concolor) (endangered, according to TOES). This species occurs sparsely over much of the state in brushy or wooded deer habitat.⁴⁷ It is possible that this species be found in the Fort Hood area; however, due to the large amount of activity in the area, it would seem unlikely that a mountain lion could remain undetected if it were present.

No threatened or endangered amphibians or reptiles are expected to be found at Fort Hood.

Other Important Species

No species found at Fort Hood fall under criteria (3) and (4) defined in Chapter 2 (p 24). All of the above-mentioned "important species" have varied food habits and do not depend solely on another single species.

Energy flows from primary producers (plants) through primary, secondary, and tertiary consumers. Scavengers derive energy from any level, a large part of their diets being carrion. Many of the species listed for a given trophic level may actually function at several levels depending on the season and food availability. Rodents consume insects as well as vegetation. Seed-eating songbirds harvest insects to feed nestlings. Raccoons, skunks, opossums, and many other species are omnivorous. Singularly, none of these species is critical to the structure or function of the ecosystem. A change in the abundance of one species will result in compensatory changes in other species'

⁴⁴ H. E. Beaty, personal communication, Temple, Texas (1978b).

⁴⁵ H. C. Oberholser The Bird Life of Texas, Vol. 1 and 2 (University of Texas Press, 1974).

⁴⁶ H. C. Oberholser, The Bird Life of Texas, Vol. 1 and 2 (University of Texas Press, 1974).

⁴⁷ W. B. Davis, The Mammals of Texas, Bulletin 41 (Texas Parks and Wildlife Department, Austin, 1974).

populations so that the overall pattern of energy flow is not adversely affected.

Significance of Local Wildlife

The terrestrial vertebrate fauna of the Fort Hood Military Reservation are generally typical of central Texas. The presence of habitat for the endangered (according to TOES) Golden-cheeked Warbler is significant due to the limited range of the species and the relatively fast pace at which suitable juniper habitats are being encroached upon. Protection of Golden-cheeked Warbler habitat should be of prime importance. No other resident faunal species of special scientific importance or limited distribution was found on the reservation.

Hunting and trapping at Fort Hood provide many man-days of recreation and, as such, provide an important economic resource for the area.

Table 9
Reptiles and Amphibians--Fort Hood

Common Name*	Scientific Name	General Habitat Preference	Observed in Project Area
Common snapping turtle	<u>Chelydra serpentina</u>	S	
Stinkpot	<u>Stenotherus odoratus</u>	S	
Yellow mud turtle	<u>Kinosternon flavescens</u>	S	
Texas river cooter	<u>Chrysemys concinna</u>	S	
Red-eared turtle	<u>Chrysemys scripta</u>	S	X0
Three-toed box turtle	<u>Terrapene carolina</u>	G,F	
Ornate box turtle	<u>Terrapene ornata</u>	G	
Spiny softshell	<u>Trionyx spiniferus</u>	S	
Smooth softshell	<u>Trionyx muticus</u>	S	
Green anole	<u>Anolis carolinensis</u>	B,F	
Collared lizard	<u>Crotophytus collaris</u>	rocky areas	X0
Texas horned lizard	<u>Phrynosoma cornutum</u>	G	0
Eastern earless lizard	<u>Holbrookia maculata</u>	G	
Texas greater earless lizard	<u>Cophosaurus texanus</u>	open, rocky or gravelly areas	X
Eastern tree lizard	<u>Urosaurus ornatus</u>	trees or rocks	
Texas spiny lizard	<u>Sceloporus olivaceus</u>	B,F	X0
Southern prairie lizard	<u>Sceloporus undulatus</u>	B,F	
Ground skink	<u>Scincella lateralis</u>	F	0
Great plains skink	<u>Eumeces obsoletus</u>	G	
Four-lined skink	<u>Eumeces fetragrammus</u>	G,B,F	X0
Five-lined skink	<u>Eumeces fasciatus</u>	G,B,F	0
Southern prairie skink	<u>Eumeces septentrionalis</u>	G,B,F	
Texas spotted whiptail	<u>Cnemidophorus gularis</u>	G,B	X
Prairie-lined racerunner	<u>Cnemidophorus sexlineatus</u>	G,B	
Western slender glass lizard	<u>Ophisaurus attenuatus</u>	G	
Diamondback water snake	<u>Nerodia rhombifera</u>	S	X0

¹Distributions follow Conant (1975) and Raun and Gehlback (1972); nomenclature follows Collins et al. (1978).

²Habitat preference

³General reconnaissance survey conducted 6-7 March 1979.

S - aquatic associated habitats
G - grasslands and other open areas
B - brushlands
F - forest and woodlands

X = observed Fall 1978
0 = observed Spring 1979

*For an explanation of terminology in table headings, see the appendix.

Table 9 (Cont'd)

Common Name	Scientific Name	General Habitat Preference	Observed in Project
Blotched water snake	<u>Nerodia erythrogaster</u>	S	X
Texas garter snake	<u>Thamnophis sirtalis</u>	S,G,F	
Checkered garter snake	<u>Thamnophis marcianus</u>	S	
Eastern blackneck garter snake	<u>Thamnophis cyrtopsis</u>	rocky hillsides, limestone hillsides, & cedar brakes	X (new county record)
Redstripe ribbon snake	<u>Thamnophis proximus</u>	S	X
Plains blind snake	<u>Leptotyphlops dulcis</u>	subterranean, stony hillsides & prairies	
Texas lined snake	<u>Tropidoclonion lineatum</u>	G,F	
Rough earth snake	<u>Virginia striatula</u>	G,F	
Smooth earth snake	<u>Virginia valeriae</u>	G	
Texas brown snake	<u>Storeria dekayi</u>	S,F,G,B,	
Eastern hognose snake	<u>Heterodon platyrhinos</u>	G	
Western hognose snake	<u>Heterodon nasicus</u>	G	
Ringneck snake	<u>Diadophis punctatus</u>	S,F	
Rough green snake	<u>Opheodrys aestivus</u>	S,F,B	0
Eastern yellowbelly racer	<u>Coluber constrictor</u>	G,B,F	
Western coachwhip	<u>Masticophis flagellum</u>	G,B	0
Texas patchnose snake	<u>Salvadora grahamiae</u>	G,B	X
Bullsnake	<u>Pituophis melanoleucus</u>	G	
Texas rat snake	<u>Elaphe obsoleta</u>	S,B,B,F	
Great plains rat snake	<u>Elaphe guttata</u>	rocky areas, hillsides	
Mexican milk snake	<u>Lampropeltis triangulum</u>	G	
Desert and/or speckled kingsnake	<u>Lampropeltis getulus</u>	S,G	
Great Plains ground snake	<u>Sonora episcopa</u>	S,G	
Longnose snake	<u>Rhinocheilus lecontei</u>	rocky hillsides	X
Flatheaded snake	<u>Tantilla gracilis</u>	G	
Texas night snake	<u>Hypsiglena torquata</u>	under rocks, debris, etc.	
Western cottonmouth	<u>Agkistrodon piscivorus</u>	G	
Broad-banded copperhead	<u>Agkistrodon contortrix</u>	S	
		S,F	

Table 9 (Cont'd)

Common Name	Scientific Name	General Habitat Preference	Observed in Project Area
Texas coral snake	<u>Micrurus fulvius</u>	cedar brakes, rocky areas	
Western massasauga	<u>Sistrurus catenatus</u>	G, rocky areas	
Timber rattlesnake	<u>Crotalus horridus</u>	B,F	
Western diamondback rattlesnake	<u>Crotalus atrox</u>	G,B,F rocky areas	0
Smallmouth salamander	<u>Ambystoma texanum</u>	S,F	
Barred tiger salamander	<u>Ambystoma tigrinum</u>	S,G	
Slimy salamander	<u>Plethodon glutinosus</u>	S,F	
Couch's spadefoot	<u>Scaphiopus couchi</u>	G,B	
Great plains narrow-mouth toad	<u>Gastrophryne olivacea</u>	G,B,F,S	
Woodhouse's toad	<u>Bufo woodhousei</u>	G,B,F,S	
Eastern green toad	<u>Bufo debilis</u>	G,B,S	
Texas toad	<u>Bufo speciosus</u>	G,B,S	
Red-spotted toad	<u>Bufo punctatus</u>	G,S, rocky areas	
Gulf coast toad	<u>Bufo valliceps</u>	G,B,F,S	
Gray treefrogs	<u>Hyla versicolor</u> and/or <u>H. chrysoscelis</u>	B,F,S	
Green treefrog	<u>Hyla cinerea</u>	F,S	
Strecker's chorus frog	<u>Pseudacris streckeri</u>	S,G,B,F	0
Spotted chorus frog	<u>Pseudacris clarki</u>	G,S	
Blanchard's cricket frog	<u>Acris crepitans</u>	S	X
Bullfrog	<u>Rana catesbeiana</u>	S	
Plains leopard frog	<u>Rana blairi</u>	G,S	
Rio Grande leopard frog	<u>Rana berlandieri</u>	G,B,F,S	

Table 10
Birds--Fort Hood

Common Name*	Scientific Name	Habitat Preference	Season	Abundance of Species Observed During Survey	
				Fall	Spring
Common Loon	<u>Gavia immer</u>	S	M,WR		
Horned Grebe	<u>Podiceps auritus</u>	S	M,WR		
Eared Grebe	<u>Podiceps nigricollis</u>	S	M,WR		U
Western Grebe	<u>Aechmophorus occidentalis</u>	S	M,WR		
Pied-billed Grebe	<u>Podilymbus podiceps</u>	S	M,R	U	
White Pelican	<u>Pelicanus erythrorhynchos</u>	S	M		
Double-crested Cormorant	<u>Phalacrocorax auritus</u>	S	M,WR		C
Anhinga	<u>Anhinga anhinga</u>	S	V		
Great Blue Heron	<u>Ardea herodias</u>	S	R	C	U
Great Egret	<u>Casmerodius albus</u>	S	SR	C	U
Snowy Egret	<u>Egretta thula</u>	S	SR		
Louisiana Heron	<u>Hydranassa tricolor</u>	S	M	C	
Green Heron	<u>Butorides virescens</u>	S	SR	C	U
Little Blue Heron	<u>Florida caerulea</u>	S	SR	U	
Cattle Egret	<u>Bubulcus ibis</u>	SG	R		
Black-crowned Night Heron	<u>Nycticorax nycticorax</u>	S	SR		
Yellow-crowned Night Heron	<u>Nyctanassa violacea</u>	S	SR	U	
American Bittern	<u>Botaurus lentiginosus</u>	S	M		
Least Bittern	<u>Ixobrychus exilis</u>	S	SR		
Wood Stork	<u>Mycteria americana</u>	S	M		
Roseate Spoonbill	<u>Ajaia ajaja</u>	S	C	U	
White-faced Ibis	<u>Plegadis chihi</u>	S	M		
Whistling Swan	<u>Olor columbianus</u>	S	WV		
Canada Goose	<u>Branta canadensis</u>	SG	M		
White-fronted Goose	<u>Anser albifrons</u>	SG	M		
Snow Goose	<u>Chen caerulescens</u>	SG	M		
Fulvous Whistling Duck	<u>Dendrocygna bicolor</u>	SG	C		

* For an explanation of terminology in table headings, see the appendix

Table 10 (Cont'd)

Common Name	Scientific Name	Habitat Preference	Season	Abundance of Species Observed During Survey	
				Fall	Spring
Mallard	<u>Anas platyrhynchos</u>	S	M,WR		
Black Duck	<u>Anas rubripes</u>	S	M,WR		
Mottled Duck	<u>Anas fulvigula</u>	S	V		
Gadwall	<u>Anas strepera</u>	S	M,WR		
Pintail	<u>Anas acuta</u>	S	M,WR		
Green-winged Teal	<u>Anas crecca</u>	S	M,WR	U	
Blue-winged Teal	<u>Anas discors</u>	S	M,R	C	U
Cinnamon Teal	<u>Anas cyanoptera</u>	S	M		
American Wigeon	<u>Anas americana</u>	S	M,WR		
Northern Shoveler	<u>Anas clypeata</u>	S	M,WR		U
Wood Duck	<u>Aix sponsa</u>	S	M,R		
Redhead	<u>Aythya americana</u>	S	M,WR		
Ring-necked Duck	<u>Aythya collaris</u>	S	M,WR		
Canvasback	<u>Aythya valisineria</u>	S	M,WR		
Greater Scaup	<u>Aythya marila</u>	S	M		U
Leaser Scaup	<u>Aythya affinis</u>	S	M,WR	U	
Common Goldeneye	<u>Bucephala clangula</u>	S	M,WR		
Bufflehead	<u>Bucephala albeola</u>	S	M,WR		
Oldsquaw	<u>Clangula hyemalis</u>	S	M		
White-winged Scoter	<u>Melanitta deglandi</u>	S	M		
Ruddy Duck	<u>Oxyura jamaicensis</u>	S	M,WR		
Hooded Merganser	<u>Lophodyts cucullatus</u>	S	M,WR		
Common Merganser	<u>Mergus merganser</u>	S	M,WR		
Red-breasted Merganser	<u>Mergus serrator</u>	S	M,WR		
Turkey Vulture	<u>Cathartes aura</u>	GRUE	R	A	C
Black Vulture	<u>Coragyps atratus</u>	GRUE	R	C	U
Mississippi Kite	<u>Ictinia mississippiensis</u>	GUE	M		U
Sharp-shinned Hawk	<u>Accipiter striatus</u>	RUS	M,WR		
Cooper's Hawk	<u>Accipiter cooperii</u>	GRUE	R		

Table 10 (Cont'd)

Common Name	Scientific Name	Habitat Preference	Season	Abundance of Species Observed During Survey	
				Fall	Spring
Red-tailed Hawk	<u>Buteo jamaicensis</u>	GRUE	R	U	
Red-shouldered Hawk	<u>Buteo lineatus</u>	RUE	R		
Ferruginous Hawk	<u>Buteo regalis</u>	GRUE	C		
Broad-winged Hawk	<u>Buteo platypterus</u>	UE	M		
Swainson's Hawk	<u>Buteo swainsoni</u>	GE	M,SR	U	
Rough-legged Hawk	<u>Buteo lagopus</u>	SG	M		U
Harris' Hawk	<u>Parabuteo unicinctus</u>	GU	R		
Golden Eagle	<u>Aquila chrysaetos</u>	GU	M,WR		
Bald Eagle	<u>Haliaeetus leucocephalus</u>	SR	M,WR		
Marsh Hawk	<u>Circus cyaneus</u>	SG	M,WR		U
Osprey	<u>Pandion haliaetus</u>	S	M		U
Caracara	<u>Caracara cheriway</u>	GUE	M		
Prairie Falcon	<u>Falco mexicanus</u>	G	M		
Peregrine Falcon	<u>Falco peregrinus</u>	G	M	U	
American Kestrel	<u>Falco sparverius</u>	G	M,WR	C	C
Merlin	<u>Falco columbarius</u>	SG	M,WR		
Bobwhite	<u>Colinus virginianus</u>	GUE	R	C	C
Turkey	<u>Meleagris gallopavo</u>	RUE	R	U	C
Sandhill Crane	<u>Grus canadensis</u>	G	M		
King Rail	<u>Rallus elegans</u>	S	SR		
Sora	<u>Porzana carolina</u>	S	M		
Purple Gallinule	<u>Porphyryla martinica</u>	S	M		
Common Gallinule	<u>Gallinula chloropus</u>	S	SR		
American Coot	<u>Fulica americana</u>	S	R		U
Semipalmated Plover	<u>Charadrius semipalmatus</u>	S	M		
Piping Plover	<u>Charadrius melodus</u>	S	M		
Snowy Plover	<u>Charadrius alexandrinus</u>	S	M		
Killdeer	<u>Charadrius vociferus</u>	SG	R	C	C
Mountain Plover	<u>Charadrius montana</u>	G	M		

Table 10 (Cont'd)

Common Name	Scientific Name	Habitat Preference	Season	Abundance of Species Observed During Survey	
				Fall	Spring
American Golden Plover	<u>Pluvialis dominica</u>	SG	M		
Black-bellied Plover	<u>Pluvialis squatarola</u>	SG	M		
American Woodcock	<u>Philohela minor</u>	RU	M		
Common Snipe	<u>Capella gallinago</u>	S	M,WR		U
Long-billed Curlew	<u>Numenius americanus</u>	SG	M		
Whimbrel	<u>Numenius phaeopus</u>	SG	M		
Upland Sandpiper	<u>Bartramia longicauda</u>	G	M		
Spotted Sandpiper	<u>Actitic macularia</u>	S	M	U	
Solitary Sandpiper	<u>Tringa solitaria</u>	SR	M	U	
Greater Yellowlegs	<u>Tringa melanoleucus</u>	S	M,WR		
Lesser Yellowlegs	<u>Tringa flavipes</u>	D	M,WR	U	
Willet	<u>Catoptrophorus semipalmatus</u>	S	M		
Red Knot	<u>Calidris canutus</u>	S	M		
Pectoral Sandpiper	<u>Calidris melanotos</u>	SG	M		
White-rumped Sandpiper	<u>Calidris fuscicollis</u>	SG	M		
Baird's Sandpiper	<u>Calidris bairdii</u>	S	M		
Least Sandpiper	<u>Calidris minutilla</u>	S	M,WR	U	
Dunlin	<u>Calidris alpina</u>	S	M		
Semipalmated Sandpiper	<u>Calidris pusillus</u>	S	M	U	
Western Sandpiper	<u>Calidris mauri</u>	S	M,WR	U	
Sanderling	<u>Calidris alba</u>	S	M		U
Short-billed Dowitcher	<u>Limnodromus griseus</u>	S	M		
Long-billed Dowitcher	<u>Limnodromus scolopaceus</u>	S	M		
Stilt Sandpiper	<u>Micropalama himantopus</u>	S	M		
Buff-breasted Sandpiper	<u>Tryngites subruficollis</u>	S	M		
Marbled Godwit	<u>Limosa fedoa</u>	SG	M		
Hudsonian Godwit	<u>Limosa haemastica</u>	S	M		
American Avocet	<u>Recurvirostra americana</u>	S	M	U	
Black-necked Stilt	<u>Himantopus mexicanus</u>	S	M,SR		

Table 10 (Cont'd)

Common Name	Scientific Name	Habitat Preference	Season	Abundance of Species Observed During Survey	
				Fall	Spring
Northern Phalarope	<u>Lobipes lobatus</u>	S	M		
Wilson's Phalarope	<u>Steganopus tricolor</u>	S	M		
Herring Gull	<u>Larus argentatus</u>	S	M,WR		
Ring-billed Gull	<u>Larus delawarensis</u>	S	M,WR		
Franklin's Gull	<u>Larus pipixcan</u>	SG	M		
Bonaparte's Gull	<u>Larus philadelphia</u>	S	M,WR		
Forster's Tern	<u>Sterna forsteri</u>	S	M		U
Least Tern	<u>Sterna albifrons</u>	S	M		
Black Tern	<u>Chlidonias niger</u>	S	M		
Mourning Dove	<u>Zenaida macroura</u>	GRUE	R	A	A
Ground Dove	<u>Columbina passerina</u>	GUE	C		
Inca Dove	<u>Scardafella inca</u>	G,H	R		
Rock Dove	<u>Columba livia</u>	H	R	C	C
Yellow-billed Cuckoo	<u>Coccyzus americanus</u>	RUE	M,SR	C	U
Black-billed Cuckoo	<u>Coccyzus erythrophthalmus</u>	UE	M		
Roadrunner	<u>Geococcyx californianus</u>	GU	R	C	
Groove-billed Ani	<u>Crotophaga sulcirostris</u>	U	C		
Barn Owl	<u>Tyto alba</u>	UEH	R		
Screech Owl	<u>Otus asio</u>	SU	R	U	
Great Horned Owl	<u>Bubo virginianus</u>	SU	R		U
Burrowing Owl	<u>Athene cunicularis</u>	G	R		
Barred Owl	<u>Strix varia</u>	RU	R	U	
Long-eared Owl	<u>Asio otus</u>	U	M,WR		
Short-eared Owl	<u>Asio flammeus</u>	SG	M,WR		
Chuck-will's-widow	<u>Caprimulgus carolinensis</u>	RUE	M,SR		C
Whip-poor-will	<u>Caprimulgus vociferus</u>	UE	M		
Poor-will	<u>Phalaenoptilus nuttallii</u>	RUE	M,SR	U	
Common Nighthawk	<u>Chordeiles minor</u>	GRUEH	M,SR	C	
Lesser Nighthawk	<u>Chordeiles acutipennis</u>	GRUEH	SR		

Table 10 (Cont'd)

Common Name	Scientific Name	Habitat Preference	Season	Abundance of Species Observed During Survey	
				Fall	Spring
Chimney Swift	<u>Chaetura pelagica</u>	UH	M,SR	U	U
White-throated Swift	<u>Aeronautes saxatalis</u>	UEH	C		
Ruby-throated Hummingbird	<u>Archilochus colubris</u>	GUH	M,SR		U
Black-chinned Hummingbird	<u>Archilochus alexandri</u>	GUH	M,SR		
--	<u>Archilochus sp. (includes two above species)</u>	GUH	M	U	
Rufous Hummingbird	<u>Selasphorus rufus</u>	GUH	M		
Belted Kingfisher	<u>Megaceryle alcyon</u>	S	R	C	
Common Flicker	<u>Colaptes auratus</u>	GUH	R		
Red-bellied Woodpecker	<u>Melanerpes carolinus</u>	UH	R	C	U
Golden-fronted Woodpecker	<u>Melanerpes aurifrons</u>	UH	R		
Red-headed Woodpecker	<u>Melanerpes erythrocephalus</u>	UH	R		
Hairy Woodpecker	<u>Picoides villosus</u>	U	M,WR		U
Downy Woodpecker	<u>Picoides pubescens</u>	U	R	C	U
Ladder-backed Woodpecker	<u>Picoides scalaris</u>	U	R	C	U
Yellow-bellied Sapsucker	<u>Sphyrapicus varius</u>	U	M,WR		
Eastern Kingbird	<u>Tyrannus tyrannus</u>	GUE	M,SR		U
Western Kingbird	<u>Tyrannus verticalis</u>	GUE	M,SR		
Scissor-tailed Flycatcher	<u>Muscivora forficata</u>	GUE	M,SR	C	C
Great Crested Flycatcher	<u>Myiarchus crinitus</u>	RU	M,SR	U	U
Ash-throated Flycatcher	<u>Myiarchus cinerascens</u>	U	M,SR		
Eastern Phoebe	<u>Sayornis phoebe</u>	SGHE	R		
Black Phoebe	<u>Sayornis nigricans</u>	SE	V		
Say's Phoebe	<u>Sayornis sayus</u>	GR	M,WR		U
Yellow-bellied Flycatcher	<u>Empidonax flaviventris</u>	RUE	M	U	
Acadian Flycatcher	<u>Empidonax virescens</u>	SUE	M,SR		
Willow Flycatcher	<u>Empidonax traillii</u>	SG	M,SR		
Least Flycatcher	<u>Empidonax minimus</u>	UE	M		
--	<u>Empidonax sp. (includes above four species)</u>	--	--	U	U
Eastern Wood Pewee	<u>Contopus virens</u>	UE	M,SR	U	U

Table 10 (Cont'd)

Common Name	Scientific Name	Habitat Preference	Season	Abundance of Species Observed During Survey	
				Fall	Spring
Olive-sided Flycatcher	<u>Nuttallornis borealis</u>	UE	M		
Vermilion Flycatcher	<u>Pyrocephalus rubinus</u>	SU	M,SR		
Horned Lark	<u>Eremophila alpestris</u>	G	R		C
Tree Swallow	<u>Iridoprocne bicolor</u>	SGR	M		
Bank Swallow	<u>Riparia riparia</u>	SGR	M,SR		
Rough-winged Swallow	<u>Stelgidopteryx ruficollis</u>	SGR	SR		U
Barn Swallow	<u>Hirundo rustica</u>	SGR	M,SR	U	U
Cliff Swallow	<u>Petrochelidon pyrrhonota</u>	SGR	M,SR		
Purple Martin	<u>Progne subis</u>	UH	M,SR		U
Blue Jay	<u>Cyanacitta cristata</u>	UH	R	U	
Scrub Jay	<u>Aphelocoma coerulescens</u>	U	R		
Common Crow	<u>Corvus brachyrhynchos</u>	GRUE	R	C	C
Carolina Chickadee	<u>Parus carolinensis</u>	UEH	R	A	U
Tufted Titmouse	<u>Parus bicolor</u>	RUE	R	A	A
Verdin	<u>Auriparus flaviceps</u>	U	R		
Bushtit	<u>Psaltriparus minimus</u>	RUE	R		
White-breasted Nuthatch	<u>Sitta carolinensis</u>	UF	R		U
Red-breasted Nuthatch	<u>Sitta canadensis</u>	UE	M,WR		
Brown Creeper	<u>Certhia familiaris</u>	EU	M,WR		
House Wren	<u>Troglodytes aedon</u>	UEH	M,WR		U
Winter Wren	<u>Troglodytes troglodytes</u>	U	M,WR		
Bewick's Wren	<u>Thryomanes bewickii</u>	UEH	R	C	U
Carolina Wren	<u>Thryothorus ludovicianus</u>	UEH	R	C	U
Cactus Wren	<u>Campylorhynchus brunneicapillus</u>	U	R		
Long-billed Marsh Wren	<u>Cistothorus palustris</u>	S	M,WR		
Short-billed Marsh Wren	<u>Cistothorus platensis</u>	SG	M,WR		
Canyon Wren	<u>Catherpes mexicanus</u>	RUE	R	U	
Rock Wren	<u>Salpinctes obsoletus</u>	U	R		
Mockingbird	<u>Mimus polyglottos</u>	GUEH	R	C	A
Gray Catbird	<u>Dumetella carolinensis</u>	RU	M,WR		

Table 10 (Cont'd)

Common Name	Scientific Name	Habitat Preference	Season	Abundance of Species Observed During Survey	
				Fall	Spring
Brown Thrasher	<u>Toxostoma rufum</u>	RU	R	U	
Curve-billed Thrasher	<u>Toxostoma curvirostre</u>	U	R		
Sage Thrasher	<u>Oreoscoptes montanus</u>	U	M,WR		
American Robin	<u>Turdus migratorius</u>	GUEH	R		U
Wood Thrush	<u>Hylocichla mustelina</u>	RU	M		
Hermit Thrush	<u>Catharus guttatus</u>	RU	M,WR		
Swainson's Thrush	<u>Catharus ustulatus</u>	R	M		U
Gray-checked Thrush	<u>Catharus minimum</u>	RU	M		
Veery	<u>Catharus fuscescens</u>	RU	M		U
Eastern Bluebird	<u>Sialia sialis</u>	GUE	R	U	
Mountain Bluebird	<u>Sialia currucoides</u>	GU	M,WR		
Townsend's Solitaire	<u>Myadestes townsendi</u>	U	M,WR		
Blue-gray Gnatcatcher	<u>Polioptila caerulea</u>	RUE	M,SR	U	U
Golden-crowned Kinglet	<u>Regulus satrapa</u>	RUE	M,WR		
Ruby-crowned Kinglet	<u>Regulus calendae</u>	RUE	M,WR		U
Water Pipit	<u>Anthus spinoletta</u>	SG	M,WR		
Sprague's Pipit	<u>Anthus spragueii</u>	G	M,WR		
Cedar Waxwing	<u>Bombycilla cedrorum</u>	GUEH	M,WR		U
Loggerhead Shrike	<u>Lanius ludovicianus</u>	GE	R	C	C
Starling	<u>Sturnus vulgaris</u>	GH	R	C	C
Black-capped Vireo	<u>Vireo articalilla</u>	U	M,SR	U	U
White-eyed Vireo	<u>Vireo griseus</u>	RUE	M,SR	C	U
Bell's Vireo	<u>Vireo bellii</u>	UE	M,SR	U	
Yellow-throated Vireo	<u>Vireo flavifrons</u>	RU	M,SR		
Solitary Vireo	<u>Vireosylva solitarius</u>	UE	M,WR		
Red-eyed Vireo	<u>Vireo olivaceus</u>	RU	M,SR		C
Philadelphia Vireo	<u>Vireo philadelphicus</u>	RU	M		
Warbling Vireo	<u>Vireo gilvus</u>	RU	M		
Black-and-white Warbler	<u>Miniotilta varia</u>	RU	M,SR	U	U
Prothonotary Warbler	<u>Protonotaria citrea</u>	R	M		

Table 10 (Cont'd)

Common Name	Scientific Name	Habitat Preference	Season	Abundance of Species Observed During Survey	
				Fall	Spring
Worm-eating Warbler	<u>Helmitheros vermivorus</u>	RU	C		
Golden-winged Warbler	<u>Vermivora chrysoptera</u>	UE	M		
Blue-winged Warbler	<u>Vermivora pinus</u>	UE	M		
Tennessee Warbler	<u>Vermivora peregrina</u>	RUE	M		
Orange-crowned Warbler	<u>Vermivora celata</u>	GRUE	M,WR		
Nashville Warbler	<u>Vermivora ruficapilla</u>	RUE	M		U
Northern Parula	<u>Parula americana</u>	RUE	M,SR		
Yellow Warbler	<u>Dendroica petechia</u>	RU	M	U	
Magnolia Warbler	<u>Dendroica magnolia</u>	RUE	M		
Cape May Warbler	<u>Dendroica tigrina</u>	RUE	M		
Black-throated Blue Warbler	<u>Dendroica caerulescens</u>	R	M		
Yellow-rumped Warbler	<u>Dendroica coronata</u>	RUE	M,WR		U
Black-Throated Gray Warbler	<u>Dendroica nigrescens</u>	UE	M		
Black-Throated Green Warbler	<u>Dendroica virens</u>	RUE	M		U
Golden-cheeked Warbler	<u>Dendroica chrysoparia</u>	UE	SR		
Cerulean Warbler	<u>Dendroica cerulea</u>	RUE	M		
Blackburnian Warbler	<u>Dendroica fusca</u>	RUE	M		
Yellow-throated Warbler	<u>Dendroica dominica</u>	RUE	M,SR		
Chestnut-sided Warbler	<u>Dendroica pensylvanica</u>	RUE	M		
Bay-breasted Warbler	<u>Dendroica castanea</u>	RUE	M		
Blackpoll Warbler	<u>Dendroica striata</u>	UE	M		
Prairie Warbler	<u>Dendroica discolor</u>	UE	M		
Pine Warbler	<u>Dendroica pinus</u>	RUE	M		
Palm Warbler	<u>Dendroica palmarum</u>	G	M		
Ovenbird	<u>Seiurus aurocapillus</u>	RU	M		U
Northern Waterthrush	<u>Seiurus noveboracensis</u>	SRU	M		
Louisiana Waterthrush	<u>Seiurus motacilla</u>	SRU	M,SR		
Kentucky Warbler	<u>Oporornis formosus</u>	RU	M,SR		
Mourning Warbler	<u>Oporornis philadelphia</u>	RU	M		

Table 10 (Cont'd)

Common Name	Scientific Name	Habitat Preference	Season	Abundance of Species Observed During Survey	
				Fall	Spring
MacGillivray's Warbler	<u>Oporornis tolmiei</u>	RU	M		
Common Yellowthroat	<u>Geothlypis trichas</u>	RU	M,WR		
Yellow-breasted Chat	<u>Icteria virens</u>	RU	M,SR		
Hooded Warbler	<u>Wilsonia citrina</u>	RU	M		
Wilson's Warbler	<u>Wilsonia pusilla</u>	RU	M	U	
Canada Warbler	<u>Wilsonia canadensis</u>	RU	M		
American Redstart	<u>Setophaga ruticilla</u>	RU	M		
House Sparrow	<u>Passer domesticus</u>	H	R	A	A
Bobolink	<u>Dolichonyx oryzivorus</u>	G	M		
Eastern Meadowlark	<u>Sturnella magna</u>	G	R	U	A
Western Meadowlark	<u>Sturnella neglecta</u>	G	R		
Yellow-headed Blackbird	<u>Xanthocephalus xanthocephalus</u>	SG	M		U
Red-winged Blackbird	<u>Agelaius phoeniceus</u>	SG	R	U	U
Orchard Oriole	<u>Icterus spurius</u>	UEH	M,SR		
Northern Oriole	<u>Icterus galbula</u>	RUE	M,SR	U	
Rusty Blackbird	<u>Euphagus carolinus</u>	R	M,WR		
Brewer's Blackbird	<u>Euphagus cyanocephalus</u>	GH	M,WR		U
Great-tailed Grackle	<u>Quiscalus mexicanus</u>	UEH	R	U	C
Common Grackle	<u>Quiscalus quiscula</u>	SGH	R	C	
Brown-headed Cowbird	<u>Molothrus ater</u>	GUE	R		C
Western Tanager	<u>Piranga ludoviciana</u>	UE	M		
Scarlet Tanager	<u>Piranga olivacea</u>	RU	M		
Summer Tanager	<u>Piranga rubra</u>	RU	M,SR	C	C
Cardinal	<u>Cardinalis cardinalis</u>	RUEH	R	A	A
Rose-breasted Grosbeak	<u>Pheucticus ludovicianus</u>	RU	M		
Black-headed Grosbeak	<u>Pheucticus melanocephalus</u>	RU	M		
Blue Grosbeak	<u>Guiraca caerulea</u>	UE	M,SR		
Indigo Bunting	<u>Passerina cyanea</u>	UE	M,SR		U
Lazuli Bunting	<u>Passerina amoena</u>	GRU	M		
Painted Bunting	<u>Passerina ciris</u>	GUE	M,SR	U	U

Table 10 (Cont'd)

Common Name	Scientific Name	Habitat Preference	Season	Abundance of Species Observed During Survey	
				Fall	Spring
Dickcissel	<u>Spica americana</u>	G	M,SR		U
Evening Grosbeak	<u>Hesperiphona vespertina</u>	UE	WV		
Purple Finch	<u>Carpodacus purpureus</u>	RUE	WV		
House Finch	<u>Carpodacus mexicanus</u>	UH	R	U	
Pine Siskin	<u>Carduelis pinus</u>	UEH	M,WR		
American Goldfinch	<u>Carduelis tristis</u>	UEH	M,WR		U
Lesser Goldfinch	<u>Carduelis psaltria</u>	GUE	R	U	
Green-tailed Towhee	<u>Pipilo chlorura</u>	UE	M,WR		
Rufous-sided Towhee	<u>Pipilo erythrophthalmus</u>	RUE	M,WR		U
Brown Towhee	<u>Pipilo fuscus</u>	UE	M	U	
Lark Bunting	<u>Calamospiza melanocorys</u>	G	M,WR		
Savannah Sparrow	<u>Passerculus sandwichensis</u>	G	M,WR		U
Grasshopper Sparrow	<u>Ammodramus savannarum</u>	G	R		
Henslow's Sparrow	<u>Ammodramus henslowii</u>	G	M		
Vesper Sparrow	<u>Poocetes gramineus</u>	GU	M,WR		U
Lark Sparrow	<u>Chondestes grammacus</u>	GUE	R	C	A
Rufous-crowned Sparrow	<u>Aimophila ruficeps</u>	GUE	R	U	U
Cassin's Sparrow	<u>Aimophila cassinii</u>	G	R		U
Black-throated Sparrow	<u>Amphispiza bilineata</u>	G	R		
Dark-eyed Junco	<u>Junco hyemalis</u>	GUE	M,WR		
Chipping Sparrow	<u>Spizella passerina</u>	UE	R		U
Clay-colored Sparrow	<u>Spizella pallida</u>	G	M,WR		
Field Sparrow	<u>Spizella pusilla</u>	GE	R	U	U
Harris' Sparrow	<u>Zonotrichia querula</u>	RUE	M,WR		
White-tailed Sparrow	<u>Zonotrichia leucophrys</u>	UEH	M,WR		U
White-throated Sparrow	<u>Zonotrichia albicollis</u>	RU	M,WR		U
Fox Sparrow	<u>Passerella iliaca</u>	RU	M,WR		
Lincoln's Sparrow	<u>Melospiza lincolni</u>	GRUE	M,WR		U
Swamp Sparrow	<u>Melospiza georgiana</u>	S	M,WR		
Song Sparrow	<u>Melospiza melodia</u>	R	M,WR		U

Table 10 (Cont'd)

Common Name	Scientific Name	Habitat Preference	Season	Abundance of Species Observed During Survey	
				Fall	Spring
McCown's Longspur	<u>Calcarius</u> <u>mccownii</u>	G	M,WR		
Chestnut-collared Longspur	<u>Calcarius</u> <u>ornatus</u>	G	M,WR		
Lapland Longspur	<u>Calcarius</u> <u>lapponicus</u>	G	M,WR		
Smith's Longspur	<u>Calcarius</u> <u>pictus</u>	G	M,WR		

¹Source: Wolfe et al. (1974), Oberholser (1974), Peterson (1963); nomenclature follows AOU (1957, 1973, 1976).

²Habitat Preference:

- S - aquatic associated habitats
- G - grasslands, pastures, and other open areas
- R - riparian woodlands
- U - upland woodlands
- E - edges
- H - areas of human habitation

³Season:

- R - Resident: Occurring regularly in the same general area through the year; Implies breeding.
- SR - Summer Resident: Implies breeding but may include non-breeders.
- WR - Winter Resident: Occurring during the winter season.
- M - Migrant: Occurs as a transient passing through the area either in spring or fall, or both.
- V - Visitor: Does not occur in numbers large enough or with frequency great enough to be considered a seasonal resident, but is not unexpected.
- C - Casual: Might be expected to occur once in ten years on the average.
- A - abundant - species easily found in large numbers in proper habitat during survey.
- C - common - species easily found in proper habitat during survey although in lesser numbers than above.
- U - uncommon - species which were hard to find even in proper habitat or which occurred locally in only a few areas.

⁴General reconnaissance survey conducted 6-7 March 1979.

Table 11

Bird Densities--Riparian Woodland--Fort Hood

Species*	FALL			SPRING		
	Strip Width(m)	No.	No./ 100ha	Strip Width(m)	No.	No./ 100ha
Tufted Titmouse	50	24	177.6	50	18	240.0
Cardinal	50	17	125.8	75	16	142.2
Carolina Chickadee	50	12	88.8	--	--	--
White-eyed Vireo	50	10	74.0	--	--	--
Yellow-billed Cuckoo	40	7	65.1	40	4	66.7
Wilson's Warbler	30	5	64.0	--	--	--
Summer Tanager	40	4	37.2	--	--	--
Carolina Wren	100	10	37.0	--	--	--
Black-and-white Warbler	40	2	18.6	--	--	--
Blue-gray Gnatcatcher	40	2	18.6	--	--	--
Bewick's Wren	50	2	14.8	--	--	--
Downy Woodpecker	50	2	14.8	--	--	--
Ladderbacked Woodpecker	50	2	14.8	40	1	33.3
Red-bellied Woodpecker	50	2	14.8	50	2	26.7
Canyon Wren	30	1	12.8	--	--	--
Yellow-bellied Flycatcher	30	1	12.8	--	--	--
Northern Oriole	40	1	9.3	--	--	--
Eastern Wood Pewee	50	1	7.4	--	--	--
Brown Towhee	50	1	7.4	--	--	--
Mourning Dove	50	1	7.4	100	11	73.3
Great-tailed Grackle	--	--	--	80	13	216.7
Redwinged Blackbird	--	--	--	200	28	186.7
Eastern Meadowlark	--	--	--	100	10	133.3
Brown-headed Cowbird	--	--	--	150	12	106.6
Lark Sparrow	--	--	--	60	4	88.9
Mockingbird	--	--	--	100	6	80.0
Bobwhite	--	--	--	120	6	66.7
Indigo Bunting	--	--	--	100	4	53.3
Scissor-tailed Flycatcher	--	--	--	80	3	50.0
Chimney Swift	--	--	--	100	2	26.7
Green Heron	--	--	--	100	1	13.3
Great Blue Heron	--	--	--	200	1	7.3

* For an explanation of terminology in table headings, see the appendix.

Table 12

Bird Densities--Deciduous-Juniper Woodland--Fort Hood

Species*	FALL			SPRING		
	Strip Width(m)	No.	No./ 100ha	Strip Width(m)	No.	No./ 100ha
Carolina Chickadee	50	28	61.6	60	6	166.7
Cardinal	50	15	33.0	100	13	216.7
Tufted Titmouse	50	14	30.8	100	12	200
White-eyed Vireo	50	9	19.8			
Blue-gray Gnatcatcher	30	4	14.8	80	8	166.7
Wilson's Warbler	40	4	11.2			
Mourning Dove	50	5	11.0			
Bewick's Wren	40	3	8.4			
Yellow-billed Cuckoo	50	3	6.6			
Ladder-backed Woodpecker	50	2	4.4			
Black-and-white Warbler	30	1	3.7	60	7	194.4
Black-capped Vireo	30	1	3.7			
Carolina Wren	100	1	1.1			
Indigo Bunting				100	2	33.3
Eastern Meadowlark				100	2	33.3
Brown-headed Cowbird				100	7	116.7
Turkey Vulture				1000	8	13.3
Field Sparrow				150	1	11.1
Rufous-sided Towhee				80	1	20.8
Ruby-throated Hummingbird				40	1	41.7
Lark Sparrow				30	1	55.6
Empidonax Flycatcher				80	2	41.6

*For an explanation of terminology in table headings, see the appendix.

Table 13

Bird Densities--Juniper Woodland--Fort Hood

Species*	FALL			SPRING		
	Strip Width(m)	No.	No./ 100ha	Strip Width(m)	No.	No./ 100ha
Cardinal	50	21	121.8	150	15	133.3
Carolina Chickadee	50	7	40.6			
Bewick's Wren	50	6	34.8			
Tufted Titmouse	50	4	23.2	100	3	40.0
Rufous-crowned Sparrow	40	3	21.9			
Mourning Dove	50	3	17.4	200	8	53.3
Blue-gray Gnatcatcher	50	2	11.6			
Hummingbird sp.	30	1	9.7			
Ladder-backed Woodpecker	50	1	5.8			
Carolina Wren	50	1	5.8			
White-eyed Vireo	100	1	2.9	100	1	13.3
Common Crow	250	2	2.4	400	1	3.3
Red-bellied Woodpecker				100	3	40.0
Turkey				150	2	17.8
Brown-headed Cowbird				60	2	44.4
Mockingbird				200	1	26.7
Lark Sparrow				80	1	16.7
Rough-legged Hawk				200	1	26.7
Bobwhite				100	1	13.3
Turkey Vulture				400	2	6.7
Black Vulture				600	1	2.2

*For an explanation of terminology in table headings, see the appendix.

Table 14

Bird Densities--Grazed Grassland--Fort Hood

Species*	FALL			SPRING		
	Strip Width(m)	No.	No./100ha	Strip Width(m)	No.	No./100ha
Bobwhite	100	18	39.6	100	5	11.4
Lark Sparrow	50	6	26.6	100	12	27.4
Mockingbird	100	6	12.4	150	12	53.3
Field Sparrow	100	2	4.4	100	2	4.6
Mourning Dove	150	3	4.4	200	8	26.7
Cardinal	100	2	4.4	150	5	22.2
Carolina Chickadee	150	1	1.5			
Tufted Titmouse				200	3	10.0
Eastern Meadowlark				150	11	48.9
Savannah Sparrow				40	3	50.0
Scissor-tailed Flycatcher				200	6	20.0
Brown-headed Cowbird				150	4	17.8
Red-bellied Woodpecker				150	1	4.4
Turkey				150	2	8.9
Summer Tanager				100	2	4.6

*For an explanation of terminology in table headings, see the appendix.

Table 15

Bird Densities--Disturbed Woodland--Fort Hood

Species*	FALL			SPRING		
	Strip Width(m)	No.	No./100ha	Strip Width(m)	No.	No./100ha
Cardinal	50	15	200.0	200	11	36.7
Lark Sparrow	40	3	50.0	100	5	33.3
Carolina Chickadee	100	3	20.0	80	1	8.3
Painted Bunting	40	1	16.7			
Mockingbird	100	2	13.3	200	5	16.7
Mourning Dove	250	1	2.7	100	7	46.7
Scissor-tailed Flycatcher	250	1	2.7			
Yellow-billed Cuckoo				100	2	13.3
Eastern Meadowlark				200	4	13.3
Brown-headed Cowbird				80	4	33.3
Tufted Titmouse				150	3	13.3
American Goldfinch				40	1	16.7
Black-capped Vireo				80	1	8.3
Great Blue Heron				80	1	8.3
Field Sparrow				60	2	22.2
Common Crow				400	1	1.7
Turkey				400	1	1.7
Turkey Vulture				200	1	3.3

*For an explanation of terminology in table headings, see the appendix.

Table 16
 Bird Densities--Road-Cruise Census--East Side, Fort Hood

Species*	FALL			SPRING		
	No.	%	No./km	No.	%	No./km
Cardinal	91	70.0	2.26	70	90.0	2.85
Carolina Chickadee	35	30.0	0.87	3	10.0	0.12
Mourning Dove	30	34.0	0.75	40	73.3	1.63
Turkey Vulture	27	12.0	0.67	7	13.3	0.28
Mockingbird	17	20.0	0.42	36	60.0	1.46
Black Vulture	13	4.0	0.32	15	10.0	0.61
Lark Sparrow	9	4.0	0.22	33	53.3	1.34
Eastern Bluebird	8	4.0	0.20	--	--	--
Killdeer	8	6.0	0.15	17	10.0	0.69
Least Sandpiper	8	2.0	0.20	--	--	--
Downy Woodpecker	6	12.0	0.15	1	3.3	0.04
Tufted Titmouse	6	8.0	0.15	26	50.0	1.06
Solitary Sandpiper	5	2.0	0.12	--	--	--
White-eyed Vireo	5	10.0	0.12	--	--	--
Great Egret	4	2.0	0.10	--	--	--
Green Heron	4	4.0	0.10	--	--	--
Common Crow	3	2.0	0.07	5	13.3	0.20
Roadrunner	3	2.0	0.07	--	--	--
Scissor-tailed Flycatcher	3	2.0	0.07	4	13.3	0.16
Bobwhite	2	6.0	0.05	3	6.7	0.12
Common Grackle	2	2.0	0.05	--	--	--
Eastern Meadowlark	2	2.0	0.05	38	56.7	1.55
Great Blue Heron	2	4.0	0.05	--	--	--
Yellow-billed Cuckoo	2	2.0	0.05	--	--	--
Belted Kingfisher	1	2.0	0.02	--	--	--
Bewick's Wren	1	4.0	0.02	1	3.3	0.04
Little Blue Heron	1	2.0	0.02	--	--	--
Red-bellied Woodpecker	1	2.0	0.02	8	13.3	0.33
Summer Tanager	1	2.0	0.02	9	16.7	0.37
Yellow Warbler	1	2.0	0.02	--	--	--
Field Sparrow	--	--	--	11	30.0	0.45
Rufous-sided Towhee	--	--	--	3	10.0	0.12
Brown-headed Cowbird	--	--	--	51	40.0	2.07
Turkey	--	--	--	7	16.7	0.28
American Robin	--	--	--	1	3.3	0.04
Rough-winged Swallow	--	--	--	4	10.0	0.16
Veery	--	--	--	1	3.3	0.04
Redwinged Blackbird	--	--	--	1	3.3	0.04
Hairy Woodpecker	--	--	--	1	3.3	0.04
Empidonax Flycatcher	1	2.0	0.02	1	3.3	0.04

* For an explanation of terminology in table headings, see the appendix.

Table 17

Bird Densities--Road-Cruise Census--West Side, Fort Hood

Species*	FALL			SPRING		
	No.	% Frequency	No./km	No.	% Frequency	No./km
Cardinal	43	46.0	1.22	79	85.0	2.59
Carolina Chickadee	25	24.0	0.62	1	2.5	0.03
Turkey Vulture	25	20.0	0.62	6	7.5	0.18
Mockingbird	18	22.0	0.45	73	77.5	2.23
Tufted Titmouse	13	14.0	0.32	27	40.0	0.82
Eastern Meadowlark	12	8.0	0.30	50	50.0	1.53
Turkey	11	2.0	0.27	3	7.5	0.09
Lark Sparrow	10	8.0	0.25	48	52.5	1.46
Killdeer	9	4.0	0.22	13	20.0	0.40
Mourning Dove	9	12.0	0.22	36	47.5	1.10
Bobwhite	8	8.0	0.20	8	12.5	0.24
Black Vulture	6	2.0	0.15	--	--	--
Downy Woodpecker	6	3.0	0.15	--	--	--
White-eyed Vireo	4	4.0	0.10	--	--	--
Belted Kingfisher	2	4.0	0.05	--	--	--
Bewick's Wren	2	4.0	0.05	1	2.5	0.03
Summer Tanager	2	2.0	0.05	3	4.0	0.09
Chimney Swift	1	2.0	0.02	--	--	--
Common Crow	1	2.0	0.02	--	--	--
Lesser Goldfinch	1	2.0	0.02	--	--	--
Loggerhead Shrike	1	2.0	0.02	--	--	--
Scissor-tailed Flycatcher	1	2.0	0.02	8	8.0	0.24
Yellow-billed Cuckoo	1	2.0	0.02	2	5.0	0.06
Lincoln's Sparrow	--	--	--	1	2.5	0.03
Redwinged Blackbird	--	--	--	81	27.5	2.47
Field Sparrow	--	--	--	11	17.5	0.34
Rufous-sided Towhee	--	--	--	14	15.0	0.43
Song Sparrow	--	--	--	2	5.0	0.06
Brewer's Blackbird	--	--	--	22	5.0	0.67
Marsh Hawk	--	--	--	1	2.5	0.03
Say's Phoebe	--	--	--	1	2.5	0.03
Brown-headed Cowbird	--	--	--	15	10.0	0.46
Cedar Waxwing	--	--	--	8	2.5	0.24
Great-tailed Grackle	--	--	--	31	5.0	0.95
Blue-gray Gnatcatcher	--	--	--	1	2.5	0.03
White-throated Sparrow	--	--	--	2	5.0	0.06
Unidentified Sp.	2	2.0	0.05	--	--	--

* For explanation of terminology in table headings, see the appendix.

Table 18
Mammals--Fort Hood

Common Name*	Scientific Name	General Habitat	Observed in Project Area
Virginia opossum	<u>Didelphis virginianus</u>	F,G,S	X
Eastern mole	<u>Scalopus aquaticus</u>	sandy areas	
Least shrew	<u>Cryptotis parva</u>	G	
Cave bat	<u>Myotis velifer</u>	caves, buildings	
Eastern pipistrelle	<u>Pipistrellus subflavus</u>	F,S	
Big brown bat	<u>Eptesicus fuscus</u>	F, buildings, caves rocky areas	
Hoary bat	<u>Lasiurus cinereus</u>	F	
Red bat	<u>Lasiurus borealis</u>	F	
Brazilian free-tailed bat	<u>Tadarida brasiliensis</u>	F,S	
Big free-tailed bat	<u>Tadarida macrotis</u>	rocky areas, caves, buildings	
Raccoon	<u>Procyon lotor</u>	S	XO
Ringtail	<u>Bassariscus astutus</u>	rocky areas, woodlands	
Mink	<u>Mustela vison</u>	S	
Long-tailed weasel	<u>Mustela frenata</u>	F,G	
Eastern spotted skunk	<u>Spilogale putorius</u>	F,G	
Striped skunk	<u>Mephitis mephitis</u>	F,G	X
Badger	<u>Taxidea taxus</u>	G	
Red fox	<u>Vulpes fulva</u>	F	
Gray fox	<u>Urocyon cinereoargenteus</u>	F	X ^a
Coyote	<u>Canis latrans</u>	G,F	X ^a
Mountain lion	<u>Felis concolor</u>	brushy deer habitat	
Bobcat	<u>Lynx rufus</u>	F, rocky area	X ^a
Mexican ground squirrel	<u>Spermophilus mexicanus</u>	brushy or grassy areas	
Fox squirrel	<u>Sciurus niger</u>	F	XO
Southern flying squirrel	<u>Glaucomys volans</u>	F	
Plains pocket gopher	<u>Geomys bursarius</u>	G	
Merriam pocket mouse	<u>Perognathus flavus</u>	shortgrass sandy soils	O
Hispid pocket mouse	<u>Perognathus hispidus</u>	sandy soil, G	
Beaver	<u>Castor canadensis</u>	S	
Fulvous harvest mouse	<u>Reithrodontomys fulvescens</u>	G	XO
Plains harvest mouse	<u>Reithrodontomys montanus</u>	G	O
Northern pygmy mouse	<u>Baiomys taylori</u>	G	O
Deer mouse	<u>Peromyscus maniculatus</u>	G,F	XO
White-footed mouse	<u>Peromyscus leucopus</u>	F	
Texas mouse	<u>Peromyscus attwateri</u>	cliffs, rocky outcrops	O
White-ankled mouse	<u>Peromyscus pectoralis</u>	cliffs, rocky outcrops	O
Hispid cotton rat	<u>Sigmodon hispidus</u>	G	X

*For an explanation of terminology in table headings, see the appendix.

Table 18 (Cont'd)

Common Name	Scientific Name	General Habitat	Observed in Project Area
Eastern woodrat	<u>Neotoma floridana</u>	G,F	X
House mouse	<u>Mus musculus</u>	human constructions, G	
Black rat	<u>Rattus rattus</u>	human constructions	
Norway rat	<u>Rattus norvegicus</u>	human constructions, G	
Nutria	<u>Myocastor coypus</u>	S	
Black-tailed jack rabbit	<u>Lepus californicus</u>	G	XO
Eastern cottontail	<u>Sylvilagus floridanus</u>	brushy areas and edges	XO
Collared peccary	<u>Pecari tajacu</u>	brushland	
White-tailed deer	<u>Odocoileus virginianus</u>	brush, G	XO
Axis deer	<u>Axis axis</u>	F	
Nine-banded armadillo	<u>Dasyopus novemcinctus</u>	brush, FG	XO

Source: Davis (1974), Beaty (2978a); nomenclature follows Jones et al. (1973).

Comments:

- S - aquatic associated habitats
- G - grasslands and open areas
- F - forest and woodlands
- X - observed during fall 1978
- O - observed during spring 1979

^aSpecies captured by Fish and Wildlife Section trappers during the period 1 March 1977 - 1 March 1978.

Table 19
Small Mammal Trapping--Fort Hood

Species*	Number Trapped/Habitat												Total			
	Juniper Woodland		Riparian Woodland		Mixed Deciduous Juniper Woodland		Disturbed Woodland		Grazed Grassland		Ungrazed Grassland			Food Plot	F	S
	F	S	F	S	F	S	F	S	F	S	F	S				
Merriam pocket mouse								5								5
Fulvous harvest mouse				1							1					1
Plains harvest mouse				1						1						2
Northern pygmy mouse	1															1
Deer mouse	39	1	2	42	7	1	1	1	1	1	1	1	1	92	2	2
Texas mouse	2				25	36						2				65
White-ankled mouse	3				20	13	2	2	1							39
Hispid cotton rat				1						5				6		
Eastern woodrat	1			2										3		
Eastern cottontail							1									1
Total	40	6	1	4	45	7	55	1	3	7	3	1	--	102	117	
Trappnights	196	150	105	161	249	2120	2205	238	154	120	154	40	--	1098	4944	
Trappnights/catch	4.9	25	105	40.3	5.5	47.1	21.4	40.1	238	51.3	17.1	51.3	40	--	10.8	42.6
Percent Success	20.4	4.0	0.95	2.5	18.1	2.1	4.7	2.5	0.4	1.9	5.0	1.9	2.5	--	9.3	2.3

* For an explanation of terminology in table headings, see the appendix.

Table 20

Mammals--Nocturnal Road-Cruise Census--Fort Hood

Species*	Fall		Number Observed	Spring	
	Number Observed	Number/km		Number Observed	Number/km
White-tailed deer	7	0.11	21	0.36	
Black-tailed jack rabbit	6	0.09	1	0.02	
Northern raccoon	6	0.09	1	0.02	
Gray fox	2	0.03	0	--	
Eastern cottontail	1	0.02	9	0.16	
Fox squirrel	1	0.02	0	--	
Nine-banded armadillo	0	--	1	0.02	
	23	0.36	33	0.57	

* For an explanation of terminology in table headings, see the appendix.

Table 21

Endangered, Threatened, and Peripheral Vertebrates--
Potential Occurrence--Fort Hood

Common Name*	Scientific Name	Status		
		TOES	IPWD	USDI
(Interior) Least Tern	<u>Sterna albifrons athalossos</u>	-	E	-
White-faced Ibis	<u>Plegadis chihi</u>	T	-	-
Roseate Spoonbill	<u>Ajaia ajaja</u>	P	-	-
Fulvous Whistling Duck	<u>Dendrocygna bicolor</u>	E	-	-
Bald Eagle	<u>Haliaeetus leucocephalus</u>	E	E	E
Golden Eagle	<u>Aquila chrysaetos</u>	T	-	-
Osprey	<u>Pandion haliaetus</u>	E	-	-
Peregrine Falcon	<u>Falco peregrinus</u>	E	E	E
Prairie Falcon	<u>Falco mexicanus</u>	T	-	-
Merlin	<u>Falco columbarius</u>	T	-	-
Golden-cheeked Warbler	<u>Dendroica chrysoparia</u>	E	-	-
Mountain lion	<u>Felis concolor</u>	E	-	-

*For an explanation of terminology in table headings, see the appendix.

Source:

TOES - Texas Organization for Endangered Species (1975)

TPWD - Texas Parks and Wildlife Department (1977)

USDI - U.S. Department of the Interior (1977)

Comments:

E - Endangered

T - Threatened

P - Peripheral

4 AQUATIC COMMUNITIES

Fort Hood Military Reservation lies entirely within the Brazos River Basin. The streams draining the reservation tend to flow easterly. From north to south, the major drainages are the Leon River, Owl Creek, Cowhouse Creek, Nolan Creek, and Reese Creek. All of these except Reese Creek and Nolan Creek flow into Belton Lake. Reese Creek flows into the Lampasas River, while Nolan Creek flows into the Leon River below Belton Lake (Figure 7). Of these, Cowhouse Creek can be considered the major drainage on the reservation.

USGS gauging stations are maintained on the Leon River above and below the reservation at Gatesville and Belton, Texas. Gauges are also maintained on Nolan Creek at Belton, Texas, and on Cowhouse Creek at Pidcoke, Texas, immediately upstream from the reservation. Only stream discharge data are available from these stations. Water quality data are available from a USGS gauging station located in Belton Lake. These data indicate that the reservoir water is moderately hard and slightly alkaline in pH. Neither large oxygen saturation deficits nor excessive amounts of nitrogen and phosphorus have been reported, indicating that the water is of good quality. No unusual quantities of dissolved constituents are apparent from these data.

A water quality study⁴⁸ using biological indicators was conducted by the U.S. Army Environmental Hygiene Agency. On the basis of samples collected in Cowhouse Creek and its tributaries, this study concluded that the effluent from the Copperas Cove sewage treatment plant was affecting Turkey Run, a tributary of Cowhouse Creek. It also concluded that the primary impact of tactical training resulted from physical disturbance and siltation in Cowhouse Creek, which limited the available habitat area for some species.

A report on a pesticide monitoring program at Fort Hood⁴⁹ showed that pesticide concentrations tended to be higher in impounded waters within the military reservation or in streams originating on the reservation, rather than in those streams traversing it. Somewhat increased concentrations of pesticides were found in fish tissue samples in comparison to the sediments, indicating that some accumulation was taking place.

Aquatic Habitats

A preliminary reconnaissance for the fall survey of aquatic habitats at Fort Hood was conducted on 9 and 10 August 1978, and the sampling program was conducted between 21 and 25 August 1978. Figure 7 shows station locations. Because of the general deficit in precipitation during the 1976-1978 period, the level of Belton Lake was down considerably during the fall survey. Henson Creek

⁴⁸ U.S. Army Environmental Hygiene Agency, Aquatic Organisms as Indicators of Water Quality, Water Quality Biological Study No. 24-002-75 (U.S. Army Environmental Hygiene Agency, 1974).

⁴⁹ U.S. Army Environmental Hygiene Agency, Pesticide Monitoring, Department of the Army Pesticide Monitoring Program, Evaluation of Environmental Samples Collected in Calendar Year 1975, Annual Report No. 44-0100-78 (U.S. Army Environmental Hygiene Agency, 1977).

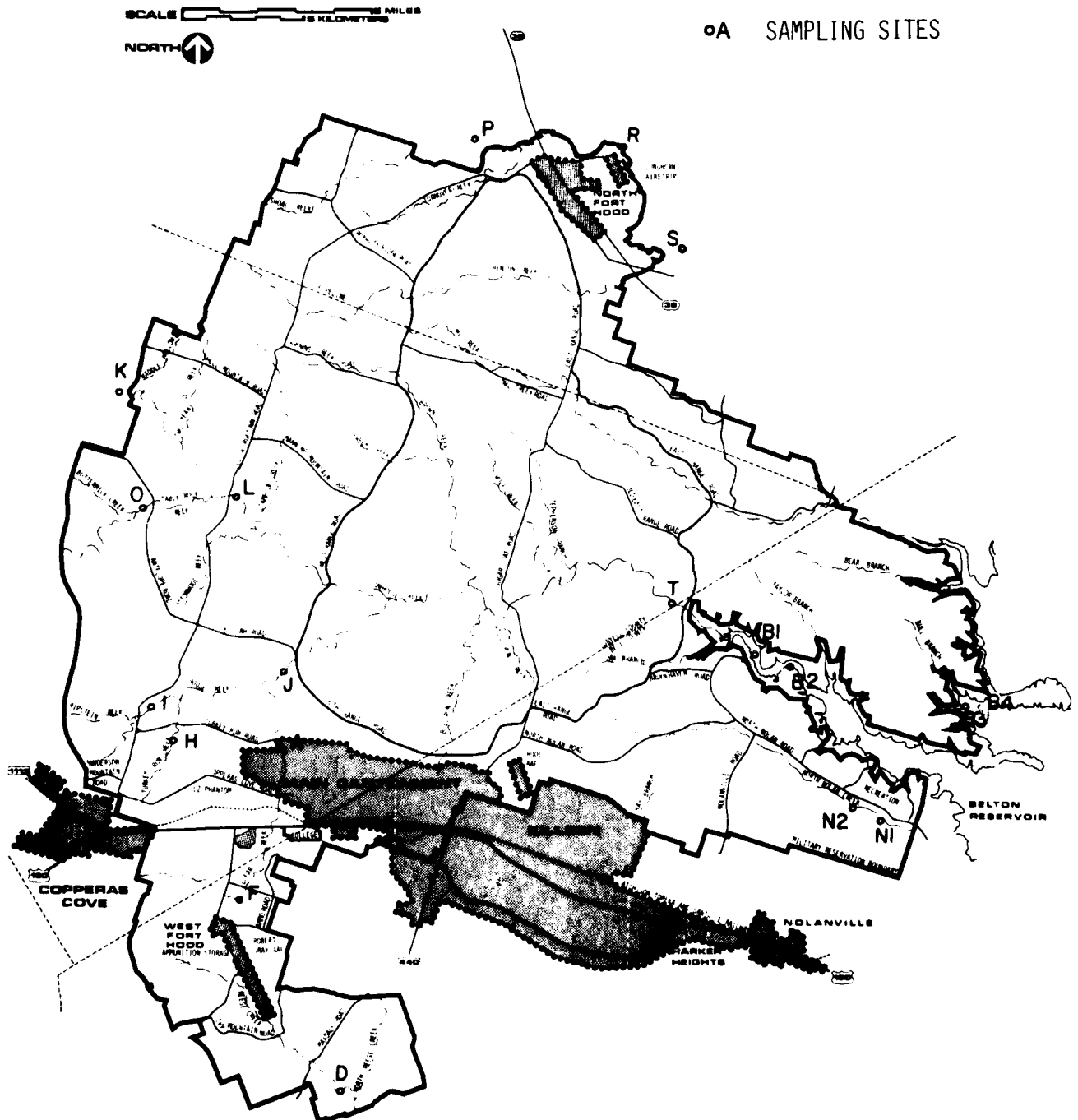


Figure 7. Aquatic sampling sites.

and Owl Creek were dry at all crossings examined, as were the smaller tributaries of the other creeks. Flowing water was observed during the survey only in lower Clear Creek, Turkey Run, and Upper House Creek (Stations A, H, and I, respectively). All other stream stations, including Cowhouse Creek and the Leon River, consisted of isolated pool habitats. With one exception, no difference in the presence or absence of flow or water level was observed between the reconnaissance survey and the major field survey. The only exception was Cowhouse Creek at Curry Crossing (Station T), where the water level was estimated to have risen some 30 to 40 cm between the reconnaissance survey and the time it was sampled during the field survey, probably as a result of a thunderstorm on 21 August. No change was noted at the West Range Road crossing of Cowhouse Creek. The spring survey was conducted between 7 and 11 May 1979. All stations contained flowing water because of the spring rains.

Table 22 presents water quality parameters measured during the fall survey. The sampling sites on Clear Creek (Stations F and A) were somewhat different, since the upper Station (F) was a pool, while the lower Station (A) was flowing. The number of taxa increased by only two at the lower station, while that station had more than double the density of organisms of the upper station. Between Stations F and A, Clear Creek receives runoff from the western portion of the Main Cantonment Area, a sanitary landfill, and a golf course. While Station A did not exhibit depressed numbers of species, a calculated diversity would be low, due to the extreme dominance of *Euglena* sp. at this station. The relatively high water temperatures observed during the survey are apparently normal for this season. The somewhat lower values for some of the creek stations probably reflect the degree of shading by riparian vegetation. Relatively low dissolved oxygen values were found in Clear Creek, North Nolan Creek, and House Creek. This seems to have been due more to the turbidity and shading characteristics of these stations than to heavy organic loading. Conductivities were high at all stations except D on Reese Creek. While pH values were often above 8.0 in Belton Lake, they were only slightly alkaline at all creek stations. Table 23 shows water quality parameters for the spring survey. Conductivities remained high at all stations, although they were lower than in the fall survey. The pH values showed that most stations were slightly alkaline. No low dissolved oxygen readings were recorded in the spring. Night measurements at Stations K and T indicated acceptable dissolved oxygen levels in Cowhouse Creek.

The following paragraphs describe the physical and chemical nature of the habitats sampled along with general observations on their biology. The stations are divided into seven groups based on the fall survey: Belton Lake, Leon River, Cowhouse Creek, flowing streams (lower Clear Creek, lower Turkey Run, upper House Creek), non-flowing streams (mid Table Rock Creek, lower North Nolan Creek, upper North Nolan Creek, upper Clear Creek, lower Reese Creek, and lower House Creek), and ponds and marshes. A seventh group established in the spring consisted of Turnover Creek, Henson Creek, and Owl Creek. These stations were not sampled in the fall. Tables 24 and 25 summarize some of the major characteristics of the habitats sampled at each station.

Belton Reservoir

Two sampling stations (B1 and B2) were established at the upstream end of the Cowhouse Creek arm of Belton Reservoir. Two control stations (B3 and B4) were established in similar areas (with respect to depth, proximity to shore,

and the presence of stands of inundated trees) in the cove immediately to the north of the Cowhouse Creek arm. Although this cove receives drainage from a portion of the Fort Hood Military Reservation, the drainages are small in area and were dry at the time of the fall survey. The drained area shows far less human use than is typical of the region either on or off the military reservation.

The effects of siltation from Cowhouse Creek were evident in the upper portions of this arm of Belton Reservoir. Extensive flats of a very soft gray clay were found at Station B1. This clay layer was approximately 40 cm deep over a hard surface on which there was a layer of largely undecayed bermuda grass, indicating that this sedimentation had occurred recently. A similar clay was present at Station B2 at a depth of 8 m. The substrate at Station B3 (depth = 1 m) was mud and organic detritus of terrestrial origin over rock. At Station B4, the substrate consisted of fine gravel at a depth of 14 m.

Leon River

Sampling stations were located on the Leon River at points upstream (Station R) and downstream (Station S) of Fort Hood. Both stations consisted of isolated pool habitats that were heavily shaded in a deeply cut stream channel. Abundant growths of filamentous algae and various higher aquatic plants were evident at both stations on the Leon River. During the spring survey, both Leon River stations were flowing rapidly. Sampling was difficult at both stations due to the flow. Station R, a control station upstream which receives no drainage from the reservation, was dammed on the upstream side by the low water bridge. The area upstream of Station S consisted of the northernmost portion of Fort Hood, including the North Fort Hood Cantonment and its attendant storm drainage and sewage treatment facilities, the northern portion of the impact area, and a small portion of the northern part of the maneuver training area.

Cowhouse Creek

In the fall, Cowhouse Creek was sampled at Station K at the confluence of Cowhouse and Bee House Creeks just upstream of the western boundary of Fort Hood (control station), at Station L in the middle of the maneuver training area, and at Station T at Curry Crossing where Cowhouse Creek emerges from the impact area. All three stations were pool habitats, with Station K showing the greatest apparent habitat diversity. In the spring survey, Station K was moved from the confluence of Cowhouse and Bee House Creeks to just inside Fort Hood because of the inaccessibility of the former Station K. This station consisted of steep-cut banks, with a bottom of rock and gravel having soft sediment and detritus along the shore. All other stations were at the same location. All three Cowhouse Creek stations were flowing in the spring. Substrate types at Station K ranged from mud to rubble. Stands of rooted aquatic vegetation were present, as well as a considerable amount of organic detritus. Station L consisted of a series of small pools. The stream bed consisted of rock slabs having holes and cracks filled with considerable amounts of silt. Large stands of *Chara* sp. were present in these small pools as were large numbers of very small fishes. This station receives drainage from large areas used extensively for training. Station T at Curry Crossing was the largest pool habitat sampled in the fall. This pool was backed up by a concrete low-water bridge. In the spring the low-water bridge was inundated by water, the station was flowing. Substrate here consisted entirely of soft mud having a depth of 20 to 30 cm over

a rock bottom. This station receives the drainage from the central portion of the impact area and receives runoff from the Main Cantonment Area of Fort Hood by way of drainage through Black and Jackson Gaps (Bull Run). Station I bottom type changed to fine gravel or sand in the pools and to rocks in the riffles. This is probably due to deposition after the spring rains.

Fall Flowing Streams

The flowing stream systems were sampled at Stations A (lower Clear Creek), H (lower Turkey Run Creek), and I (upper House Creek). Collections were made in both pool and riffle areas at all three sites. Station A at Clear Creek contained a riffle and pool having a bottom consisting of mud and organic detritus with numerous stands of aquatic macrophytes and floating mats of filamentous blue-green algae. Station H on Turkey Run consisted of a pool and riffle system largely free of aquatic macrophytes or large masses of filamentous algae. Station I on House Creek had a slab and rubble bottom and was choked by large masses of the filamentous green alga, *Hydrodictyon* sp. Although all three stations still consisted of pool and riffle systems, the flow was increased over what it had been in the fall. Only Station H contained large amounts of filamentous algae in the spring. Stations H and I drain the maneuver training areas and receive urban runoff and/or sewage discharges from sources outside the Fort Hood Military Reservation. During the spring survey, this station was flowing.

Upper Clear Creek (Station F) consisted of a pool habitat in a gravel stream bed. A considerable amount of trash was present at the lower end of this pool in the fall, but no trash was noted in the spring. No significant stands of aquatic macrophytes or filamentous algae were present at this station, since it was shaded relatively heavily.

Fall Non-Flowing Streams

The non-flowing stations included mid Table Rock Creek (Station O), lower North Nolan Creek (Station N1), upper North Nolan Creek (Station N2), upper Clear Creek (Station F), lower Reese Creek (Station D), and lower House Creek (Station J). All of these stations were flowing in the spring.

Station O on Table Rock Creek in the fall was a small remnant pool remaining after the evaporation of a much more extensive isolated pool. The substrate was primarily rock slab covered by a thick layer of silt. This station had good flow in the spring. The smell of H_2S was evident. The drainage area of this station includes a large area used extensively for maneuver training.

Station N1 on North Nolan Creek was a small shallow pool in fall. Although this pool had a deep, soft mud bottom, the stream bed was rock both up- and downstream of the pool. Aquatic macrophytes and filamentous algae were absent from this station in the fall. Station N2 on North Nolan Creek was a considerably larger pool, having a substrate consisting largely of fine gravel with smaller admixtures of mud and organic detritus. Both stations contained more water than in the fall and were flowing in the spring survey. Both stations appeared to be located in an area used lightly for maneuver training. These stations are also adjacent to the Belton Lake Recreation Area. North Nolan Creek receives sewage discharge from the treatment plant located there.

Station F on Clear Creek drains the built-up area around Robert Gray Army Airfield. Farther down Clear Creek, Station A also receives runoff from the housing facilities to the west of the Main Cantonment Area.

Station D on Reese Creek in the fall was an extremely turbid, shallow pool in a stream bed consisting of gravel, cobbles, and boulders. The pool was well shaded and enclosed in very steep stream banks. In the spring, this station was flowing. H₂S bubbles were noted as well as decreased turbidity from the fall. Neither filamentous algae nor aquatic macrophytes were present at this station in the fall survey. Station D on Reese Creek drains an area primarily used for bivouac. This area gives the appearance of being used much less heavily than the maneuver training areas west of the West Range Road.

Station J on House Creek was an artificially impounded, shallow, mud-bottom pool in the fall. Although large, this pool was heavily shaded. The mud bottom overlapped a rock stream bed and did not contain a large amount of organic detritus. No significant stands of aquatic macrophytes were present. In the spring, Station J increased in depth. Flow was slow and over the impoundment.

Fall Dry Streams

Three stations with flowing water were sampled in the spring; all of these stations were dry during the fall. The stations sampled were Station Z - Owl Creek, Station Y - Henson Creek, and Station P - Turnover Creek.

Owl Creek (Station Z), which drains the eastern-most section of the impact area, consisted of shallow pools and riffles with rock and gravel bottoms. Henson Creek (Station Y) was a pool and riffle system consisting of steep banks with an open canopy. The water was shallow with good flow, and the bottom consisted mostly of solid rock covered in places by a thin layer of silt. This station drains the northern part of the impact area. Turnover Creek (Station T) was a pool and riffle system draining part of the northern-most section of Fort Hood. The pools contained sand bottom, and the riffles consisted of rock and gravel. Flow was slow, the water was clear, and the canopy was open.

Ponds, Springs and Marshes

Standing water habitats at Fort Hood were limited to numerous small impoundments (stock ponds and Soil Conservation Service flood control lakes). No marsh areas of significance were found. The stock ponds are managed to some extent in order to provide a recreational fishing resource; however, the biota of these ponds were not sampled, since they are managed as a fishery resource and adequate characterization data are already available.

Detention ponds have been constructed along the northern perimeter of the Main Cantonment Area to trap runoff, particularly the vehicle parks and maintenance areas. Overflow from these detention ponds reaches an area from Cowhouse Creek through Bull Run (Figure 7).

Aquatic Biota

The results of the biological sampling program are presented in the following sections. The Appendix presents methods and materials for each organism group.

Phytoplankton

Table 26 lists the phytoplankton taxa and the estimated density of each at all stations sampled during the fall survey. It also lists the total number of taxa and the total density estimated at each station. Table 27 presents the results of the spring survey.

In the fall, Cowhouse Creek (Stations K and T) and Table Rock Creek (Station O) had the largest number of taxa, with 41, 42, and 40, respectively. Lower Reese Creek (Station D) and upper House Creek (Station I) had the fewest taxa, with 10 and 12, respectively. An average of 30 taxa were collected at the other 12 stations. The total number of taxa in the phytoplankton increased during the spring (97 taxa identified in spring, compared with 88 in fall). (The greater diversity of diatoms suggests that some may have been scoured from benthic substrates.) During the spring survey, upper House Creek (Station I), upper Nolan Creek (Station N2), Belton Reservoir (Station B3), mid Cowhouse Creek (Station L), lower Nolan Creek (Station N1), lower Cowhouse Creek (Station T), and lower Clear Creek (Station A), had the largest number of taxa, with 38, 36, 36, 35, 34, 32, and 32, respectively. Samples from the Leon River Stations (Station R and Station S) contained no phytoplankton due to flushing caused by the spring rains. An average of 22 taxa were collected at the other 12 stations.

The number of taxa observed in the House Creek stations during the fall survey increased from 12 to 30 between Station I (flowing) and Station J (pool). While this might be attributed to the influence of the supposedly nutrient-rich Turkey Run (Station H) and Clear Creek (Stations F and A), the total density of organisms did not increase significantly; however, the reverse occurred in the spring survey. The number of taxa had decreased from Station I to Station J. Station I contained 38 taxa, whereas Station J contained 29. The density also decreased significantly. Turkey Run (Station H), influenced by the Copperas Cove sewage treatment plant, exhibited a blue-green algal population less than that of upper House Creek (Station I), which has no known point source of enrichment. However, during the fall survey, Station H exhibited a greater blue-green algal population than Station I. The sampling sites on Clear Creek (Stations F and A) were somewhat different since the upper station (F) was a pool, while the lower station (A) was flowing. The number of taxa increased by only two at the lower station, although that station had more than twice the density of organisms of the upper station. The spring survey showed an increase of five taxa between Stations F and A, although Station A still contained twice the density of Station F. Between Stations F and A, Clear Creek receives runoff from the western portion of the Main Cantonment Area, a sanitary landfill, and a golf course. While Station A did not exhibit a decreased number of species, a calculated diversity would be low, due to the extreme dominance of *Euglena* sp. during the fall survey. The relatively high phytoplankton density at this station, due largely to the

presence of the pollution-tolerant genus Euglena,⁵⁰ suggests that this portion of Clear Creek is being impacted by current polluting practices. In the spring survey, the dominance of diatoms at this station resulted from the flushing actions of the spring rains. Station J, located below the confluences of both Turkey Run and Clear Creek, shows some evidence of enrichment. The numbers of phytoplankton taxa and the density observed at Station J are nearly average for the reservation, although five relatively tolerant taxa⁵¹ accounted for nearly 75 percent of the total phytoplankton. In the spring, the density was below average, whereas the number of taxa was above average. This was due to an increase in diatoms.

The outfall of the Belton Lake Recreation Area sewage treatment plant into North Nolan Creek could not be positively located during the field survey; the plant was apparently not discharging at that time. Based on the observed phytoplankton community, neither North Nolan Creek Station (N1 or N2) appeared to be enriched heavily.

Reese Creek (Station D) was the only sampling site during the fall survey that contained neither blue-green algae nor green algae (Chlorophyta) (Table 27). The absence of these taxa, combined with the fact that 88 percent of the population of only 10 taxa was composed of an unidentified euglenoid-type organism, made this a typical "stressed" situation. In all probability, the stress was due mostly to the extreme turbidity and heavy shading at this station. The spring survey showed a dominance of diatoms as well as the occurrence of blue-green and green algae. The lack of the euglenoid type of algae as well as the dominance of the diatoms was due to flooding.

Within the Cowhouse Creek drainage system, phytoplankton populations were generally dominated by green algae (Tables 28 and 29). Two exceptions were Stations I (upper House Creek) and A (lower Clear Creek). Upper House Creek was dominated by diatoms (Bacillariophyta), which were 86 percent of the total population in the fall and 71 percent in the spring; lower Clear Creek was dominated by euglenoid cells which formed 88 percent of the population in the fall and by diatoms, which formed 68 percent of the population in the spring. Exactly half of the eight sampling sites within the Cowhouse Creek drainage system were dominated by the group described as "miscellaneous green algae" (Table 8) in the fall survey. These algal cells were so small that they could not be identified positively beyond the division level. This group is an important food source of various zooplankton species.⁵² The other stations not dominated by the miscellaneous green algae were usually dominated or subdominated by members of the chlorococcales, particularly the genus Scenedesmus. The chlorococcales are generally characteristic of small bodies of water.

⁵⁰ M. C. Palmer, "A Composite Rating of Algae Tolerating Organic Pollution," J. of Phycology, No. 5 (1969), pp 78-82.

⁵¹ M. C. Palmer, "A Composite Rating of Algae Tolerating Organic Pollution," J. of Phycology, No. 5 (1969), pp 78-82; R. L. Lowe, Environmental Requirements and Pollution Tolerance of Fresh Water Diatoms (Nation. Env. Res. Ctr., USEPA, Cincinnati, 1974).

⁵² F. Ruttner, Fundamentals of Limnology (Univ. of Toronto Press, 1966).

Outside the Cowhouse Creek drainage (North Nolan Creek, Reese Creek, and the Leon River), the sampling stations in the fall survey were dominated and/or subdominated by flagellated algae of the divisions Euglenophyta, Chrysophyta, and Cryptophyta (Table 27). These algal forms are also characteristic of small bodies of water. Forms such as Euglena sp., Trachelomonas sp., and Lepocinclis sp. often occur in alkaline water which is generally rich in nutrients, particularly when nitrogen, phosphorus, and organic content are high.⁵³

Dominant populations changed between the fall and spring surveys. The dominance of the diatoms (Bacillariophyta) at all stations other than Belton Reservoir (Stations B1, B2, B3, and B4), upper Cowhouse Creek (Station T), and lower Cowhouse Creek (Station K) was the result of the spring rains. Dominant algae in Belton Reservoir changed from blue-greens to the Cryptophyta. Overall phytoplankton densities were lower in the spring survey than in fall 1978 (Tables 22 and 23), except at Station T where densities increased several times (12 614/ml in fall compared with 63 061/ml in spring). Flushing of smaller creeks into Cowhouse Creek as well as backwater from Lake Belton could be responsible for higher densities at this station. The most dramatic reduction in phytoplankton densities due to flushing occurred at the Leon River Stations R and S where no algae were observed in the samples.

The most significant difference in phytoplankton occurred between the various drainage systems and Belton Lake. Within the reservoir itself, the sampling sites showed an increase in the proportion of blue-green algae in the total community and a decrease in the proportions of both the Chlorophyta and Euglenophyta. Although Stations B1 and B2 are located in a cove influenced by the Cowhouse Creek watershed and B3 and B4 are in another cove that has no significant runoff, their phytoplankton populations are similar (Tables 30 and 31). The miscellaneous green algae (Table 29) was the dominant green algal group at all reservoir sampling sites during the fall. With reference to the blue-green algae, all stations were dominated by Spirulina sp., and three of the four had Schizothrix sp. as a subdominant in the spring (Table 32). Creek drainage system seems to have had little or no influence on the phytoplankton populations within the reservoir during the survey.

Periphyton

The 112 species of attached diatoms collected at Fort Hood (Table 33) can generally be described as having a cosmopolitan distribution and requiring water of neutral pH; best growth occurs slightly above a pH of 7.⁵⁴ Diatoms for which there is information are characteristic of water having high nutrient concentrations and/or conductivity. Also included are at least two common soil species (Hantzschia amphioxys and Navicula mutica) which are easily introduced into aquatic habitats.

The Cowhouse Creek drainage system (including tributaries) seems to be dominated in the fall by Nitzschia palea and Cyclotella meneghiniana. In all but one case (lower House Creek, Station J), one of these species was the

⁵³ F. E. Round, The Biology of the Algae (Edward Arnold LTD, London, 1966).

⁵⁴ R. L. Lowe, Environmental Requirements and Pollution Tolerance of Fresh Water Diatoms (Nation. Env. Res. Ctr., USEPA, Cincinnati, 1974).

dominant or subdominant form. In lower House Creek, N. amphibia replaced N. palea as a subdominant. The genus Nitzschia is frequently associated with nutrient-rich situations.⁵⁵ Both N. palea and C. meneghiniana occur frequently in areas heavily damaged by organic pollution;⁵⁶ however, this does not indicate that N. palea and C. meneghiniana have strict requirements for highly enriched water, but rather that they are more tolerant of such conditions.⁵⁷ N. palea was the dominant form along Cowhouse Creek (Table 34). This, and the fact that the total number of diatom species at both upper and lower Cowhouse Creek stations was almost identical (Table 35), seems to indicate that neither point sources nor non-point sources of pollution greatly affect the attached diatom populations of Cowhouse Creek. In the spring, the Cowhouse Creek drainage system was dominated by Cocconeis pediculus. Gomphonema parvulum was a subdominant at mid Cowhouse Creek (Station L).

G. parvulum was found in large numbers in areas receiving both treated and raw sewage.⁵⁸ This species occurred in Turkey Run, lower House Creek, and lower Cowhouse Creek, all downstream from known sewage discharges. However, G. parvulum also occurred in Table Rock Creek and in upper House Creek and constituted a larger proportion of the attached diatom community than it did at the stations immediately below sewage discharges. Thus, the organic loading of the Cowhouse Creek system seemed to be widespread and not confined to areas downstream from sewage treatment plants.

Effects of point source pollution might be indicated by the reduction of total species number between upper and lower House Creek stations as a result of the inflow of Turkey Run and Clear Creek (Tables 33 and 34). Caution must be used in this assessment, however, because the total species number was reduced by almost one half between upper and middle Cowhouse Creek stations for no apparent reason. A similar situation occurred in the Leon River, where total species number was reduced from 52 at the upper station to 15 at the lower station in the fall. Reduction in species number between these stations could conceivably have been caused by localized seasonal environmental conditions, as in the spring.

The North Nolan Creek Station N1 (lower) contained both N. palea and C. meneghiniana at very low densities, and contained Anomoeoneis vitrea as the dominant form in the fall and Cocconeis placentula as the dominant in the spring. While this is not indicative of a pristine condition, neither is it an indication of gross pollution. N. amphibia was the subdominant in the fall. Table 35 shows that N. amphibia was the dominant form below the sewage treatment plant at Turkey Run (Station H) as well as in North Nolan Creek in

⁵⁵ R. Patrick, "Ecology of Freshwater Diatoms and Diatom Communities," pp 284-332, In: D. Werner (ed.), The Biology of Diatoms (Blackwell Scientific Publ., London, 1977).

⁵⁶ J. H. Olive and J. L. Price, "Diatom Assemblages of the Cuyahoga River, N.E. Ohio (USA)," Hydrobiologia, No. 57 (1978), pp 175-187.

⁵⁷ R. L. Lowe and J. M. McCullough, "The Effect of Sewage Treatment Plant Effluent on Diatom Communities in the North Branch of the Portage River, Wood County, Ohio," Ohio I. Sci., No. 74 (1974), pp 154-161.

⁵⁸ R. L. Lowe and J. M. McCullough, "The Effect of Sewage Treatment Plant Effluent on Diatom Communities in the North Branch of the Portage River, Wood County, Ohio," Ohio I. Sci., No. 74 (1974), pp 154-161.

the fall. Thus, North Nolan Creek appears to show some effect from the discharge at the Belton Lake Recreation Area sewage treatment plant.

The attached diatom community within the study area was dominated by species which show a wide tolerance to environmental conditions. For example, N. palea the fall dominant, occurs in streams where the pH ranges from 3.8 to 8.5.⁵⁹ Within a drainage system like Fort Hood's, seasonal change could affect the populations of attached diatoms much more dramatically than minor land use changes. The periphyton diatom populations observed at these stations did not differ substantially from what would be expected in similar habitats in the central Texas region.

Periphyton data presented in Tables 34 and 36 demonstrated an increase in the number of taxa between fall and spring. Although species composition was not identical, many of the same taxa were identified. The dominant species changed, with the most abundant taxon overall in spring being C. pediculus and N. palea and C. meneghiniana in the fall. The changes from fall to spring seem to be more in response to local conditions (e.g., fall drought vs. spring floods) than to changes in organic loading from point or nonpoint sources.

Macrophytes

Macrophytes were present in pools of all the larger drainages at Fort Hood, including the Leon River (Stations R and S), Cowhouse Creek (Stations K, L, and T), House Creek (Stations I and J), Clear Creek (Stations A and F), and North Nolan Creek (Station N2), but were absent from the smaller creeks (Table 24) during the fall survey. Chara sp. (stonewort), a macroalga, was present in all these creeks except House and North Nolan Creeks and was particularly dense at Station L on Cowhouse Creek. Vascular macrophytes collected included Lemna sp. (duckweed), which formed a floating mat completely covering the surface of one pool at Station S; Najas guadalupensis (common water-nymph), a submerged aquatic, which was found in pools in several creeks; Myriophyllum sp. (water milfoil), also a submerged aquatic, found only at Station N2; Sagittaria platyphilla (arrowhead), an emergent found mainly along margins at Station A; and Bacopa rotundifolia, an emergent found along margins in several streams.

Of the aquatic macrophytes collected at Fort Hood, Chara sp. was the most widespread in spring, as it had been in the fall (Table 37). Some marginal vegetation which had been inundated by high water was collected. In addition, some species not observed during the fall survey were collected from a seep along the bank of Nolan Creek (Station N1). Macrophytes collected in the spring survey, but not observed in the fall included Justicia americana (American Waterwillow), Eleocharis montevidensis (Spikerush), Potamogeton (Pondweed), Samolus parviflorus (Water Pimpernel), Veronica (Speedwell), and Zanichellia palustris (Common Poolmat).

The major value of macrophytes to aquatic environments is shelter for fishes, insects, and crustaceans. Macrophytes also provide substrates for periphyton, on which many macroinvertebrates graze. Submerged macrophytes can

⁵⁹ F. D. Hancock, "The Ecology of the Diatoms of the Klip River," Southern Transval., Hydrobiologia, No. 42 (1973a), pp 243-284.

contribute substantially to daytime DO levels, as observed in Pool 2 at Station L (Table 23), but excessive growth may cause nighttime DO depletion. Unattached or loosely attached macrophytes are often swept downstream during seasonal floods.

Zooplankton

Tables 38 and 39 present the estimated density of each zooplankton taxon at each station, the total number of taxa identified, and a summary of the total estimated density for each station. Tables 40 and 41 summarize the relative abundance of major zooplankton groups at each station.

Rotifers were the primary groups at the four Belton Lake stations, comprising 99.0, 100.0, 89.8, and 89.2 percent during the fall, and 70.8, 81.1, 86.9 and 49.8 percent in the spring at Stations B1, B2, B3, and B4, respectively. In the fall survey, 13 of 14 species collected were rotifers at Stations B1 and B4; at Station B2, all species collected were rotifers, and at Station B3, 10 of 14 species were rotifers. Most of the rotifers observed at the Belton Lake stations during both surveys were characteristically planktonic forms or those frequently found in lacustrine environments. These include Brachionus sp., Conochilus unicornis, Conochiloides dossuarius, Filinia longiseta, Hexarthra mira, Keratella cochlearis, Polyarthra vulgaris, Synchaeta pectinata, S. stylata, Ploesoma hudsoni, Anuraeopsis fissa, and Trichocerca sp.⁶⁰ Species of the genus Brachionus, restricted to alkaline waters,⁶¹ were common in Belton Lake, where pH values ranged from 7.1 to 8.6.

No cladocerans were collected from any of the Belton Lake stations in the fall, but some were found in the spring survey. Although they made up less than 10 percent of the populations at Stations B1, B2, and B3, they made up 25.5 percent of the population at Station B4. Copepods represented a small percentage of the organisms captured; naupliar larvae were the only copepod instars observed during the fall survey. Copepods remained a small percentage of the organisms captured during the spring survey at Stations B1, B2, and B3; however, at Station B4, copepods made up 24.4 percent of the population. Of the four Belton Lake stations during the fall survey, B4 possessed the greatest zooplankton density with 294 organisms/L, while the lowest density observed (114 organisms/L) was at B3 (Table 32). The spring survey showed that Station B3 had the greatest abundance of zooplankton (215 organisms), whereas the lowest density was at Station B1 (129 organisms). The differences may be due partly to differences in water clarity.⁶² Density was highest at Station B4, which had the clearest water (Secchi disk reading of 164 cm compared to 23, 64, and 61 cm at Stations B1, B2, and B3, respectively). This relationship did not recur in the spring survey, when the reading for Station B3 was 78 cm, and 134 cm for B1.

⁶⁰ G. E. Hutchinson, A Treatise on Limnology, Vol II (John Wiley and Sons, 1967).

⁶¹ E. H. Ahlstrom, "A Revision of the Rotatorian Genera Brachionus and Platyias With Descriptions of One New Species and Two New Varieties," Bull. Amer. Mus. Nat. Hist., Vol 77 (1940), pp 143-184.

⁶² L. G. Williams, "Dominant Planktonic Rotifers of Major Waterways of the United States," Limnol. Oceanogr., No. 11 (1966), pp 83-91.

Overall, zooplankton densities at Belton Lake stations were moderate to low, with correspondingly low phytoplankton densities at the same locations (Tables 26 and 27) during both surveys. The zooplankton community observed in Belton Lake is similar to that of other reservoirs in this region at that time of year.⁶³

During the fall, rotifers represented 92 percent of the zooplankton community on the upper Leon River (Station R), while copepods comprised 7 percent (Table 40). No cladocerans were observed at Station R. In contrast, on the lower Leon River (Station S) copepods were the primary group (64 percent), while rotifers and cladocerans represented 28 percent and 7 percent, respectively. The spring survey showed a decrease in rotifers at Station R (49 percent), whereas copepods increased to 39 percent (Table 41). At Station S, rotifers increased in importance to 50 percent of the total, diptera increased to 40 percent.

The species compositions of the two Leon River stations were quite different. The sample from Station R, in addition to exhibiting a higher density (7945 organisms/L compared to 1325 organisms/L at Station S), was dominated by small-bodied rotifers, probably because it was a grab sample, and not filtered through a net. Many organisms that might ordinarily pass through the 64-micron mesh of the net were thus retained. The most abundant rotifers at Station R were the Trichocerca sp. These species are found mainly in productive ponds⁶⁴ or macrophyte zones, although some are definitely planktonic.⁶⁵ Station S was dominated by nauplii and immature cyclopoid copepods. Both Leon River stations exhibited relatively high densities of these species, which are often associated with ponds or pools where a no-flow or long detention time regime allows populations to increase. At both stations, diverse food supplies may also have contributed to the zooplankton density. Species compositions of the Leon River stations included both planktonic and littoral species, which is typical of shallow pools having a variety of microhabitats. Variable zooplankton populations (by species composition and abundance) are often noted in such intermittent stream situations. At the Leon River stations, this was probably the result of operant factors inherent in pond and intermittent stream environments (e.g., variety of habitat, diversity of food supply, fluctuation of water levels, little or no flow).

The species composition of the Leon River stations changed in the spring survey. At Station R, the rotifers decreased in dominance, and at Station S,

⁶³ B. B. Harris and J. K. G. Silvey, "Limnological Investigations on Texas Reservoir Lakes," Ecol. Monogr., No. 10 (1940), pp 111-143; J. R. MacRae and B. Maguire, Jr., Before and After Studies of the Effects of a Power Plant Installation on Lake Lyndon B. Johnson; Before Studies, Vol. 1, Monitoring Data, Progress Report No. 3 to Lower Colorado River Authority, Contract IAC (74-75) 1089 (Lower Colorado River Authority, 1975).

⁶⁴ G. E. Hutchinson, A Treatise on Limnology, Vol II (John Wiley and Sons, 1967).

⁶⁵ A. Ruttner-Kolisko, Plankton Rotifers Die Binnengewasser, Vol 26, Part 1 (E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart, 1974).

the rotifers increased to 50 percent of the sample. The decrease at Station R can be attributed primarily to the use of a 64-micron mesh net to filter the sample. The decrease in density of both stations (7945 in fall compared to 53 in spring at Station R, and 1325 in fall compared to 40 in spring at Station S) was primarily the result of the flood conditions.

Lower Clear Creek (Station A), Turkey Run (Station H), and upper House Creek (Station I) were the only stations which had running water during the fall field survey. These stations had relatively low densities, ranging from 294 organisms/L at upper House Creek to 508 organisms/L at lower Clear Creek. This was probably a result of flow; for example, the non-flowing upper Clear Creek had a density of 3287 organisms/L or approximately six times the density of lower Clear Creek. No flow was observed at upper Clear Creek, which may account for the higher density. In a pond, where no current is evident, detention time is greater than in moving water, enabling the development of a denser zooplankton community. In addition, lower Clear Creek was somewhat more turbid than upper Clear Creek, and turbidity tended to limit zooplankton densities. In addition, small ponds consist of both littoral and limnetic regions,⁶⁶ which provide a variety of habitats and food sources. This allows the development of communities that include both planktonic and littoral species, which contribute to higher densities.

Rotifers dominated the catch at all three stations in the fall. Each had a diverse assemblage of both riverine and littoral rotifer species, as expected in a pool-riffle system. The community at Station H on lower Turkey Run, which receives effluent from Copperas Cove, was not noticeably affected by this input. The three stations with flow (A, H, and I) were among the most diverse in terms of numbers of taxa, although absolute abundances were not high. Stations A, H, and I (lower Clear Creek, Turkey Run Creek, and upper House Creek, respectively) still contained running water during the spring survey. Overall densities at all three stations were lower due to the spring flood, and rotifers dominated at all three locations.

Of the remaining creek stations sampled, all were isolated pools in the fall like Leon River. Upper Cowhouse Creek (Station K) had a zooplankton density of 1306 organisms/L, while lower Cowhouse Creek (Station T) had a relatively low density (382 organisms/L) in the fall. Neither of these stations had flowing water. Reasons for the disparity in densities are unclear, since there was not a corresponding major difference in phytoplankton densities at these two stations. Both of these stations exhibited a zooplankton assemblage consisting primarily of species typically found in lentic habitats. During the spring survey, upper Cowhouse Creek (Station K), mid Cowhouse Creek (Station L) and lower Cowhouse Creek (Station T) had low densities (3, 1, and 57, respectively). The low densities reflect the effects of spring rains. Lower Cowhouse Creek (Station T), which has the greatest density, reflects the effect of longer retention time.

Table Rock Creek (Station O) exhibited a very high density of 4481 organisms/L in the fall, as did upper Clear Creek (Station F), which had 3287 organisms/L. Since these were pool habitats, the high densities were expected. The spring sampling showed the effect of the spring flood, with

⁶⁶ R. E. Coker, Streams, Lakes, and Ponds (Harper and Row, 1954).

densities at both Station O and Station F decreasing (1 organism/ml and 30 organisms/ml, respectively).

Both stations sampled on North Nolan Creek (N1 and N2) during the fall had high densities in relation to all other stations sampled. This may be partly because 1-gallon grab samples were taken at these locations, thus retaining small organisms that would have otherwise passed through a 64-micron plankton net. The high densities may also be due to the nature of the habitats (isolation and reduced predation). Station N1, with a total density of 23,776 organisms/L (Table 32), was a shallow pool with no flow, populated mainly by ubiquitous planktonic rotifer species and some copepods, mainly nauplii. Station N1 may have been receiving some enrichment from organic wastes from cattle in the area and from the outfall of the Belton Lake Recreation Area sewage treatment plant (Figure 7). Station N2, with a density of 8445 organisms/L, was populated mainly by a few species of rotifers and copepod nauplii. Fewer species were noted here than at other stations.

The spring survey at the Nolan Creek Stations (N1 and N2) showed a decrease from the fall for densities for two reasons: (1) the spring survey used a 64-micron plankton net which would have allowed many small organisms to pass through, and (2) the flow caused by the spring flood caused a further decrease by flushing.

Station D on lower Reese Creek had a density of 407 organisms/L, with copepods the most abundant group during the fall. A large number of the predaceous dipteran larvae (Chaoborus sp.) were collected in the sample at Station D. Chaoborus sp., along with the high turbidity, might have influenced the community's population density. Deonier⁶⁷ found that Chaoborus sp. was a voracious predator of all types of zooplankton. In the spring survey, the overall density of zooplankton decreased due to the flowing conditions. Lower House Creek (Station J), Owl Creek (Station Z), Henson Creek (Station Y), and Turnover Creek (Station P) were not sampled in fall because they were dry. The stations were sampled in the spring. All had low densities (1 to 3 organisms/ml), as expected.

Overall zooplankton densities at most stations were extremely low in the spring except in Belton Lake, where densities were similar to those observed in the fall (Tables 38 and 39). Sixty-eight taxa were identified, including some of the same species found in the fall, when 74 taxa were collected. Rotifers continue to be the most abundant and diverse group as in the fall. Keratella cochlearis, Polyarthra vulgaris, and Copepod nauplii remain the most widespread and abundant taxa overall, although other species dominated at some stations in the spring.

Macroinvertebrates

The results of macroinvertebrate sampling at all stations are presented in Tables 42 and 43 (density estimates from dredge and Surber samples) and Tables 44 and 45 (collections by dip net).

⁶⁷ C. C. Deonier, "Biology of the Immature Stages of the Clear Lake Gnat," Ann. Ent. Soc. Amer., No. 36 (1943), pp 383-388.

Benthic samples collected at Belton Lake in the fall (Stations B1, B2, B3, and B4) consisted entirely of Diptera, which were primarily the predaceous Tanypodinae (Table 35). Coelotanypus sp. was the most abundant taxon at all stations except B4, where Polypedilum illinoense and Tanypus stellatus were codominants. Substrates at B1, B2, and B3 were fine clay, as compared with fine gravel at B4. Light penetration was also much greater at Station B4. These differences may account for the presence of Polypedilum illinoense, since members of this genus are typically algal grazers.

Species diversity was low at all Belton Lake stations, particularly at Station B1.⁶⁸ Here, the deep, apparently recently accumulated clay sediment layer may account for the low diversity. The highest diversity was at B3, where sediments contained a large amount of organic detritus. Standing crop was low at all reservoir stations, but was highest (4181/m²) at B2. This station had sediments similar to those of B1, but was probably less silted, since it is located farther from the mouth of Cowhouse Creek. High water prevented collection at the Belton Lake stations in the spring.

In the fall the benthic community at upper Leon River (Station R) was primarily Diptera (55 percent) and Oligochaeta (41 percent). This relatively high abundance of worms, particularly Tubificids, is indicative of organic pollution.⁶⁹ The dominant Diptera were the same Tanypodinae that were abundant in Belton Lake. The dominant oligochaetes included immature Tubificidae and Branchiura sowerbyi. B. sowerbyi is thought to be an introduced species, and is known to be tolerant and may even prefer warm water, since it has been observed in a variety of thermal regimes in temperate lakes and streams.⁷⁰

Species diversity in benthic samples was higher at Station R in comparison with most creeks. Diversity was 2.425, and 19 taxa were collected. The standing crop at Station R was 2157/m, which was higher than in most creeks, but lower than in Belton Lake. Quantitative samples were not taken in the spring survey at Stations R and S because of the depth, increased flow, and change in bottom type.

The number of taxa collected by dip net in the fall at Leon River Stations R and S was the same as was taken in the quantitative samples (Table 44). This was somewhat less than the number collected from most other creeks at Fort Hood. Although similar in diversity, the macroinvertebrate assemblages were somewhat different between these two stations. Plumatella repens (Bryozoa) and Orthotrichia sp. (Trichoptera) were found only at one other station (Station A), and Spongilla sp. (Porifera) was collected only at Station R. Several of the taxa collected at Station R are usually found in flowing water, although no flow was recorded during the August 1978 survey. Most freshwater sponges are intolerant of silt, and their presence at Station R reflects the relatively unsilted condition of this station.

⁶⁸ C. E. Shannon and W. Weaver, The Mathematical Theory of Communication (University of Illinois Press, 1949).

⁶⁹ R. O. Brinkhurst, "Taxonomical Studies on the Tubificidae (Annelida, Oligochaeta)," Int. Rev. Ges. Hydrobiol. Suppl., No. 51 (1966), pp 727-742.

⁷⁰ R. O. Brinkhurst, "Taxonomical Studies on the Tubificidae (Annelida, Oligochaeta)," Int. Rev. Ges. Hydrobiol. Suppl., No. 51 (1966), pp 727-742.

Dip net collections in the spring survey at Leon River stations showed a decrease in the number of taxa (7 in the spring as compared to 76 in the fall). This low number is indicative of the effects of the spring floods.

Taxa found at Leon River Station S in the fall but not at Station R include the Conchostraca (Lynceus sp.) and Crustacea (Hyalella azteca and Palaemonetes sp.) (Table 44). The Conchostraca are indicative of temporary pools, while the other Crustacea are detritivores commonly found in weedy habitats. More detritus occurred on the bottom at Station S than at Station R. Pools at Station S, being much smaller than those at R, might also be less permanent. Species adapted to lotic (running water) habitats at Station R were mostly absent from Station S, possibly indicating lower flows during wet seasons at Station S. This observation is supported by the presence of finer substrates (muck and detritus) at Station S when compared with Station R (fine gravel), and the greater abundance of algae and macrophytes, which would tend to be swept away in higher flows. The possibility of greater nutrient enrichment at Station S might also account for the abundant growth of macrophytes.

Macroinvertebrates collected by dip net at Cowhouse Creek include species tolerant of a wide range of environmental conditions (Table 44). Most are typically found in the quiet waters of streams, lakes, and ponds. Differences in macroinvertebrate assemblages at various stations are attributable to differences in substrates and food sources at the Cowhouse Creek stations. These differences are exemplified by the variety of mayfly taxa found at each station in the fall. Caenis sp. and Stenonema tripunctatum, found at Station K, inhabit quiet water, cling to rocks or woody debris, and are tolerant of silt. Both feed on algae (including diatoms) and detritus.⁷¹ These species were also found at Station L, along with Baetis sp. and Callibaetis sp. The greater diversity of mayflies at Station L may be attributed to the abundance of Chara sp. at this station. Hexagenia bilineata, found only at Station T, is a burrower in bottom sediments. Station T was the only one on Cowhouse Creek where a deep sediment layer occurred. This was primarily due to runoff from nearby unvegetated areas.

In the fall survey, Cowhouse Creek Station K supported fewer taxa (9) than Stations L or T (21 and 19, respectively) (Table 44). The abundance of Chara sp. at Station L probably contributed significantly to the diversity of habitats at this station.

The spring survey showed a decrease in the total number of taxa collected. Eight taxa were collected by dip net from both Stations K and L. The decrease in taxa, particularly at Station L, can be attributed to the spring floods. Quantitative taxa samples were taken at Station L during the spring survey. Only three taxa, consisting of 21 organisms/m were collected. The calculated diversity at this station was low.

Flow was detected during the fall at creek Stations A, H, and I. At Turkey Run Creek (Station H), the base flow is from sewage discharge from

⁷¹ B. D. Burks, "The Mayflies or Ephemeroptera of Illinois," Ill. Nat. Hist. Surv. Bull., No. 26 (1953); G. F. Edmunds, Jr., S. L. Jensen, and L. Berner, The Mayflies of North and Central America (Univ. of Minn. Press, Minneapolis, 1976).

Copperas Cove, while at lower Clear Creek (Station A) and upper House Creek (Station I) flow presumably comes from natural sources.

Surber samples were collected in the fall survey in riffles at Stations H and I and exhibited very low standing crops, particularly at H ($120/m^2$). The sandy substrate where Surber samples were collected at Station H probably provides a less stable habitat for macroinvertebrates than does the gravel substrate at Station I. Possible effects of the sewage effluent discharged to this creek from Copperas Cove cannot be discounted. However, species diversities at these stations were among the highest collected at Fort Hood and were comparable to those at Leon River Station R. The dominant group at both stations was Diptera; other important groups collected in riffles included the Oligochaeta, Odonata, Hemiptera, and Coleoptera at Station H, and the Oligochaeta and Gastropoda at Station I.

Surber samples were taken at all three stations during the spring survey. An Ekman dredge sample was also taken at lower Clear Creek Station (Station A). All stations supported a lower number of taxa than in the fall. The diversity of Station H showed a dramatic increase from 0.2336 in the fall to 1.767 in the spring. The Oligochaeta was the dominant group at this station, although the Diptera were subdominant. At Station A, the diversity index slightly decreased to 2.024 from 2.493 in the fall. Diptera remained the dominant group. Quantitative results from Station A at upper Clear Creek showed the differences in both sample technique and bottom types. The Ekman samples, which were taken from areas where the jaws of the dredge could close, such as muddy bottom areas, showed a diversity of 1.4648, with 3275 organisms/ m^2 . These organisms came from 20 taxa and were dominated by the Oligochaeta. The Surber samples, which were taken from shallow riffles, showed a diversity index of 1.7465, based on 1331 organisms/m made up of 20 taxa. These were dominated by the Diptera.

Dip net collections at Stations A, H, and I included the highest numbers of taxa found at Fort Hood. Clear Creek Station A had the highest number of taxa (40), probably because of its diversity of habitats, including the rock riffle and the soft-bottomed pool which contained an abundance of macrophytes. Several taxa, including Corydalis sp., Psephenus sp., Plumatella repens, and Orthotrichia sp., found at Stations A, H, or I during the July 1978 survey, are adapted to flowing water habitats and attach themselves to rocks or woody debris in currents. In the spring survey, the dip net collections from Stations A, H, and I showed a decrease in the number of taxa from fall. The loss of the number of species in the spring is at least partially accounted for by the spring flood. The remaining creek stations sampled, like Leon River, were isolated pools.

Benthic samples were taken only at Station T on Cowhouse Creek in the fall due to the lack of fine substrates at Cowhouse Creek Stations K and L (Table 26). The standing crop ($8836/m^2$) and diversity (1.997) were high at Station T in comparison with most other stations at Fort Hood (Table 42). Community composition was similar to other creeks, with about 62 percent Oligochaeta and 35 percent Diptera. As in the Leon River, some organic enrichment of Cowhouse Creek is indicated by the high proportion of oligochaetes and the low number of most insect orders. Because of the spring flooding, only dip net samples were taken at Station T in the spring. Dominance at Station T was evenly divided between the Ephemeroptera, Diptera and the Hemiptera.

Quantitative benthic samples were collected at Stations O, N1, N2, F, D, and J, all of which had no flow recorded during the 21 through 25 August 1978 aquatic survey. Standing crops of benthos at Stations O, N1, N2, F, D, and J ranged from a low of 1749/m² at Station N2 to 11,163/m² at Station O. Standing crops in creeks were generally higher than in Belton Lake. The minimum (at Station N2) was similar to Leon River Station R, and the maximum (at Station O) was similar to Cowhouse Creek Station T. These stations are discussed together because of their similarity with respect to lack of flow.

In the spring, quantitative benthos samples were taken at Stations O, N1, N2, D, J, P, and Z. Unlike the fall survey, all of these stations had flowing water in the spring. The standing crop ranged at these sites from 10,746₂ organisms/m at Station J (lower House Creek) to a low of 612 organisms/m² at Station Z (Owl Creek). Station J was pooled behind a low dam and was made up of 87 percent Oligochaeta.

Diptera and Oligochaeta were the dominant taxonomic groups in natural substrate samples due to the fine sediments and leafy detritus occurring at most of these creek stations. Oligochaeta comprised at least 50 percent of the benthic community in the fall at Stations N1, N2, D, and J, and less than 50 percent at Stations O and F. The higher percentage (86 percent) of oligochaetes at Station J, in comparison with other stations is attributable to the permanent nature of the pool formed by a dam on House Creek. The dominant Oligochaeta were the same as those collected from the Leon River and Cowhouse Creek Stations R and T. Diptera was the dominant group at Stations O and F, having a relative abundance greater than 50 percent at each of these stations. The dominant species of Diptera were generally the same as those collected in Belton Lake, although additional species were found in creeks.

Diptera and Oligochaeta dominated all stations (O, N1, N2, J, P, and Z) during the spring survey; however, at Station D, the Gastropods dominated.

During the fall, species diversity of these non-flowing stations ranged from 1.464 at N1 to 2.238 at F. Diversity at Stations O, N1, N2, F, D, and J was generally higher than at Belton Lake but lower than at Stations R and T. The lowest diversities occurred at Stations O, J, and N1. Station C, with six taxa, and Station N1, with nine taxa, appeared to be somewhat stressed aquatic habitats. Low water levels caused by a late summer drought were particularly evident at these stations. Station O was heavily silted from erosion and had a very concentrated fish population because of the low water level. Station N1 had a very soft bottom which evidently had been disturbed frequently by cattle. This well-shaded station is near the sewage outfall of the Fort Hood Recreation Area sewage treatment plant. Organic nutrient loading and lack of light probably account for the low DO levels measured here (Table 23).

Species diversity in the spring ranged from 0.882 at Station O (mid Table Rock Creek) to 2.598 at Station N1 (Nolan Creek). The lower number of taxa varied from a low of 10 at Station Z (Owl Creek) to a high at Station N2 of 23. Stations O, J, P, and Z were dominated by Oligochaeta. Nolan Creek stations were dominated by the Diptera.

Taxa collected by dip net at pooled-up stations ranged in number from 9 at Station N1 to 26 at Station F. The most widespread and abundant groups collected were the Oligochaeta (worms), Arachnida (water mites), Amphipoda (scuds),

Ephemeroptera (mayflies), Odonata (dragonflies, damselflies), Coleoptera (beetles), Diptera (flies), and Gastropoda (snails). Most of the taxa collected are tolerant of a wide range of conditions and are commonly found in quiet water, especially among vegetation or detritus. *Caenis* sp., the most common mayfly collected, occurs in silted streams and feeds on detritus and algae. A total of 18 taxa of Odonata were collected, including bottom sprawlers, burrowers, and slender forms which cling to vegetation and wood. All members of this group are predaceous on other invertebrates, and are typically found in quiet pools. Gastropods collected were all members of the subclass Pulmonata, which breathe by means of a pulmonary sac. This enables them to withstand low DO levels like those often occurring in shallow nutrient-enriched pools. Except at Station N1, the macroinvertebrate assemblages in these intermittent creeks appeared to be fairly diverse and typical of the locality and the season.

Dip net collections for the spring survey at Stations P, O, N1, N2, D, J, Y, A, and Z contained between nine and 22 taxa. Station P (Turnover Creek) and Station D (lower Reese Creek) contained nine taxa, whereas Station N2 (lower Nolan Creek) contained 22 taxa. The Crustacea, Ephemeroptera, Odonata, Trichoptera, Hemiptera, Diptera, and Gastropoda were the most widespread and abundant groups collected in the spring.

Overall macroinvertebrate samples collected by Ekman dredge and Surber samples were less diverse in the spring than in the fall survey (64 taxa in the fall compared with 54 in the spring). Although many of the same taxa were collected (Tables 42 and 43), densities were lower at most stations in spring, although the silty substrate at Station J supported a more abundant Oligochaete population, and total densities were higher at this station. Although Diptera were still an important group in terms of abundance, they were considerably less abundant and diverse in benthic samples taken in spring than in the fall. Macroinvertebrates collected by dip net were also less diverse in the spring (67 taxa in the spring compared with 109 in the fall) as shown in Tables 44 and 45). Inundation of rock riffles and scouring of substrates probably account for much of the decrease in diversity. Many of the taxa identified in the spring were the same as those observed in the fall.

Fish

Little published information is available for describing Fort Hood's fish communities. Beaty⁷² includes a checklist of the fish known to occur in the waters of the Little Lampasas and Leon Rivers, Nolan Creek, and Belton and Stillhouse Hollow Reservoirs. His list is compiled from records of periodic fish surveys made by the Texas Parks and Wildlife Department, Austin, TX.

Table 46 lists fish that could potentially occur at the Fort Hood Military Reservation, as well as those actually collected on-site. Of the 64 species which may occur in the area, 29 were collected at one or more of the 14 stations in the fall. Most of these (26 species) were collected in the small intermittent creeks; 13 species were collected in Belton Lake, and six in the Leon River. This was probably a result of unequal collection effort being expended in each of these water body types (i.e., 11 stations were in

⁷² H. E. Beaty, A Checklist of Flora and Fauna in Central and West Bell County, Texas, unpublished manuscript (3414 Forest Trail, Temple, TX, 1978a).

intermittent creeks, two were in Belton Reservoir, and one was in Leon River), as well as increased diversity of habitat types in the large number of intermittent creeks.

The spring survey collected 26 taxa; of these, only three were collected in the spring that had not been collected in the fall. Ictiobus bubalus, smallmouth buffalo, Morone chrysops, the white bass, and the Lepomis humilis, the orange-spotted sunfish, were the additional taxa found in the spring. Most were collected in either Cowhouse Creek (14 species) or the intermittent creeks (14 species). Twelve were collected in Belton Reservoir, and seven were collected in Leon River. The differences are the result of both unequal collection effort at each type of water body, and in the sampled stations' different habitats.

Seining produced 26 species in the fall, and shocking and gill netting added three more. The species collected by gill netting were the longnose gar (Lepisosteus osseus), carp (Cyprinus carpio), and flathead catfish (Pylodictus olivaris). The most common species collected by gill netting and shocking were the gizzard shad (Dorosoma cepedianum) (25), followed by channel catfish (I. punctatus) (11), and longnose gar (L. osseus) (9). These species are common at a 25-year-old reservoir.

Twenty-three species were collected in Cowhouse Creek, Leon River, and the intermittent creeks by seining, and 12 species were collected in Belton Reservoir by electroshocking and gill netting. Of the 12, only three were unique to Belton. C. carpio (carp), I. bubalus (smallmouth buffalo), and M. chrysops (white bass).

Table 47 presents the results (number collected, weights, and lengths) of the fish collected by seining in the fall survey for each of the 14 stations. Approximately 12,000 fish were collected during the field surveys. Most (72 percent) of these were collected at Station 0 in mid Table Rock Creek (6645) and at Station A on lower Clear Creek (1966). The numbers of fish collected per station were fairly evenly distributed among the rest of the stations except at Belton Reservoir Station B1, where only 27 individuals were collected.

Table 48 gives the results of the spring survey, in which approximately 1800 fish were collected. This reduction (down from 12,000 in fall) is to be expected, because the fall survey was conducted when most of the station samples were remnant pools having little or no flow between them. The drought conditions would have forced fish to move to these pools and concentrated in them. However, the spring flood, while stressing the populations, would reopen the stream and allow the fish to move to other areas of the stream reach.

Although considerable variability was evident in species composition, richness, and density among the stations sampled, no consistent relationships were apparent between these parameters of the fish community and the stations' various physical or ecological characteristics. Differences in water quality or sediment loadings did not produce consistent differences in fish faunas. Likewise, substrate type, general morphometry, and presence or extent of macrophytes appeared to significantly affect the fish communities. No consistent relationship was apparent between fish community parameters and distance up the watershed, although evidence of Belton Lake's influence was

at Station T on Cowhouse Creek, where Tidewater Silverside (Menidia beryllina), a lake species, was present in the fall survey.

The most commonly collected species in the fall was the mosquitofish (Gambusia affinis). This species represented approximately 65 percent of all fish collected. In addition, this species accounted for approximately 78 percent of the fish collected at mid Table Rock Creek (Station O) and 82 percent of those collected at lower Clear Creek (Station A). These two stations were ranked first and second in total number of individuals collected, simply because these collections contained large numbers of mosquitofish. High concentrations of mosquitofish are common in shallow, protected areas because of the concealment provided by these areas (i.e., protection from larger predators) and their tolerance (relative to other species) of stressful conditions.

The second and third most commonly collected species were the red shiner (Notropis lutrensis) and bluegill (Lepomis macrochirus). These two species accounted for an additional 16 percent of the 12,000 fish collected. Most of the red shiners were collected at either upper or lower House Creek (Stations I and J), while most of the bluegills were collected at mid Table Rock Creek (Station O). The remaining 23 species collected by seining account for the remaining 19 percent of the fish. The most commonly collected fish in Belton Reservoir was the long-nosed gar (Lepisosteus osseus). This species, which accounted for 20 percent of the total from the reservoir, was found only at stations B1 and B2, and account for 39 percent of the fish collected from that station.

The red shiner was the most common species found in the Leon River, accounting for 50 percent of the individuals collected from Stations R and S. Station R was not seined due to the rate of flow and depth, so fish were collected with a dip net at this location.

The collection at Cowhouse Creek was dominated by the red shiners, which accounted for 74 percent of the total individuals collected. Fish were not collected from lower Cowhouse Creek (Station T) due to high water. Red shiners also dominated at Stations Y (Henson Creek), A (lower Clear Creek), I (upper House Creek), J (lower House Creek), and P (Turnover Creek), making up 86 percent of the individuals collected at these stations.

The Nolan Creek stations (N1 and N2) were dominated by the mosquitofish, which made up 84 percent of the populations. Bluegills were the only fish found at upper Clear Creek (Station F) and at Owl Creek (Station Z). However, only three individuals were found at these stations. The long-ear sunfish (Lepomis megalotis) was the most common fish found at lower Turkey-Run (Station H), accounting for 65 percent of that population.

Members of the families Poeciliidae (livebearers), Cyprinidae (minnows), and Centrarchidae (sunfishes) were the most commonly collected. This is consistent with the literature and was expected, since these families contain large numbers of species, many of which occur in central Texas. Based on frequency of occurrence (i.e., number of stations at which a species was collected), the bluegill was the most cosmopolitan in the fall, followed by the mosquitofish and the red shiner. The bluegill was collected at 12 stations, the mosquitofish at 12, and the red shiner at eight during the fall survey. In spring, the most cosmopolitan was still the bluegill (14 stations),

followed by another member of the Centarchidae family -- the long-eared sunfish (nine stations) -- and two members of the Cyprinidae family -- the red shiner and black tail shiner (Notropis venustus) -- both found at seven stations. The mosquitofish, a member of the Poeciliidae family, was found at seven stations. This was expected, since these species are widely distributed, have a tendency to form large populations, and are easily collected by seining.

The largest number of species collected in the fall was at lower Cowhouse Creek (Station T), mid Table Rock Creek (Station O), and lower Clear Creek (Station A). Eleven species were collected at each of these stations. Belton Lake Station B1 represented the lowest number of species, having a total of three. An average of six species was collected at the remaining 10 stations, with the species collected ranging from five to eight. It is not surprising that more species and larger numbers of individuals were collected at lower Cowhouse Creek, mid Table Rock Creek, and lower Clear Creek, since these streams had large pooled-up areas where the fish were concentrated. In addition, these areas were easily seined. The species collected in these pooled areas represent inhabitants of a variety of habitat types (e.g., riffles, vegetated areas, protected undercut banks, shallow flats) which are forced to cohabit pooled refugia during stressful (e.g., drought) conditions.

The largest number of species collected in the spring was from Belton Reservoir (Station B3), where 10 taxa were collected. The lowest number of taxa collected was from Stations R, F, and Z (upper Leon River, upper Clear Creek, and Owl Creek). The other 12 stations averaged approximately seven taxa. This lower number of taxa is expected under the spring survey conditions.

Overall, data presented in Tables 47 and 48 show that the number of individuals was generally much lower in the spring than in the fall except at Reese Creek (Station D) and Belton Lake (Station I). The number of each species collected from each station was also lower in spring except at Belton Lake and lower House Creek (Station J). Overall, the red shiner (Notropis lutrensis) was the most abundant species collected from creek habitats in the spring, although several other species were also widespread. Of the 28 taxa identified from spring collections, all but four were collected in the fall survey, when the total number of taxa was 26.

Important Species

Chapter 2 defines "Important Species."

Recreationally or Commercially Important Species

There is no commercial fishery at Belton Reservoir at this time, and the Texas Parks and Wildlife Department does not foresee the establishment of one. Species which could possibly form the basis for a commercial fishery at Belton Lake are carp (Cyprinus carpio), buffalo (Ictiobus bubalus) and gar (Lepisosteus oculatus and L. osseus).

Valuable recreational species at Belton Lake include largemouth bass (Micropterus salmoides), spotted bass (Micropterus punctulatus), white bass

(Morone chrysops), white crappie (Pomoxis annularis), flathead catfish (Pylo-dictis olivaris), and channel catfish (Ictalurus punctatus). Smallmouth bass (Micropterus dolomieu) and hybrid stripers (Morone chrysops x Morone saxatilis) were stocked in the lake in 1978.⁷³

There are approximately 20 lakes, ranging in size from 3 to 25 surface acres, and an additional 130 to 135 smaller ponds within Fort Hood's boundaries. These waters are periodically stocked with channel catfish (I. punctatus) and largemouth bass (M. salmoides), depending on building and restoration activities associated with the impoundments. An average of three impoundments per year are stocked.⁷⁴

Threatened and Endangered Species

The U.S. Department of the Interior's 1976 list of threatened and endangered fish species contains no species known to inhabit the project area. In addition, no freshwater mussels, snails, or crustaceans found within the study area are listed as threatened or endangered.

Hubbs⁷⁵ lists as problematical five species that could occur at Fort Hood: the suckermouth minnow (Phenacobius mirabilis), the gray redbreast (Moxostoma congestum), the big scale logperch (Percina macrolepida), the blue sucker (Cycleptus elongatus), and the Guadalupe bass (Micropterus treculi). The suckermouth minnow, gray redbreast, and big scale logperch are listed as "limited" (i.e., "species with reasonably broad distribution but limited to few areas [habitats] therein"). The blue sucker and Guadalupe bass are listed as "depleted" (i.e., "species whose abundance has declined substantially"). None of these species were collected during the surveys.

Other Important Species

Although no single species is considered critical to the well-being of the recreationally or commercially valuable species discussed above, forage fishes, as a group, are extremely important as food to the larger predatory game fishes. Based on survey results, the most important forage species onsite appear to be minnows, shad, and mosquitofish. Smaller species (most sunfishes) feed largely on aquatic invertebrates.

The most important species for maintaining the structure and function of Fort Hood's aquatic systems are those capable of converting terrestrial organic matter into animal biomass (detrital-based food chains). These species include most of the Crustacea and Oligochaeta and several orders of insect species. In many of the stream areas examined, considerable organic matter appears to be produced in situ by filamentous algae (Chlorophyta). The organisms responsible for converting this type of material to animal biomass (primary consumers) are often the same as, or closely related to, species

⁷³ B. Bounds, Texas Parks and Wildlife Department, Austin, personal communication (1978).

⁷⁴ Fort Hood Fish and Wildlife Section, Fort Hood, Texas, personal communication (1978).

⁷⁵ Clark Hubbs, A Checklist of Texas Freshwater Fishes, Tech. Ser. No. 11 (Tex. Parks and Wildlife Dept., 1976).

which feed on detritus. Most of these species are generalized feeders and, as such, one species assemblage may be replaced by another without apparent disruption of energy flow to higher trophic levels.

Significance of Local Aquatic Biology

Belton Lake is a multi-purpose reservoir that supplies potable water for domestic and industrial use. In addition, it is a recreational facility providing an area for sport fishing, boating, and water sports. The lake water chemistry and physical parameters is similar to those of other impoundments in the same drainage basin.

The numerous lakes and ponds at Fort Hood provide sport fishing. In addition, the various streams which form the drainage system for Fort Hood and the surrounding area provide an area for sport fishing, as well as contribute to the landscape's general aesthetic value.

The aquatic fauna and flora of Fort Hood's drainage system are similar in many respects to those of other areas in the south central United States. This diverse assemblage of micro- and macroscopic plants and animals interacts together and with the abiotic environment to produce a structured aquatic ecosystem. Because of the redundancy in organismic niches and the diversity of pathways for energy flow within the structure, this aquatic ecosystem can continue to exist under the changing conditions caused by natural seasonal variation in climate and/or manmade environmental alterations.

Table 22

Physical and Chemical Characteristics--Fall

Station*	Water Body	Date	Time	Depth (m)	Temperature (C)	Dissolved Oxygen (mg/L)	Conductivity (μ mhos/cm ²)	pH	Secchi Depth (cm)
B1	Belton Lake	23 Aug 78	1745	0.50	32.3	8.0	430	8.6	23
B2	Belton Lake	23 Aug 78	1815	Surface	32.0	8.0	435	8.1	64
				1.0	32.0	7.8	435	-	-
				2.0	31.8	7.4	445	-	-
				3.0	31.5	7.4	450	-	-
				4.0	31.5	6.2	455	-	-
				8.0	-	-	-	-	-
B3	Belton Lake	24 Aug 78	1530	Surface	33.0	8.0	460	7.1	61
				1.0	33.0	6.4	485	-	-
B4	Belton Lake	24 Aug 78	1815	Surface	32.0	7.8	440	-	164
				7.5	31.0	7.8	455	-	-
				14.5	30.0	7.1	448	-	-
R	Upper Leon River	25 Aug 78	1700	Surface	31.0	7.1	1020	-	35
S	Lower Leon River	22 Aug 78	1830	Surface	28.0	>15.0	780	-	Bottom
K	Upper Cowhouse Creek	21 Aug 78	1510	Surface	29.8	7.8	550	7.7	30
L	Mid Cowhouse Creek (Pool 1)	21 Aug 78	1635	Surface	34.0	6.9	550	7.7	Bottom
L	Mid Cowhouse Creek (Pool 2)	21 Aug 78	1635	Surface	34.0	>15.0	-	-	-
T	Lower Cowhouse Creek	22 Aug 78	1105	Surface	25.5	5.0	780	-	30
O	Mid Table Rock Creek	21 Aug 78	1745	Surface	32.0	7.1	550	-	6
N1	Lower North Nolan Creek	25 Aug 78	1240	Surface	30.5	4.9	650	-	30
N2	Upper North Nolan Creek	24 Aug 78	1415	Surface	28.0	2.8	480	-	37
F	Upper Clear Creek	24 Aug 78	1030	Surface	25.5	1.6	315	7.0	30
A	Lower Clear Creek	22 Aug 78	1235	Surface	28.0	7.3	400	7.7	20
D	Lower Reese Creek	23 Aug 78	0830	Surface	25.2	2.0	190	7.3	5
H	Lower Turkey Run Creek	22 Aug 78	1105	Surface	25.5	5.0	780	-	30
I	Upper House Creek	22 Aug 78	0900	Surface	26.0	2.9	780	7.2	Bottom
J	Lower House Creek	22 Aug 78	1235	Surface	29.5	3.9	590	7.1	35

*For an explanation of terminology in table headings, see the appendix.

Table 23

Physical and Chemical Characteristics--Fort Hood--Spring

Station*	Water Body	Coordinates	Date	Time	Depth	Temp (C)	DO Mg/L	COND $\mu\text{mhos}/\text{cm}^2$	pH	Secchi Depth
B1	Belton Lake	329509	9 May	1530	Surface	22.2	9.2	382	8.4	134
B2	Belton Lake	344505	9 May	1330	Surface	22.3	8.9	381	8.3	61
B3	Belton Lake	409494	10 May	1440	Surface	27.2	8.4	457	6.5	78
B4	Belton Lake	415491	10 May	1505	Surface	25.6	10.8	408	8.0	108
R	Upper Leon River	215725	8 May	1805		21.2	10.7	375	8.0	
S	Lower Leon River	291676	8 May	1530		21.1	10.4	344	8.0	
K	Upper Cowhouse Creek	067618	9 May	0940		23.1	8.2	514	7.0	
K				2345		24.9	7.6	412	6.1	
L	Mid-Cowhouse Creek	148539	8 May	1030		22.7	11.7	476	8.1	
T	Lower Cowhouse Creek	299566	10 May	1815		29.2	18.0	482	8.2	
T				2445		26.8	7.1	476	7.9	
O	Mid Table Rock Creek	075572	8 May	0830		22.2	9.4	476	7.4	
N1	Lower Nolan Creek	389439	10 May	1650		26.0	9.1	440	7.9	
N2	Upper Nolan Creek	375445	9 May	1825		23.2	8.1	370	8.2	
F	Upper Clear Creek	115406	7 May	1640		25.1	8.7	572	8.1	
A	Lower Clear Creek	129449	7 May	1235		23.9	9.9	477	7.2	
A	Lower Clear Creek Inflow					23.5	9.9	488	8.0	
D	Lower Reese Creek	160325	7 May	1720		27.3	7.5	493	8.1	

* For an explanation of terminology in table headings, see the appendix.

Table 23 (Cont'd)

Station	Water Body	Coordinates	Date	Time	Depth	Temp (C)	D0 Mg/L	COND $\mu\text{mhos}/\text{cm}^2$	pH	Secchi Depth
H	Lower Turkey Run Creek	085479	7 May	1330		23.0	9.8	658	8.3	
H	Lower Turkey Run Pool			1330		22.5	9.3	661	8.4	
I	Upper House Creek	069488	7 May	1440		25.3	7.5	631	8.2	
J	Lower House Creek	135505	7 May	1535		26.0	10.3	573	8.4	
P	Turnover Creek	175695	8 May	1700		25.5	10.3	405	8.0	
Y	Hensen Creek	253663	8 May	1855		24.4	10.8	476	7.9	
Z	Owl Creek	310572	8 May	1425		25.8	11.3	474	8.1	

Table 24

Habitat Characteristics--Fall

Station*	Dimensions (m)	Depth (m)	Substrate	Detritus	Algae/Macrophytes	Canopy	Banks
B ₁ Belton Reservoir		1.0	Very soft clay muck			Open water	
B ₂ Belton Reservoir		4.0-8.0	Soft muck			Open water	
B ₃ Belton Reservoir		1.0-1.5	Soft mud and detritus over rock	Leafy	<u>Aphanothece</u> masses	Open water	
B ₄ Belton Reservoir		5.0	Fine gravel			Open water	
R Upper Leon River	10x100	0.5-1.2	Firm coarse sand, gravel	Woody, leafy	<u>Najas</u> , <u>Lemna</u> , algal mats	Partly open	Steep clay
S Loer Leon River	3-5x8-10	1.0-1.5	Cobbles, muck detritus	Leafy	<u>Najas</u> , <u>Lemna</u> , <u>Chara</u> , algal mats	Partly open	Steep clay
K Upper Cowhouse Creek	15x100	1.0-1.3	Gravel, rock near shore; muck, H ₂ S mud, detritus in channel	Leafy	Algal mats	Open; West bank shaded	Steep clay with roots on west; east bank gravel, rock, steep dirt
L Mid Cowhouse Creek		0.3	Rock with silt in holes		<u>Chara</u>	Open	Steep dirt
T Lower Cowhouse Creek	20x100	1.0-2.0	Soft mud, silt, detritus over rock	Leafy	<u>Chara</u> , green algal mats	Open	Unvegetated dirt
O Mid Table Rock Creek	5x75	0.4	Mud, silt over rock			Open; shaded North bank	Steep cut
N1 Lower North Nolan Creek	3x30	0.5	Very soft muck, detritus	Woody and leafy		Closed	Mud
N2 Upper North Nolan Creek	4x40	0.4	Firm fine gravel, mud, detritus over rock	Leafy	<u>Bacopa</u> , <u>Myriophyllum</u>	Partly open	Steep clay with roots
F Upper Clear Creek	5x50	1.0	Rock, detritus, some H ₂ S mud	Leafy	<u>Chara</u>	Partly open to closed	Undercut dirt with roots

*For an explanation of terminology in the headings, see the appendix.

Table 24 (Cont'd)

Station*	Dimensions (m)	Depth (m)	Substrate	Detritus	Algae/ Macrophytes	Canopy	Banks
A Lower Clear Creek ^a	5x30	0.4-0.6	Soft muck in pool; rock riffle		Lemna, Bacopa, Sagittaria, blue-green algal mats	Open, shaded banks	Rock, steep clay
D Lower Reese Creek	6x30	1.2	Boulders, muck, detritus	Leafy		Closed	Rock, mud
H Lower Turkey Run Creek ^a	4x20 pool 2x30 riffle	0.4-0.7	Sand, rock in pool; rock and boulder riffle			Closed over pool; riffle unshaded	Steep clay
I Upper ^a House Creek	4x50	0.4	Silt, gravel over rock slab in pool; boulder riffle		Hydrodictyon mats, Bacopa	Partly open over pool; closed over riffle	Cut dirt, rock
J Lower ^b House Creek	10x75	1.0	Silt over rock	Woody, leafy	Some emergents	Partly open, well-shaded banks	Cut dirt (clay) with roots

Comments:

^aFlowing at time of sampling

^bDam below pool

Table 25

Habitat Characteristics--Spring Survey

Station	Water Body	Dimensions	Depth	Substrate	Detritus	Algae/Macrophytes	Canopy	Banks
B1	Belton Reservoir		1.0	Very soft clay muck			Open Water	
B2	Belton Reservoir		8	Soft mud			Open Water	
B3	Belton Reservoir		1	Inundated mud flat			Open Water	
B4	Belton Reservoir		14	Fine gravel			Open Water	
R	Upper Leon River		.2-.3m over bridge				Closed	Steep Clay
S	Lower Leon River			Gravel/sand rocks				Partly Open
K	Upper Cowhouse Creek	10x100	.6m	Gravel	Leafy		Open	Steep Clay
L	Mid Cowhouse Creek		.6m	Rock, gravel			Open	Steep Dirt
T	Lower Cowhouse Creek	3x5	1-2m over bridge	Silt on low water bridge			Open	Steep Dirt
O	Mid Table Rock Creek		7/m	Soft muck, H ₂ S mud	Woody	<u>Chara</u> , <u>Najas</u> , <u>Zannichellia</u> <u>Palustris</u>	Open	Steep Cut
M1	Lower Nolan Creek	3x30	.6m	Soft muck, detritus	Woody and Leafy	<u>Chara</u> , <u>Samolus</u> <u>Parviflorus</u>	Closed	Mud
M2	Upper Nolan Creek	2x40	.4m	Soft muck, gravel	Leafy	<u>Myriophyllum</u> <u>Bacopa</u> <u>Potamogeton</u>	Open, Shaded North	Steep Clay with roots
F	Upper Clear Creek	12x50	1.3	Rock, mud	Leafy	<u>Chara</u>	Partly Open	Undercut dirt with roots
A	Lower Clear Creek	5x30	.6	Mud, gravel detritus	Leafy	<u>Sagittaria</u> <u>Platyphylla</u> <u>Zannichellia</u> <u>Palustris</u> <u>Lemma</u>	Open, Shaded Banks	Rock, Steep clay

* For an explanation of terminology in table headings, see the appendix.

Table 25 (Cont'd)

Station	Water Body	Dimensions	Depth	Substrate	Detritus	Algae/Macrophytes	Canopy	Banks
D	Lower Reese Creek	6x30	.3-1.1	Rocks, H ₂ S Mud, Detritus	Leafy	<u>Chara</u>	Partly Closed	Rock, mud
H	Lower Turkey Run Creek	3x50	.4m	Rocks, sand	Leafy	<u>Veronica</u>	Closed	Steep Clay
I	Upper House Creek	3x50	.5m	Gravel/sand in pool Rocks in riffles	Leafy		Partially Open	Cut Dirt Rock
J	Lower House Creek	12x75	1.5	Mud	Leafy		Open	Undercut Clay
P	Turnover Creek	3x40	.3	Gravel Sand			Open	Steep Clay
Y	Henson Creek	3x50	.4	Slab/Gravel/ Silt Layer	Leafy		Open	Steep Clay
Z	Owl Creek	6x30	.5	Rock Gravel		<u>Chara</u>	Open	Steep Clay

Table 26
Phytoplankton--Organisms/ml--Fort Hood--Fall

Taxa*	Station:																
	B1	B2	B3	B4	R	S	K	T	O	M1	M2	F	A	D	H	I	J
CHLOROPHYTA																	
<i>Pectinostrom hantzschii</i>				17	17	68	323	34	680	1768		17	238				527
<i>Ankistrodesmus falcatus</i>				17	170			85					170				170
<i>Carteria</i> sp.				17				4675					17				17
<i>Ceratostrius</i> sp.																	
<i>Characium limneticum</i>																	
<i>Characium</i> sp.				17	68	34	34	884	51	17			34				391
<i>Chlamydomonas</i> sp.				17	60	17	170	34	442				289				170
<i>Chlorococcum</i> sp.	119							17	17				527				17
<i>Chlorogonium elongatum</i>	34	17						153									
<i>Closterium</i> sp.						17											
<i>Coelastrum</i> sp.									34								
<i>Cosmarium</i> sp.	136	68	9				136	34	306								
<i>Crucigenia rectangularis</i>			60	85	136	17	136	255	2601	17	48	136			221		17
<i>Crucigenia tetraedra</i>			17	34	51		425	425	714			17			68		
<i>Dictyosphaerium</i> sp.	136				136		51	272									
<i>Flakothrix</i> sp.				68			425		68						697		
<i>Furcilia</i> sp.									34						187		
<i>Gloeocystis</i> sp.						17											
<i>Golenkinia</i> sp.	34	17	17	51	136	17	17		170						119		85
<i>Kirchneriella</i> sp.	17	34	17			51	442	204	238	102		85			17		272
<i>Micractinium</i> sp.							34			68					221		17
<i>Oocystis</i> sp.	17	17		374	102	85	17	136	7242				17		187		17
<i>Pandorina morum</i>	51																
<i>Pediastrum duplex</i>													17				
<i>Pediastrum simplex</i>																	
<i>Protoderma</i> sp.	51	102	26	17	527		1241		187								
<i>Scenedesmus armatus</i>									136				68				
var. <i>bicaudatus</i>			51														
<i>Scenedesmus denticularis</i>																	

*For an explanation of terminology in table headings, see the appendix.

Table 26 (Cont'd)

Taxa	Station:																	
	B1	B2	B3	B4	R	S	K	T	O	N1	N2	F	A	D	H	I	J	
CHLOROPHYTA (cont'd)																		
<i>Scenedesmus dimorphus</i>	68	102	68	34	238	68	1020	68	442	850		68	680	238			2686	
<i>Scenedesmus quadricauda</i>			34	136	255	17	1224	306	2822			68	153	136			204	
<i>Scenedesmus sp.</i>					17	153		68	17				68	629			34	
<i>Schroederia setigera</i>	68								68				17					
<i>Selenastrum westii</i>	34								68				17					
<i>Spermatozopsis exultans</i>								53	34				17					
<i>Sphaerocystis sp.</i>		34	9	68	17	68	85	221	102				34					
<i>Staurastrum sp.</i>		17					17							187				
<i>S. ichococcus bacillaris</i>												17	17					
<i>Tetraedron gracile</i>								68		17								
<i>Tetraedron regulare</i>					17			17		85	14	51					17	
<i>Tetrastrum sp.</i>								17	391									
Miscellaneous green algae	935	2023	1182	2159	850	1496	3332	1530		187	565	6188	51	3179	561	1037		
EUGLENOPHYTA																		
<i>Cryptoglena pigra</i>								102					136					
<i>Euglena acus</i>	17					255	765	238		238	143	1207	374	578				
<i>Euglena spirogyra</i>												17						
<i>Euglena sp.</i>	170	136	111	17	1360	1853	102	68	136	510	129	238	20094	136	51	1343		
<i>Euglenophyceae</i>																		
<i>Lepocinclis ovum</i>	17				51	102	153	17			170	17	17	119				
<i>Phacus longicauda</i>	34								17		20	68	17					
<i>Phacus torvus</i>	34							17		323	41	85	68	17				
<i>Phacus sp.</i>	51				34	17	68		17	68	85	51	51	17				
<i>Trachelomonas volvocina</i>	170	85	17	17	85	918		85	1530	408	163	187	17				17	
<i>Trachelomonas sp.</i>	102	102	68		1003	697		17	1598	1666	75	153	85	612			68	

Table 26 (Cont'd)

Taxa	Station:																
	B1	B2	B3	B4	R	S	K	T	O	N1	N2	F	A	D	H	I	J
CHRYSOPHYTA																	
<i>Centrictactus</i> sp.					17	68.											
<i>Dinobryon</i> sp.		17		17	85	119	442	68	153	1054	122	153	68	85	34		41
<i>Mallomonas</i> sp.	34	34				136	170										
BACILLARIOPHYTA																	
<i>Cyclotella meneghiniana</i>	170	51	51	34	68		289	391	187	119		68	204		187	6511	1581
<i>Euplectes</i> sp.															34	17	17
<i>Gyrodinium parvulum</i>			9														
<i>Pastoriana</i> sp.			17		17		306	34									
<i>Petalosira granulata</i>							170										
<i>Melosira granulata</i>																	
var. <i>angustissima</i>																	
<i>Navicula pupula</i>																	
<i>Navicula radiosa</i>			9							34			34				
<i>Navicula rhynchocephala</i>											14						
<i>Navicula</i> sp.	51	85	34	187	17	85		85	102	17		17	17		68	68	34
<i>Nitzschia acicularis</i>																	
<i>Nitzschia closterium</i>										374		102					
<i>Nitzschia linearis</i>	17								17								
<i>Nitzschia pelea</i>	119	17	34		85		102	102	272	187	48	289	68	408	476	425	391
<i>Nitzschia</i> sp.									102						68	119	
<i>Pinnularia</i> sp.								17									
<i>Pleurosigma</i> sp.																	
<i>Synedra delicatissima</i>	1530	1156	442			17											
<i>Synedra ulna</i>	68	51	51	102		17	136										34

Table 26 (Cont'd)

Taxa	Station:																
	B1	B2	B3	B4	R	S	K	T	O	N1	N2	F	A	D	H	I	J
PYRROPHYTA																	
<i>Ceratium hirundinella</i>			9		17	204	17				14	255					17
<i>Clemodinium</i> sp.	17	102	26	51	357	697				34	34						
<i>Peridinium</i> sp.														17			
CYANOPHYTA																	
<i>Anabaena</i> sp.	17	17				51											17
<i>Aphanocapsa</i> sp.	17				17												
<i>Chroococcus</i> sp.	68	170	34	68	221	204	306	561	901		54	255					
<i>Coelosphaerium</i> sp.																	
<i>Nolopedium</i> sp.				34				170									
<i>Merismopedia</i> sp.	816	510	170	1904			323	306	51			17			187	102	
<i>Microcystis</i> sp.	68	153	51	544	238	34	1037	221	34			187				102	
<i>Oscillatoria</i> sp.			34										17				
<i>Schizothrix</i> sp.	1105	663	264	425	85	102	986	476				34	51		51	136	102
<i>Spirulina</i> sp.	1411	1326	561	629							41						
CRYPTOPHYTA																	
<i>Cryptomonas</i> sp.	680	680	366	204	1020	867	697	51	714	612	381	1037	119	374	85		1037
Total (No. Taxa)	32	36	34	26	34	32	41	42	40	24	18	29	31	10	29	12	30
Total (No./ml)	8245	8109	3926	7276	7548	8415	15096	12614	22763	8789	2062	11067	23647	7310	8874	8279	10472

Table 27
Phytoplankton Densities--Organisms/ml--Fort Hood--Spring

Taxa*	Stations: B1	B2	B3	B4	R	S	K	T	O	N1	N2	F	A	D	I	J
<u>Chlorophyta</u>																
<u>Actinastrum hantzschii</u>	51.0	8.5	42.5	6.8			13.6	17.0			3.4		3.4			
<u>Ankistrodesmus sp.</u>		47.6	28.4					255.1							6.8	8.5
<u>Carteria sp.</u>								34.0		13.6				1.7		
<u>Characium limneticum</u>			5.6						14.2	10.2	12.4	2.2		6.8	10.2	
<u>Characium sp.</u>		39.1	144.6				25.0	187.0	26.0	54.4	12.4	23.1	152.5	6.8	119.0	3.4
<u>Chlamydomonas sp.</u>							518.1	45850.3	20.4			1.0		8.5	120.8	184.2
<u>Chlorella sp.</u>		20.4	25.5	31.8			34.0		17.0	51.0	63.5	3.6	3.4	8.5	141.2	34.0
<u>Closterium sp.</u>			17.0	6.8				34.0	1.7						53.8	8.0
<u>Coelastrum sp.</u>			17.0					51.0	7.4	20.4	3.4		2.3			11.4
<u>Costrarium sp.</u>	11.4	8.5	17.0	13.6							2.2					
<u>Crucigenia tetrapedia</u>											6.8					
<u>Elakotrix sp.</u>	136.1	34.0	79.4	11.4				51.0		6.8	6.8					
<u>Gloeoecystis sp.</u>								136.0		105.4	79.4					
<u>Golenkinia sp.</u>																
<u>Kirchneriella sp.</u>																
<u>Microctinium sp.</u>	45.4	85.0	5.6	102.5			26.0	136.0		40.8	3.4		6.8			
<u>Oocystis sp.</u>			5.6													
<u>Pediastrum boryanum</u>			5.6	215.4												
<u>Protoderma sp.</u>			45.4													
<u>Scenedesmus armatus</u>	158.8		51.0	45.4												
<u>Scenedesmus dimorphus</u>								68.0								
<u>Scenedesmus quadricauda</u>		61.2	79.4	68.0			54.4	34.0		13.6	13.6				102.0	
<u>Scenedesmus sp.</u>			22.7				224.4	935.4								
<u>Schroederia setigera</u>			79.4							27.2	45.4		5.1		3.4	73.7
<u>Selenastrum sp.</u>		17.0					47.6	510.2		37.4	45.4					
<u>Sphaerocystis sp.</u>	272.1	159.8	51.0	206.4			107.7		1.7	10.2	31.8			10.2		6.8
<u>Stauroneis sp.</u>							5.6									

*For an explanation of terminology in table headings, see the appendix.

Table 27 (Cont'd)

Taxa	Stations:	L	P	Y	Z
<u>Chlorophyta</u>					
<u>Actinastrum hantzschii</u>		18.2			
<u>Ankistrodesmus sp.</u>		61.2			
<u>Chlorella sp.</u>					
<u>Characium limneticum</u>					
<u>Characium sp.</u>		6.8	24.0	9.8	30.6
<u>Chlamydomonas sp.</u>		86.2			
<u>Chlorella sp.</u>					
<u>Coelastrum sp.</u>					
<u>Coelastrum sp.</u>					
<u>Coscinus sp.</u>		3.4			
<u>Crucigenia tetrapedia</u>					
<u>Elakatothrix sp.</u>					
<u>Gloeocystis sp.</u>					
<u>Golenkinia sp.</u>					
<u>Kirchneriella sp.</u>		5.6			
<u>Micractinium sp.</u>					
<u>Oocystis sp.</u>		44.2			20.4
<u>Pediastrum boryanum</u>					
<u>Protococcus sp.</u>					
<u>Protoderma sp.</u>					
<u>Scenedesmus armatus</u>					
<u>Scenedesmus dimorphus</u>		13.6			
<u>Scenedesmus quadricauda</u>		208.6			
<u>Scenedesmus sp.</u>					
<u>Schroederia setigera</u>		42.0			
<u>Selenastrum sp.</u>					
<u>Sphaerocystis sp.</u>		9.0			
<u>Stauroneis sp.</u>					

Table 27 (Cont'd)

Taxa	Stations:	B1	B2	B3	B4	R	S	K	T	O	N1	N2	F	A	D	11	I	J	
Chlorophyta (cont'd)																			
<i>Tetraedron minimum</i>											3.4	3.4							
<i>Tetrastrum stauro-</i> <i>geniforma</i>			11.3						17.0 34.0										
<i>Tetrastrum</i> sp.																			
Euglenophyta																			
<i>Euglena acus</i>			8.5										11.4			3.4	11.4		
<i>Euglena spirogyra</i>											3.4	22.6							
<i>Euglena</i> sp.			5.6					11.4	493.2 17.0		10.2		12.4	1.7	3.4	22.7	6.2		
<i>Lepocinclis ovum</i>											6.8					6.8			
<i>Phacus pyriformis</i>									51.0 17.0		3.4	2.2	0.8	39.1 1.7	1.7		8.5		
<i>Trachelomonas</i> sp.																			
Chrysophyta																			
<i>Chrysoamoeba</i> sp.																			
<i>Dimobryon</i> sp.					408.2						10.2	8.0				1.7			1.7
<i>Mallomonas</i> sp.			6.8	19.8	11.4			11.4	170.0		6.8	6.8		2.3					
Bacillariophyta																			
<i>Achnanthes linearis</i>			56.6					32.8		360.0	20.4	4.5	60.7	47.0	149.7	16.9	19.8	38.0	
<i>Achnanthes microcephala</i>													1.0				34.0	2.2	
<i>Amphora ovalis</i>															1.7				
<i>Amphora</i> sp.			5.6							2.2									
<i>Caloneis</i> sp.			6.8																
<i>Cocconeis placentula</i>																			
<i>Cocconeis pediculus</i>																			
<i>Cyclotella meneghiniana</i>			93.5	249.4				259.6	952.4		3.4	96.4	69.4	125.8		416.6	8.5	9.0	
<i>Cymbella cymbiformis</i>		90.7								204.1			3.0	52.7			8.5	145.1	
<i>Cymbella microcephala</i>										45.4		6.8	1.0		35.7		11.4	4.6	

Table 27 (Cont'd)

Taxa	Stations:	L	P	Y	Z
<u>Chlorophyta (cont'd)</u>					
<u>Tetraedron minimum</u>					
<u>Tetrastrum stauro-</u>					
<u>geniforma</u>					
<u>Tetrastrum sp.</u>					
<u>Euglenophyta</u>					
<u>Euglena acus</u>					
<u>Euglena spirogyra</u>					
<u>Euglena sp.</u>	15.8				1.7
<u>Lepocinclis ovum</u>					
<u>Phacus pyrum</u>					
<u>Phacus sp.</u>					
<u>Trachelomonas sp.</u>					
<u>Chrysophyta</u>					
<u>Chrysoamoeba sp.</u>					
<u>Dinobryon sp.</u>					
<u>Halimnionas sp.</u>	5.6				
<u>Bacillariophyta</u>					
<u>Achnanthes linearis</u>			26.6	83.4	272.1
<u>Achnanthes microcephala</u>	30.6			3.6	5.1
<u>Amphicura pellucida</u>					
<u>Amphora sp.</u>			2.8		
<u>Caloneis lewisii</u>			2.6		
<u>Cocconeis placentula</u>	47.6		53.3	31.0	
<u>Cocconeis pediculus</u>					
<u>Cyclotella meneghiniana</u>	97.5		26.6	10.0	
<u>Cymbella subformis</u>					
<u>Cymbella microcephala</u>	3.4			16.4	

Table 27 (Cont'd)

Taxa	Stations:	B1	B2	B3	B4	R	S	K	T	O	M1	M2	F	A	D	11	I	J	
Bacillariophyta (cont'd)																			
<i>Cymbella minuta</i>				59.5		71.4			38.6	10.2			39.6	54.4	90.1		144.6	38.6	
<i>Cymbella</i> sp.									4.6		4.6		1.0	4.5	3.4				
<i>Diploleis</i> sp.												4.6							
<i>Eunotia</i> sp.													4.2		20.4		11.4	4.0	
<i>Fragilaria</i> sp.					1167.8								3.0		1.7				
<i>Gomphonema parvulum</i>						6.8			1.7				6.6	4.6	35.7			4.6	
<i>Gomphonema</i> sp.														5.1	11.9	3.4	42.5		
<i>Gyrosigma scalproides</i>															1.7				
<i>Hantzschia amphioxys</i>																			
<i>Melosira granulata</i>											267.6						11.4		
<i>Melosira</i> sp.																			
<i>Meridion circulare</i>																			
<i>Navicula capitata</i>																			
<i>Navicula lanceolata</i>								51.0										226.8	
<i>Navicula pupula</i>									4.6									1.7	
<i>Navicula radiosa</i>				62.4		6.8			6.8					2.2	5.1			6.2	
<i>Navicula</i> sp.						30.6		17.0	66.9	57.8		6.8	26.6	113.9	98.6	64.6	462.0	87.3	
<i>Navicula viridula</i>																			
var. <i>linearis</i>										3.4									
<i>Neidium</i> sp.																			
<i>Nitzschia acicularis</i>		5.6	13.6	53.8		71.4	170.1	1.7	13.6	3.4	3.4	3.4	3.4	4.0		6.8		14.8	
<i>Nitzschia filiformis</i>						5.7													
<i>Nitzschia linearis</i>																			
<i>Nitzschia palea</i>				119.1	20.4	233.6	374.2	148.0	108.8	45.4	50.6	158.2	4.0	5.1	51.0	210.8	1731.8	349.8	
<i>Nitzschia recta</i>								4.6							11.9			4.0	
<i>Nitzschia sigma</i>													1.0						
<i>Nitzschia sigmaidea</i>																			
<i>Nitzschia tryblionella</i>														2.3				4.6	
<i>Nitzschia tryblionella</i>														1.7				4.6	
var. <i>levidensis</i>																			
<i>Nitzschia</i> sp.								14.8						7.4	16.9	23.8	113.4	6.8	

Table 27 (Cont'd)

Taxa	Stations:	L	P	Y	Z
<u>Bacillariophyta (cont'd)</u>					
<u>Cymbella minuta</u>		17.0	79.4	46.5	54.4
<u>Cymbella tumida</u>		56.7			32.3
<u>Denticula elegans</u>					
<u>Diploneis</u> sp.					
<u>Eunotia</u> sp.					
<u>Fragilaria</u> sp.					
<u>Gomphonema parvulum</u>		8.0			76.5
<u>Gomphonema</u> sp.		6.8			
<u>Gyrosigma</u> sp.					
<u>Hantzschia amphioxys</u>					
<u>Helosira granulata</u>					
<u>Helosira</u> sp.					
<u>Meridion circulare</u>			0.8		1.7
<u>Navicula cryptocephala</u>		20.4			3.4
<u>Navicula heufleri</u>					
<u>Navicula lanceolata</u>		6.8	3.8		
<u>Navicula pupula</u>					
<u>Navicula sp.</u>		76.0	19.8		5.1
<u>Navicula viridula</u>					
var. <u>linearis</u>					
<u>Neidium</u> sp.					
<u>Nitzschia acicularis</u>		53.3	36.4	29.8	100.3
<u>Nitzschia denticulata</u>		9.0			15.3
<u>Nitzschia linearis</u>		277.8	126.6	41.6	30.6
<u>Nitzschia palea</u>					
<u>Nitzschia recta</u>					
<u>Nitzschia sigma</u>					
<u>Nitzschia sigmaidea</u>					
<u>Nitzschia tryblionella</u>					
<u>Nitzschia tryblionella</u>		2.2			
var. <u>levioidensis</u>		11.4		1.4	
<u>Nitzschia</u> sp.					

Table 27 (Cont'd)

Taxa	Stations:	B1	B2	B3	B4	R	S	K	T	O	N1	N2	F	A	D	11	I	J	
Bacillariophyta (cont'd)																			
<i>Surirella ovalis</i>								5.6									8.5	6.8	6.8
<i>Surirella ovata</i>				17.0				17.0									22.7	22.7	2.7
<i>Synedra tenera</i>				8.5															
<i>Synedra ulna</i>								26.0		2.2	10.2	3.4	33.2	6.8	1.7				
<i>Synedra</i> sp.		22.7								6.8	5.6	4.4			18.7	1.7			9.6
Pyrophyta																			
<i>Ceratium hirundinella</i>		5.6	30.6	17.0	11.4						3.4								
<i>Glenodinium</i> sp.		34.0		5.6					17.0										
<i>Peridinium</i> sp.				8.5					17.0				0.8						
Cyanophyta																			
<i>Anabaena</i> sp.												2.2							
<i>Aphanotece</i> sp.								27.2										22.7	
<i>Chroococcus</i> sp.				59.5	74.8				578.2	13.6	163.2	54.4			45.9			153.0	
<i>Merismopedia</i> sp.												197.3							
<i>Microcystis</i> sp.		17.0	20.4																
<i>Oscillatoria</i> sp.																			
<i>Schizothrix</i> sp.		11.4	8.5					18.2		13.6	17.0	2.2	7.4		15.3	5.1	141.7		
Cryptophyta																			
<i>Chroomonas</i> sp.		1275.5	816.4	586.8	1035.5				521.6	4013.6	6.8	78.2	26.1	1.7	7.4			73.7	
<i>Cryptomonas</i> sp.		1315.2	956.6	887.2	637.2				87.3	7874.2	18.2	364.0	256.2	6.7	28.4			189.9	1.7
Total (No. taxa)		15	19	36	18	0	0	29	32	25	34	36	27	32	28	25	38	29	
Total (No./ml)		3452.5	2434.3	2967.3	4074.8	0	0	2522.4	63060.9	827.4	1499.7	1355.8	361.0	881.5	710.6	1105.2	4280.3	859.5	

Table 27 (Cont'd)

Taxa	Stations:	L	P	Y	Z
Bacillariophyta (cont'd)					
<i>Rhicosphenia curvata</i>		3.4			
<i>Surirella ovalis</i>					
<i>Surirella ovata</i>				0.7	
<i>Synedra tenera</i>		74.8			49.3
<i>Synedra ulna</i>					
<i>Synedra</i> sp.					
Pyrophyta					
<i>Ceratium hirundinella</i>					
<i>Glenodinium</i> sp.					
<i>Peridinium</i> sp.					
Cyanophyta					
<i>Anabaena</i> sp.					
<i>Aphanothece</i> sp.				0.7	
<i>Chroococcus</i> sp.		27.7			
<i>Merismopedia</i> sp.					
<i>Microcystis</i> sp.					
<i>Oscillatoria</i> sp.					
<i>Schizothrix</i> sp.		32.8	17.5	10.2	30.6
Cryptophyta					
<i>Chromonas</i> sp.		53.2		0.8	3.4
<i>Cryptomonas</i> sp.		35.2		3.6	
Total (No. taxa)		35	13	15	18
Total (No./ml)		1466.8	420.2	289.5	734.5

Table 28
Algae--Percent Composition--Fall--Fort Hood

Taxa*	Station:	K	T	O	F	A	I	J	H	N1	N2	R	S	D	B1	B2	B3	B3
<u>Chlorophyta</u>		59.3	76.1	74.3	59.5	9.2	8.9	54.9	84.8	35.7	31.5	36.2	23.7	0	19.0	32.3	39.5	41.9
<u>Euglenophyta</u>		8.3	4.3	14.5	18.6	88.2	0.6	13.6	1.7	36.6	35.9	33.6	45.7	87.9	6.0	5.7	5.0	0.5
<u>Chrysophyta</u>		4.1	0.5	0.7	1.4	0.3	0	0.5	0.4	12.0	5.9	1.4	3.8	1.2	0.4	0.6	0	0.2
<u>Bacillariophyta</u>		7.0	5.0	3.1	4.3	1.4	86.4	19.6	9.4	7.9	3.0	2.9	1.6	5.6	23.7	16.8	16.7	4.4
<u>Pyrrrophyta</u>		0.1	0	0	2.3	0	0	0.2	0	0.8	0.7	5.0	10.7	0.2	0.2	1.3	1.1	0.7
<u>Cyanophyta</u>		17.6	13.7	4.3	4.6	0.4	4.1	1.3	2.7	0	4.6	7.4	4.2	0	42.5	35.0	28.4	49.5
<u>Cryptophyta</u>		4.6	0.4	3.1	9.3	0.5	0	9.9	1.0	7.0	18.4	13.5	10.3	5.1	8.2	8.3	9.3	2.8

*For an explanation of terminology in table headings, see the appendix.

Table 29
Algae--Percent Composition--Spring

TAXA ^a	STATION																						
	B1	B2	B3	B4	R	S	K	T	O	N1	N2	F	A	D	H	I	J	L	P	Y	Z		
CHLOROPHYTA	19.5	14.8	24.8	17.4	43.4	76.5	8.6	26.3	24.1	8.3	19.7	3.6	26.5	13.7	11.7	34.	5.71	3.39	6.94				
EUGLENOPHYTA			0.5		0.5	.92		1.6	2.3	0.2	7.3	0.5	1.2	1.3	0.7	1.08						.231	
CRYSTOPHYTA		0.3	0.7	10.3	0.5	.27		1.1	1.1		0.3		0.3		0.2	.38							
BACILLARIOPHYTA	3.4	4.7	21.3	29.2	29.7	2.5	83.3	29.3	32.8	86.9	68.7	78.9	68.9	71.2	87.1	57.73	90.12	91.33	38.20				
PYRROPHYTA	1.1	1.3	1	0.3		.05		0.2															
CYANOPHYTA	0.8	1.2	2	1.8	1.8	.92	3.3	12	18.9		15.8	0.5	7.9		3.78	4.16	3.77	4.17					
CRYPTOPHYTA	75	72.8	49.7	41.1	24.1	18.85	3	29.5	20.8	2.3	4.06	1.2	2.6	6.2	0.2	6.03	1.52						
Total # of Organisms/ml	3452.5	2434.3	2967.3	4074.8	--	2522.4	63060.9	827	1499.7	1356.8	361	881.5	710.6	1105.2	4280.3	859.5	1466.8	420.2	289.5				
Total # of Taxa	15	14	36	18	--	24	32	25	34	36	27	32	28	25	38	29	35	13	15				

^a For an explanation of terminology in table headings, see the appendix.

Table 30
Chlorophyta and Euglenophyta--Dominant Form--
Fort Hood--Fall

Station*	Dominant Form	Subdominant Form
Upper Cowhouse Creek (K)	Miscellaneous ¹	Scenedesmus
Lower Cowhouse Creek (T)	Carteria	Miscellaneous
Table Rock Creek (C)	Oocystis	Scenedesmus
Upper Clear Creek (F)	Miscellaneous	Euglena
Lower Clear Creek (A)	Euglena	Scenedesmus
Upper House Creek (I)	Miscellaneous	Chlamydomonas
Lower House Creek (J)	Scenedesmus	Euglena
Turkey Run (H)	Miscellaneous	Schrederia
Upper N. Nolan Creek (N1)	Ankistrodesmus	Trachelomonas
Lower N. Nolan Creek (N2)	Lepocinclis	Trachelomonas
Upper Leon River (R)	Euglena	Trachelomonas
Lower Leon River (S)	Euglena	Miscellaneous
Reese Creek (D)	Euglenophyceae	Euglena
Belton Lake (B1)	Miscellaneous	Trachelomonas and Euglena
Belton Lake (B2)	Miscellaneous	Euglena
Belton Lake (B3)	Miscellaneous	Euglena
Belton Lake (B4)	Miscellaneous	Oocystis

*For an explanation of terminology in table headings, see the appendix.

¹Miscellaneous - unidentified green algae.

Table 31

Chlorophyta and Euglenophyta--Dominant Form--Fort Hood--Spring

Station*	Dominant Form	Subdominant Form
B1	Sphaerocystis sp.	Scenedesmus Armatus
B2	Sphaerocystig sp.	Oocystis sp.
B3	Chlamydomonas sp.	Glorocystis sp. Sceneoesmus Quadrkauna
B4	Sphacrocystis sp.	Protococcys sp.
K	Chlamydomonas sp.	Scenepesmus quaoricaoua
T	Chlamydomonas sp.	Scenepesmus quaoricaoua
O	Chlamydomonas sp.	Chlorella sp.
N1	Gloeocystis	Chlamydomonas sp.
N2	Gloeocystis	Closterium
F	Chlamydomonas sp.	Closterium
A	Chlamydomonas sp.	Phacus sp.
D	Chorella sp.	Characium sp.
H	Chorella sp.	Chlamydomonas sp.
I	Chlamydomonas sp.	Characium sp.
J	Chlamydomonas sp.	Chorella
L	Sceneorsmus quaoricauda	Chlamydomonas sp.
P	Charalium Limneticum	
Y	Chlamydomonas sp.	
Z	Chlamydomonas sp.	Oocystis sp.

*For an explanation of terminology in table headings, see the appendix.

Table 32

Cyanophyta--Dominant Forms--Belton Lake

Station	Dominant Form		Subdominant Form	
	Fall	Spring	Fall	Spring
Belton Lake 1	<u>Spirulina</u>	<u>Microcystis</u> sp.	<u>Schizothrix</u>	<u>Schizothrix</u>
Belton Lake 2	<u>Spirulina</u>	<u>Microcystis</u> sp.	<u>Schizothrix</u>	<u>Schizothrix</u>
Belton Lake 3	<u>Spirulina</u>	<u>Chroococcus</u> sp.	<u>Schizothrix</u>	
Belton Lake 4	<u>Spirulina</u>	<u>Chroococcus</u>	<u>Microcystis</u>	

Table 33

Periphytic Diatoms--Relative Abundance (%)--Fort Hood--Fall

Taxa*	R		S	K		L	T ^a	T	2 ^b	O	MI	A	H	I	J
	1 ^a	2 ^a		1 ^a	2 ^a										
<i>Melosira granulata</i>				5.8			5.0	6.1	4.8						0.5
<i>Melosira granulata</i> var. <i>angustissima</i>	6.1			11.6					3.8						
<i>Melosira</i> sp.					2.5										
<i>Cyclotella atomus</i>	0.5						5.0	0.9							
<i>Cyclotella meneghiniana</i>	0.9					1.0	5.0	26.8	14.3						
<i>Cyclotella pseudostelligera</i>		3.2	0.4	3.4				2.8	4.8		0.5	15.7	23.8	5.7	3.7
<i>Cyclotella stelligera</i>	0.5				1.0										
<i>Stephanodiscus hantzschii</i>								0.5							
<i>Stephanodiscus invisitatus</i>								1.4	2.9						
<i>Stephanodiscus minutus</i>							6.1	4.7							
<i>Terpsinoe americana</i>		0.3							2.9						
<i>Inalassosira fluviatilis</i>									0.5						
<i>Fragilaria leptostauron</i>									0.5		0.5				
<i>Fragilaria vaucherii</i>															
<i>Synedra acus</i>		0.5													58.7
<i>Synedra ulna</i>		3.7	1.7	0.5				2.3	1.4						
<i>Achnanthes affinis</i>									1.0						
<i>Achnanthes exigua</i>															
<i>Achnanthes exigua</i> var. <i>constricta</i>					2.0								1.9		0.5
<i>Achnanthes lanceolata</i>											0.5				
<i>Achnanthes lapponica</i>	0.9											0.5			
<i>Achnanthes linearis</i>	0.5						1.5					25.3	8.1	0.5	
<i>Achnanthes microcephala</i>					2.0										
<i>Achnanthes</i> sp.					0.5										
<i>Cocconeis pediculus</i>	1.4														
<i>Cocconeis pediculus</i>	0.5						0.8								
<i>Navicula accomoda</i>			0.4						0.5						0.5

* For an explanation of terminology in table headings, see the appendix.

Table 33 (Cont'd)

Taxa	Station:		R	S		K		L	T		O	MI	A	H	I	J
	1 ^a	2 ^a		1 ^a	2 ^a	1 ^a	2 ^a		1 ^a	2 ^a						
<i>Navicula arvensis</i>	0.5										0.5					
<i>Navicula capitata</i>						0.5										
<i>Navicula cryptocephala</i>																
var. <i>veneta</i>																
<i>Navicula cuspidata</i>			0.5					0.5								
<i>Navicula grimmi</i>						0.5		1.0								
<i>Navicula halophila</i>	0.5					0.5		1.5								
<i>Navicula heufleri</i>	0.5		0.5			0.5		1.0	0.8		1.4			0.9	21.0	
<i>Navicula lanceolata</i>	0.5		0.5			1.0		0.5			1.0			0.9	0.5	
<i>Navicula mutica</i>																
<i>Navicula piacentula</i>																
var. <i>rostrata</i>	1.4															
<i>Navicula pupula</i>	2.8		0.5			1.5		3.0	0.4		2.4			0.5	0.5	
<i>Navicula pupula</i>									0.4							
var. <i>mutata</i>	0.5															
<i>Navicula pygraea</i>						1.0		0.5			0.5			0.9	1.0	0.5
<i>Navicula radiosa</i>			13.0					0.5			0.5					
<i>Navicula radiosa</i>								0.5								
var. <i>tenella</i>	1.9		5.1					0.5	0.8						2.4	
<i>Navicula rhynchocephala</i>								2.0	0.4							
<i>Navicula savannahiana</i>						0.5										
<i>Navicula</i> sp.	2.3												1.4			
<i>Navicula symmetrica</i>	0.5										2.3		0.5		1.4	0.5
<i>Navicula texana</i>								0.5								
<i>Navicula viridula</i>																
<i>Navicula viridula</i>																
var. <i>linearis</i>	1.9															
<i>Pinnularia biceps</i>			0.5			1.9			0.4					0.5		
<i>Pinnularia</i> sp.								1.0								
<i>Caloneis bacillum</i>								2.5								
<i>Caloneis bresonica</i>											1.4					

Table 33 (Cont'd)

Taxa	Station: 1 ^a		R		S		K		L		T		O		NI		A		H		I		J	
	1 ^a	2 ^b	1 ^a	2 ^b	1 ^a	2 ^b	1 ^a	2 ^b	1 ^a	2 ^b	1 ^a	2 ^b	1 ^a	2 ^b	1 ^a	2 ^b	1 ^a	2 ^b	1 ^a	2 ^b	1 ^a	2 ^b	1 ^a	2 ^b
<i>Caloneis ventricosa</i>																								
<i>Anomoeoneis sphaerophora</i>	1.4									1.0														
<i>Anomoeoneis vitrea</i>		3.7	6.8	13.5																				
<i>Diploneis elliptica</i>		1.4																						
<i>Diploneis smithi</i>	0.9		3.4	1.5																				
<i>Stauroneis anceps</i>		0.5	1.5	1.0																				
<i>Amphipleura pellucida</i>		0.5																						
<i>Gyrosigma balticum</i>		0.5																						
<i>Gyrosigma scalproides</i>																								
<i>Gyrosigma</i> sp.					0.4																			
<i>Pleurosigma</i> sp.	0.5																							
<i>Hastogloia smithii</i>		6.5	0.5																					
<i>Gomphonema brasiliense</i>	13.6																							
<i>Gomphonema dichotomum</i>		0.5	0.9	1.0																				
<i>Gomphonema intricatum</i>										10.0														
<i>Gomphonema intricatum</i> var. <i>vibrilo</i>																								
<i>Gomphonema parvulum</i>	0.5	3.2	1.3																					
<i>Gomphonema subclavatum</i>																								
<i>Cymbella laevis</i>																								
<i>Cymbella microcephala</i>																								
<i>Cymbella minuta</i>		0.5	1.9	3.0																				
<i>Cymbella sinuata</i>																								
<i>Cymbella tumida</i>																								
<i>Amphora normanii</i>																								
<i>Amphora ovalis</i>	0.9	0.9																						
<i>Amphora veneta</i>																								
<i>Epitnemia argus</i>																								
var. <i>protracta</i>		0.5																						
<i>Epithemia turpida</i>		7.4																						
<i>Rhopalodia gibba</i>																								
<i>Rhopalodia gibberula</i>	0.9	3.2			45.1																			
<i>Rhopalodia gibberula</i> var. <i>vanheurckii</i>	6.1	0.9																						

Table 33 (Cont'd)

Taxa	Station:		S	R		L	K		I ^a	J	O		H	I	J
	1 ^a	2 ^a		1 ^a	2 ^a		MI	A			MI	A			
<i>Nitzschia amphioxys</i>															
<i>Nitzschia acicularis</i>															
<i>Nitzschia amphibia</i>															
<i>Nitzschia apiculata</i>															
<i>Nitzschia closterium</i>															
<i>Nitzschia denticula</i>															
<i>Nitzschia dissipata</i>															
<i>Nitzschia filiformis</i>															
<i>Nitzschia frustulum</i>															
<i>Nitzschia hungarica</i>															
<i>Nitzschia linearis</i>															
<i>Nitzschia recta</i>															
<i>Nitzschia palea</i>															
<i>Nitzschia paradoxa</i>															
<i>Nitzschia sigma</i>															
<i>Nitzschia</i> sp. 1															
<i>Nitzschia</i> sp. 9															
<i>Nitzschia tryblionella</i>															
var. <i>levidensis</i>															
<i>Nitzschia tryblionella</i>															
<i>Cymatopleura elliptica</i>															
<i>Surirella ovata</i>															
var. <i>pinnata</i>															
<i>Surirella ovata</i>															
Total No. Taxa	28	37	15	28	24	22	32	22	36	24	22	14	28	11	

Comments: ^a Two substrates collected

Table 34

Periphyton Diatom Relative Abundances (%)--Fort Hood--Spring

Taxa*	Stations: S	L	T	O	N ₁	N ₂	A	I	J
<u>Melosira granulata</u>					2.9	1.9			
<u>Melosira varians</u>	4.0								
<u>Cyclotella atomus</u>					0.5				
<u>Cyclotella meneghiniana</u>	1.5		0.5		2.4	2.4	1.5		
<u>Cyclotella stelligera</u>					3.4	1.0			
<u>Stephanodiscus invisitatus</u>		1.0							
<u>Meridion circulare</u>									0.9
<u>Synedra delicatissima</u>		1.0				1.9			
<u>Synedra rumpens</u>						0.5			
<u>Synedra ulna</u>	17.4	2.9	1.9		4.9	9.5			0.4
<u>Achnanthes lanceolata</u>		2.0							
<u>Achnanthes microcephala</u>	10.0	7.4		75.6	9.8	27.6	7.4		0.4
<u>Eunotia sp.</u>					5.9				
<u>Rhoicosphenia curvata</u>			5.6				2.5	10.8	10.3
<u>Cocconeis pediculus</u>	8.5		46.9				37.2	34.5	35.2
<u>Cocconeis placentula</u>			5.6		34.6			11.8	15.5
<u>Navicula accomoda</u>	3.0	0.5	0.5			3.8	1.0		
<u>Navicula auriculata</u>	0.5				0.5	0.5			
<u>Navicula capitata</u>	2.5		0.5				1.0		
<u>Navicula cryptocephala</u> var. <u>veneta</u>			1.4		0.5				
<u>Navicula heufleri</u>	5.0		2.3		1.0	2.4	3.4	2.5	0.9
<u>Navicula lanceolata</u>	4.0		0.9	2.2	1.0	1.9	3.9	3.4	3.4
<u>Navicula pelliculosa</u>		0.5							
<u>Navicula pupula</u>	1.0								
<u>Navicula pygmaea</u>		0.5	1.9	0.7					
<u>Navicula radiosa</u>			0.5		7.3	3.3	6.9		
<u>Navicula salinarum</u>	1.0		0.9	0.4	1.0	1.9		0.5	2.1
<u>Navicula symmetrica</u>	3.0					5.2			0.9
<u>Navicula tridentula</u>				0.4					
<u>Navicula viridula</u> var. <u>linearis</u>							3.9		
<u>Navicula sp.</u>								9.9	
<u>Pinnularia braunii</u>				0.4					
<u>Pinnularia sp.</u>			0.5						
<u>Caloneis bacillum</u>					0.5	1.0			
<u>Anomoeoneis vitrea</u>						1.0			
<u>Diploneis sp.</u>	2.5			0.7	5.9	5.2			
<u>Stauroneis sp.</u>					0.5				

* For an explanation of terminology in table headings, see the appendix.

Table 34 (Cont'd)

Taxa	Stations: D	F	P	Y	Z
<u>Melosira granulata</u>					
<u>Melosira varians</u>					
<u>Cyclotella atomus</u>					
<u>Cyclotella meneghiniana</u>					
<u>Cyclotella stelligera</u>					
<u>Stephanodiscus minutus</u>		0.5			
<u>Stephanodiscus invisitatus</u>					
<u>Fragilaria pellucida</u>	.05				
<u>Meridion circulare</u>					
<u>Synedra delicatissima</u>					
<u>Synedra rumpens</u>					
<u>Synedra ulna</u>	7.7	9.1	10.1	5.9	4.1
<u>Achnanthes lanceolata</u>		1.0			
<u>Achnanthes microcephala</u>	12.0	43.9	43.4	20.2	47.2
<u>Eunotia sp.</u>					
<u>Eunotia flevuosa</u>	12.5	0.5		0.4	
<u>Rhoicosphenia curvata</u>					
<u>Ampiusa pellucida</u>				0.8	
<u>Cocconeis pediculus</u>	1.0	25.2			
<u>Cocconeis placentula</u>					
<u>Navicula accomoda</u>					
<u>Navicula auriculata</u>					
<u>Navicula capitata</u>					
<u>Navicula cryptocephala</u>					
var. <u>veneta</u>		0.5	1.5	13.5	
<u>Navicula heufleri</u>	1.0				
<u>Navicula lanceolata</u>			4.0	1.7	1.0
<u>Navicula pelliculosa</u>					
<u>Navicula pupula</u>	2.5				
<u>Navicula pygmaea</u>					
<u>Navicula radiosa</u>	0.5				
<u>Navicula salinarum</u>					
<u>Navicula symmetrica</u>					
<u>Navicula tridentula</u>					
<u>Navicula viridula</u>					
var. <u>linearis</u>					
<u>Navicula sp.</u>					
<u>Pinnularia braunii</u>					
<u>Pinnularia sp.</u>					
<u>Caloneis bacillum</u>		0.5	1.0		1.0
<u>Caloneis lewisii</u>				1.3	
<u>Anomoeoneis vitrea</u>	1.4				
<u>Diploneis sp.</u>					
<u>Diploneis ovalis</u>	0.5	0.5			
<u>Stauroneis phoenicentron</u>			0.5		

Table 34 (Cont'd)

Taxa	Stations:	S	L	T	O	N ₁	N ₂	A	I	J
<u>Gyrosigma</u> sp.		0.5								
<u>Mastogloia</u> smithii					0.4					
<u>Gomphonema</u> parvium		1.0	34.3	0.9	1.9	1.5	4.3	2.0	1.0	0.9
<u>Cymbella</u> cistula							0.5			
<u>Cymbella</u> cymbiformis				0.5		0.5	1.9			
<u>Cymbella</u> microcephala		1.5		0.5	13.0	1.0	0.5			0.4
<u>Cymbella</u> minuta		3.5	37.3	2.8	2.6	4.4	7.6	0.5		3.0
<u>Amphora</u> ovalis		1.5		1.4			1.0	10.3	1.5	0.9
<u>Amphora</u> veneta							0.5			
<u>Rhopalodia</u> gibberula		0.5								
<u>Hantzschia</u> amphioxys		1.0							1.5	0.4
<u>Nitzschia</u> amphibia		1.0	1.5	1.4	0.4	0.5	1.0	1.0		
<u>Nitzschia</u> apiculata			1.0	2.8				5.9		
<u>Nitzschia</u> dissipata		2.5				0.5		3.4		1.7
<u>Nitzschia</u> frustulum			0.5			0.5	0.5			
<u>Nitzschia</u> hungarica		3.5								
<u>Nitzschia</u> linearis			1.0	0.9	1.5	2.4	2.9	2.0	1.0	5.2
<u>Nitzschia</u> palea		5.5	7.8	7.0		4.4	5.7	2.0	14.8	13.3
<u>Nitzschia</u> sigmoidea		3.5								
<u>Nitzschia</u> tryblionella			1.0							0.9
<u>Nitzschia</u> tryblionella var. levidensis		4.0				1.0			0.5	
<u>Nitzschia</u> sp.									1.0	2.6
<u>Denticula</u> elegans						0.5				
<u>Cymatopleura</u> solea								2.0		
<u>Surirella</u> angusta				2.3		0.5		0.5	1.3	
<u>Surirella</u> biseriata		1.0		0.5				1.0		
<u>Surirella</u> minuta		1.0				0.5	1.9			
<u>Surirella</u> ovata									3.4	0.9
<u>Surirella</u> ovata var. pinnata							1.0			
<u>Surirella</u> ovalis		5.0		8.9						
<u>Surirella</u> robusta								0.5		
<u>Surirella</u> spiralis								0.5		
Total No. Taxa		30	16	26	13	30	30	23	17	21

Table 34 (Cont'd)

Taxa	Stations: D	F	P	Y	Z
<u>Gyrosigma</u> sp.					
<u>Gurosiana scalorsides</u>	0.5				
<u>Mastogloia smithii</u>					
<u>Gomphonema parvulum</u>			5.0	8.9	6.6
<u>Cymbella cistula</u>	0.5				
<u>Cymbella cymbiformis</u>			0.5		
<u>Cymbella microcephala</u>	26.9	3.0	2.5	3.4	2.0
<u>Cymbella minuta</u>		14.6	31.3	38.0	10.7
<u>Cymbella tumida</u>	14.9				
<u>Amphora normanii</u>					1.0
<u>Amphora veneta</u>					
<u>Rhopalodia gibberula</u>					
<u>Hantzschia amphioxys</u>					
<u>Nitzschia amphibia</u>					0.5
<u>Nitzschia apiculata</u>					
<u>Nitzschia denticula</u>	15.4				
<u>Nitzschia dissipata</u>					
<u>Nitzschia frustulum</u>		0.5			
<u>Nitzschia hungarica</u>					
<u>Nitzschia linearis</u>	2.4			2.5	1.0
<u>Nitzschia palea</u>				3.4	
<u>Nitzschia sigmoides</u>					
<u>Nitzschia tryblionella</u>					
<u>Nitzschia tryblionella</u> var. <u>levidensis</u>	0.5				
<u>Nitzschia</u> sp.	1.0				
<u>Denticula elegans</u>					24.9
<u>Cymatoplaura solea</u>					
<u>Surirella angusta</u>	0.5				
<u>Surirella biseriata</u>					
<u>Surirella minuta</u>					
<u>Surirella ovata</u>					
<u>Surirella ovata</u> var. <u>pinnata</u>					
<u>Surirella ovalis</u>					
<u>Surirella robusta</u>					
<u>Surirella spiralis</u>					
Total No. Taxa	19	12	10	12	11

Table 35

Periphytic Diatoms--Dominant Forms--Fort Hood--Fall

Station*	Total No. Species	Dominant Diatom	% of Total	Subdominant Diatom	% of Total
R Upper Leon River	52	<u>Nitzschia palea</u>	26.6	<u>Nitzschia amphibia</u>	23.7
S Lower Leon River	15	<u>Rhopalodia gibba</u>	45.1	<u>Fragilaria sp. A</u>	42.1
K Upper Cowhouse Creek	43	<u>Nitzschia palea</u>	58.3	<u>Anomoeoneis vitrea</u>	20.3
L Mid Cowhouse Creek	22	<u>Nitzschia palea</u>	26.1	<u>Nitzschia frustulum</u>	19.7
T Lower Cowhouse Creek	42	<u>Nitzschia palea</u>	35.3	<u>Cyclotella meneghiniana</u>	31.8
O Mid Table Rock Creek	36	<u>Cyclotella meneghiniana</u>	14.3	<u>Nitzschia palea</u>	12.0
N Lower North Nolan Creek	23	<u>Anomoeoneis vitrea</u>	44.4	<u>Nitzschia amphibia</u>	26.1
A Lower Clear Creek	22	<u>Achnanthes linearis</u>	25.3	<u>Nitzschia palea</u>	12.9
H Lower Turkey Run Creek	14	<u>Nitzschia amphibia</u>	44.3	<u>Cyclotella meneghiniana</u>	23.8
I Upper House Creek	28	<u>Navicula heufleri</u>	21.0	<u>Nitzschia palea</u>	16.7
J Lower House Creek	11	<u>Fragilaria sp. a</u>	58.7	<u>Nitzschia amphibia</u>	28.6

*For an explanation of terminology in table headings, see the appendix.

Table 36

Periphytic Diatoms--Dominant Forms--Fort Hood--Spring

Station*	Total No. of Species	Dominant Diatom	% of Total	Subdominant Diatom	% of Total
R Upper Leon River	0				
S Lower Leon River	30	<u>Synedra Ulna</u>	17.4	<u>Achnanthes Microcephala</u>	10.0
K Upper Cowhouse Creek	0				
L Mid Cowhouse Creek	16	<u>Cymbella Minuta</u>	37.3	<u>Gomphonema Parvulum</u>	34.3
T Lower Cowhouse Creek	26	<u>Cocconeis Pediculus</u>	46.9	<u>Syrirella Ovalis</u>	8.9
O Mid-Table Creek	13	<u>Achnanthes Microcephala</u>	75.6	<u>Cymbella Microcephala</u>	13.0
N ₁ Lower Nolan Creek	30	<u>Cocconeis Placentula</u>	34.6	<u>Achnanthes Microcephala</u>	9.8
N ₂ Upper Nolan Creek	30	<u>Achnantes Microcephala</u>	27.6	<u>Cymbella Minuta</u>	7.6
A Lower Clear Creek	23	<u>Cocconeis Pediculus</u>	37.2	<u>Amphora Ovalis</u>	10.3
H Lower Turkey Run Creek	0				
I Upper House Creek	17	<u>Cocconeis Pediculus</u>	34.5	<u>Rhoicospheni Curvata</u>	10.8
J Lower House Creek	21	<u>Cocconeis Pediculus</u>	35.2	<u>Nitzschia Palea</u>	13.3
D Lower Reese Creek	19	<u>Cymbella Microcephala</u>	26.9	<u>Cymbella Tumida</u>	14.9
F Upper Clear Creek	12	<u>Acholanthus Microcephala</u>	43.9	<u>Cocconeis Pediculus</u>	25.2
P Turnover Creek	10	<u>Achnanthes Microcephala</u>	43.4	<u>Cymbella Minuta</u>	31.3
Y Hensen Creek	12	<u>Cymbella Minuta</u>	38.0	<u>Achnanthes Microcephala</u>	20.2
Z Owl Creek	11	<u>Achnanthes Microcephala</u>	47.2	<u>Denticula Elegans</u>	24.9

* For an explanation of terminology in table headings, see the appendix.

Table 37

Aquatic and Marginal Vegetation Collected from
Aquatic Habitats at Fort Hood, Texas --
Spring and Fall

Scientific Name*	Common Name	Station: O	N1	N2	F	A	D	H	Z
Acanthaceae <u>Justicia americana</u>	American waterwillow								X
Alismataceae <u>Sagittaria platyphylla</u>	Arrowhead					⊗			
Characeae <u>Chara</u> sp.	Stonewort	X	X		⊗		X		X
Cyperaceae <u>Eleocharis montevidensis</u>	Spikerush								X
Haloragaceae <u>Myriophyllum</u> sp.	Water-milfoil					⊗			
Najacaceae <u>Najas</u> sp.	Water-nymph		X						
Potamogetonaceae <u>Potamogeton</u> sp.	Pondweed				X				
Primulaceae <u>Samolus parviflorus</u>	Water pimpernel			X					
Scrophulariaceae <u>Veronica</u> sp.	Speedwell								X
Zannichelliaceae <u>Zannichellia pelustris</u>	Common poolmat	X				X			
<u>Bacopa</u>	Water Hyssop				0	0			
<u>Lemna</u>	Duckweed					0			

*For an explanation of terminology in table headings, see the appendix.

Comments:

X = observed in Spring

0 = observed in Fall

⊗ - observed in both Spring and Fall

Table 38

Zooplankton--Number/L--Fort Hood--Fall

Taxa*	Stations:	B1	B2	B3	B4	R	S	K	T	O	M1	M2	F	A	D	I1	I
PROTIZOA																	
<i>Diffugia</i> sp.				8.9	1.9	211.9	12.5	59.4	0.9		104.9		1.9	16.9			
NEMATODA				0.5		1129.9								0.9			1.2
ROTIFERA																	
<i>Anuraeopsis fissa</i>																	
<i>Ascomorpha</i> sp.					1.9	211.9											
<i>Asplanchna briohowellii</i>						1129.9											
<i>Asplanchna priodentia</i>								37.5					3.8				
<i>Brachionus angularis</i>							21.9	9.4									
<i>Brachionus bidentata</i>		12.2	17.8	12.2	3.8	141.2	206.2	9.4					131.2	35.6	2.8	120.9	
<i>Brachionus budapestinensis</i>			1.9							3.1				5.6	6.6		
<i>Brachionus caudatus</i>			23.4					7.5									
<i>Brachionus bavanaensis</i>							262.5	2.8		1437.5	1958.0		3.8				
<i>Brachionus patulus</i>							3.1	0.9		203.1			7.5				
<i>Brachionus quadridentatus</i>							6.2			9.4			5.6	11.2			
<i>Brachionus rubens</i>													5.6				
<i>Cephalodella</i> sp.																	
<i>Cephalodella</i> sp. 1																	
<i>Colorella</i> sp.										6.2							
<i>Conochiloides desquariis</i>						35.3				18.8							
<i>Conochilus unicornis</i>		2.8	2.8	0.5	8.4			162.5	3.8								
<i>Epiphanes naeroura</i>				4.2			175.0	9.4									
<i>Euchlanis dilatata</i>							18.8										
<i>Euchlanis</i> sp.										31.2							
<i>Filinia longiseta</i>						600.3											
<i>Filinia opolienis</i>		6.6	7.5	5.2	0.9	35.3	31.2			1181.2	35.0		6.2				
<i>Gastropus hyptopus</i>							34.4							146.2	0.9	27.2	23.8
																	4.7

*For an explanation of terminology in table headings, see the appendix.

Table 38 (Cont'd)

Taxa	B1	B2	B3	B4	R	S	K	T	O	N1	N2	F	A	D	11	1
ROTTIFERA (Cont'd)																
<i>Hexarthra mira</i>		1.9	1.9	10.3			12.5									
<i>Keratella cochlearia</i>	37.5	38.4	45.0	86.2			46.9		34.4	1328.7	979.6		7.5		0.9	1.2
<i>Lecane hastata</i>						25.0	3.1	0.9	9.4						17.8	1.2
<i>Lecane luna</i>						12.5										1.2
<i>Lecane unguilata</i>	4.7	1.9		0.9			3.1		346.9	104.9		6.2	20.6	8.4	114.4	22.5
<i>Lecane sp. C</i>					70.6											
<i>Lecane sp. X</i>					353.1				6.2	69.9				0.9	1.9	
<i>Lepadella sp.</i>							3.1									
<i>Lophocharis sp.</i>							3.1									
<i>Monostyla sp.</i>							3.1									
<i>Monostyla bulla</i>																
<i>Monostyla closterocerca</i>					35.3											
<i>Monostyla quadridentata</i>					141.2					101.3			3.8		0.9	
<i>Platylas quadricornis</i>																
<i>Ploesoma hudsoni</i>										35.0						
<i>Ploesoma truncatum</i>				1.4	19.7											
<i>Polyarthra vulgaris</i>	29.1	41.2	21.6	96.6	706.2	75.0	15.6	10.3	756.2	8671.3	1317.4		46.9	0.9	2.8	3.8
<i>Rotaria sp.</i>	2.8	3.8			565.0	6.2		5.6	31.2	35.0			39.4	60.0	30.0	36.2
<i>Searidium longicaudum</i>					35.3											
<i>Synchaeta pectinata</i>	24.4	55.3	9.8	0.9			9.4						3.8		24.4	
<i>Synchaeta stylata</i>				18.8			6.2		12.5						0.9	
<i>Tetradinella patina</i>															1.9	
<i>Trichocerca multicornis</i>				11.2												
<i>Trichocerca similis</i>				2.8												
<i>Trichocerca sp. B</i>	5.6	13.1	0.9		70.6					6643.4	776.9					1.2
<i>Trichocerca sp. 8</i>	3.8	5.6			1800.8	12.5	3.1	8.4	156.2	2062.9	1418.8		1.9	0.9		7.5
<i>Trichotria sp.</i>									3.1							
<i>Unidentifiable Bdelloid</i>																
<i>Unknown Rotifer #3</i>	15.0	1.9			35.3			1.9	59.4	104.9		6.2	52.5	10.3	25.1	57.5

Table 38 (Cont'd)

Taxa	Stations: B1	B2	B3	B4	R	S	K	T	O	M1	M2	F	A	D	11	1
OSTRACODA					35.3				3.1			6.2	5.6	1.9	4.7	1.2
CLADOCERA												62.5				
<i>Bosmina longirostris</i>					75.0	28.1						262.5				
<i>Ceriodaphnia lacustris</i>					12.5		0.9					81.2				
<i>Ceriodaphnia pulchella</i>												18.8			0.9	1.2
<i>Ceriodaphnia rigaudi</i>																3.8
<i>Chydorus sphaericus</i>																
<i>Diaphanosoma leuchtenbergianum</i>						15.6	9.4			35.0		6.2	1.9			
<i>Hyocryptus spinifer</i>													3.8			
<i>Macrothrix hirsuticornis</i>																1.2
<i>Moina brachiata</i>									131.2							
<i>Scapholeberis kingii</i>																
<i>Simocephalus serrulatus</i>					6.2											
COPEPODA																
<i>Copepod nauplii</i>	1.9				494.3	543.8	268.8	15.9	25.0	979.0	2128.1	2056.2	50.6	151.9	21.6	46.2
<i>Calanoid copepodid</i>			2.3	31.9		59.4			3.1							1.2
<i>Cyclopid copepodid</i>					35.3	300.0	40.6	2.8	9.4	419.6	337.8	450.0	26.2	38.4	3.8	8.8
<i>CYCLOPS SP.</i>							9.4					18.8	1.9	22.5	0.9	
<i>Diaptomus pallidus</i>							15.6		3.1							
<i>Mesocyclops edax</i>														22.5		
OLIGOCHEATA																
<i>Chaoborus SP.</i>								4.7				6.2	3.8	2.4	2.8	1.2
DIPTERA																
<i>Chaoborus SP.</i>																
Total (No./2)	198.0	216.5	114.4	294.3	7944.6	1324.9	1306.1	382.4	4480.9	23776.3	8444.9	3287.1	508.3	407.2	471.4	294.4
Total (No. Taxa)	14	14	13	14	20	16	26	18	24	17	10	17	26	20	29	25

Table 39
 Zooplankton Densities--Number/L--Fort Hood--Spring

Taxa*	Stations: B1	B2	B3	B4	R	S	L	K	T	O	N1	N2	F	A	D	H	I	J	Z	Y	P
PROTOZOA																					
<u>Codoneilla crotera</u>	3.1	2.5		0.6	1.0						0.2	1.9									<0.1
NEMATODA																					
ROTIFERA																					
<u>Ascomorpha</u> sp.				3.1	3.8																
<u>Bdelloidea</u>																					
<u>Brachionus angularis</u>	0.6	7.5	0.6		8.2	3.2	<0.1	0.1	4.5	<0.1	0.2	0.6	0.1	0.1		0.3	0.2	0.1	0.2	0.2	<0.1
<u>Brachionus bennini</u>					0.2																<0.1
<u>Brachionus bidentata</u>					0.5	0.6															0.1
<u>Brachionus calyciflorus</u>					0.2																<0.1
<u>Brachionus nilsoni</u>	0.6				0.2	0.3	<0.1	<0.1	0.2												<0.1
<u>Brachionus patulus</u>					1.2	2.3		<0.1													<0.1
<u>Brachionus quadridentatus</u>																					<0.1
<u>Brachionus variabilis</u>																					<0.1
<u>Cephalodella</u> sp.				0.6								0.6	<0.1	<0.1	<0.1	0.2	<0.1				
<u>Collotheca</u> sp.				1.9	0.6	1.2															
<u>Conochiloides dossuarius</u>	1.9	2.5		0.6																	
<u>Conochilus unicornis</u>	2.5	3.8	0.6	6.2	0.2			<0.1	0.2			1.2	0.2			0.8	<0.1	0.2			<0.1
<u>Epiphanes senta</u>																					
<u>Euchlanis dilatata</u>																					
<u>Filinia longiseta</u>																					
<u>Gastropus hyptopus</u>																					
<u>Hexarthra mira</u>	13.1																				
<u>Keratella cochlearis</u>	25.6	45.0	48.8	25.0	4.2	3.9	0.1	0.1	17.5		1.4	1.2									0.1
<u>Keratella earlinae</u>	15.6	16.9	1.9	1.9	1.0		0.1	0.1	0.2		5.0	5.0									<0.1

* For an explanation of terminology in table headings, see the appendix.

Table 39 (Cont'd)

Taxa	Stations:	B1	B2	B3	B4	R	S	L	K	T	O	M1	M2	F	A	D	H	I	J	Z	Y	P
<i>Keratella quadrata</i> v. <i>va</i> lga						2.0		0.1	0.2	<0.1				<0.1							0.2	
<i>Lecane crepidula</i>		0.6												<0.1						<0.1		<0.1
<i>Lecane luna</i>																						
<i>Lecane ohioensis</i>																						
<i>Lecane pycnina</i>																						
<i>Lepadella</i> sp.						0.5	0.3	<0.1	<0.1	<0.1				<0.1							<0.1	
<i>Lophocharis</i> sp.						0.2	0.3	<0.1	<0.1	<0.1												0.1
<i>Monostyla bulla</i>								0.1	0.1	0.5												
<i>Monostyla closteroerca</i>		0.6																				0.1
<i>Monostyla crenata</i>																						0.2
<i>Monostyla lunaris</i>								<0.1	<0.1	0.2	0.2											
<i>Platylas quadricornis</i>		0.6																				
<i>Polyarthra dolicoptera</i>		11.2	1.9			0.6																
<i>Polyarthra euryptera</i>		33.1	73.1	24.4	40.0			<0.1	11.8		0.7	10.0										
<i>Polyarthra vulgaris</i>						1.0					0.9	5.0										
<i>Pompholyx sulcata</i>				1.2		2.2	1.0	0.2	0.1	1.8	0.4			0.2	<0.1		0.6	0.4	<0.1	<0.1	0.2	0.1
<i>Rotaria</i> sp.				100.6						0.8												
<i>Synchaeta oblonga</i>		1.2			5.0	0.2																
<i>Synchaeta pectinata</i>																						
<i>Synchaeta stylata</i>						0.2				0.5												
<i>Testudinella mucronata</i>																						
<i>Testudinella patina</i>						0.2																
<i>Trichocerca multicornis</i>				1.2		0.2	0.3	<0.1	0.5		0.2											<0.1
<i>Trichocerca</i> sp.						0.2	0.3															
<i>Trichotria tetractis</i>						0.2		<0.1														
Unknown Rotifer #3						1.0	0.2	0.2	1.2	0.5	0.4			0.1	<0.1	0.1	0.2	0.2	0.2	0.1	<0.1	0.1
<i>Molgea spinifera</i>																						

Table 39 (Cont'd)

Taxa	Stations	B1	B2	B3	B4	R	S	L	K	T	O	N1	M2	F	A	D	H	I	J	Z	Y	P	
OSTRACODA						0.2	1.0					0.9		<0.1	<0.1							0.1	
CLADOCERA																							
<i>Alona costata</i>																							
<i>Alona guttata</i>																							
<i>Bosmina longirostris</i>		6.9	11.2	3.1	22.5	1.0	0.6	0.3	<0.1	0.2	<0.1	0.2											
<i>Leriodaphnia lacustris</i>		4.4			20.6				<0.1			0.7	13.1	0.2	0.2							<0.1	<0.1
<i>Chydorus sphaericus</i>				2.5		0.2	0.3					0.2	2.5										
<i>Daphnia ambigua</i>					0.6																		
<i>Daphnia laevis</i>							0.6					1.0	0.6										
<i>Daphnia</i> sp.													1.2										
<i>Diaphanosoma brachyurum</i>													1.9										
<i>Macrothrix hirsuticornis</i>						0.2							1.2									<0.1	
COPEPODA																							
<i>Copepod nauplii</i>		12.5	23.1	21.9	36.2	16.5	9.4	0.3	0.4	8.2	0.1	3.7	83.8	1.1	<0.1	0.2	0.4	0.5	0.2	0.1	0.4	0.8	
<i>Calanoid copepodid</i>		2.5			0.6	0.8	0.3					0.2	3.8									<0.1	
<i>Cyclopoid copepodid</i>		8.1	2.5	2.5	5.0	3.2	3.2		0.2	3.5		5.1	43.8	0.1						<0.1	0.4	<0.1	
<i>Harpacticoid copepodid</i>												0.2											
<i>Cyclops</i> sp.													3.1										
<i>Diaptomus</i> sp.						0.8							1.9										
DIPTERA								0.3		0.4	2.0	0.1	1.6	0.6	0.4	0.2	0.1	0.4	1.1		0.2	0.2	
Total (No./L)		128.6	208.0	214.8	171.6	52.5	39.5	1.4	2.5	57.0	0.8	18.0	193.0	2.6	0.5	1.2	3.1	3.0	1.0	0.9	2.5	2.2	
Total (No. Taxa)		14	16	18	17	29	26	12	21	20	7	18	24	13	6	12	12	9	10	10	11	17	

Table 40

Zooplankton--Relative Abundance (%)--Fort Hood--Fall

Station*	Total No./L	Rotifera	Cladocera	Copepoda	Other ^a
B1 Belton Lake	198.0	99.0	-	1.0	-
B2 Belton Lake	216.5	100.0	-	-	-
B3 Belton Lake	114.4	89.8	-	2.0	8.2
B4 Belton Lake	294.3	89.2	-	10.8	-
R Upper Leon River ^b	7944.6	92.9	-	6.7	0.4
S Lower Leon River	1324.9	28.3	7.1	63.7	0.9
K Upper Cowhouse Creek	1306.1	62.0	3.3	30.2	4.5
T Lower Cowhouse Creek	382.4	91.0	2.7	4.9	1.5
O Table Rock Creek	4480.9	96.1	2.9	0.9	0.1
N1 Lower North Nolan Creek ^b	23776.3	93.5	0.1	5.9	0.4
N2 Upper North Nolan Creek ^b	8444.9	70.8	-	25.2	4.0
F Upper Clear Creek	3287.1	9.5	13.3	76.8	0.4
A Lower Clear Creek	508.3	81.2	1.1	15.5	2.2
D Lower Reese Creek	407.2	36.3	-	57.8	5.9
H Lower Turkey Run Creek	471.4	92.6	0.2	5.6	1.6
I Upper House Creek	294.4	77.6	2.1	19.1	1.2

*For an explanation of terminology in table headings, see the appendix.

Comments:

^aIncludes Nematoda, Protozoa, Ostracoda, Diptera, Oligochaeta

^bGrab samples

Table 41

Zooplankton--Relative Abundance (%) --Fort Hood--Spring

TAXA ^a	B1	B2	B3	B4	R	S	L	K	T	O	N1	N2	F	A	D	H	I	J	Z	Y	P		
PROTOZOA	2.4	1.2		0.3	1.9							1.0											
NEMATODA				5.3	4.1	14.3					1.1											1.9	
ROTIFERA	70.8	81.1	86	49.8	49.1	50.4	78.6	76	75.6	87.5	23.3	17.4	38.5	80	66.1	83.9	43.3	80	88.9	61.54	51.11		
OSTRACODA				0.4	2.5						5		3.8	8.3			3.3						
CLADOCERA	8.8	5.4	2.6	25.5	2.7	4.6	7.1	4	0.4	12.5	11.7	10.6	7.7	16.7								3.85	2.22
COPEPODA	18	12.3	11.4	24.4	39	32.7	21.4	24	20.5	12.5	51.1	70.7	46.1	20	16.7	12.9	16.6	20	22.2	32.69	37.78		
DIPTERA				39.5		16	3.5	12.5	8.9	0.3	15.4	40	8.3	12.9	36.7	22.2						8.89	
Total # of Organisms/liter	128.6	208	214.8	171.6	52.5	39.5	1.4	2.5	57	0.8	18	193	2.6	0.5	1.2	3.1	3	1	0.9	2.6	2.25		
Total # of Taxa	14	16	18	17	29	26	12	21	20	7	18	24	13	6	12	12	9	10	10	19	17		

^aFor an explanation of terminology in table headings, see the appendix.

Table 42

Macroinvertebrates--Numbers/m² Collected by Dredge (E) and Surber (S)--Fort Hood--Fall

Taxa*	Station: B1 Sampling Gear: E	B2 E	B3 E	B4 E	R E	T E	O E	N1 E	N2 E	F E	D E	H S	I S	J E
NEMATA						43								
ANNELIDA														
<u>Oligochaeta</u>														
<u>Branchiura sowerbyi</u>	194	259	4827	2241	711	670						86	3857	
<u>Dero digitata</u>		86				172						16		
<u>Dero nivea</u>												5		
<u>Dero vagus</u>		43												
<u>Limnodrilus cervix</u>	65	172								129		43	22	
<u>Limnodrilus hoffmeisteri</u>												5	22	
<u>Limnodrilus maumeensis</u>									86					
<u>Limnodrilus profundicola</u>	22													
<u>Limnodrilus spiralis</u>		431						43		86	86	5	11	86
<u>Lumbriculidae</u>		43												
<u>Naididae</u>		345						43		172			16	
<u>Tubificidae (immature)</u>	603	4095	388	216	108	216	1595			204	1961	16	5215	
<u>Total</u>	884	5474	5215	2500	884	2911				560	2911	21	424	
Hirudinea														22
ARTHROPODA														
Crustacea														
Amphipoda														5
<u>Hyalolella azteca</u>														

*For an explanation of terminology in table headings, see the appendix.

Table 42 (Cont'd)

Taxa	Station: B1	B2	B3	B4	R	T	O	N1	N2	F	D	H	I	J	
	Sampling	E	E	E	E	E	E	E	E	E	E	S	S	E	
	Gear:														
ARTHROPODA (cont'd)															
Insecta															
Ephemeroptera															
Baetidae															
Baetis sp.					22	86							5		
Caenis sp.													32		
Callibaetis sp.													16		
Hexagenia Timbata					22	86		22	22				11	22	
<u>total</u>					22	86		22	22				69	22	
Odonata															
Erpetogomphus sp.												5			
Lestidae												5			
Macrothemus sp.					22							5			
<u>total</u>					22							15			
Hemiptera															
Trichocorixa sp.												5			
Cerris sp.												5			
<u>total</u>												10			
Neuroptera															
Corydalus sp.													16	43	
Sialis sp.													16	43	
<u>total</u>													32	86	
Coleoptera															
Elodes sp.												5			
Laccornis sp.							43								
Helochares sp.												5			
Stenelmis sp.					22								11	22	
Tropisternus sp.					22								15	22	
<u>total</u>					22								31	44	

Table 42 (Cont'd)

Taxa	Station: B1 Sampling Gear: E	B2 E	B3 E	B4 E	R E	T E	O E	N1 E	N2 E	F E	D E	H S	I S	J E
ARTHROPODA (cont'd)														
Insecta (cont'd)														
Trichoptera														
<u>Orthotrichia</u> sp.						43								
Diptera														
<u>Chaoborus punctipennis</u>		409	230		172			172	65	43	345			
<u>Chironomus thummi</u> group		22			86	43				302	431	5	366	
<u>Clinotanytus</u> sp.					43									
<u>Coelotanytus</u> sp.	344	3082	460	29		1034	474	43	22	43				
<u>Cricotopus</u> sp. A														
<u>Cricotopus exilis</u>														22
<u>Cryptochironomus</u> sp.			57		43				43	86				16
<u>Cryptocladopelma</u> sp.								43						5
<u>Cryptotendipes</u> sp.					86			43	22					
Culicoidinae														
<u>Dicrotendipes</u> sp.												38	59	
<u>Einfeldia</u> sp.								43						
<u>Glyptotendipes dreisbachi</u>						86								
<u>Glyptotendipes</u> sp.														38
<u>Goeidichironomus</u> sp.					22									54
<u>Lauterborniella</u> sp.					43									
<u>Parachironomus</u> sp.														
<u>Paracladopelma</u> sp.						43								
<u>Pentaneura</u> sp.		22			22	129			22			5	129	22
<u>Polypedilum illinoense</u>		43	115	57	22	517			65	43	22	11	349	
<u>Procladius</u> sp.									22					
<u>Psectrotanytus</u> sp.														5
<u>Tabanus</u> sp.														

Table 42 (Cont'd)

Taxa	Station: B1	B2	G3	B4	R	T	O	N1	N2	F	D	H	I	J
	Sampling Gear: E	E	E	E	E	E	E	E	E	E	E	S	S	E
ARTHROPODA (cont'd)														
Insecta (cont'd)														
Diptera (cont'd)														
<i>Tanytus punctipennis</i>		129		409	129			43	194	690	43			259
<i>Tanytus stellatus</i>	14	409	57	237	1078	5215		517	388	129	690			
<i>Tanytarsini</i>					43									
<i>Tanytarsus flavellus</i>		65		22	216			904	843	1336	1531	59	1043	22
<i>Tanytarsus</i> sp.		4181	862	143	1185	3145	5905	904	843	1336	1531	59	1043	151
Total	358	4181	862	143	1185	3145	5905	904	843	1336	1531	59	1043	454
MOLLUSCA														
Gastropoda														
<i>Helisoma</i> sp.										129				86
<i>Physa</i> sp.										129			199	65
Total										129			199	151
Pelecypoda														
<i>Sphaerium</i> sp.					22					86				280
Total (No./m²)	358	4181	862	143	2157	8836	11163	3404	1749	2111	4442	120	1762	6942
Total (No. Taxa)	2	8	4	3	19	22	6	10	14	13	11	14	27	16
Species Diversity	0.162	0.954	1.155	1.056	2.425	1.997	1.068	1.464	1.866	2.238	1.932	0.234	2.493	1.329

Table 43

Densities (No./m²) of Macroinvertebrates Collected by Ekman Dredge (E) and Surber Sampler (S)--
Fort Hood, Spring

Taxa*	Station: O		N1	N2	D	H		I		J
	E	E				E	S	S	S	
TURBELLARIA										
<u>Dugesia sp.</u>					129					
ANNELIDA										
<u>Oligochaeta</u>										
<u>Brachiura sowerbyi</u>	172		72	573	57					1,494
<u>Dero nivea</u>			72		72					201
<u>Limnodrilus cevix</u>	244					11				57
<u>Limnodrilus hoffmeisteri</u>	158							5		29
<u>Limnodrilus profundicola</u>	29									
<u>Limnodrilus spiralis</u>	776			19		16				144
<u>Lumbriculidae</u>			29							
<u>Naididae</u>			86		331					115
<u>Tubificidae (immature)</u>	5,877		14	19	29	102		22		7,326
<u>Hirudinea</u>			14		57					
ARTHUROPODA										
Crustacea										
<u>Amphipoda</u>										
<u>Hyalella azteca</u>			43	76	14					
Insecta										
<u>Ephemeroptera</u>										
<u>Caenis sp.</u>	29		72	19						29
<u>Hexagenia limbata</u>				210						
<u>Odonata</u>										
<u>Argia sp.</u>							5			
<u>Agrionidae</u>			14	19						

* For an explanation of terminology in table headings, see the appendix.

Table 43 (Cont'd)

Taxa	Station: 0		N1		N2		D		H		I		J	
	Sampling	Gear: E	E	E	E	E	E	E	S	S	S	S	S	E
Megaloptera														
<i>Sialis</i> sp.			29		38									
Trichoptera			29						16		16			
<i>Cheumatopsyche</i> sp.			29		115						5			
Diptera														
<i>Ablabesmyia</i> sp.														
Ceratopogonidae														
<i>Chironomus thummi</i> group	14		14		38		144							
<i>Coelotanypus</i> sp.														
<i>Conchapelopia</i> sp.									5		22			
<i>Cricotopus</i> sp. A									22					
<i>Cricotopus</i> sp. B											11			
<i>Cricotopus fugax</i>									43					
<i>Cryptochironomus</i> sp.					57									
<i>Dicrotendipes</i> sp.	14			43	38		43							
<i>Parachironomus</i> sp.					38									
<i>Polypedilum</i> sp.					19									
<i>Procladius</i> sp.	29		14		115				22		5		172	144
<i>Rheotanytarsus</i> sp.	14		72											
<i>Simulium</i> sp.														
<i>Stictochironomus</i> sp.	29				191									
<i>Tabanus</i> sp.					19									
<i>Tanytarsus</i> sp.			345		57		29							
MOLLUSCA														
Pelecypoda														
Sphaeriidae	72		29		554								862	
Castropoda														
<i>Gyalus</i> sp.			43		19								115	

Table 43 (Cont'd)

Taxa	Station: O	N1	N2	D	H	I	J
Sampling Gear:	E	E	E	E	S	S	E
<u>Helisoma</u> sp.	14	29	19	560			29
<u>Lymnaca</u> sp.			19	57			
<u>Physa</u> sp.		86	229	101		11	29
Total (No./m ²)	7,471	1,178	2,500	1,723	242	102	10,746
Total (No. taxa)	14	21	23	15	9	9	14
Diversity	0.882	2.598	2.445	2.194	1.767	2.024	1.183

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Taxa	Station: S	L	A	A	P	Z
Sampling Gear:	E	S	E	S	E	S
Megaloptera						
<u>Sialis</u> sp.						
Trichoptera						
<u>Cheumatopsyche</u> sp.				554		65
<u>Chimarra</u> sp.				48		43
<u>Orthetrichia</u> sp.				75	43	
Diptera						
<u>Ablabesmyia</u> sp.			29			
Ceratopogonidae			14		72	
Chironomus thummi group			29		14	
<u>Coelotanypus</u> sp.					57	
<u>Conchapelopia</u> sp.					29	
<u>Cricotopus</u> sp.				43		
<u>Cricotopus</u> sp. B				156		
<u>Cricotopus fugax</u>						
<u>Cryptochironomus</u> sp.			43	5	72	

Table 43 (Cont'd)

Taxa	Station: S		L	A		P		Z
	S	E		A	E	A	E	
	Sampling Gear:		S	E	S	E	S	S
<u>Dicrotendipes</u> sp.					5	115		
<u>Glyptotendipes</u> sp.				86	5	57		
<u>Harmischia</u> sp.				57		43		5
<u>Polypedilum</u> sp.								5
<u>Procladius</u> sp.					328			436
<u>Rheotanytarsus</u> sp.					59			
<u>Simulium</u> sp.								
<u>Stictochironomus</u> sp.				14				
<u>Tabanus</u> sp.				43				
<u>Tanytarsus</u> sp.				43			86	
<u>Tanytarsus</u> sp.								
MOLLUSCA								
Pelecypoda								
Sphaeriidae		14		43	5		29	
Gastropoda								
<u>Gyraulus</u> sp.		14						
<u>Helisoma</u> sp.		14		43			43	
<u>Lymnaea</u> sp.							14	
<u>Physa</u> sp.		57		72			101	27
Total (No./m ²)	214	214	21	3275	1331	2398	612	
Total (No. taxa)	8	8	3	20	16	19	10	
Diversity	1.9301	1.9301	1.0221	1.4648	1.7465	1.9812	1.0956	

Table 44

Macroinvertebrates--Numbers Collected by Dip Net--Fort Hood--Fall

Taxa*	Station:	R	S	K	L	T	O	N1	N2	F	A	D	H	I	J
PORIFERA															
Demospongia															
<u>Spongilla</u> sp.		1													
COELENTERATA															
Hydrozoa										3					
<u>Hydra</u> sp.															
PLATYHELMINTHES															
Turbellaria							5	1			8				1
<u>Dugesia tigrina</u>															
ECTOPROCTA															
Phytolactolaemata															
<u>Plumatella repens</u>		1									1				
ANNELIDA															
Oligochaeta															
<u>Branchiura sowerbyi</u>				3		1	15	1		7	1	1		2	
<u>Dero digitata</u>															
<u>Naididae</u>															
<u>Nais variabilis</u>															1
<u>Nais</u> sp.									1						
<u>Tubificidae</u> (immature)						1									1
Hirudinea			1	1			1		1		1				1

*For an explanation of terminology in table headings, see the appendix.

Table 44 (Cont'd)

Taxa	Station:	R	S	K	L	T	O	N1	N2	F	A	D	H	I	J
ARTHROPODA															
Arachnida															
Acari															
<u>Albia</u> sp.							2								
<u>Arrenurus</u> sp.							3	1	1					1	
<u>Atractides</u> sp.							6								
<u>Eylais</u> sp.	1	1							1						
<u>Frontipoda</u> sp.								7	6					4	
<u>Lebertina</u> sp.															
<u>Mideopsis</u> sp.							12								
Crustacea															
<u>Conchostraca</u>			1							4				1	
<u>Lynceus</u> sp.															
Amphipoda															
<u>Hyalella</u> <u>azteca</u>		7	1					1	3	2	1				
Decapoda															
Astacidae															
<u>Palaeomonetes</u> sp.		1									1				
Insecta															
Ephemeroptera															
<u>Baetis</u> sp.						1			3	1		3	2		5
<u>Caenis</u> sp.						6		2	5	15	1	1		5	
<u>Callibaetis</u> sp.						1									
<u>Hexagenia</u> <u>bilineata</u>	1	2	2			5									
<u>Stenonema</u> <u>tripunctatum</u>						1									
				8	4										

Table 44 (Cont'd)

Taxa	Station:	R	S	K	L	T	O	N1	N2	F	A	D	H	I	J
ARTHROPODA (cont'd)															
Insecta (cont'd)															
Odonata															
<u>Archilestes</u> sp.				1							3				
<u>Argia</u> sp.												3	8	6	2
<u>Brechmorhoga</u> sp.		4											2		
<u>Erpetogomphus</u> sp.										1					
<u>Erythemis</u> sp.		1								1					
<u>Gomphus</u> sp.								4	6				3		1
<u>Leptheimis</u> sp.										1					1
<u>Lestes</u> sp.		1			1			8					2		
Lestidae															
<u>Libellula</u> sp.									1	1	1				
<u>Macrodiplox</u> sp.									1	2				2	2
<u>Macromia</u> sp.															1
<u>Nasiaeschna</u> sp.													1		
<u>Neurocordulia</u> sp.								1	1	2	1	4	1	1	
<u>Orthemis</u> sp.													1		
<u>Plathemis</u> sp.														6	
<u>Tauriphila</u> sp.														1	
<u>Tetragoneuria</u> sp.				3					2			5			
Hemiptera															
<u>Ambrysus</u> sp.															
<u>Belostoma</u> sp.		5									3		1	2	1
Corixidae (immature)															
Gerridae (immature)													1		
Gerris sp.								1						1	
<u>Hydrometra</u> sp.															1
<u>Nepa</u> sp.															
<u>Ranatra</u> sp.															1
<u>Trepobates</u> sp.								1							
<u>Trichocorixa</u> sp.		1									1				1
															13

Table 44 (Cont'd)

Taxa	Station:	R	S	K	L	T	O	N1	N2	F	A	D	H	I	J
ARTHROPODA (cont'd)															
Insecta (cont'd)															
Diptera															
<u>Chaoborus punctipennis</u>												1			
<u>Chironomus "thummi" group</u>				12					1	2	2	5	5	19	3
<u>Chrysops sp.</u>							2				1	2	1		
<u>Coelotanytus sp.</u>										1	1		1	5	
<u>Cricotopus sp. A</u>														1	
<u>Cryptocladopelma sp.</u>															
<u>Dicrotendipes sp.</u>	3					1				1	1	7	17	11	
<u>Einfeldia sp.</u>														1	
<u>Glyptotendipes dreisbachi</u>	1					2				4			3		
<u>Goeldichironomus sp.</u>					7	3			1	7		5	1		
<u>Parachironomus sp.</u>					1	1				1					
<u>Pentaneura sp.</u>	1					1				6			2		
<u>Phaenopsectra sp.</u>								1							
<u>Polypedilum illinoense</u>										1					22
<u>Polypedilum sp.</u>													2		
<u>Procladius bellus</u>														1	
<u>Procladius sp.</u>								1							
<u>Psorophora sp.</u>										1					
<u>Rheotanytarsus sp.</u>									1					2	
<u>Rhipidia sp.</u>														1	

Table 44 (Cont'd)

Taxa	Station:	R	S	K	L	T	O	N1	N2	F	A	D	H	I	J
ANTHROPODA (cont'd)															
Insecta (cont'd)															
Neuroptera															
<u>Corydalus sp.</u>													4	3	
<u>Sialis sp.</u>	1							3							
Coleoptera															
<u>Berosus sp.</u>	2	5	2	6	7			2	1	7	1	2	1		1
<u>Bidessus sp.</u>										2		1		3	
<u>Dineutus sp.</u>														1	
<u>Dubiraphia sp.</u>	1						2								
<u>Elodes sp.</u>					3		8			1					2
<u>Enochrus sp.</u>		1	3		1			1		1		1			
<u>Gyretes sp.</u>				1										1	
<u>Halipilus sp.</u>				1											
<u>Helichus sp.</u>		2	2							1	3	2			
<u>Helophorus sp.</u>										1		2			
<u>Laccophilus sp.</u>										1				1	
<u>Notomicrus sp.</u>										1					
<u>Peltochus sp.</u>				1						2				1	
<u>Pronotenus sp.</u>				1						2					
<u>Psephenus sp.</u>															
<u>Stenelmis sp.</u>	11	1	1	4	1					1					1
<u>Tropisternus sp.</u>		4	1	1	3					5				2	
Trichoptera															
<u>Orthotrichia sp.</u>	1									11					
Lepidoptera															
<u>Pyralidae</u>															1

Table 44 (Cont'd)

Taxa	Station:	R	S	K	L	T	O	N1	N2	F	A	D	H	I	J
MOLLUSCA															
Gastropoda															
<u>Ferrisia</u> sp.					2				2	1	3			3	3
<u>Gyraulus</u> sp.				6					1	13	3	3			2
<u>Helisoma</u> sp.				2					1						
<u>Lymnaea</u> sp.				1				2							
<u>Physa</u> sp.		2	2	4	3	5		2	1	18	2	3	5	4	
<u>Tropicorbis</u> sp.														1	
Pelecypoda															
<u>Amblyma</u> sp.		1													
<u>Sphaeridae</u>									11	3	1				
Unionidae (juvenile)		5	1	1	3					1					
Total No. Taxa		16	16	9	21	19	16	9	19	26	40	18	29	31	18

Table 45

Occurrence of Macroinvertebrates--Collected by Dip Net--Fort Hood-- Spring

Taxa*	Station:	R	S	K	L	P	T	O	N1	N2	F	A	D	H	I	J	Y	Z	
TURBELLARIA																			
<u>Dugesia</u> sp.														3					
ANNELIDA																			
<u>Oligochaeta</u>																			
<u>Brachiura sowerbyi</u>																		2	
<u>Tubificidae (immature)</u>										1									
<u>Hirudinea</u>									1					3					
ARTHROPODA																			
<u>Crustacea</u>																			
<u>Amphipoda</u>																			
<u>Hyaella azteca</u>			2				2	4	4	3	10		2					7	
<u>Decapoda</u>																			
<u>Astacidae</u>																			1
<u>Archnida</u>																			
<u>Lebertia</u> sp.			1																5
Insecta																			
<u>Ephemeroptera</u>																			
<u>Baetidae</u>							2	1					1						
<u>Baetis</u> sp.		1								2	4	6	1					2	1
<u>Caenis</u> sp.		2	2	1	2					3	1							1	
<u>Hexagenia limbata</u>									1	1	4	1							
<u>Isonychia</u> sp.									1										
<u>Siphonurus</u> sp.																			
<u>Stenonema tripunctatum</u>							6	3		1	1	2						3	
<u>Stenonema pulchellum</u>										1									
<u>Stenonema</u> sp. (early instar)																			1
																			1

*For an explanation of terminology in table headings, see the appendix.

Table 45 (Cont'd)

Taxa	Station:	R	S	K	L	P	T	O	N1	N2	F	A	D	H	I	J	Y	Z
ARTHROPODA (cont'd)																		
Insecta (cont'd)																		
Odonata																		
<u>Agrionidae</u>																		
<u>Argia sp.</u>									1	2	1	1		2	2	2		
<u>Enallagma sp.</u>								3	3	2	1	1		2	2	2		4
<u>Erpetogomphus sp.</u>					1					1				3				
<u>Gomphus sp.</u>														1				
<u>Hetaerina sp.</u>													1					
<u>Libellula sp.</u>														2				
<u>Nasiaeschna sp.</u>									1									
<u>Neurocordulia sp.</u>										2								
<u>Pachydiplax sp.</u>									1						2			
<u>Plathemis sp.</u>														1	1			
<u>Sympetrum sp.</u>								1			1					1		
Plecoptera																		
<u>Perlesta sp.</u>			2		5					3	4		3				3	
Trichoptera																		
<u>Cheumatopsyche sp.</u>				3		2		6		2	5	5	5			2	2	9
<u>Chimarra sp.</u>								1					3		1	1	1	1
Hemiptera																		
<u>Belostoma Sp.</u>														1	2			
<u>Corixidae</u>																		
<u>Gerris sp.</u>		1					4	2	1	1	1	1	1					1
<u>Limnogonus sp.</u>						1	1	2	1	1	1	1	1		1	1	1	
<u>Trepobates sp.</u>									1									
<u>Trichocorixa sp.</u>			1				1					1					1	1
							1											

Table 45 (Cont'd)

Taxa	Station:	R	S	K	L	P	T	O	N1	N2	F	A	D	H	I	J	Y	Z	
ARTHROPODA (cont'd)																			
Insecta (cont'd)																			
Coleoptera																			
<u>Agabus</u> sp.							1	1			2					1		1	
<u>Berosus</u> sp.							2									1		1	
<u>Dineutus</u> sp.	1																2		1
<u>Dubiraphia</u> sp.																1			
<u>Enochrus</u> sp.					1										1				1
<u>Halipus</u> sp.							2								1				
<u>Helicus</u> sp.				2															
<u>Hydrochus</u> sp.			2								2								
<u>Hydroporus</u> sp.							1	3	1					3	2				2
<u>Laccophilus</u> sp.	1																		
<u>Tropisternus</u> sp.															1				
Diptera																			
<u>Ablabesmyia</u> sp.																			1
Cetatopogonidae																			
<u>Conchapelopia</u> sp.												1							1
<u>Cricotopus</u> sp. A												1							1
<u>Cricotopus</u> <u>fugax</u>					1														
<u>Dicrotendipes</u> sp.						1													
<u>Eukiefferiella</u> sp.					1														
<u>Polypedilum</u> sp.						4			1	5	6								
<u>Sepedon</u> sp.									1										1
<u>Simulium</u> sp.						5													
<u>Stictochironomus</u> sp.	1		1				1			19									2
<u>Tanytarsus</u> sp.																			1

Table 45 (Cont'd)

Taxa	Station:	E	S	K	L	P	T	O	N1	N2	F	A	D	H	I	J	Y	Z
MOLLUSCA																		
Pelecypoda										1	1	2						
Sphaeriidae								11								11		
Unionidae																1		
Gastropoda																		
Amnicola sp.									1					1				
Gyraulus sp.								2	2	1		4						
Helisoma sp.							2	1	11	10	1	2		4	3	1	3	5
Physa sp.						2		1						1				4
Tropicorbis sp.																		1
Total No. Taxa		2	5	8	8	9	12	13	19	22	15	18	9	11	13	15	14	13

Table 46

Fishes--Potential Occurrence--Fort Hood

Species*	Common Name	Leon River	Belton Reservoir	Intermittent Creeks	Cow-house Creek
<u>Lepisosteus platostomus</u>	Shortnose gar				
<u>Lepisosteus oculatus</u>	Spotted gar				
<u>Lepisosteus osseus</u>	Longnose gar		⊗		0
<u>Dorosoma cepedianum</u>	Gizzard shad		⊗	⊗	X
<u>Dorosoma perenense</u>	Threadfin shad				X
<u>Astyanax mexicanus</u>	Mexican tetra			⊗	
<u>Campostoma anomalum</u>	Stoneroller			⊗	
<u>Cyprinus carpio</u>	Carp		0		
<u>Hybopsis aestivalis</u>	Speckled chub				
<u>Notemigonus crysoleucas</u>	Golden shiner			⊗	⊗
<u>Opsopoeodus emiliae</u>	Pugnose minnow				
<u>Phenacobius mirabilis</u>	Suckermouth minnow				
<u>Notropis atherinoides</u>	Emerald shiner				
<u>Notropis potteri</u>	Chub shiner				
<u>Notropis percobromus</u>	Plains shiner				
<u>Notropis buccula</u>	Smalleye shiner				
<u>Notropis buchanani</u>	Ghost shiner			X	0
<u>Notropis lutrensis</u>	Red shiner	⊗	X	⊗	⊗
<u>Notropis oxyrhynchus</u>	Sharpnose shiner				
<u>Notropis shumardi</u>	Silverband shiner				
<u>Notropis venustus</u>	Blacktail shiner	X	X	⊗	⊗
<u>Notropis volucellus</u>	Mimic shiner				
<u>Hybognathus placitus</u>	Plains minnow				
<u>Pimephales promelas</u>	Fathead minnow				
<u>Pimephales vigilax</u>	Bullhead minnow	0	⊗	⊗	⊗
<u>Cypleptus elongatus</u>	Blue sucker				
<u>Carpiodes carpio</u>	River carpsucker		X		
<u>Ictiobus bubalus</u>	Smallmouth buffalo		0		
<u>Moxostoma congestum</u>	Gray redbreast				
<u>Ictalurus melas</u>	Black bullhead			⊗	
<u>Ictalurus natalis</u>	Yellow bullhead			X	
<u>Ictalurus punctatus</u>	Channel catfish		⊗	X	0
<u>Ictalurus furcatus</u>	Blue catfish				
<u>Noturus gyrinus</u>	Tadpole madtom				
<u>Pylodictus olivaris</u>	Flathead catfish		X		
<u>Anguilla rostrata</u>	American eel				
<u>Fundulus kansae</u>	Plains killifish				
<u>Zygionectes notatus</u>	Blackstripe topminnow				⊗
<u>Zygionectes olivaceus</u>	Blackspotted topminnow				
<u>Gambusia affinis</u>	Mosquitofish	⊗		⊗	⊗
<u>Menidia beryllina</u>	Tidewater silverside		⊗	X	X

*For an explanation of terminology in table headings, see the appendix.

Table 46 (Cont'd)

Species	Common Name	Leon River	Belton Reservoir	Intermittent Creeks	Cow-house Creek
<u>Morone chrysops</u>	White bass		0		
<u>Lepomis auritus</u>	Redbreast sunfish			X	X
<u>Lepomis cyanellus</u>	Green sunfish			(X)	(X)
<u>Lepomis gulosus</u>	Warmouth			X	
<u>Lepomis humilis</u>	Orangespotted sunfish			0	0
<u>Lepomis macrochirus</u>	Bluegill	(X)	(X)	(X)	(X)
<u>Lepomis megalotis</u>	Longear sunfish	0	0	(X)	0
<u>Lepomis microlophus</u>	Redear sunfish		X	(X)	X
<u>Lepomis punctatus</u>	Spotted sunfish	X		X	
<u>Micropterus dolomieu</u>	Smallmouth bass				
<u>Micropterus punctulatus</u>	Spotted bass			X	(X)
<u>Micropterus salmoides</u>	Largemouth bass	0	(X)	X	(X)
<u>Micropterus sp.</u>				0	
<u>Micropterus treculi</u>	Guadalupe bass				X
<u>Poxomis annularis</u>	White crappie	X	(X)		
<u>Poxomis nigromaculatus</u>	Black crappie				
<u>Stizostedion vitreum</u>	Walleye				
<u>Etheostoma spectabile</u>	Orangethroat darter			0	X
<u>Percina caprodes</u>	Logperch				X
<u>Percina macrolepida</u>	Big scale logperch				
<u>Aplodinotus grunniens</u>	Freshwater drum				
<u>Cichlasoma cyanoguttatum</u>	Rio Grand perch				
<u>Mugil cephalus</u>	Striped mullet				
<u>Percinia sciera</u>	Dusky oarter	0			X

Source: Hubbs (1976); Beaty (1978)

Comments:

X = Observed in Fall 1978

0 = Observed in Spring 1979

(X) = Observed in both Spring and Fall

Table 47

Results of Fish Collections--Fort Hood--Fall

Taxa*	Station: 81				Belton Reservoir				Upper Leon River				
	Total No.	Total Wt. (g)	Mean Wt. (g)	Wt. Range (g)	Total No.	Total Wt. (g)	Mean Wt. (g)	Wt. Range (g)	Total No.	Total Wt. (g)	Mean Wt. (g)	Wt. Range (g)	Total Length Range (mm)
<i>Dorosoma cepedianum</i>					7	124.3	17.8	0.1-43.5					22-137
<i>Dorosoma petenense</i>													
<i>Lepisosteus osseus</i>													
<i>Notropis buchanani</i>													
<i>Notropis lutrensis</i>	2	2.9	1.4	1.2-1.7									
<i>Notropis venustus</i>	10	4.6	0.5	0.1-0.9	20	38.1	1.9	0.6-2.8		6	5.7	1.0	0.4-1.6
<i>Pimephales vigilax</i>										2	4.1	2.1	1.9-2.2
<i>Ictalurus melas</i>													46-49
<i>Ictalurus natalis</i>													
<i>Ictalurus punctatus</i>													
<i>Zygonectes notatus</i>													
<i>Cambusia affinis</i>													
<i>Bentia beryllina</i>	15	3.1	0.2	0.1-0.5	91	73.9	0.8	0.1-1.6		12	1.0	0.1	<0.1-0.1
<i>Lepomis auritus</i>													10-21
<i>Lepomis cyaneus</i>													
<i>Lepomis gulosus</i>													
<i>Lepomis macrochirus</i>													
<i>Lepomis megalotis</i>	1	3.4											
<i>Lepomis microlophus</i>	3	5.7	1.7	1.6-2.0						84	17.3	0.2	<0.1-0.7
<i>Lepomis punctatus</i>													13-32
<i>Micropterus punctulatus</i>													51
<i>Micropterus salmoides</i>													
<i>Pomoxis annularis</i>													
<i>Etheostoma spectabile</i>										1			72
<i>Percine caprodes</i>													
Total No.	27				122								106
Total No. Taxa	3				5								6

* For an explanation of terminology in table headings, see the appendix.

Table 47 (Cont'd)

Taxa	Upper Cowhouse Creek					Mid Cowhouse Creek					Lower Cowhouse Creek				
	Total No.	Total Wt. (g)	Mean Wt. (g)	Range (g)	Length (mm)	Total No.	Total Wt. (g)	Mean Wt. (g)	Range (g)	Length (mm)	Total No.	Total Wt. (g)	Mean Wt. (g)	Range (g)	Length (mm)
	K														
<i>Dorosoma cepedianum</i>	1	6.5			86										
<i>Dorosoma petenense</i>															
<i>Ca-postona anomalum</i>															
<i>Notemigonus crysoleucas</i>	5	1.6	0.3	0.3-1.6	34-61										
<i>Notropis buchanaui</i>															
<i>Notropis lutrensis</i>															
<i>Notropis venustus</i>	143	106.5	0.7	<0.1-2.1	25-65	82	56.1	0.7	<0.1-2.8	23-69	33	38.7	1.2	0.3-2.5	24-46
<i>Pimephales vigilax</i>						12	9.3	0.8	<0.1-1.2	30-51	5	4.5	0.9	0.4-1.8	24-45
<i>Ictalurus melas</i>															
<i>Ictalurus natalis</i>															
<i>Ictalurus punctatus</i>															
<i>Zygonectes notatus</i>						140	86.4	0.6	<0.1-1.6	30-56	1	1.0			38
<i>Gambusia affinis</i>	18	3.8	0.2	<0.1-0.8	19-36	411	125.7	0.3	<0.1-1.5	12-45	17	5.3	0.3	0.1-1.0	14-34
<i>Penidia beryllina</i>											157	183.3	1-2	0.3-2.0	23-55
<i>Lepomis auritus</i>						15	61.1	4.1	1.3-7.7	42-69					
<i>Lepomis cyaneilus</i>						24	66.1	2.7	1.2-5.5	42-64					
<i>Lepomis gulosus</i>															
<i>Lepomis macrochirus</i>	5	3.5	0.7	<0.1-1.6	19-47	9	10.3	1.1	0.1-3.1	20-57	23	51.5	2.2	0.4-7.2	24-58
<i>Lepomis megalotis</i>															
<i>Lepomis microlopinus</i>															
<i>Lepomis punctatus</i>															
<i>Micropterus punctulatus</i>															
<i>Micropterus salmoides</i>	1	1.5				1	0.5			78.1	4	23.6	5.9	3.7-10.1	48-67
<i>Pomoxis annularis</i>	2	16.1	8.1	6.5-9.6	49.3										
<i>Theostoma spectabile</i>	1	<0.1			83-96										
<i>Percina caprodes</i>					28.2										
Total No.	176					694					1	4.2			72
Total No. Taxa	8					8					269				11

Table 47 (Cont'd)

Taxa	Mid Table Rock Creek					Lower North Nolan Creek					Upper Clear Creek				
	Total No.	Total Mt. (g)	Mean Mt. (g)	Wt. Range (g)	Length Range (mm)	Total No.	Total Mt. (g)	Mean Mt. (g)	Wt. Range (g)	Length Range (mm)	Total No.	Total Mt. (g)	Mean Mt. (g)	Wt. Range (g)	Length Range (mm)
<i>Dorosoma cepedianum</i>	16	145.4	9.1	6.5-14.3	86-114										
<i>Dorosoma petenense</i>															
<i>Catostoma anomalum</i>															
<i>Notropis crissaleucas</i>	9	3.8	0.4	0.2-0.5	29-43										
<i>Notropis buchanani</i>															
<i>Notropis venustus</i>	147	76.5	0.5	0.1-1.2	22-50										
<i>Pimephales vigilax</i>	10	10.9	1.1	0.1-1.9	26-58										
<i>Ictalurus nebulosus</i>															
<i>Ictalurus natalis</i>	5	1530.9	306.2	70.7-507	214-440										
<i>Ictalurus punctatus</i>															
<i>Zygonectes notatus</i>	5181	1073.0	0.2	<0.1-2.0	9.5-50	66	6.9	0.1	<0.1-0.1	11-24	215	70.0	0.3	<0.1-1.7	13-45
<i>Cambusia affinis</i>						1	0.1			23					
<i>Hemidia beryllina</i>															
<i>Lepomis auritus</i>	273	1961.3	7.2	0.3-75.0	27-153	1	0.2			20	4	32.7	8.2	6.5-9.8	54-63
<i>Lepomis cyaneellus</i>						1	58.2			111					
<i>Lepomis microlophus</i>	567	826.4	1.5	<0.1-116.1	15-172	31	207.9	6.7	<0.1-43.7	13-104	28	46.4	1.7	0.1-13.7	18-72
<i>Lepomis megalotis</i>	412	3202.6	7.8	0.3-87.6	29-185						1	29.0	29.0	29.0	87
<i>Lepomis microlophus</i>						1	59.7			115					
<i>Lepomis punctatus</i>						2	17.4	8.7	8.3-9.1	61					
<i>Micropterus punctulatus</i>	13	385.4	29.6	3.4-26.0	60-179						8	9.7	1.2	0.4-2.5	27-38
<i>Micropterus salmoides</i>	12	71.7	197.6	2.7-1221.3	62-267						2	5.9	2.9	2.5-3.4	43-54
<i>Pomoxis annularis</i>															
<i>Etheostoma spectabile</i>															
<i>Percina caprodes</i>															
Total No.	6645					103					258				
Total No. Taxa	11					7					6				

Table 47 (Cont'd)

Taxa	Lower Clear Creek Stations: A				Reese Creek D				Lower Turkey Run Creek H			
	Total No.	Total Wt. (g)	Mean Wt. (g)	Length Range (mm)	Total No.	Total Wt. (g)	Mean Wt. (g)	Length Range (mm)	Total No.	Total Wt. (g)	Mean Wt. (g)	Length Range (mm)
<i>Dorosoma cepedianum</i>												
<i>Dorosoma petenense</i>	6	21.8	3.6	3.4-4.6								
<i>Campostoma anomalum</i>	16	214.5	13.4	5.9-20.0								
<i>Notemigonus crysoleucas</i>												
<i>Notropis buchanani</i>	100	25.6	0.3	<0.1-1.3	1	4.7		70				
<i>Notropis lutrensis</i>	3	9.7	3.2	0.2-8.2	14	1.0	0.1	0.1-4.3				
<i>Notropis venustus</i>	3	1.6	0.5	0.2-0.6								
<i>Pimephales vigilax</i>	1	7.8		65								
<i>Ictalurus melas</i>												
<i>Ictalurus natalis</i>					1	1.5		48				
<i>Ictalurus punctatus</i>												
<i>Zygonectes notatus</i>	1622	444.3	0.3	<0.1-1.1	38	9.4	0.2	<0.1-0.7	182	39.3	0.2	0.1-2.0
<i>Gambusia affinis</i>												
<i>Menidia beryllina</i>												
<i>Lepomis auritus</i>												
<i>Lepomis cyaneilus</i>	66	92.1	1.4	0.3-61.8	12	119.0	9.9	<0.1-64.8	266	247.8	0.9	0.4-74.0
<i>Lepomis gulosus</i>												
<i>Lepomis macrochirus</i>	33	22.8	0.7	0.1-2.0	19	84.1	4.4	<0.1-37.2	23	14.4	0.6	0.1-1.5
<i>Lepomis megalotis</i>	115	289.1	2.5	0.3-28.1					1	37.7		91
<i>Lepomis microlophus</i>												
<i>Lepomis punctatus</i>									57	107.7	1.9	0.4-2.8
<i>Micropterus punctulatus</i>												
<i>Micropterus salmoides</i>	1	54.9	54.9	126	1	10.2		93.5				
<i>Pomoxis annularis</i>												
<i>Etheostoma spectabile</i>												
<i>Percina caprodes</i>												
Total No.	1966				86							
Total No. Taxa	11				7							529
												5

Table 47 (Cont'd)

Taxa	Upper House Creek I				Lower House Creek J					
	Total No.	Total Wt. (g)	Mean Wt. (g)	Wt. Range (g)	Length Range (mm)	Total No.	Total Wt. (g)	Mean Wt. (g)	Wt. Range (g)	Length Range (mm)
<i>Dorosoma cepedianum</i>	2	4.0	2.0	1.5-2.5	45-52					
<i>Dorosoma petenense</i>										
<i>Camptostoma anomalum</i>										
<i>Rotemigonus crysoleucas</i>										
<i>Notropis buchanani</i>										
<i>Notropis lutrensis</i>	386	190.9	0.5	0.2-2.1	20-44	514	81.7	0.2	<0.1-1.2	18-44
<i>Notropis venustus</i>	1	0.3			25					
<i>Pimephales vigilax</i>	2	1.1	0.6	0.5-0.6	28-32					
<i>Ictalurus melas</i>										
<i>Ictalurus natalis</i>										
<i>Ictalurus punctatus</i>										
<i>Zygonectes notatus</i>										
<i>Gambusia affinis</i>	8	1.9		0.1-1.0	15-33	18	4.4	0.2	<0.1-0.6	13-38
<i>Menidia beryllina</i>										
<i>Lepomis auritus</i>										
<i>Lepomis cyaneillus</i>	5	15.9	3.2	2.4-3.4	41-47	6	11.4	1.9	0.6-4.5	33-63
<i>Lepomis gulosus</i>										
<i>Lepomis macrochirus</i>										
<i>Lepomis megalotis</i>										
<i>Lepomis microlophus</i>										
<i>Lepomis punctatus</i>										
<i>Micropterus punctulatus</i>										
<i>Micropterus salmoides</i>										
<i>Pomoxis annularis</i>										
<i>Etheostoma spectabile</i>										
<i>Percina caprodes</i>										
Total No.	404					563				
Total No. Taxa	6					6				

Table 48
Results of Fish Collections¹ From Fort Hood--Spring

Taxa*	Station: B1				Station: B3					
	Total No.	Total Wt. (g)	Mean Wt. (g)	Wt. Range (g)	Length Range (mm)	Total No.	Total Wt. (g)	Mean Wt. (g)	Wt. Range (g)	Length Range (mm)
<i>Lepisosteus osseus</i>	11	10,319.1	939.1	567.0-1,360.8	592-740	3	476.9	158.9	96.0-214.7	170-240
<i>Dorosoma cepedianum</i>	5	952.9	190.6	126.3-340.2	175-258	1	26.3			99
<i>Dorosoma petenense</i>										
<i>Carpasoma anomalum</i>										
<i>Cyprinus carpio</i>	1	2,513.2			445					
<i>Notemigonus crysoleucas</i>										
<i>Notropis buchanaei</i>										
<i>Notropis lutrensis</i>										
<i>Notropis venustus</i>										
<i>Pimephales vigilax</i>										
<i>Ichtiobus bubalus</i>	2	4,989.5	2,494.8	1,360.8-3,628.7	390-493	4	6.0	1.5	1.2-1.9	38-44
<i>Ictalurus melas</i>										
<i>Ictalurus punctatus</i>						3	2,758.3	914.4	600.3-1,402.9	330-440
<i>Zygonectes notatus</i>										
<i>Gambusia affinis</i>										
<i>Menidia beryllina</i>	1	2.4			62	4	7.7	1.9	1.0-3.4	43-68
<i>Parone chrysops</i>	1	283.2			235	2	1,154.7	577.4	558.1-596.6	300-310
<i>Lepomis cyanellus</i>										
<i>Lepomis humilis</i>										
<i>Lepomis macrochirus</i>	1	84.6			125	7	162.8	23.3	5.6-116.5	56-145
<i>Lepomis megalotis</i>						1	109.9			132
<i>Lepomis microlophus</i>										
<i>Micropterus punctulatus</i>	1	143.7			185	1	60.3			138
<i>Micropterus salmoides</i>										
<i>Micropterus</i> sp.	5	837.2	167.4	71.9-453.6	139-240	1	10.7			79
<i>Pomoxis annularis</i>										
<i>Etheostoma spectabile</i>										
<i>Percina sclera</i>										
Total No.	28					27				
Total No. Taxa	9					10				

¹For an explanation of terminology in table headings, see the appendix.

²Fish collected by dip net, seine, electroshocker, and gill net.

Table 48 (Cont'd)

Taxa	Molan Creek M2				Henson Creek Y					
	Total No.	Total Mt. (g)	Mean Mt. (g)	Mt. Range (g)	Length Range (mm)	Total No.	Total Mt. (g)	Mean Mt. (g)	Mt. Range (g)	Length Range (mm)
<u>Lepisosteus osseus</u>	2	179.6	89.8	80.7-98.9	161-167					
<u>Dorosoma cepedianum</u>										
<u>Dorosoma petenense</u>										
<u>Campostoma anomalum</u>										
<u>Cyprinus carpio</u>										
<u>Notemigonus crysoleucas</u>										
<u>Notropis buchananii</u>										
<u>Notropis lutrensis</u>						218	180.4	0.8	0.5-3.0	28-48
<u>Notropis venustus</u>						2	6.8	3.4	3.3-3.5	53-83
<u>Pimephales vigilax</u>						21	30.2	1.4	0.7-3.2	35-52
<u>Ictiobus bubalus</u>										
<u>Ictalurus melas</u>										
<u>Ictalurus punctatus</u>										
<u>Zygonectes notatus</u>										
<u>Gambusia affinis</u>	15	8.8	0.6	<0.1-1.1	8-35					
<u>Menidia beryllina</u>										
<u>Korone chrysope</u>										
<u>Lepomis cyanellus</u>										
<u>Lepomis humilis</u>						2	4.2	2.1	1.5-2.7	35-42
<u>Lepomis macrochirus</u>	5	117.0	23.4	6.8-37.2	51-96	4	11.2	2.8	2.1-9.3	41-50
<u>Lepomis megalotis</u>										
<u>Lepomis microlophus</u>	2	204.5	102.2	56.5-148.0	113-150					
<u>Micropterus punctulatus</u>										
<u>Micropterus salmoides</u>										
<u>Micropterus sp.</u>										
<u>Pomoxis annularis</u>										
<u>Etheostoma spectabile</u>										
<u>Percina sciera</u>										
Total No.	24					247				
Total No. Taxa	4					5				

Table 48 (Cont'd)

Taxa	Upper Cowhouse Creek				Mid Cowhouse Creek				Turnover Creek			
	Total No.	Total Mt. (g)	Mean Mt. (g)	Length Range (mm)	Total No.	Total Mt. (g)	Mean Mt. (g)	Length Range (mm)	Total No.	Total Mt. (g)	Mean Mt. (g)	Length Range (mm)
<u>Lepisosteus osseus</u>					2	1,933.7	966.8	790.0-1,143.7				
<u>Dorosoma cepedianum</u>												
<u>Dorosoma petenense</u>												
<u>Campestris anomalum</u>												
<u>Cyprinus carpio</u>												
<u>Notemigonus crysoleucas</u>					1	18.3		97				
<u>Notropis buchani</u>					53	39.5	0.74	0.6-1.0				
<u>Notropis lutrensis</u>					435	395.6	0.9	0.3-2.6				
<u>Notropis venustus</u>					9	27.6	3.0	1.7-6.5				
<u>Pimephales vigilax</u>	3	14.4	4.8	2.6-6.9	49-69				29	63.9	2.2	1.2-5.1
<u>Actinopterus bubalus</u>	1	0.9		37	17	32.5	1.9	0.9-4.6	2	0.2	0.1	0.1-0.1
<u>Ictalurus melas</u>												
<u>Ictalurus punctatus</u>	1	290.9		235								
<u>Zygonectes notatus</u>	1	0.7		35								
<u>Gambusia affinis</u>	32	18.3	0.6	0.1-1.6	20-38	4	2.9	0.2-1.3				
<u>Menidia beryllina</u>												
<u>Brama chrysops</u>												
<u>Lepomis cyanellus</u>	5	20.2	4.0	1.7-7.3	38-60				1	4.3		47
<u>Lepomis humilis</u>												
<u>Lepomis macrochirus</u>	6	29.1	4.8	1.0-9.0	32-64	4	18.6	4.6	3.8-5.2			
<u>Lepomis megalotis</u>	9	73.3	8.1	3.1-26.4	45-87	1	2.4					
<u>Lepomis microlophus</u>												
<u>Micropterus punctulatus</u>	1	11.4		83								
<u>Micropterus salmoides</u>												
<u>Micropterus sp.</u>												
<u>Pomoxis annularis</u>												
<u>Etheostoma spectabile</u>												
<u>Percina sciera</u>												
Total No.	59				526				36			
Total No. Taxa	9				9				6			

Table 48 (Cont'd)

Taxa	Lower Clear Creek				Reese Creek				Lower Turkey Run Creek			
	Total No.	Total Wt. (g)	Mean Wt. (g)	Length Range (mm)	Total No.	Total Wt. (g)	Mean Wt. (g)	Length Range (mm)	Total No.	Total Wt. (g)	Mean Wt. (g)	Length Range (mm)
<i>Lepisosteus osseus</i>	5	7.0	0.2	0.1-0.3	18-24	3	0.5	0.17	0.1-0.3	16-28		
<i>Dorosoma cepedianum</i>												
<i>Dorosoma petenense</i>												
<i>Lepisosteus osseus</i>	1	12.0		100								
<i>Syrphius carpio</i>	21	34.7	1.6	0.2-3.0	23-50							
<i>Motrilopsis buchannani</i>	10	11.4	1.14	0.1-4.6	19-58	14	65.0	4.6	3.0-6.2	51-69		
<i>Motrilopsis lutrensis</i>												
<i>Pimpla fulvipes</i>												
<i>Pimpla fulvipes</i>												
<i>Ichneumon bubalus</i>												
<i>Ichneumon melas</i>												
<i>Ichneumon punctatus</i>												
<i>Zygonectes notatus</i>	4	2.8	0.7	<0.1-1.2	8-35							
<i>Garbusia affinis</i>												
<i>Menidia beryllina</i>												
<i>Harems chrysope</i>												
<i>Lepomis cyanellus</i>	2	10.6	5.3	4.3-6.3	50-55							
<i>Lepomis humilis</i>												
<i>Lepomis macrochirus</i>												
<i>Lepomis megalotis</i>	1	8.2		58								
<i>Lepomis microlophus</i>												
<i>Micropterus punctulatus</i>												
<i>Micropterus salmoides</i>												
<i>Micropterus</i> sp.												
<i>Pomoxis annularis</i>												
<i>Cheostoma spectabile</i>												
<i>Percina sciera</i>												
Total No.	44					227						
Total No. Taxa	7					5						
												20
												3

Table 48 (Cont'd)

Taxa	Upper Leon River R				Lower Leon River S					
	Total No.	Total Wt. (g)	Mean Wt. (g)	Wt. Range (g)	Length Range (mm)	Total No.	Total Wt. (g)	Mean Wt. (g)	Wt. Range (g)	Length Range (mm)
<u>Lepisosteus osseus</u>										
<u>Dorosoma cepedianum</u>										
<u>Dorosoma petenense</u>										
<u>Carpostoma anomalum</u>										
<u>Cyprinus Carpio</u>										
<u>Notemigonus crysoleucas</u>										
<u>Notropis buchanani</u>										
<u>Notropis lutrensis</u>						62	36.3	0.59	0.1-3.3	22-51
<u>Notropis venustus</u>										
<u>Pimephales vigilax</u>						22	35.6	1.6	0.3-5.4	25-63
<u>Ictiobus bubalus</u>										
<u>Ictalurus nebulosus</u>										
<u>Ictalurus punctatus</u>										
<u>Zygonectes notatus</u>										
<u>Cambusia affinis</u>										
<u>Menidia beryllina</u>										
<u>Morone chrysops</u>						3	1.5	0.5	0.2-0.9	21-34
<u>Lepomis cyanellus</u>										
<u>Lepomis humilis</u>										
<u>Lepomis macrochirus</u>										
<u>Lepomis megalotis</u>	2	1.5	0.75	0.4-1.1	27-37					
<u>Lepomis microlophus</u>						13	27.6	13.8	1.5-26.1	37-88
<u>Micropterus punctulatus</u>							91.8	7.1	1.0-21.9	31-78
<u>Micropterus salmoides</u>						1	18.3			90
<u>Pomoxis annularis</u>										
<u>Etheostoma spectabile</u>						1	3.5			65
<u>Percina sciera</u>										
Total No.	2					104				
Total No. Taxa	1					7				

Table 48 (Cont'd)

Taxa	Mid Table Rock Creek 0				Lower Nolan Creek NI				Upper Clear Creek F				
	Total No.	Total Wt. (g)	Mean Wt. (g)	Wt. Range (g)	Total No.	Total Wt. (g)	Mean Wt. (g)	Wt. Range (g)	Total No.	Total Wt. (g)	Mean Wt. (g)	Wt. Range (g)	Total Length Range (mm)
<i>Lepisosteus osseus</i>													
<i>Dorosoma cepedianum</i>													
<i>Dorosoma petenense</i>													
<i>Carpostoma anomalum</i>	9	4.8	0.5	0.1-1.0	1	0.2							19
<i>Cyprinus carpio</i>													
<i>Notemigonus crysoleucas</i>													
<i>Notropis buchhami</i>													
<i>Notropis lutrensis</i>													
<i>Notropis venustus</i>	12	67.0	5.6	0.3-12.4									
<i>Pimephales vigilax</i>	25	3.8	0.15	0.1-0.4									
<i>Ictiobus bubalus</i>													
<i>Ictalurus melas</i>													
<i>Ictalurus punctatus</i>													
<i>Zygonectes notatus</i>	22	8.5	0.38	<0.1-1.5	65	21.9	0.34	<0.1-1.2					8-36
<i>Gambusia affinis</i>													
<i>Menidia beryllina</i>													
<i>Korone chrysope</i>													
<i>Lepomis cyanellus</i>													
<i>Lepomis humilis</i>													
<i>Lepomis macrochirus</i>	2	6.0	3.0	2.6-3.4	4	3.1	0.77	0.1-2.5					18-42
<i>Lepomis megalotis</i>	29	398.2	13.7	5.7-32.0					2	28.2	14.1	1.1-27.1	34-86
<i>Lepomis microlophus</i>													
<i>Micropterus punctulatus</i>													
<i>Micropterus salmoides</i>													
<i>Micropterus sp.</i>													
<i>Pomoxis annularis</i>	44	6.1	0.14	<0.1-0.1	1	0.2							22
<i>Etheostoma spectabile</i>													
<i>Percina sciera</i>													
Total No.	143				71								
Total No. Taxa	7				4								

Table 48 (Cont'd)

Taxa	Upper House Creek			Lower House Creek			Orl Creek		
	Total No.	Total Wt. (g)	Mean Wt. Range (g)	Total No.	Total Wt. (g)	Mean Wt. Range (g)	Total No.	Total Wt. (g)	Mean Wt. Range (g)
<i>Lepisosteus osseus</i>	1	<0.1							
<i>Dorosoma cepedianum</i>									
<i>Dorosoma petenense</i>									
<i>Campostoma anomalum</i>			14						
<i>Cyprinus carpio</i>									
<i>Notemigonus crysoleucas</i>									
<i>Notropis buchanani</i>				2	6.7	3.3	2.3-4.4		57-65
<i>Notropis lutrensis</i>	115	209.3	1.8	1.4-9.1	38-64				
<i>Pimephales vigilax</i>				122	139.1	1.14	0.4-4.0		27-54
<i>Ictiobus bubalus</i>				1	3.6				57
<i>Ictalurus melas</i>									
<i>Ictalurus punctatus</i>				1	44.1				119
<i>Zygonectes notatus</i>									
<i>Cambusia affinis</i>									
<i>Menidia beryllina</i>									
<i>Morone chrysops</i>									
<i>Lepomis cyanellus</i>									
<i>Lepomis humilis</i>									
<i>Lepomis macrochirus</i>				3	225.4	75.1	17.7-106.8		76-141
<i>Lepomis megalotis</i>				1	6.5				56
<i>Lepomis microlophus</i>				15	70.8	4.7	1.9-8.3		39-60
<i>Micropterus punctulatus</i>	1	14.1		1	20.0			1	4.7
<i>Micropterus salmoides</i>				1	29.5				77
<i>Micropterus</i> sp.									91
<i>Pomoxis annularis</i>									
<i>Etheostoma spectabile</i>									
<i>Percina sciera</i>									
Total No.	117								
Total No. Taxa	3			147					1

5 ECOLOGICALLY SENSITIVE AREAS

Terrestrial Areas

Terrestrial areas at Fort Hood which should be considered sensitive include mature Ashe juniper woodland, riparian woodland, and many of the small isolated springs which dot the area. Woodland containing mature Ashe juniper is essential habitat for the endangered (according to TOES) Golden-cheeked Warbler. Riparian woodland is important because it is relatively rare in the Fort Hood area. Its small, isolated springs are important as a source of fresh water for many species and as breeding habitat for others.

The riparian woodlands on the reservation are ecologically important as wildlife habitat, as corridors for migration through the extensive reservation, and as local reservoirs of plant and animal diversity. These woodlands harbor numerous eastern species which probably would not occur regularly at Fort Hood in the absence of such habitat. Riparian woodlands are probably no more sensitive to environmental perturbations than upland vegetation, but they are more worthy of preservation for the reasons noted above.

The eastern portion of Fort Hood, on either side of the Cowhouse Creek Arm of Lake Belton, is less disturbed than other parts of the reservation and generally provides better habitat for both plants and animals. The disjunct populations of big-tooth maple and white dog-tooth violet occur here, and portions of the area are recognized as prime habitat for the Golden-cheeked Warbler. The specific localities of the big-tooth maple and white dog-tooth violet populations are especially sensitive.

Aquatic Areas

The only aquatic area of the reservation which is particularly sensitive ecologically is the Cowhouse Creek area of Belton Lake. This area is important both as a recreational resource for fishing and other water-related activities and as a public water supply. Because of training activities at Fort Hood, this area is vulnerable to siltation. In addition to replacing the water volume with sediments, siltation tends to disrupt or otherwise restrict breeding of fish which prefer hard substrates. For example, many important game fish breed in gravel or sandy areas which can be eliminated by the settling of silt.

6 SUMMARY

Major components of Fort Hood's terrestrial and aquatic ecosystems were systematically sampled and analyzed. Studies of the terrestrial ecosystems included the delineation and characterization of vegetational communities, including quantification of vegetational components of representative communities and preparation of floristic species lists. In addition, representative communities were characterized according to their wildlife components. This included preparation of species lists for all terrestrial vertebrates and bird and mammal censuses in representative habitats. Representative aquatic communities were sampled for periphyton, phytoplankton, zooplankton, macrophytes, macroinvertebrates, and fish. Each aquatic system was characterized by species composition, density, and/or relative abundance.

The reservation is about 38 percent grassland and savanna, 57 percent woodland and scrub, and 5 percent built-up land. The woody vegetation of the reservation is primarily Ashe juniper (Juniperus ashei), live oak (Quercus fusiformis), and Texas oak (Q. texana). The grassland of the reservation includes elements of tall grass prairie, which is characteristic of the higher rainfall areas of the Blackland Prairie to the east, and the more important short-grass grasslands to the west.

Floristic surveys of Fort Hood revealed 380 species or varieties of plants representing 81 families. Two species of particular interest were the big-tooth maple (Acer Grandidentatum), and the white dog-tooth violet (Erythronium albidum).

Like the vegetation, the wildlife is typical of the Edwards Plateau. Qualitative and quantitative field surveys at Fort Hood revealed 28 species of amphibians and reptiles, 128 species of birds, and 20 species of mammals. The most notable bird species observed were the Roseate Spoonbill (Ajaia ajaja), the Osprey (Pandion haliaetus), and the Peregrine Falcon (Falco peregrinus).

Riparian woodland provides the best habitat for bird species diversity. Species diversity was lowest in the grazed grassland census area. Densities of birds were greatest in riparian woodland, followed by mixed woodland, juniper woodland, and grassland. The bird encountered over the widest portion of the survey area during the road-cruise censuses was the Cardinal (Cardinalis cardinalis).

Common mammal species observed on the reservation included the raccoon (Procyon lotor), white-tailed deer (Odocoileus virginianus), and black-tailed jack rabbit (Lepus californicus). Trapping indicated that the deer mouse (Peromyscus maniculatus) was the most common small mammal in the fall, and the Texas mouse (Peromyscus attwateri) and the White-ankled mouse (Peromyscus pectoralis) were most common in the spring.

Aquatic communities at Fort Hood were similar to those in other areas of Central Texas. Most of the stations sampled, other than those in Belton Lake, exhibited variable communities in terms of species compositions and densities. This was often the case in intermittent stream environments, where fluctuations in water level create pools or where floods drastically reduce resident populations and may considerably alter the physical habitat. During the fall

field surveys, most of the streams were not flowing, due to dry weather conditions in the area, thus creating a series of pools or ponds.

These communities were typical of those commonly observed in the calcareous streams of central Texas. Phytoplankton densities were lower in the spring; however, the diversity of diatoms increased due to scouring of the substrate by the spring rains.

Similar results were obtained in the zooplankton sampling program. The results of the phytoplankton, periphyton, and zooplankton surveys did not indicate any effects resulting from siltation directly. On the other hand, the indications of moderate, widespread enrichment observed may have been due, at least in part, to nutrients entering the streams along with soil particles. Zooplankton densities were generally lower in the spring.

Belton Lake had rather distinct phytoplankton and zooplankton assemblages during both surveys. This is the normal condition, considering the vast difference in habitat between the reservoir and its tributary streams.

Based on phytoplankton and zooplankton data collected from 7 to 11 May 1979, flood events at Fort Hood in spring 1979 appeared to have the greatest impact on the Leon River. Slower-moving, pool-like habitats, like those at Lower Cowhouse Creek and Belton Lake, appeared to be less affected by floods than some of the intermittent creeks where currents were faster and more scouring of substrates was likely to occur.

The macroinvertebrate survey showed that most stations were dominated by oligochaetes and dipterans. While this is often the case in enriched situations, these groups are also usually dominant in soft-sediment habitats. Doubtless, both conditions contributed to the large numbers and widespread occurrence of these organisms. The highest densities of organically enriched habitats were found at stations in Table Rock, House, and Cowhouse Creeks. All of these stations were characterized by thick layers of silty sediments over the original rocky stream beds. Densities were lower at most stations in the spring, although the silty substrate at Station J supported a more abundant oligochaete population, and total densities were higher at this station. Although Dipterans were still an important group in terms of abundance, they were considerably less abundant and diverse in benthic samples than they were in the fall. However, quantitative and qualitative analyses of samples indicated that the numbers of taxa observed were not excessively low, nor were individual species densities high enough to indicate a heavily polluted situation.

The results of both fish collections, both in the streams sampled and in Belton Lake, do not indicate any conditions that would be considered unusual in the types of habitat sampled. Members of the families Cyprinidae (minnows) and Centrarchidae (sunfishes) were the most commonly collected.

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APPENDIX: METHODS

Vegetation

Quantitative vegetational surveys and qualitative floristic surveys were conducted at the Fort Hood Military Reservation in 1978 between 11 and 15 September and 19 and 24 September. In addition, a ground reconnaissance was performed on 9 and 10 August 1978, and an aerial reconnaissance was performed on 29 September 1978. The spring vegetative study was conducted between 22 May and 27 May 1979 using the same methods as the previous fall. The urban environment was not studied in detail because its composition is under human control and is altered with little regard to normal ecological principles.

Vegetation Mapping Methods

The generalized vegetation map of Fort Hood Military Reservation (Figure 2) was based on terrain analysis maps prepared by the U.S. Army Engineer Topographic Laboratory in 1977. The original terrain analysis delineated 15 categories on the basis of vegetational physiognomy, which included four categories of coniferous woodland and scrub, four of mixed woodland and scrub, four of deciduous woodland and scrub, two of grassland, and one in which vegetation was not a significant factor. The map was prepared by eliminating parcels which were too small to be portrayed effectively at the small scale necessary for this report. In some cases, physiognomic categories were combined when field studies failed to reveal a useful vegetational distinction among them.

Plant Community Survey Methods

The vegetation at Fort Hood was surveyed and sampled to describe the plant communities in terms of areal extent and composition by dominant and characteristic species. Seventeen stands of vegetation were selected as being representative of the reservation's plant communities.

Quantitative samples were obtained in selected woodland stands, using the point-centered quarter method of Cottam and Curtis.⁷⁶ The quarter method involves measuring the distance from an arbitrarily selected point to the nearest tree in each of the four 90-degree quadrants and measuring and recording the tree's diameter at breast height (dbh) and its scientific name. The average point-to-tree distance is squared to compute the mean area for individual trees in the stand. The parameters sampled by the point-centered quarter method are density, basal area, and frequency of tree species. The following definitions pertain to the quarter method.

Mean Area is the square of the average point-to-tree distance. It designates the space occupied by an average tree.

Density is the number of trees per unit area.

⁷⁶ G. Cottam and J. T. Curtis, "The Use of Distance Measures in Phytosociological Sampling," Ecol., No 37 (1956), pp 450-460.

Frequency of a species is the percentage of quarter points at which that species is sampled.

Mean Basal Area is the average cross-sectional area of the trunk of a tree species measured at 1.5 m.

Total Basal Area of a species is the product of the species' density and its mean basal area.

Relative Density is the number of sampled trees of a species divided by the total number of trees sampled. % Relative Density = Relative Density x 100.

Relative Frequency of a species is the frequency of that species divided by the sum of frequency values for all species. % Relative Frequency = Relative Frequency x 100.

Relative Basal Area is the total basal area of a species divided by the sum of the total basal area for all species.

Important Percentage is the average of % relative values (frequency, density, and basal area) for a species.

In the present study, 10 to 15 points (40 to 60 trees) were sampled in each stand. Points were selected at 20-m intervals throughout the stands. Tree diameters at 1.5 m (dbh) were measured with a diameter tape. In each stand, observations were made at frequent intervals to determine the shrub and ground-cover components of the stand. Qualitative observations on species composition were also made in a number of stands which were not sampled by the quarter method or other quantitative means. Taxonomic names follow Correll and Johnston.⁷⁷

Terrestrial Wildlife

Quantitative and/or qualitative surveys of amphibians, reptiles, birds, and mammals of the Fort Hood Military Reservation were conducted during 21 through 25 August 1978 and from 28 August through 1 September 1978. In addition, visits were made to Fort Hood on 9 and 10 August and on 11 and 12 September. The spring wildlife survey was conducted between 22 April and 3 May 1979. The urban environment was not surveyed in detail because normal ecological principles do not maintain their complete integrity in urban systems, and there was not fall data to use for comparison.

Amphibians and Reptiles

There is no acceptable technique for quantifying amphibian and reptile populations without extensive mark-recapture techniques, and these are of questionable value. Therefore, qualitative amphibian and reptile surveys were performed daily by general field reconnaissance and observation within the

⁷⁷ D. Correll and M. Johnston, Manual of the Vascular Plants of Texas (Texas Research Foundation, Renner, 1970).

boundaries of the Fort Hood Military Reservation. Rocks, logs, and associated debris were overturned in search of organisms; vocally active species were identified by their calls in late evening and after rains, and roads were driven at night in search of nocturnal species. Captured and/or observed specimens were identified using Blair, et al.,⁷⁸ Ernst and Barbour,⁷⁹ and Conant.⁸⁰ Nomenclature follows Collins, et al.⁸¹

Birds

Birds were observed daily in various habitats within the project area. Habitats used and relative abundance were recorded for each species.

Quantitative estimations of small bird densities were determined by walking five Emlen⁸² type transects as follows: one 1500-m transect in grazed grassland; one 300-m transect in mixed juniper-deciduous forest; one 500-m transect in a burned disturbed woodland; one 900-m transect (in two segments) in riparian woodland; and one 1150-m transect in juniper woodland. Figure 6 shows the locations of these transects. Emlen and other closely related transects are considered the most appropriate for natural resource inventories calling for density estimates of bird species in an area throughout the year.⁸³ Field procedures and subsequent data interpretation followed the methods described by Emlen⁸⁴ for estimating bird densities during the non-breeding season, except that a minimum specific strip of 30 m was used to avoid artificially high estimates of birds observed in low numbers adjacent to the trail. Balph, et al.,⁸⁵ describes a method of analyzing transect data in this manner. The mean of the repetitions of each transect was used to compute densities as suggested by Emlen.⁸⁶ Emlen transects are inappropriate for estimating densities of large wide-ranging species;⁸⁷ therefore, birds such as vultures and hawks were excluded from the density estimates. The results of

⁷⁸ W. F. Blair, A. P. Blair, P. Brodkorb, F. K. Cagle, and G. A. Moore, Vertebrates of the United States (McGraw-Hill Book Co., Inc., 1968).

⁷⁹ C. H. Ernst and R. W. Barbour, Turtles of the United States (Univ. Press of Kentucky, Lexington, 1972).

⁸⁰ R. Conant A Field Guide to Reptiles and Amphibians of Eastern and Central North America, 2nd ed. (Houghton Mifflin Co., 1975).

⁸¹ J. T. Collins, J. F. Huheey, J. L. Knight, and H. M. Smith, Standard Common and Current Scientific Names for North American Amphibians and Reptiles, Misc. Publ. Cir. No. 7 (SSAR, 1978).

⁸² J. T. Emlen, "Population Densities of Birds Derived From Transect Counts," Auk, No. 88 (1971), pp 323-342.

⁸³ M. H. Balph, L. C. Stoddart, and D. F. Balph, "A Simple Technique for Analyzing Bird Transect Counts," Auk, No. 88 (1977), pp 606-607.

⁸⁴ J. T. Emlen, "Population Densities of Birds Derived From Transect Counts," Auk, No. 88 (1971), pp 323-342.

⁸⁵ M. H. Balph, L. C. Stoddart, and D. F. Balph, "A Simple Technique for Analyzing Bird Transect Counts," Auk, No. 88 (1977), pp 606-607.

⁸⁶ Emlen, et al., 1971.

⁸⁷ Emlen, et al., 1971.

each transect were evaluated and compared using Whittaker's⁸⁸ index of species diversity/richness as follows:

$d = S/\log A$, where

S = number of species, and

A = area sampled (in square meters)

In addition to the Emlen transects in specific habitat types, two 25-mi quantitative road-cruise bird censuses were conducted. Each census route transversed a variety of habitats. The transects were started at sunrise and all birds seen or heard during a three-minute period at each of 50 stops (1/2 mi apart) were recorded. Results are presented as number of birds observed per mile of transect. Figure 6 shows the road-cruise census routes.

Bird identification during the surveys was facilitated by using Peterson⁸⁹ and Robbins, et al.⁹⁰ Nomenclature is according to the American Ornithologists' Union.⁹¹

Mammals

Mammals were surveyed on Fort Hood either by direct observation, detection of tracks, scat or nests, and/or capture.

Small mammals were censused using 3 x 3 x 9-in. Sherman live traps. Trap lines consisting of a variable number of trap stations, each separated by approximately 10 to 25 m, were established in the following habitats: grazed grassland, ungrazed grassland, mixed juniper-deciduous woodland, burned disturbed woodland, juniper woodland, riparian woodland, and a fenced food plot. Traps were baited with rolled oats, and each line was run a maximum of four consecutive nights. Data for 1080 trap-nights were collected and results expressed as trap-night ratios and percent success. Figure 6 shows the trapping locations.

A 64-km spotlight road-cruise mammal census was conducted on 30 August. A speed of about 10 mph was maintained except when closer observation required temporary stops. All species observed and the numbers of each were recorded. Results are presented as number of mammals per mile. Figure 6 shows the census route.

Additional information concerning game species was obtained from the Fish and Wildlife Section at Fort Hood.

⁸⁸ R. H. Whittaker, Communities and Ecosystems, 2nd ed. (Macmillan Publishing Co., 1975).

⁸⁹ R. T. Peterson, A Field Guide to the Birds of Texas (Houghton-Mifflin Co., Boston, 1963).

⁹⁰ C. S. Robbins, B. Brunn, and H. S. Zim, A Guide to Field Identification: Birds of North America (Golden Press, 1966).

⁹¹ C. S. Robbins, B. Brunn, and H. S. Zim, A Guide to Field Identification: Birds of North America (Golden Press, 1966).

Identifications of specimens were based on Davis⁹² Blair, et al.,⁹³ and Lowery.⁹⁴ Nomenclature follows Jones, et al.⁹⁵

Aquatic Communities

The aquatic communities at Fort Hood were characterized according to water quality, phytoplankton, periphyton, zooplankton, macroinvertebrates, and fish. Collections for each of the organism groups were made at 14 stations between 21 and 25 August 1978. In addition, a ground reconnaissance was performed on 9 and 10 August 1978. A spring survey of 17 stations was conducted between 7 and 11 May 1979.

Water Quality

Physical-chemical parameters collected in aquatic habitats at Fort Hood include dissolved oxygen (DO) and temperature, using a YSI Model 51A DO meter; specific conductance, using a YSI Model 33 salinity-conductivity-temperature meter; pH, using a Leeds and Northrup Model 7417 portable pH meter; and light penetration, using a 20.32 cm black-and-white secchi disk. The spring survey used a Horiba Model 4-7 water quality checker to measure pH, temperature, conductivity, turbidity, and DO. The turbidity readings were discarded due to calibration problems. The parameters were measured in the field at the time of biological sampling.

Phytoplankton

Phytoplankton was collected by taking duplicate 1-liter grab samples from undisturbed areas at each station. Phytoplankton samples were preserved by adding of M-3 at a final concentration of 3 percent. Each replica was concentrated to 50 ml by settling. Phytoplankton organisms were identified and enumerated at 400x magnification using a counting chamber similar to that described by Palmer and Maloney.⁹⁶ The results are expressed as density (no./ml) of each species averaged over the two replica samples. Taxonomic

⁹² W. B. Davis, The Mammals of Texas, Texas Parks and Wildlife Department Bull. 41, Austin (1974).

⁹³ Blair, et al., 1968.

⁹⁴ G. H. Lowery, Louisiana Birds (Louisiana State Univ. Press, Baton Rouge, 1974).

⁹⁵ Jones, et al., 1973.

⁹⁶ C. M. Palmer and T. E. Maloney, "A New Counting Slide for Nannoplankton," Limnol. and Oceanogr., Spec. Publ. 21 (1954), pp 1-6.

sources used include Patrick and Reimer,⁹⁷ Boyer,⁹⁸ Hustedt,⁹⁹ U.S. Department of the Interior,¹⁰⁰ Prescott,¹⁰¹ and Smith.¹⁰²

Periphyton

Periphyton samples were obtained by collecting one or more examples of common substrates at each station. These were placed in clean sample containers, preserved with formalin, and returned to the lab for analysis. The substrates were scraped and the resulting assemblage was treated with hydrogen peroxide and potassium dichromate to prepare the diatoms for identification. The cleaned diatoms were mounted in Hyrax- and enumerated (strip count) at 1000x magnification until at least 200 individuals were encountered. The results for each station are expressed as the relative abundance (percent) of each species. Taxonomic sources were the same as those used for phytoplankton.

Zooplankton

At most stations in the fall and at all stations in the spring, zooplankton samples were composites of eight 5-liter grab samples poured through a No. 25 mesh (64 microns) plankton net with a Wisconsin bucket. In some cases in the fall (Stations R - Upper Leon River, N1 - Lower Nolan Creek, N2 - Lower Nolan Creek), the above method was not feasible and a 1-gal grab sample was obtained instead. Samples were preserved by adding formalin to yield a final concentration of 10 percent. In the lab, samples were diluted to appropriate volumes for counting. Using Sedgwick-Rafter cells, at least 200 individuals, or five slides, were counted. Rotifers, cladocerans, and adult copepods were identified to species when possible. Immature copepods were identified as calanoid, cyclopoid, or nauplii. Results are reported as number per liter.

⁹⁷ R. Patrick and C. W. Reimer, "The Diatoms of the United States," Vol 1, Acad. Nat. Sci. Phila., Monogr. No. 13 (1966).

⁹⁸ C. S. Boyer, "Synopsis of North American Diatomaceae, Part I," Proc. Acad. Nat. Sci., Phila., No. 78 (1926), pp 1-228.

⁹⁹ F. Hustedt, "Bacillariophyta," (1930), pp 1-466, In: A. Pascher, Die Susswasser-Flora Mitteleuropas, Heft 10, Gustav Fischer, Jena.

¹⁰⁰ U.S. Department of Interior, A Guide to Common Diatoms at Water Pollution Surveillance System Stations (FWPCA, Cincinnati, 1966).

¹⁰¹ G. W. Prescott, Algae of the Western Great Lakes Area (Wm. C. Brown Co. Publishers, Dubuque, 1962).

¹⁰² G. M. Smith, The Freshwater Algae of the United States, 2nd ed. (McGraw-Hill Book Co., Inc., 1950).

Taxonomic sources used include Ahlstrom,¹⁰³ Edmondson,¹⁰⁴ Chengalath and Mulamootil,¹⁰⁵ and Ruttner-Kolisko.¹⁰⁶

Macroinvertebrates

Composite quantitative macroinvertebrate samples were collected, using a 15.24- x 15.24-cm Ekman dredge where substrates were silt, detritus, or fine gravel. In sand or gravel riffles, a 30.48- x 30.48-cm Surber sampler was used. Quantitative samples were not collected where bottom substrates were rock. In Belton Lake, three dredge hauls were composited at each station. At other stations, two quantitative samples were composited. Samples were washed in the field, using a 30-mesh sieve bucket. Qualitative macroinvertebrate samples were collected in all available habitats at each creek station, using a 30-mesh dip net. A standard sampling effort of about 20 minutes per station was expended. Organisms picked from rocks and woody debris were included in dip net samples. All macroinvertebrate samples were preserved in 70 percent formalin (final concentration) and returned to the laboratory for analysis.

In the laboratory, samples were washed in a 30-mesh screen to remove formalin. Dredge samples containing large amounts of detritus were split into portions and a representative subsample, usually one-fourth to one-half, was picked. Techniques used to facilitate picking samples include staining with rose bengal and sucrose flotation.¹⁰⁷ Organisms were placed in vials with 70 percent alcohol/5 percent glycerin as preservative. When feasible, species were identified using an Olympus SZIII or a Bausch and Lomb Stereo Zoom 7 dissecting microscope. Diptera and Oligochaetes were mounted in Berlese's mounting medium¹⁰⁸ and identified with the aid of an Olympus KHC compound microscope. Raw counts for Ekman and Surber samples were converted to density estimates, or average number per meter for two or three replica.

Species diversity of the benthic community was calculated from Ekman and Surber density estimates by the equation of Wilhm and Dorris¹⁰⁹ using natural logarithms:

$$\bar{d} = -\sum(n_i/n) \ln(n_i/n)$$

where n_i = the number of individuals of the i th species
 n = total number of individuals in the sample.

¹⁰³E. H. Ahlstrom, "A Revision of the rotatorian Genera Brachinus and Platyias With Descriptions of One New Species and Two New Varieties," Bull. Amer. Mus. Nat. Hist., Vol 77 (1940), pp 143-184.

¹⁰⁴W. T. Edmondson, "Trophic Relations of the Zooplankton," Trans. Amer. Micros. Soc., No. 76 (1957), pp 225-245.

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Fish

Several gear types were used to collect fish at Fort Hood. Seine samples were taken with a 6.10- x 1.22-m x 0.64-cm minnow seine at 12 creek stations and two lake stations. When possible, an area of 185 m was sampled at each station. In conjunction with the seine hauls, additional sampling was done with a 0.64-cm mesh dip net. Gill net collections were made, using a 45.72-m experimental gill net. These nets are divided into six sections of different mesh sizes: 2.5 cm, 3.8 cm, 5.0 cm, 6.3 cm, 7.5 cm, and 8.9 cm. Two nets were placed at Station B2 for one night and at Station B4 the following night. Electrofishing with a 4-kw generator was used at all four stations in Belton Lake, and the catch was composited into two total samples: B1 with B2, and B3 with B4. Each sample represented a total of 45 minutes of shocking, with a concentration of effort on shoreline and brushy areas.

Fish collected by seine were sorted in the field, preserved in formalin, and returned to the laboratory for analysis. Fish collected by gill netting and electroshocking were analyzed in the field. Data collected for seine samples included species, total number and weight, average and range of weight, and standard length range. Fish collected by gill netting and electroshocking were identified, measured, and weighed.

Taxonomic references include Blair, et al.,¹¹⁸ Pflieger,¹¹⁹ Hubbs,¹²⁰ and Bailey.¹²¹

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