Life History

Black-capped Vireos arrive in Texas from mid-March to mid-April. Adult males often arrive before females and first-year males to select their territories. Vireos' territories are often clustered in patches of suitable habitat. Although territories range in size from 1 to 16 acres, most territories are 5 to 10 acres. Males sing to attract mates and defend territories. Many males can be heard singing throughout the breeding season, but singing begins to decline by July. The vireo's song is described as hurried and harsh, composed of numerous phrases separated from one another by pauses of 1 to 3 seconds.

Nesting begins after the females arrive in late March to early April. Both the male and female select the nest site and build the nest, but the female often completes it. First nests are built in about 6 to 9 days, but subsequent nests can be built in one day. The cup-shaped nest is suspended from its rim in a fork of a branch about 1 to 6 feet above the ground. However, most Black-capped Vireos nest at about "door-knob" height. Nests have been found in a variety of species including shin oak, scalybark oak, Texas oak, Vasey oak, sumac, Texas persimmon, juniper, Texas redbud, Mexican buckeye and Texas mountain laurel.

The vireo usually nests more than once in the same year. A new nest is constructed each time. Three to four eggs are usually laid in the first nesting attempt, but later clutches may contain only 2 to 3 eggs. The first egg is usually laid one day after completion of the nest, with one egg being laid each subsequent day. Incubation takes 14 to 17 days, and is shared by the male and female.

Vireo chicks are fed insects by both adults. The young leave the nest 10 to 12 days after hatching. Fledglings are cared for by the female alone, the male alone, or by both adults. Sometimes the parents split the brood and each care for one or more young. Occasionally, males or females will leave the care of the young to their mate, and attempt another nesting effort.

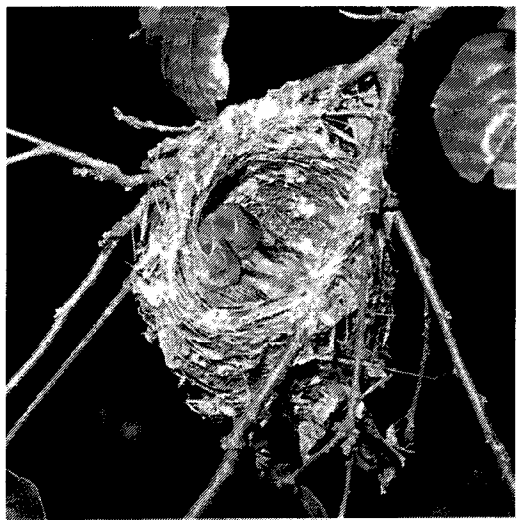
Vireos may live for more than five years, and usually return year after year to the same territory, or one nearby. The birds migrate to their wintering grounds on Mexico's western coast beginning in July, and are gone from Texas by mid-September.

Threats and Reasons for Decline

The Black-capped Vireo is vulnerable to changes in the abundance and quality of its habitat. Habitat may become unsuitable for vireos because of natural plant succession, sustained brood parasitism by the Brown-headed Cowbird, or because of human activities. Factors that can adversely affect vireo habitat include broad-scale or improper brush clearing, fire suppression, over browsing by deer and livestock, and urbanization. Loss of tropical wintering habitat is also a concern, but requires further study.

Poorly planned brush management practices on rangeland may remove too much low growing woody cover, especially when large acreages are treated at one time. This eliminates or reduces habitat value for vireos and for other wildlife, such as White-tailed deer, quail, small mammals, and various songbirds. Over browsing of broad-leaved shrubs by goats, deer, and exotic animals reduces the vegetation in the 2- to 4-foot zone, making it unsuitable for vireo nesting. Continued overuse of these preferred browse plants over many years may eventually eliminate them from the plant community, thus permanently altering the habitat.

In the absence of natural processes, active, well-planned land management is often required to maintain good vireo habitat, especially in the eastern portion of its range. Disturbance, particularly fire, plays an important role in maintaining, improving, or creating vireo habitat. The rangelands of central Texas, and the various plant communities these lands support, evolved under the influence of periodic fires. Historically, these natural and man-made fires maintained a matrix of open grassland, shrubland and woodland. Fire stimulated shrubs to sprout multiple stems at the base, thus providing areas of dense foliage at the 2- to 4-foot level, required by vireos. In the past, fire was responsible for maintaining or periodically returning some areas to vireo habitat. Today, prescribed burning, a valuable range and wildlife management tool occurs on many ranches throughout Texas. However, the combination of overgrazing, brush clearing, and lack of fire in the recent past has reduced vireo habitat in many other areas. Natural plant succession is less of a concern in the western portion of its range where suitable habitat persists for long periods.



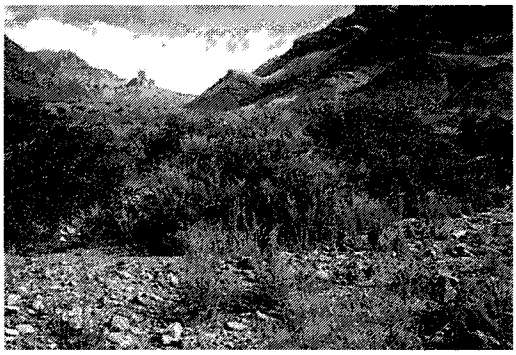
Black-capped Vireo nest
© TPWD Glen Mills

Nesting vireo
© Greg W. Lasley

Human activities have provided favorable habitat for the Brown-headed Cowbird, which parasitizes vireo nests. The cowbird is usually associated with livestock, farms, dairies, and grain fields, where it benefits from waste grain and insects. They may also be attracted to backyard bird feeders, trash dumps, or other urban areas where food and water are available. Cowbirds lay their eggs in other birds' nests, leaving the host bird to raise their young. The female cowbird often removes an

Habitat at Kickapoo Caverns State Park
© Matt Wagner

Habitat with low-growing shrubs
© Matt Wagner



Habitat in Big Bend National Park
© USFWS A. Shull

egg or a nestling from the host nest before she lays an egg in it. Cowbird chicks hatch earlier than most hosts's young and are thus able to out-compete the smaller vireo nestlings for food and, consequently, the young vireos typically starve. While some birds remove cowbird eggs from their nest, the vireo does not, although it is known to abandon parasitized nests. Thus parasitized nests usually fail to produce vireos. The amount of brood parasitism varies greatly from one population to another throughout the state, ranging from 10 to over 90% of the nests. Brown-headed Cowbirds are also known to remove vireo chicks from active nests. Evidence indicates that sustained parasitism pressure may lead to local extinctions of vireo populations.

Direct habitat loss and fragmentation due to urban and suburban development is a major threat in expanding urban areas of Travis, McLennan, Dallas, Bexar, and Kerr counties. Problems associated with suburban expansion, such as increases in predation by dogs, cats, raccoons, skunks, and jays, have also impacted the vireo.

Recovery Efforts

Research is underway to better understand the distribution, life history, habitat requirements, and land management practices affecting the Black-capped Vireo. Population surveys during the breeding season are being conducted in known and potential habitat areas. Efforts to provide information and educational opportunities to landowners and the public regarding life history and habitat requirements of the vireo are also a vital part of the recovery effort. Major research and/or recovery efforts are being conducted on Department of Defense's Fort Hood and Camp Bullis, Travis County and the City of Austin's Balcones Canyonlands Preserve, the U.S. Fish and Wildlife Services' Balcones Canyonlands National Wildlife Refuge, TPWD's Kerr Wildlife Management Area, properties owned and/or managed by The Nature Conservancy of Texas, and in Mexico. Additionally, Environmental Defense through their Safe Harbor Agreement with the U.S. Fish and Wildlife Service is assisting many landowners with thousands of acres to manage and/or create habitat for the benefit of the vireo. Research is ongoing regarding the impact of cowbirds on vireo populations in Texas. Research efforts in Mexico are also underway to gather information concerning life history, habitat requirements, and conservation threats on the wintering range. TPWD biologists are monitoring populations on both state and private lands, and voluntary cowbird trapping is being conducted by more than 400 landowners in counties throughout the range of the vireo.

Habitat conservation planning is underway in counties such as Travis and Bexar to allow for urban expansion and development while still conserving endangered species habitat. Intensive monitoring of a large population at the U.S. Army Fort Hood Military Installation is on-going. Finally, efforts to provide information, technical assistance, and incentives for private landowners to incorporate management for Black-capped Vireos into their livestock and wildlife operations are an essential part of the recovery process.

Where To See the Black-capped Vireo

A number of state lands offer opportunities to see and learn more about the Black-capped Vireo. These include Colorado Bend State Park State Park (SP), Devils River State Natural Area (SNA), Kerr Wildlife Management Area, Kickapoo Cavern SP, Lost Maples SNA, and Hill Country SNA. Also, the Balcones Canyonlands National Wildlife Refuge near Austin offers additional opportunities to see Black-capped Vireos.

Because the Black-capped Vireo is an endangered species, birders and other observers should carefully follow certain viewing ethics. Observers should be careful not to flush birds from the nest or disturb nests or young. Black-capped Vireos should be viewed only from a distance with binoculars. Do not use recorded calls of the Black-capped Vireo or the Screech Owl to attract birds, and be careful that your presence does not unduly disturb or stress the birds.

How You Can Help

You can help by learning more about the habitat requirements of the Black-capped Vireo and incorporating management practices which create or maintain habitat for these birds. You can also encourage and support private landowners who are managing their land to protect and provide habitat for endangered species.

The Black-capped Vireo is a beautiful songbird and is much sought after among people who enjoy birdwatching and nature study. Possibilities exist for landowners to take advantage of the growing demand for natural history tours and vacations. Landowners interested in more information concerning nature-based tourism opportunities should contact the Wildlife Diversity Branch, Texas Parks and Wildlife Department, Austin (800) 792-1112; Environmental Defense, Austin (512) 478-5161; the Nature Conservancy, San Antonio (210) 224-8774.

You can also be involved with the conservation of Texas' nongame wildlife resources by supporting the Special Nongame and Endangered Species Conservation Fund. Special nongame stamps and decals are available at Texas Parks and Wildlife Department (TPWD) field offices, most state parks, and the License Branch of TPWD headquarters in Austin. Part of the proceeds from the sale of these items is used to conserve habitat and provide information to the public concerning endangered species. Conservation organizations in Texas also welcome your participation and support.

For More Information Contact

Texas Parks and Wildlife Department
Wildlife Diversity Branch
4200 Smith School Road
Austin, Texas 78744
(512) 912-7011 or (800) 792-1112
or
U.S. Fish and Wildlife Service
Ecological Services Field Office
10711 Burnet Road, Suite 200
Austin, Texas 78758
(512) 490-0057

Management guidelines are available from the Texas Parks and Wildlife Department and U.S. Fish and Wildlife Service for landowners and managers wishing to know more about rangeland management practices which improve habitat for the Black-capped Vireo.

Cowbird egg (spotted) in Black-Capped Vireo nest
© Glen Mills

References

Armstrong, W.E., M.W. Lockwood, and D.K. Stuart. 1992. *Performance report: Black-capped vireo management on Texas Parks and Wildlife Department lands.* Federal Aid Project No. E-1-4, Job No. 3.2.

Armstrong, W.E., C. Travis, and B.G Alexander. 1989. *Final report: Black-capped vireo management.* Federal Aid Project No. W-103-R-19, Job No. 60.

Farquhar, C.C. and J. P. Maresh. 1998. *Population biology and habitat characterization of black-capped vireos at Dolan Falls Ranch Preserve, Val Verde County, Texas. Year two final report.* Endangered Resources Branch, Texas Parks and Wildlife Department. Austin, Texas.

Graber, J.W. 1961. *Distribution, habitat requirements, and life history of the black-capped vireo.* Ecol. Mon. 31:313-336.

Grzybowski, J.A., R.B. Clapp, and J.T. Marshall, Jr. 1986. *History and current population status of the Black-capped vireo in Oklahoma.* American Birds 40:1151-1161.

Grzybowski, J,A., D.J. Tazik, and G.D. Schnell. 1994. *Regional analysis of black-capped vireo breeding habitats.* Condor 96:512-544.

Grzybowski, J.A. 1995. "Black-capped vireo (*Vireo atricapillus*)." The birds of North America, No. 181. The Academy of Natural Sciences, Philadelphia, and The American Ornithologist Union, Washington D.C.

Oberholser, H.C. 1974. *The bird life of Texas.* Edgar Kincaid, Ed., University of Texas Press, Austin, Texas. Vol. 2, 1069 pp.

Robinson, S.K., S.I. Rothstein, M.C. Brittingham, L.J. Petit, and J.A. Grzybowski. 1995. "Ecology and behavior of cowbirds and their impact on host populations" (pp 428-460) *in* T.E. Martin and D.M. Finch, eds. *Ecology and management of neotropical migratory birds.* Oxford University Press, New York, New York.

U.S. Fish and Wildlife Service. 1991. *Black-capped vireo recovery plan.* Endangered Species Office, Albuquerque, N.M.

U.S. Fish and Wildlife Service. 1996. *Black-capped vireo population and habitat viability assessment report.* Complied and edited by Carol Beardmore, Jeff Hatfield, and Jim Lewis in conjunction with workshop participants. Report of a September 18-21, 1995 workshop arranged by the U.S. fish and Wildlife Service in partial fulfillment of U.S. National Biological Service Grant No. 80333-1423. Austin, Texas. ix + 57 pp.

Funds for the production of this leaflet were provided by the U.S. Fish and Wildlife Service, under Section 6 of the Endangered Species Act.

Golden-cheeked Warbler

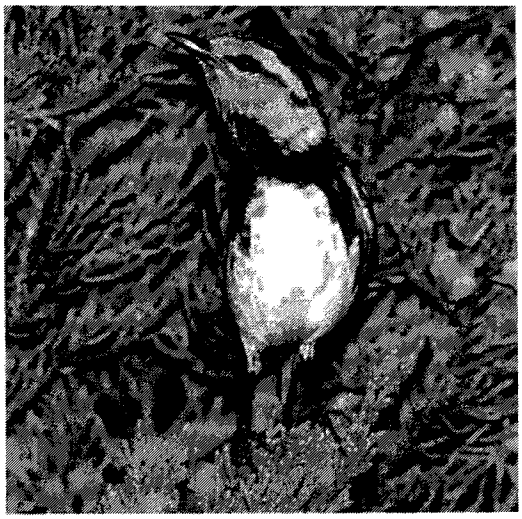
Scientific Name: *Dendroica chrysoparia*

Federal Status: Endangered, 5/4/90 • State Status: Endangered

Description

The Golden-cheeked Warbler is a small, migratory songbird, 4.5 to 5 inches long, with a wingspan of about 8 inches. The male has a black back, throat, and cap; and yellow cheeks with a black stripe through the eye. Females are similar, but less colorful. The lower breast and belly of both sexes are white with black streaks on the flanks.

Male Golden-cheeked Warbler
© Greg W Lasley



Female Golden-cheeked Warbler
© Greg W Lasley

Habitat

Typical nesting habitat is found in tall, dense, mature stands of Ashe juniper (blueberry cedar) mixed with trees such as Texas (Spanish) oak, Lacey oak, shin (scalybark) oak, live oak, post oak, Texas ash, cedar elm, hackberry, bigtooth maple, sycamore, Arizona walnut, escarpment cherry, and pecan. This type of woodland generally grows in relatively moist areas such as steep-sided canyons, slopes, and adjacent uplands. A mix of juniper and deciduous trees on the slopes, along drainage bottoms, and in creeks and draws provide an ideal mix of vegetation for these birds. Warblers can also be found in drier, upland juniper-oak (i.e., Texas oak, live oak, post oak, blackjack oak) woodlands over flat topography.

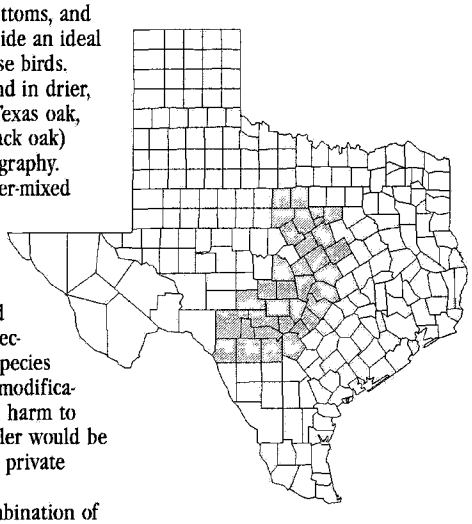
Not all mature juniper-mixed deciduous woodlands are used by Golden-cheeked Warblers. Only habitat actually used by endangered or threatened animals is subject to protection by the Endangered Species Act (ESA). (Only habitat modifications that would result in harm to the Golden-cheeked Warbler would be considered a violation by private actions under the ESA.)

Warblers need a combination of mature Ashe juniper and hardwood trees in their nesting habitat. Mature juniper trees vary in age and growth form, depending on site factors. Generally, trees required for nesting habitat are at least 15 feet tall with a trunk diameter of about five inches at four feet above the ground. The essential element is that juniper trees have shredding bark, at least near the base of the tree.

Although the composition of woody vegetation varies within suitable warbler habitat, Ashe juniper is often, but not always, the dominant species. One study showed that juniper comprises anywhere from 10-90% of total trees in occupied habitat at 27 sites scattered throughout the breeding range.

Golden-cheeked Warblers have been found in patches of habitat smaller than 12 acres, although populations of warblers in larger tracts of woodland habitats will persist longer than populations in small tracts of land. With increasingly fragmented habitat, smaller patches may become more important to warblers, particularly those located near areas of occupied habitat.

In general, Golden-cheeked Warblers occur in areas with a moderate to high density of older trees, and dense foliage in the upper canopy. Higher warbler densities are associated with larger contiguous patches, greater average tree height, greater variability in tree heights, and greater density of deciduous trees.



Life History

The Golden-cheeked Warbler's entire nesting range is currently confined to habitat in 33 counties in central Texas. The birds are dependent on Ashe juniper (blueberry juniper or cedar) for fine bark strips used in nest construction. Although nests may be placed in various species of trees, such as juniper, Texas oak, live oak, and cedar elm, all nests contain strips of Ashe juniper bark woven together with spider webs.

Warblers feed almost entirely on caterpillars, spiders, beetles, and other insects found in foliage. The birds are thought to take advantage of insect blooms associated with different plants as the growing season progresses. For example, broad-leaved trees and shrubs, especially oaks, are particularly important in providing habitat for insects during the first

part of the nesting season. Later in the season, warblers are frequently seen foraging in Ashe juniper. Mesic (relatively moist) conditions, such as those found on wooded slopes, canyon bottoms, and along creeks and draws, are especially favorable for the production of insect foods.

Depending on the location and quality of habitat, Golden-cheeked Warblers forage and nest in areas of habitat ranging in size from five to 20 acres per pair. Within suitable nesting habitat, male Golden-cheeked Warblers occupy an area, called a territory, which is vigorously defended against all other male Golden-cheeked Warblers. Nesting territories range in size from three to ten acres, depending on habitat quality. Banding studies show that males often occupy the same territory in subsequent breeding seasons. Male warblers can often be located through their territorial song, described as a rather hurried, buzzy "tweah-tweah-twee-sy." Single, sharp "chipping" calls can frequently be heard as Golden-cheeks forage among the trees.

The female does most of the work of nest building and incubating the eggs. The cup-like nest is often neatly tucked into the fork of a vertical limb and camouflaged to blend with the bark of the tree. Nests are constructed at an average height of 15 feet above ground, although they have been found as low as five feet and as high as 32 feet. The male stays close by, singing his distinctive song and defending his territory during incubation.

During April, a single clutch of three to four eggs is laid. Warblers usually nest only once per season, unless a nest is lost to accident or predation. The eggs hatch in 12 days, and both parents care for the young. After the young hatch, male singing declines, although they can still be heard into June. Nestlings fledge eight or nine days after hatching, but remain in the vicinity of the territory for at least four weeks while being cared for by both parents.

Golden-cheeked Warblers migrate to their wintering grounds in the pine-oak woodlands of southern Mexico (Chiapas), Guatemala, Honduras, and Nicaragua from late June to mid August. They return to Texas in early to mid-March.

Threats and Reasons for Decline

The most serious problems facing the Golden-cheeked Warbler today, as in the recent past, are habitat loss and fragmentation. Since warblers have limited and specific habitat requirements, direct habitat loss has resulted in population reduction, although precise comparisons of historic and current populations are not available.

Recently, serious losses in nesting habitat have occurred in counties such as Travis, Williamson, and Bexar, where rapid urban development has spread into oak-juniper woodlands associated with canyonlands. Flood control and other impoundments have also reduced habitat for the warbler by inundating the juniper-oak woodlands existing on canyon slopes and bottoms along springs, streams, and rivers. Construction of large reservoirs has also led to loss of warbler habitat due to development of lake-side communities.

Historically, some warbler habitat was lost as a result of clearing juniper/oak woodlands for increased livestock production or improved livestock handling. Stands of large juniper trees were also cut for sale as fence posts and other timber products, especially before 1940. Over-browsing by white-tailed deer, goats, and exotic ungulates is believed to contribute to habitat degradation by reducing the survival of seedling oaks and other deciduous trees, which are a vital component of warbler habitat. Also, many of the deeper and more fertile soils in much of the Hill Country are found in small floodplains along creeks or intermittent streams associated with hillside drainage. Many of these areas, some of them supporting a variety of deciduous trees, were cleared and converted to forage crops and pasture, often resulting in a decrease in the amount of warbler habitat.

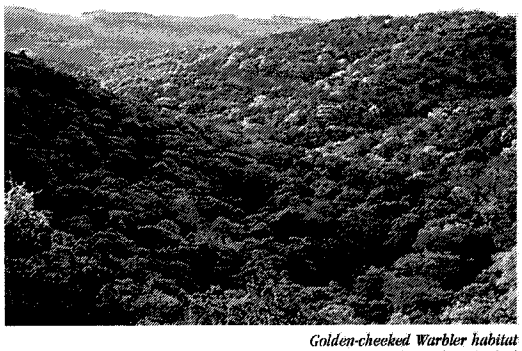
Habitat loss may be obscured by the increase in juniper on rangeland throughout central Texas. The invasion of juniper on upland sites is often the result of fire suppression, overgrazing, or a combination of both. These young juniper stands invading open rangelands generally lack the kinds and numbers of hardwood trees required by warblers. Warblers are usually not found in monocultures (pure stands) where juniper comprises over 90% of the composition throughout a large area.

Poor grazing management practices and fire suppression result in a decline in the diversity and productivity of rangeland. The decline in range condition associated with improper management has led to increases in juniper throughout the Hill Country.

Brood parasitism by Brown-headed Cowbirds may threaten successful reproduction of Golden-cheeked Warblers, although the degree of

Female warbler with insect
© TPWD Dean Keddy-Hector

Warbler at a nest
© TPWD Dean Keddy-Hector



Golden-cheeked Warbler habitat
© TPWD David Riskind

Closed canopy habitat
© Carol Beardmore

Juniper with peeling bark
© TPWD D. Kelly-Hector

Creek bottom habitat
© TPWD Glen Mills

impact of cowbird parasitism on warbler productivity is not fully understood. Cowbirds lay their eggs in other birds' nests, leaving the host bird to raise the cowbird young. Golden-cheeked Warblers apparently will either abandon parasitized nests, or raise young cowbirds in addition to or in place of their own young. Warblers that abandon parasitized nests may renest later in the season. However, abandonment of first clutches, or raising cowbird young in addition to their own, decreases the total number and survivability of Golden-cheeked warbler young produced.

Habitat fragmentation reduces the quality and quantity of warbler habitat. In small woodland patches, the increased proportion of habitat edge to interior area may increase rates of brood parasitism and predation, so that the surviving populations cannot maintain themselves. Also, increased distances between patches may make recolonization of vacated habitat more difficult.

In Texas, Mexico and Central America, habitat management and protection, responsible land stewardship, and incentives for landowners to maintain and develop habitat, are keys to the survival and recovery of the Golden-cheeked Warbler. The diverse mix of hardwoods and junipers in canyons, and on slopes and adjacent hilltops, provide ideal habitat for the warbler. Numerous beautiful and interesting native plants and animals are also found in these canyons.

Recovery Efforts

Research is underway to better understand the life history, habitat requirements, limiting factors, and land management practices affecting the Golden-cheeked Warbler. Population surveys during the breeding season are being conducted in known and potential habitat areas. Efforts to provide information and educational opportunities to landowners and the public regarding life history and habitat requirements of the warbler are also a vital part of the recovery effort. Major recovery efforts are being conducted on Department of Defense's Fort Hood and Camp Bullis, Travis County and the City of Austin's Balcones Canyonlands Preserve, the U.S. Fish and Wildlife Services' Balcones Canyonlands National Wildlife Refuge, and many properties owned and/or managed by the Nature Conservancy. Additionally, Environmental Defense through their Safe Harbor Agreement with the U.S. Fish and Wildlife Service is assisting many landowners to manage and/or create habitat for the benefit of the warbler. Voluntary cowbird trapping is being conducted by more than 400 landowners in counties throughout the range of the warbler.

Recently, a consortium of researchers in governmental and non-governmental agencies has proposed a multinational effort to better understand and coordinate approaches to managing and recovering the Golden-cheeked Warbler. Additional research in Mexico and Central America is planned to gather information concerning life history and habitat requirements on the wintering range. Studies are needed to assess the potential for income generating activities, such as selective harvest of juniper, which may be compatible with habitat protection.

Where To See the Golden-cheeked Warbler

A number of state lands, including Colorado Bend State Park (SP), Dinosaur Valley SP, Garner SP, Guadalupe River SP, Honey Creek State Natural Area (SNA), Hill Country SNA, Kerr Wildlife Management Area, Longhorn Cavern SP, Lost Maples SNA, Meridian SP, Pedernales Falls SP, and Possum Kingdom SP offer opportunities for people to see Golden-cheeked Warblers and their habitat. Other locations include the Balcones Canyonlands National Wildlife Refuge, Travis Audubon Sanctuary, Wild Basin Preserve, and Emma Long City Park in the Austin area; and Friedrich Wilderness Park near San Antonio. Once open to the public, Government Canyon State Natural Area, located northwest of San Antonio, will offer additional opportunities to see Golden-cheeked Warblers.

Because the Golden-cheeked Warbler is an endangered species, birders and other observers should carefully follow certain viewing ethics. Recorded calls of the Golden-cheeked Warbler or Screech Owl should not be used to attract birds and observers should be careful not to disturb or stress birds.

How You Can Help

You can help by providing encouragement and support for private landowners who are managing their land to protect natural diversity and endangered species habitat. Landowners are encouraged to learn the facts about the Golden-cheeked Warbler and its habitat needs, and to protect areas of habitat found on their property.

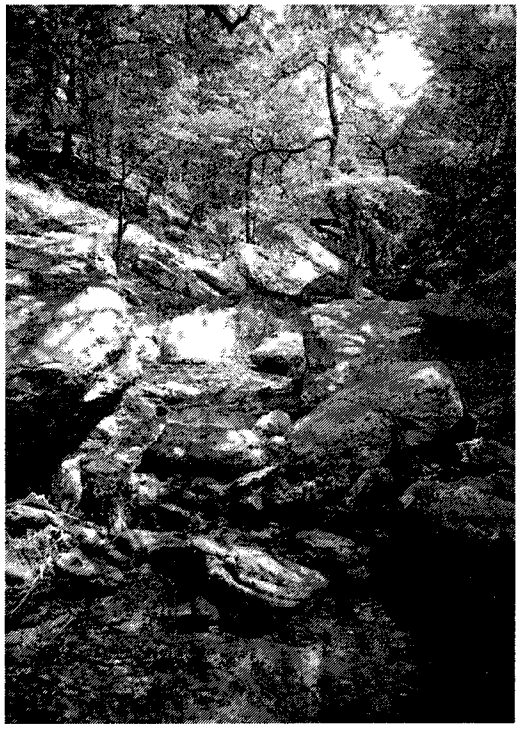
The Golden-cheeked Warbler is a beautiful songbird, and is much sought after among people who enjoy bird-watching and nature study. Possibilities exist for landowners to take advantage of the growing demand for natural history tours and vacations. Landowners interested in more information concerning nature tourism opportunities should contact the Nature Tourism Coordinator, Texas Parks and Wildlife Department, Austin (512) 389-4396; Environmental Defense, Austin (512) 478-5161; or the Nature Conservancy, San Antonio (210) 224-8774.

Finally, you can be involved in the conservation of Texas' nongame wildlife resources by supporting the Special Nongame and Endangered Species Conservation Fund. Special nongame stamps and decals are available at Texas Parks and Wildlife Department (TPWD) field offices, most state parks, and the License Branch of TPWD headquarters in Austin. Conservation organizations in Texas also welcome your participation and support.

For More Information Contact

Texas Parks and Wildlife Department
Wildlife Diversity Branch
4200 Smith School Road
Austin, Texas 78744
(512) 912-7011 or (800) 792-1112
or
U.S. Fish and Wildlife Service
Ecological Services Field Office
10711 Burnet Road, Suite 200
Austin, Texas 78758
(512) 490-0057

Management guidelines are available from the Texas Parks and Wildlife Department and U.S. Fish and Wildlife Service for landowners and managers wishing to maintain and improve habitat for the Golden-cheeked Warbler.



Golden-cheeked Warbler habitat
© TPWD Bill Reaves

References

Arnold, K.A., C.L. Coldren, and M.L. Fink. 1996. *The interactions between avian predators and golden-cheeked warblers in Travis County, Texas.* Research report 1983-2 for Texas Department of Transportation.

Coldren, C.L. 1998. *The effects of habitat fragmentation on the golden-cheeked warbler.* Ph.D. Dissertation, Texas A&M University, College Station, Texas.

Engels, T.M. 1995. *Conservation biology of the golden-cheeked warbler.* Ph.D. Dissertation, University of Texas, Austin, Texas

Fink, M.L. 1996. *Factors contributing to nest predation within habitat of the golden-cheeked warbler, Travis County, Texas.* M.S. Thesis, Texas A&M University, College Station, Texas.

Huss, D.L. 1954. *Factors influencing plant succession following fire in ashe juniper woodland types in Real County, Texas.* MS Thesis, Texas A&M University, College Station, Texas. 77pp.

Ladd, C. and L. Gass. 1999. "Golden-cheeked warbler (*Dendroica chrysoparia*)." In The Birds of North America, No. 420. (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Mass, D.S. and G.D. Schnell. 1998. "Effects of habitat fragmentation on demographics of golden-cheeked warblers (*Dendroica chrysoparia*)." Masters Thesis, Part 1 of 2, University of Oklahoma, Norman, Oklahoma.

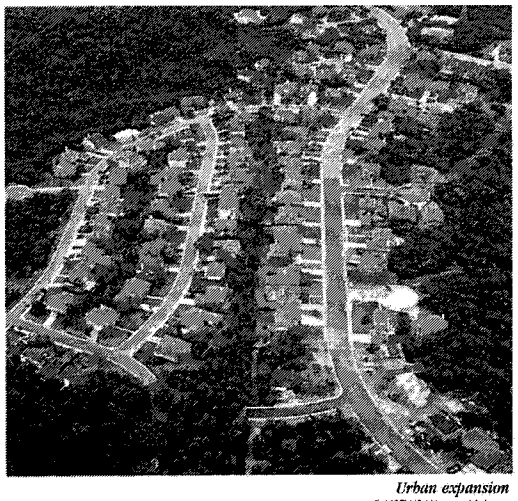
Oberholser, H.C. 1974. *The bird life of Texas.* University of Texas Press, Austin, Texas.

Pulich, W. 1976. *The golden-cheeked warbler, a bioecological study.* Texas Parks and Wildlife Department, Austin, Texas. 172pp.

U.S. Fish and Wildlife Service (USFWS). 1992. *Golden-cheeked warbler recovery plan.* USFWS, Endangered Species Office, Albuquerque, NM. 88pp.

U.S. Fish and Wildlife Service (USFWS). 1996. *Golden-cheeked warbler population and habitat viability assessment report.* Compiled and edited by Carol Beardmore, Jeff Hatfield, and Jim Lewis in conjunction with workshop participants. Report of an August 21-24, 1995 workshop arranged by the U.S. Fish and Wildlife Service in partial fulfillment of U.S. National Biological Service Grant No. 80333-1423. Austin, Texas. xii+48pp.+Appendix.

Wahl, R., D.D. Diamond, and D. Shaw. 1990. *The golden-cheeked warbler: a status review.* U.S. Fish and Wildlife Service, Ecological Services Office, Austin, Texas.



Urban expansion
© USFWS Wyman Meinzer

Warbler with identification band
© TPWD

Funds for the production of this leaflet were provided by the U.S. Fish and Wildlife Service, under Section 6 of the Endangered Species Act.

USDA NRCS Natural Resources Conservation Service

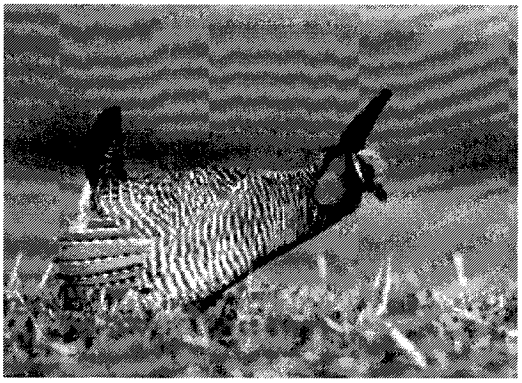
Wildlife Habitat Management Institute

Wildlife Habitat Council

Lesser Prairie-Chicken

(*Tympanuchus pallidicinctus*)

September 1999 *Fish and Wildlife Habitat Management Leaflet* *Number 6*



General Information

The lesser prairie-chicken is an upland, grassland-nesting bird present in regions of Kansas, Colorado, Oklahoma, New Mexico, and Texas. Related to the sharp-tailed grouse and differing only slightly from the greater prairie-chicken in color, size, and primarily in range, the lesser prairie-chicken is best known for its unique courtship displays and "gobbling" grounds. A highly social animal, the lesser prairie-chicken is most easily observed in spring when males gather to display for females. Once present in large numbers, the lesser prairie-chicken population and its original distribution have declined significantly since 1800. In the twentieth century, human influences such as the conversion of native rangelands to cropland, decline in habitat quality due to herbicide use, petroleum and mineral extraction activities, and excessive grazing of rangelands by livestock have contributed to this decline. Severe drought has also significantly impacted prairie-chicken populations. Unfortunately, the lesser prairie-chicken has been studied less than many other more common and widely distributed grassland birds. Due to these factors, the lesser prairie-chicken is now being considered by the U.S. Fish and Wildlife Service as a species in need of protection through the Endangered Species Act.

This leaflet is designed to serve as an introduction to the habitat requirements of the lesser prairie-chicken and to assist landowners and managers in the development of a comprehensive lesser prairie-chicken management plan. The success of any individual species management plan depends on targeting the specific needs of the desired species and analyzing the designated habitat area to ensure that all required habitat elements are present. This leaflet provides a number of practical habitat management activities that can be conducted on private lands to boost local lesser prairie-chicken populations and encourages involving fish and wildlife professionals in the management plan to identify additional management actions needed over time.

Range

As a year-round resident, the breeding, summer, and winter ranges of the lesser prairie-chicken are identical. The lesser prairie-chicken is present in southeastern Colorado in Baca, Prowers, and Kiowa counties. In Kansas, the lesser prairie-chicken exists in nearly the entire southwestern quarter of the state bordering Oklahoma and Colorado. The species occurs in Oklahoma's panhandle and northwest counties, and New Mexico counties of Harding and Union on the north to Eddy and Lea counties on the south. The northeastern and southwestern counties of Hemphill,

Lipscomb, Wheeler, Donley, Cochran, Yoakum, and Gaines in the Texas panhandle support populations as well.

Habitat Requirements

General

Native rangeland in different stages of plant succession and consisting of a diversity of native, short- to mid-height grasses and forbs interspersed with low-growing shrubby cover comprises optimum lesser prairie-chicken habitat. Sand sagebrush (*Artemisia filifolia*) communities dominated by sand dropseed (*Sporobolus cryptandrus*), side oats grama (*Bouteloua curtipendula*), and little bluestem (*B. scoparium*) make up the most preferred lesser prairie-chicken habitat in Kansas, Colorado, Texas and northern Oklahoma. Texas, New Mexico, and western Oklahoma provide shinnery oak/bluestem habitat dominated by sand bluestem (*B. hallii*), little bluestem, Indiangrass, switchgrass, buffalo grass, sand dropseed, and sand sagebrush. These habitat types provide protective cover for nesting and brood-rearing activities, as well as food. Sand plum (*Prunus angustifolia*) and skunkbush sumac (*Rhus aromatica*) are valuable shrubs for providing shade and brood-rearing cover as well. Display grounds, or leks, are established in open areas of low-growing vegetation and generally are located within or close to grassland nesting cover. Adequate cover is among the greatest factors affecting lesser prairie-chicken populations, and the continued loss of shrub/grassland habitat remains the greatest threat to the lesser prairie chicken's future. Preserving these shrub/grassland communities and properly managing rangelands can help landowners boost local lesser prairie-chicken populations, as well as populations of other species that rely on similar habitat.

Food

The lesser prairie-chicken's diet consists of insects, seeds, and leaves, catkins, and buds of forbs (broad-leaved plants) and cultivated crops. Juveniles less than 10 weeks old feed primarily on insects such as short-and long-horned grasshoppers and beetles; however leafhoppers and other smaller insects are eaten in the initial weeks following hatching. Within shinnery oak/grassland habitat, insects make up more than half of the spring and summer diet of adult lesser prairie-chickens. Sand sage leaves and buds and various forbs are consumed in spring and summer as well. Seeds are primary foods in autumn, supplemented with vegetative matter and insects. Shinnery oak acorns, sage leaves, wild buckwheat, rye and seeds from native wild plants, fruits, and flowers are eaten in winter months. Lesser prairie-chickens will eat corn, oats, wheat, rye, grain sorghum, and other small grain crops left as waste grain after harvest, or left standing as a food plot.

Important lesser prairie-chicken food items. The following items are known to be important foods in the diet of the lesser prairie-chicken.

Insects:
short-horned grasshoppers leafhoppers long-horned grasshoppers beetles treehoppers others.....

Seeds/mast and forbs:
sage leaves winter wheat buds seeds wild buckwheat shinnery oak acorns and galls dayflower evening primrose queensdelight wild sweet pea prairie ragwort ragweed beard-tongue wild four-o'clock

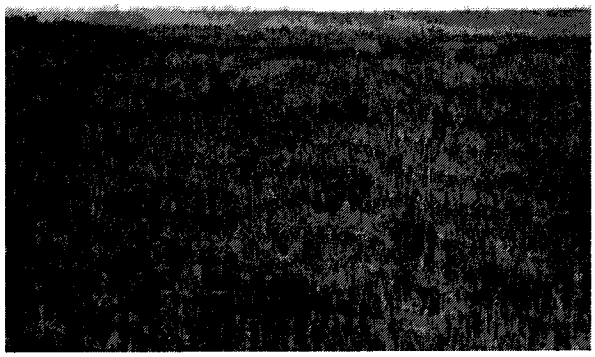
Cultivated crops:
corn oats wheat rye grain sorghum milo sunflowers other small grain crops

Cover – Breeding

Display grounds (leks) used for breeding are characterized by low-growing vegetation on open ground. In grassland communities, elevated knolls or ridges with flat surfaces often serve as leks. Grazed rangelands, agricultural fields, prairie dog towns, and other open areas where vegetation height is short in spring are also used. Human disturbances such as roads, oil pads, and bare areas resulting from herbicide treatments have also been used as leks.

Cover – Nesting and Brood-rearing

Nesting and brood-rearing cover for lesser prairie-chicken consists of grassland dominated by sand bluestem, sand dropseed, side oats grama, and little bluestem, interspersed with sand sagebrush, sand plum, skunkbush sumac, and shinnery oak shrubs. Dense tall grasses growing in clumps, or mottes, varying from 3 to 10 feet in diameter are best for nesting lesser prairie-chickens; thick stands of even-growth vegetation do not. Females scratch shallow, bowl-shaped depressions in the soil and line them with dried grasses, leaves, and feathers to serve as nests. Ideal nesting habitat consists of an interspersion of 65 percent grassy mottes, 20 to 30 percent shrubs, and 5 to 15 percent forbs, with grasses and shrubs averaging at least 20 inches in height. Present-day range conditions rarely meet these conditions, however. Rangelands with taller grass species in good range condition can still be valuable to lesser prairie-chickens with a lesser shrub component. Tall grass in good condition is more important for nesting cover than the condition of the shrub component. Nesting sites are frequently established on north or northeast facing slopes to reduce exposure to southwest winds and direct sunlight, and are usually located one to two miles from the nearest lek.



Native grasses and sand sage provide ideal lesser prairie-chicken nesting cover.

Where grass condition seems to dictate the quality of nesting cover, existence of shrubs and forbs is more important for good brood-rearing cover. Ideal brood-rearing cover consists of an interspersion of 40 to 45 percent sand sagebrush, sand plum, and shinnery oak; 40 to 45 percent of short- to medium-height grasses; and 15 to 20 percent forbs containing a high insect abundance. In areas where lesser prairie-chickens are present, proper grazing management practices that provide various stages of plant succession can help increase nesting and brood-rearing cover quality. Vegetation communities within two miles of active leks should be managed for optimal nesting and brood-rearing habitat.

Cover – Winter

Winter habitat requirements for lesser prairie-chickens differ little from nesting, brood-rearing, and summer cover types. Short- to medium-height grasslands comprised of sand dropseed, side oats grama, sand bluestem, and little bluestem interspersed with shinnery oak, sand plum, skunkbush sumac, or sand sagebrush are used as winter cover by lesser prairie-chickens. Grain fields near high range condition grassland/shrubland cover are used for foraging in winter months. Due to the varying winter temperatures within the five states supporting lesser prairie-chicken populations, availability of common food sources (especially insects) may differ, but cover requirements are similar.

Water

Daily foraging activities and the types of foods eaten provide lesser prairie-chickens with an adequate amount of water. However, birds will use open water during droughts when available in close proximity to sufficient cover.

Interspersion of Habitat Components

Ideal interspersion of lesser prairie-chicken habitat components consists of a complex of sand sagebrush, sand plum, skunkbush sumac, and shinnery oak shrubs and sand dropseed, side oats grama, sand bluestem, and little bluestem grasses growing in various stages of development on open rangelands with flat surfaces. In order for successful lesser prairie-chicken reproduction and survival to occur, all required habitat components must be available in relatively close proximity to one another (within 2-4 mi^2). For example, the highest-quality nesting habitat is of little use if the nearest open foraging habitat is not close by. Distribution and interspersion of food and cover in the form of varying habitats determines whether or not an area can support a lesser prairie-chicken population and the number of individuals in a population.

Minimum Habitat Area

The minimum land area needed to maintain a breeding population of lesser prairie-chickens is an area of prime nesting and brood-rearing cover approximately two-square miles (1,280 acres) in size, surrounded by a minimum of 10,000 acres of feeding and loafing habitat. Complexes of suitable lesser prairie chicken habitat of up to 25,000 acres provide optimum conditions for maintaining populations. While smaller parcels by themselves may not provide the area needed, each contributes to the mosaic of larger habitat blocks that do meet minimum habitat size requirements. Although typically not a limiting factor on rangelands due to cattle grazing patterns, lek areas created through active habitat management efforts should be at least 50 yards in diameter per 15 males and located on higher ground with little or no shrub cover.

Lesser Prairie-Chicken Habitat Requirements Summary Table.

Habitat Component	Habitat Requirements
Food – Young	• Insects – especially leafhoppers, beetles, and short-and long-horned grasshoppers.
Food – Adult	• Insects. • Vegetative material - sage leaves, buds, flowers, forbs, winter wheat, and wild buckwheat. • Mast and seeds - primarily shinnery oak acorns. • Cultivated crops – corn, oats, wheat, rye, sorghum, and other small grain crops.
Breeding Cover (Leks)	• Open rangelands, idle agricultural fields, elevated knolls and ridges with flat surfaces and low-growing vegetation, prairie dog towns. • Human disturbances such as roads, oil pads, and bare areas resulting from herbicide treatment, reverted cropland.
Nesting, Brood-rearing, and Winter Cover	• Mid-grass grasslands growing in different stages of plant succession and comprised of sand dropseed, side oats grama, sand bluestem, and little bluestem interspersed with shinnery oak, sand plum and sand sagebrush. • Nesting cover – 65% grass, 20-30% shrubs, 5-15% forbs • Brood-rearing cover – 40-45% grass, 40-45% shrubs, 15-20% forbs
Water	• Foods eaten provide adequate water. Birds will use open water from livestock ponds, playa lakes, and others during drought conditions.
Interspersion	• Prefer a complex of sand sagebrush, shinnery oak, sand plum, or skunkbush sumac shrubs, sand dropseed, side oats grama, sand bluestem, and little bluestem grasses on open rangelands with flat surfaces.
Minimum Habitat Size	• Two-square miles, or 1,280 acres, of prime nesting and brood-rearing cover surrounded by a minimum of 10,000 acres of feeding and loafing habitat. • Smaller areas that form complexes of suitable habitat contribute to meeting size requirements.

Rangeland Management: ***Grazing*** – Season-long grazing systems are typically stocked to include as many cattle on a grazing unit that is financially beneficial; this type of grazing does not leave adequate time for rangeland to recover to a state where it is valuable to wildlife. Grazing livestock rotationally in pastures and on rangelands may be the best management strategy to maintain vegetation in suitable condition for lesser prairie-chickens. For example, rangeland divided into seven different grazing units should have two units left idle for two years at a time. Research shows that light grazing (<35 percent of available forage consumed) maintains good nesting and brood-rearing cover. However, if range condition is deteriorated, then stocking levels would need to be substantially lower. The table below shows suggested stocking levels for maintaining nesting, brood-rearing, and foraging habitat based on average annual rainfall and range condition.

Stocking level (% of available annual forage production) and recommended pasture rest for rangeland based on range condition and average annual precipitation.

Range Condition	Annual Rainfall	
	< 13"	≥ 13"
Poor	10%, rest 1 in 2 years	20%, rest 1 in 3 years
Fair	25%, rest 1 in 3 years	35%, rest 1 in 4 years
Good	40%, rest 1 in 4 years	50%, rest 1 in 5 years

Prescribed Burning – Prescribed burning is best conducted under the advisement of range and/or wildlife management professionals. These professionals can help in the development of a burn plan and possibly provide tools, equipment, supervision, and assistance in obtaining any required permits. Prescribed burns should be conducted on a three to six year rotational basis in early spring (March) to promote new growth of shrubs and grasses valuable as lesser prairie-chickens nesting, brood-rearing, and foraging cover. Leks may be maintained or created using prescribed fire as well. Burning an area to leave undisturbed nesting habitat adjacent to burned plots can be beneficial. Disked firebreaks should be created around burn areas.

Disking – Disking strips or blocks of land near leks and nesting cover on a four- to five-year rotational basis may help increase foraging and brood-rearing habitat and food resources. Disking to a depth of four to eight inches is sufficient to disturb the ground and promote new vegetation growth. It is important to leave ample undisturbed habitat (at least 100 yards) between disked areas and leks or nesting habitat, and it is necessary to disk only a few blocks within a combined area of rangeland. Note: Disking and planting food plots are supplemental management techniques that should be conducted only after good range condition is established.

Food Plots - Food plots are a management tool that can be used to potentially attract lesser prairie-chickens to quality nesting and winter habitat from areas of poor habitat. Areas of good habitat not inhabited by lesser prairie-chickens may be made attractive to birds by planting grain sorghum food plots within one mile of lekking grounds. Food plots planted with the sole intention of providing supplemental food have not been proven to improve lesser prairie-chicken survivability in an area. Landowners should plan with caution to avoid food plots being counterproductive by drawing lesser prairie-chickens from good habitat to poor habitat.

Limiting Factors

For planning purposes, subjectively rate the availability and quality of lesser prairie-chicken habitat within a planning area, based on the above habitat requirements descriptions. Habitat communities and components that are absent or rated low are likely limiting lesser prairie-chicken habitat quality. Land uses on adjacent properties may need to be considered to accurately rate the quality of a planning area as lesser prairie-chicken habitat.

Habitat Component	Availability/Quality			
	High	Medium	Low	Absent
Food				
Breeding cover				
Nesting cover				
Brood-rearing and winter cover				
Interspersion of habitat components				
Minimum habitat size				

Management Prescriptions

Management treatments should address the habitat components that most limit lesser prairie-chicken habitat potential. For planning purposes, select among the possible actions listed below to raise the quality or availability of each habitat component determined to be limiting. NRCS Conservation Practices and various programs that may provide financial or technical assistance to carry out specific management practices are listed where applicable.

Habitat Component	Management Options for Increasing Habitat Quality or Availability	Conservation Practices and Assistance Programs
Food	• Maintain forb and grass components within sand sagebrush, sand plum, and shinnery oak grasslands by conducting prescribed rotational burning, rotational shrub/brushland management, and rotational or deferred grazing (especially during drought) where appropriate.	647, 338, 528A WHIP, EQIP, PFW, CRP
	• Use minimum or no-till farming techniques to leave waste corn, oats, wheat, rye, sorghum, and other small grain crops on the surface after harvest activities.	329
	• Limit herbicide and insecticide use on rangelands to small areas or use mechanical means to minimize damage to shrubs, forbs, or insects used as food.	
	• Disk strips or blocks of land near leks and nesting cover on a four to five year rotational basis.	647 WHIP, EQIP, PFW
	• Plant food plots of grain sorghum within one mile of leks to provide supplemental winter food resources	647 WHIP, EQIP, PFW, CRP
Courtship display cover	• Preserve and maintain open areas on rangelands by conducting prescribed burning and rotational grazing when and where appropriate.	338, 528A WHIP, EQIP, PFW, CRP
Nesting, brood-rearing, and winter cover	• Maintain sand sagebrush, sand plum, skunkbush sumac, and shinnery oak mixed-grasslands with occasional prescribed burning, rotational brush management, and rotational or deferred grazing (especially during drought) when and where appropriate.	647, 338, 528A WHIP, EQIP, PFW, CRP
	• Restore reverting croplands with native species such as sand dropseed, side oats grama, sand bluestem, and little bluestem grasses, as well as shinnery oak, sand plum, sand sagebrush, and forbs.	327 WHIP, EQIP, PFW, CRP
	• Avoid or eliminate herbicide application during peak nesting and brood-rearing months (mid-April-July) and minimize use to occasional small brush treatments	
	• Disk strips or blocks of habitat near leks and nesting cover on a four- to five-year rotational basis.	WHIP, EQIP, PFW
Interspersion & minimum habitat size	• Combine above prescriptions to increase interspersion of habitat components or amount of suitable lesser prairie-chicken habitat.	

NRCS Conservation Practices that may be useful in undertaking the above management actions.

Conservation Practice	Code	Conservation Practice	Code
Conservation Cover	327	Prescribed Grazing	528A
Residue Management	329A,B,C	Upland Wildlife Management	645
Prescribed Burning	338	Early Successional Habitat Development	647

Landowners interested in making their individual efforts more valuable to the community can work with the Wildlife Habitat Council and NRCS to involve school, scout, and community groups and their families, as well as state and federal fish and wildlife agency personnel, in habitat projects when possible. On-site education programs demonstrating the necessity of lesser prairie-chicken habitat management can greatly increase the value of your individual lesser prairie-chicken management project as well. Corporate landowners should encourage interested employees to become involved.

Programs that provide technical and financial assistance to develop habitat on private lands.

Program	Land Eligibility	Type of Assistance	Contact
Conservation Reserve Program (CRP)	Highly erodible land, wetland, and certain other lands with cropping history. Stream-side areas in pasture land	50% cost-share for establishing permanent cover and conservation practices, and annual rental payments for land enrolled in 10 to 15-year contracts. Additional financial incentives are available for some practices	NRCS or FSA State or local Office
Environmental Quality Incentives Program (EQIP)	Cropland, range, grazing land & other agricultural land in need of treatment	Up to 75% cost-share for conservation practices in accordance with 5 to 10-year contracts. Incentive payments for certain management practices	NRCS State or local Office
Partners for Fish and Wildlife Program (PFW)	Most degraded fish and/or wildlife habitat	Up to 100% financial and technical assistance to restore wildlife habitat under minimum 10-year cooperative agreements	Local office of the U S. Fish and Wildlife Service
Waterways for Wildlife	Private land	Technical and program development assistance to coalesce habitat efforts of corporations and private landowners to meet common watershed level goals	Wildlife Habitat Council (301-588-8994)
Wildlife at Work	Corporate land	Technical assistance on developing habitat projects into a program that will allow companies to involve employees and the community	Wildlife Habitat Council (301-588-8994)
Wildlife Habitat Incentives Program (WHIP)	High-priority fish and wildlife habitats	Up to 75% cost-share for conservation practices under 5 to 10-year contracts	NRCS State or local Office
State fish and wildlife agencies and private groups such as Pheasants Forever may have assistance programs or other useful tools in your state.			State or local contacts

References

Bidwell, T. G., C. B. Green, A. D Peoples, and R. E. Masters. Prairie chicken management in Oklahoma. E-945. Oklahoma Cooperative Extension Service Stillwater, OK

Crawford, J A., and E G. Bolen. 1976 Effects of land use on lesser prairie chickens in Texas J. Wildl. Manage. 40 96-104.

Giesen, K. M. 1998. Lesser prairie-chicken (*Tympanuchus pallidicinctus*) *in* The Birds of North America, No. 364 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Hitchcock, A. S. 1971 Manual of the grasses of the United States, Volumes I&II. Second ed. Dover Publications, Inc., New York, NY. 1051 pp.

Riley, T. Z., C. A. Davis, M. A. Candelaria, and H. R Suminski. 1994. Lesser prairie-chicken movements and home ranges in New Mexico Prairie Naturalist 26:183-186.

Sauer, J. R., J. E. Hines, G. Gough, I. Thomas, and B. G. Peterjohn. 1997. The North American Breeding Bird Survey Results and Analysis Version 96 4 Patuxent Wildlife Research Center, Laurel, MD.

Taylor, M. A., and F S. Guthery. 1980. Status, ecology and management of the lesser prairie-chicken. USDA Forest Service General Technical Report RM-77. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 15 pp.

NRCS
Wildlife Habitat Management Institute
100 Webster Circle, Suite 3
Madison, MS 39110
(601) 965-5886

In cooperation with partners, the mission of the Wildlife Habitat Management Institute is to develop and disseminate scientifically based technical materials that will assist NRCS field staffs and others to promote conservation stewardship of fish and wildlife and deliver sound habitat management principles and practices to America's land users.

www.whmi.iastate.edu

Wildlife
Habitat Council
1010 Wayne Avenue, Suite 920
Silver Spring, MD 20910
(301) 588-8994

The Wildlife Habitat Council's mission is to increase the amount of quality wildlife habitat on corporate, private, and public land. WHC engages corporations, public agencies, and private, non-profit organizations on a voluntary basis as one team for the recovery, development, and preservation of wildlife habitat worldwide.

Wildlife Habitat Council

www.wildlifehc.org

This leaflet was developed in cooperation with the members of the **HIGH PLAINS PARTNERSHIP**

Western Governors' Association

We received helpful comments on the draft manuscript from Roger Applegate, Jim Bailey, Colin Berg, Ken Giesen, Stephanie Harmon, Russ Horton, John Hughs, Ken Kuiper, Roger Peterson, Terry Riley, Randy Rodgers, Dave Seery, Terry Skadeland, Steve Tully, and Gary Valentine.

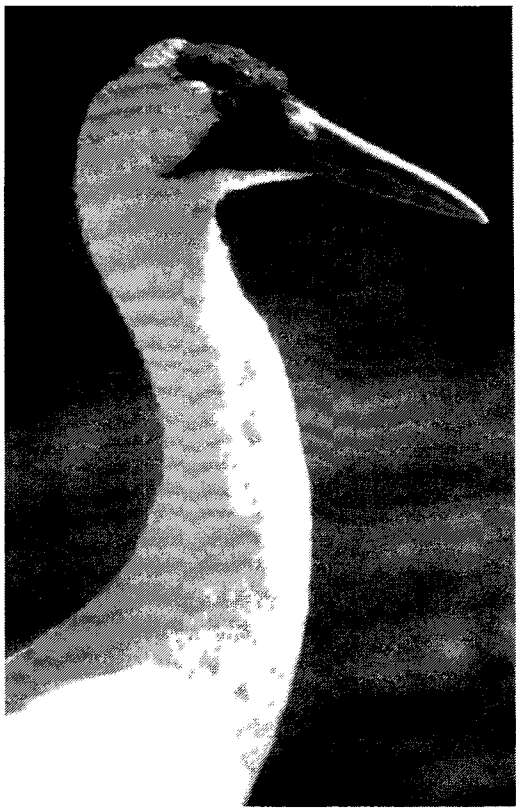
Whooping Crane

Scientific Name: *Grus americana*

Federal Status: Endangered, 6/2/70 • State Status: Endangered

Description

The stately Whooping Crane is the tallest bird found in North America, with males approaching nearly five feet in height. Adult birds are white overall with some red and black on the head. Their inner wing feathers droop over the rump in a "bustle" that distinguishes cranes from herons. With a seven foot wingspan and a slow wing beat, Whooping Cranes fly with their long necks and legs fully extended. When in flight, the birds' black wingtips or primary feathers



Whooping Crane
© USFWS Steve Van Riper

can be seen, and their long legs extend beyond their tail. Their dark olive-gray beaks are long and pointed. The area at the base of the beak is pink and the eyes are yellow. The Whooping Crane's call, from which it derives its name, has been described as a shrill, bugle-like trumpeting.

Whooping Crane chicks are a reddish cinnamon color. At four months of age, white feathers begin to appear on the neck and back. Juvenile feathers are replaced through the winter months. By the following spring, juvenile plumage is primarily white, with rusty colored feathers remaining only on the head, upper neck, and on the tips of wing feathers. Young birds generally have adult plumage by late in their second summer.

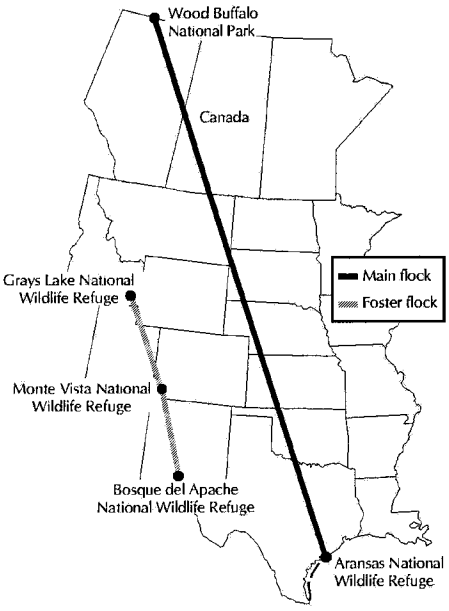
There are a number of birds that may appear similar to the Whooping Crane. The Sandhill Crane, the Whooping Crane's closest relative, is gray in color, not white. Also, Sandhill Cranes are somewhat smaller, with a wingspan of about five feet. Sandhill Cranes occur in flocks of two to hundreds, whereas Whooping Cranes are most often seen in flocks of two to as many as 10 to 15, although they sometimes migrate with Sandhill Cranes. Snow Geese and White Pelicans are white birds with black wingtips, however both of these birds have short legs that do not extend beyond the tail when in flight. In addition, Snow Geese generally occur in large flocks, are much smaller, and fly with a rapid wing beat. White Pelicans fly with their neck folded and can be distinguished by their long yellow bill. Finally, swans are all white and have short legs, and herons and egrets fly with their long necks folded.

Status and Distribution

The historical range of the Whooping Crane extended from the Arctic coast south to central Mexico, and from Utah east to New Jersey, South Carolina, Georgia, and Florida. Distribution of fossil remains suggests a wider distribution during the cooler, wetter climate of the Pleistocene.

Although once numbering above 10,000, it has been estimated that only 500 to 1,400 Whooping Cranes inhabited North America in 1870. Although the exact number is unknown, Whooping Cranes were uncommon, and their numbers had rapidly declined by the late 19th century.

In the mid 1800's, the principal breeding range extended from central Illinois northwestward through northern Iowa, western Minnesota, northeastern North Dakota, southern Manitoba and Saskatchewan, to the area near Edmonton, Alberta. The



Whooping Crane disappeared from the heart of its breeding range in the north-central United States by the 1890's. The last documented nesting in southern Canada occurred in Saskatchewan in 1922. By 1937, only two small breeding populations remained; a nonmigratory population in southwestern Louisiana and a migratory population that wintered on the Aransas National Wildlife Refuge (NWR) on the Texas coast and nested in a location that at the time was unknown. The remnant population in southwestern Louisiana was reduced from 13 to 6 birds following a hurri-

cane in 1940, and the last individual was taken into captivity in 1950. In the winter of 1938-39, only 14 adult and 4 juvenile Whooping Cranes were found on the Aransas NWR. The nesting area of the Aransas Wildlife Refuge population was discovered in 1954 in Wood Buffalo National Park (NP), Northwest Territories, Canada. This population is the only historical one that survives.

Whooping Cranes currently exist in three wild populations and a breeding population kept in captivity. The species numbers approximately 420 birds, all in Canada and the United States. The only self-sustaining wild population is the one that winters on the Texas coast and nests primarily within Wood Buffalo NP. In 2002, this population consisted of 50 nesting pairs, with a total of 185 birds wintering in Texas.

In 1975, Whooping Crane eggs were transferred from Wood Buffalo NP to Grays Lake National Wildlife Refuge in Idaho and placed in Sandhill Crane nests in an effort to establish a migratory population in the Rocky Mountains. The Rocky Mountain birds spend the summer in Idaho, western Wyoming, and southwestern Montana, and winter in the middle Rio Grande Valley of New Mexico. Reintroductions ended in 1989 after the adult Whooping Cranes did not pair up or mate due to imprinting problems from their foster Sandhill Crane parents. The last Whooping Crane in the flock died in 2002.

The second persisting wild population in 2003 consisted of approximately 90 birds remaining from over 250 captive-reared Whooping Cranes released in central Florida south of Orlando beginning in 1993. These birds were released as the first step in an effort to establish a non-migratory population in Florida, and in 2002, produced the first whooping crane chick born in the wild in the United States since 1939.

The third wild population was initiated in 2001 when several young captive-reared whooping cranes were released in potential nesting habitat at Necedah National Wildlife Refuge in Wisconsin. The young birds were trained to migrate to Florida's Gulf Coast by following ultra light aircraft. Although not yet of breeding age, the birds led south in both 2001 and 2002 returned north on their own the following spring.

Habitat

Within Wood Buffalo NP, Whooping Cranes nest in poorly drained wetlands interspersed with numerous potholes (small areas of open water). These wetlands are separated by narrow ridges that support trees such as white and black spruce, tamarack, and willows, and shrubs such as dwarf birch, Labrador tea, and bearberry. Bulrush is the dominant plant in areas used by nesting birds, although cattail, sedge, musk-grass and other aquatic plants are common. Nest sites are often located in the rushes or sedges of marshes and sloughs, or along lake margins. An abundance of invertebrates, such as mollusks, crustaceans, and aquatic insects have been found in the ponds near occupied nests.

Whooping Cranes use a variety of habitats during their long migrations between northern Canada and the Texas coast. Croplands are used for feeding, and large wetland areas are used for feeding and roosting. Whooping Cranes are known to roost in riverine habitat along the Platte, Middle Loup, and Niobrara Rivers in Nebraska, Cimarron River in Oklahoma, and the Red River in Texas. The birds often roost on submerged sandbars in wide unobstructed channels isolated from human disturbance. Whooping Cranes also use large wetland areas associated with lakes for roosting and feeding during migration.

The Whooping Crane's principal wintering habitat consists of about 22,500 acres of marshes and salt flats on Aransas National Wildlife Refuge and adjacent publicly and privately owned wetlands. Plants such as salt grass, saltwort, smooth cordgrass, glasswort, and sea ox-eye dominate the outer marshes. At slightly higher elevations, Gulf cordgrass is more common. The interior portions of the refuge are characterized by oak mottes, grassland, swales, and ponds on gently rolling sandy soils. Live oak, redbay, and bluestems are typical plants found on upland sites. Upland sites have been managed using grazing, mowing, and controlled burning. About 14,250 acres of grassland are managed for cranes, waterfowl, and other wildlife.

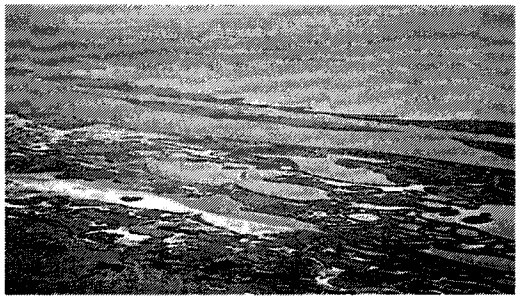
Whooping Crane at Aransas National Wildlife Refuge
© TPWD Bill Reaves

Whooping Crane chick
© USFWS

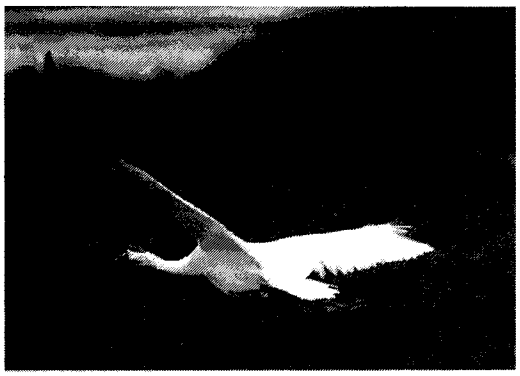
Life History

Whooping Cranes usually mate for life, although they will remate following the death of their mate. They mature at 3 to 4 years of age, and most females are capable of producing eggs by 4 years of age. It is estimated that Whooping Cranes can live up to 22 to 24 years in the wild. Captive individuals live 30 to 40 years.

Whooping Cranes begin leaving the Texas coast in late March and early April, returning to their nesting area in Wood Buffalo NP by late April. Experienced pairs arrive first and normally nest in the same vicinity each year. Nesting territories vary considerably in size, ranging from 0.5 to 1.8 square miles. From the start of egg laying until the chicks are a few months old, the birds' activities are restricted to the breeding territory. Eggs are normally laid in late April to mid May, and



Aerial view of Aransas National Wildlife Refuge
© TPWD



Whooping Crane in flight
© TPWD Bill Reaves

hatching occurs one month later. Most nests contain 2 eggs. The eggs are light-brown or olive-buff in color with dark, purplish-brown blotches primarily at the blunt end. Whooping Cranes will occasionally renest if their first clutch is destroyed during the first half of the incubation period. They usually nest each year, but occasionally a pair will skip a nesting season for no apparent reason. When nesting conditions are unsuitable, some pairs do not attempt to nest.

Whooping Crane parents share incubation and brood-rearing duties, and one member of the pair remains on the nest at all times. Females take the primary role in feeding and caring for the young. During the first 3 or 4 days after hatching, parents and young return to the nest each night. After that, the young are protected by their parents wherever they happen to be during inclement weather or at nightfall. During the first 20 days after hatching, families generally remain within 1 mile of the nest site.

Whooping cranes feed by probing the soil with their bills or taking food items from the soil surface or vegetation. Parents feed young chicks. Summer foods include large insect nymphs or larvae, frogs, rodents, small birds, minnows, and berries.

Fall migration begins in mid-September. Whooping Cranes normally migrate as a single, pair, family group, or in small flocks, sometimes accompanying Sandhill Cranes. Flocks of up to 10 sub-adults have been observed feeding at stopover areas. Whooping Cranes migrate during the day, and make nightly stops to feed and rest. Although they use a variety of habitats during migration, they prefer isolated areas away from human disturbance.

Whooping Cranes arrive on the Texas coast between late-October and mid-December. They spend almost 6 months on the wintering grounds at and near Aransas NWR. Pairs and family groups generally occupy and defend discrete territories, although close association with other Whooping Cranes is sometimes tolerated. Juveniles stay close to their parents throughout their first winter. Recent estimates of territory size average 292 acres. Studies indicate a declining territory size as the wintering population increases. Sub adults and unpaired adults form small flocks and use areas outside occupied territories. Sub adult birds often spend the winter near the territories where they spent their first year. Also, young adult pairs will often locate their first territory near the winter territory of one of their parents.

During the wintering period on the Texas coast, Whooping Cranes eat a variety of plant and animal foods. Blue crabs, clams, and the fruits of wolfberry are predominant in the winter diet. Clams are relatively more important in the diet when water depths are low and blue crabs are less abundant. Most clams and small blue crabs (2 inches or less in width) are swallowed whole. Larger crabs are pecked into pieces before being swallowed.

Whooping Cranes feed mostly in the brackish bays, marshes, and salt flats. Occasionally, they fly to upland sites for foods such as acorns, snails, crayfish, and insects, returning to the marshes in the evening to roost. Upland sites are more attractive when they are flooded by rainfall, burned to reduce plant cover, or when food is less available in the marshes and salt flats. Some Whooping Cranes use the upland parts of the refuge occasionally in most years, but use of croplands adjacent to the refuge is rare.

As spring approaches, the courtship displays for which Whooping Cranes are famous begin. These displays include loud unison calling, wing flapping, head bowing, and leaps into the air by one or both birds, increase in frequency. These rituals serve to forge and strengthen pair bonds. Family groups and pairs usually depart first, normally between March 25 and April 15. The last birds are usually gone by May 1, but occasional stragglers may stay into mid-May. During the 16-year period between 1938 and 1992, a total of 27 birds have remained at Aransas NWR throughout the summer. Some of these birds were ill or crippled or mates of birds which were crippled.

Parents separate from their young of the previous year at the beginning of spring migration, while in route to the breeding grounds, or soon after arrival on the breeding grounds. Most juveniles spend the summer near the area where they were born.

Threats and Reasons for Decline

Whooping Cranes gradually disappeared as agriculture claimed the northern Great Plains of the United States and Canada. Man's conversion of the native prairies and potholes to pasture and crop production made much of the original habitat unsuitable for Whooping Cranes. Rural electrification brought power lines, resulting in an increase in death and serious injury due to collisions.

Human disturbance has also played a role in the decline of the Whooping Crane. The birds are wary on the breeding grounds. They will tolerate human intrusion for short intervals, but will not remain near constant human activity. The mere presence of humans during settlement of the mid-continent and coastal prairies may have interfered with the continued use of traditional breeding habitat by Whooping Cranes.

The Aransas population, the only population that is self-sustaining, remains vulnerable to accidental spills that could occur along the Gulf Intracoastal Waterway. The Intracoastal Waterway carries some of the heaviest barge traffic of any waterway in the world, and it runs right through the center of the Whooping Crane winter range. Much of the cargo is petrochemical products. Although spill response plans have been developed,

an accident resulting in a spill could potentially destroy Whooping Cranes or their food resources.

Records of Whooping Cranes known to have died from gunshot or other causes from colonial times to 1948 show that about 66% of the losses occurred during migration. Shooting represented a substantial drain on the population, particularly from 1870 to 1920. Large and conspicuous, Whooping Cranes were shot for both meat and sport. Laws enacted to protect the birds have led to a decline in human caused mortality, but shootings still occur. The most recent known cases involved an adult female being mistaken for a snow goose near Aransas NWR in 1989, an adult female shot by a vandal as she migrated northward through Texas in 1991, and two shot by a vandal in Florida in 1990.

Biological factors such as delayed sexual maturity and small clutch size prevent rapid population recovery. The major population of Whooping Cranes is now restricted to breeding grounds in northern Canada. This may hamper productivity because the ice-free season is only 4 months, barely enough time to incubate their eggs for 29 to 31 days and rear their chicks to flight age in the remaining 3 months. Unless nest loss occurs early in the incubation period, there is rarely time to successfully rear a second clutch if the first clutch fails.

Drought during the breeding season presents a serious hazard because nest site availability and food supplies are reduced and newly hatched chicks are forced to travel long distances between wetlands. Drought also increases the exposure of eggs and chicks to predators such as ravens, bears, wolverines, foxes, and wolves.

Although little is known about the importance of disease and parasites as mortality factors, there have been documented cases of wild Whooping Cranes dying of avian tuberculosis, avian cholera, and lead poisoning. Coccidia, a parasite which causes digestive tract disorder, has also been found in wild and captive birds.

Finally, Whooping Cranes are exposed to a variety of hazards and problems during their long migrations. Natural events such as snow, hail storms, low temperatures, and drought can make navigation hazardous or reduce food supplies. Collision with utility lines, predators, disease, and illegal shooting are other hazards that affect migrating cranes.

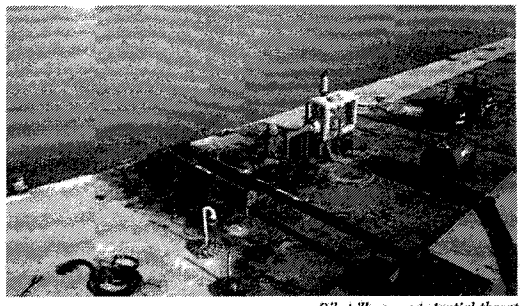
Recovery Efforts

The comeback story of the Whooping Crane has been heralded as one of the conservation victories of the 20th Century. The increase and stabilization of the Aransas/Wood Buffalo population has been a result of many factors, including legal protection, habitat protection, and biological research in both the United States and Canada.

In 1975, the U.S. Fish and Wildlife Service initiated a migration monitoring program to protect migrating Whooping Cranes from disease outbreaks and other potential hazards, and to compile information on the characteristics of stopover sites. This monitoring program is now coordinated with a network of people from the Canadian Wildlife Service, U.S. Fish and Wildlife Service, States, and Provinces along the migration corridor.

Flightless young Whooping Cranes were captured and marked with colored plastic leg bands in Wood Buffalo NP from 1977 through 1988. Of the 133 birds banded, 14% could still be identified in the spring of 2003. This marking program has provided a wealth of information on Whooping Crane biology. A radio tracking program, in which miniature radio transmitters were attached to the color leg bands of young Whooping Cranes banded at Wood Buffalo NP, has also yielded valuable information concerning migration timing and routes, stopover locations, habitat use, social behavior, daily activity, and causes of death. Recently, tests of line marking devices have identified techniques effective in reducing collisions with utility lines.

The wintering territories of Whooping Cranes on the Texas coast place the birds in close proximity to human disturbance factors such as tour boats, boat and barge traffic along the Intracoastal Waterway, recreational and commercial fishing boats, airboats, and air traffic. A number of recent and ongoing studies have addressed the issue of how human disturbance factors might affect wintering birds. Additional research studies currently underway include evaluating the relationship between freshwater inflows, blue crabs and Whooping Cranes. Significant habitat research has also been conducted on the nesting grounds in Canada.

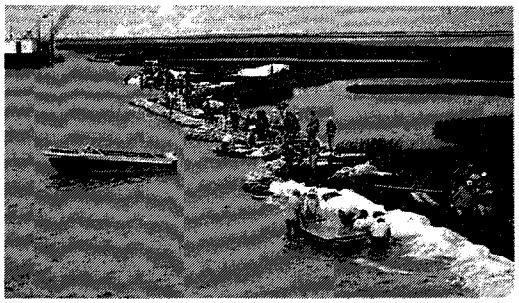


Oil spills are a potential threat
© TPWD

Prescribed burning is used on Aransas NWR to reduce height and density of grasses, top kill brush, and to modify plant composition on the uplands to make them more attractive to Whooping Cranes. Burned areas are immediately used by the birds. Currently, 15 prescribed burning units averaging 1,410 acres in size are burned on a 3-year rotation.

The most complete count of the Aransas/Wood Buffalo population is made during the winter. Aerial counts are made weekly throughout the winter period, although counts are made less frequently during midwinter. These flights provide information on mortality, habitat use, pair formation, territory establishment, and age structure by identifying all color banded birds present. Additional protection of habitat outside Aransas NWR is provided by the National Audubon Society, which leases several islands from the State of Texas, by Texas Parks and Wildlife Department, and by private landowners, several of whom have signed conservation agreements to protect Whooping Cranes on their property. Monitoring of nesting pairs also takes place at Wood Buffalo NP.

Construction of the Gulf Intracoastal Waterway through the marshes of Aransas NWR in the early 1940's, and subsequent erosion by wind and boat wakes, has resulted in 11% loss of wintering habitat. Between 1989 and 1992, volunteers placed over 57,000 sacks of cement to protect 8,752 feet of shoreline. In 1992, the U.S. Army Corps of Engineers placed 2,013 feet of interlocking cement mats to stop erosion. Between 1999 and 2001, additional armoring done by the Corps protected 15.3 miles of



Erosion control efforts along the Intracoastal Waterway at Aransas National Wildlife Refuge
© TPWD

shoreline within critical habitat of the Whooping Crane.

Dredged material deposited from periodic maintenance of the Intracoastal Waterway has destroyed some marsh areas and unintentionally created others. In 1991, Mitchell Energy and Development Corporation built a dike around 10 acres of open shallow bay, filled the area with dredge material, and planted it to wetland vegetation. Whooping Cranes began using the area the following winter. In 1993 and 1995, Mitchell Energy built 20 more acres of marsh adjacent to the first area. In 1995, the Corps of Engineers created nearly 50 acres of marsh. The Corps has plans to create an additional 1,500 acres of marsh using dredged material beneficially over the next 50 years.

Several efforts have been initiated to establish new populations of Whooping Cranes as a means of safeguarding the species against a catastrophe in the Aransas/Wood Buffalo population. The effort in Idaho used Sandhill Cranes as foster parents to incubate Whooping Crane eggs, raise the chicks, and teach them migration paths to New Mexico. Foster-parenting has proved to be an unsuitable technique, however, as imprinting led to problems for the Whoopers in establishing pair bonds. An effort in Florida is using techniques developed successfully with the endangered Mississippi Sandhill Crane to try to establish a non-migratory flock of Whooping Cranes. Meanwhile, new techniques for establishing a second migratory population continue to be explored. In 2001 and 2002, 23 Whooping Crane chicks were costume-raised and flown behind an ultralight aircraft from Wisconsin to Florida. In the spring of 2003, the 16 surviving birds led south by ultralight returned to their summer reintroduction site on their own.

These reintroduction efforts have been made possible by a successful captive breeding program for Whooping Cranes. Although Whoopers at Wood Buffalo NP lay two eggs, usually only one hatches. In most years between 1967 and 1996, biologists from the United States and Canada collected eggs from wild nests in order to establish captive populations and support reintroduction efforts. Three primary captive breeding facilities exist, including Patuxent Wildlife Research Center in Maryland, the International Crane Foundation in Wisconsin, and Calgary Zoo in Alberta, Canada. Additional breeding cranes are kept at the San Antonio Zoo, Texas, and the Audubon Center for Research on Endangered Species in Louisiana.

Finally, there is much evidence that people value Whooping Cranes. Numerous books, magazine articles, television programs, and nature documentary films have been produced about this magnificent bird. Each year 70,000 to 80,000 people visit Aransas NWR, most during the winter. These visitors spend a significant amount of money locally on lodging, gasoline, and supplies. In 2003, three large tour boats operating out of Rockport/Fulton offered trips to view Whooping Cranes along the Gulf Intracoastal Waterway. Approximately 10,000 people took these tours, paying an average of $30 per ticket, for a total seasonal amount of $300,000. The city of Rockport estimates that wildlife-related activities result in annual gross economic benefits of $6 million to the local economy. Some of these benefits result from the nearby presence of Whooping Cranes. The possibility of sighting Whooping Cranes, along with large numbers of migrating Sandhill Cranes, is an additional attraction to tourists in other areas of the United States. For example, approximately 80,000 people visit the Platte River area of Nebraska each year during the peak of spring crane migrations, spending approximately $15 million. The Chamber of Commerce of Grand Island, Nebraska has responded by sponsoring an annual festival, "Wings over the Platte," to further promote this interest in birds.

Where To See Whooping Cranes

Visit Aransas National Wildlife Refuge near Austwell, Texas during November through March to see Whooping Cranes as well as migratory waterfowl and other wildlife. As mentioned above, there are a number of commercially operated boat tours, departing from both Rockport/Fulton and Port Aransas which offer visitors the chance for a close look at Whooping Cranes, waterfowl, shorebirds, herons, and hawks. Contact Aransas NWR (361) 286-3559, Rockport/Fulton Chamber of Commerce (800) 242-0071, or Port Aransas Chamber of Commerce (800) 452-6278 for more information. Also, the San Antonio Zoo exhibits captive Whooping Cranes as part of the recovery effort.

How You Can Help

Whooping Cranes migrate over north and east-central Texas on their way to and from Aransas NWR each fall and spring. The birds are particularly vulnerable to human disturbance and other hazards during this migration period. They sometimes stop in fields or wetlands near rivers or lakes to feed or rest. If you see migrating Whooping Cranes, view them from a distance and be careful not to disturb them. Report sightings to the Texas Parks and Wildlife Department (webcomments@tpwd.state.tx.us or 1-800-792-1112) or the U.S. Fish and Wildlife Service. Remember that harassing, shooting, or attempting to capture a Whooping Crane is a violation of Federal Law. If you find a dead or injured bird, report it immediately to one of the numbers listed below or to your local game warden. Since injured Whooping Cranes are delicate and require special care, you should quickly contact a representative of Texas Parks and Wildlife or U.S. Fish and Wildlife and carefully follow their instructions.

You can be involved in the conservation of Texas' nongame wildlife resources by supporting the Special Nongame and Endangered Species Conservation Fund. Special nongame stamps and decals are available at Texas Parks and Wildlife Department (TPWD) Field Offices, most State Parks, and the License Branch of TPWD headquarters in Austin. Some of the proceeds from the sale of these items are used to conserve habitat and provide information concerning rare and endangered species. Conservation organizations such as the Whooping Crane Conservation Associ-

ation, National Audubon Society, International Crane Foundation, and The Nature Conservancy of Texas also welcome your participation and support.

For More Information Contact

Texas Parks and Wildlife Department
Wildlife Diversity Branch
4200 Smith School Road
Austin, Texas 78744
(512) 912-7011 or (800) 792-1112
or
U.S. Fish and Wildlife Service
Ecological Services Field Office
10711 Burnet Road, Suite 200
Austin, Texas 78758
(512) 490-0057
or
U.S. Fish and Wildlife Service
Corpus Christi Ecological Services
Field Office
c/o TAMU-CC, Campus Box 338
6300 Ocean Drive, Room 118
Corpus Christi, Texas 78412
(361) 994-9005
or
Aransas National Wildlife Refuge
P.O. Box 100
Austwell, Texas 77950
(361) 286-3559

References

Allen, R.P. 1952. *The Whooping crane.* National Audubon Society Resource Report 3. 246 pp.

Bishop, M.A. and D.R. Blankinship. 1982. "Dynamics of subadult flocks of Whooping cranes at Aransas National Wildlife Refuge, Texas, 1978-1981." Pages 180-189, *in* J.S. Lewis, eds. Proceedings 1981 International Crane Workshop. National Audubon Society, Tavernier, Florida.

Mabie, D.W., L.A. Johnson, B.C. Thompson, J.C. Barron, and R.B. Taylor. 1989. *Responses of wintering Whooping cranes to airboat and hunting activities on the Texas coast.* Wildlife Society Bulletin 17(3):249-253.

Mirande, C., R. Lacy, and U. Seal (Ed.). 1991. *Whooping crane* (Grus americana) - *conservation viability assessment workshop report.* Captive Breeding Specialist Group (CBSG/SSC/IUCN), Apple Valley, MN. 119 pp.

Slack, R.D. and H. Hunt. 1987. *Habitat use by Whooping cranes and Sandhill cranes on the Aransas Wildlife Refuge.* U.S. Fish and Wildlife Service Contract No. 14-16-0002-82-220. 146 pp.

U.S. Fish and Wildlife Service. 1994. *Whooping Crane Recovery Plan.* Albuquerque, New Mexico. 76 pp.

Funds for the production of this leaflet were provided by the U.S. Fish and Wildlife Service, under Section 6 of the Endangered Species Act.

April 10, 2007

Mr. Brian Almon, P.E.
Public Utilities Commission
P.O. Box 13326
Austin, TX 78711-3326

RE: Nomination of Potential Competitive Renewable Energy Zones (CREZ) (PUC Docket #33672)

Dear Mr. Almon:

Texas Parks and Wildlife Department (TPWD) has reviewed the Commission staff's petition for designation of CREZ by the companies listed below. TPWD staff has reviewed the areas nominated for CREZ designation and offers the following information for consideration.

Areas Nominated for CREZ Designation

The areas discussed in these comments are based on the zones identified as having the best wind resource potential in the study titled "Analysis of Transmission Alternatives for Competitive Renewable Energy Zones" released by the Energy Reliability Council of Texas (ERCOT) in December 2006. The following table lists the nominated zones:

Company Name	Zone(s) Nominated	Comments
Mesa Power LLC.	4	
NRG Texas LLC.	5,6,9	requests eastern boundary of Zone 5 to be moved 10 miles east (area included in zone 11)
ITC Grid Development LLC.	1,2,3,4,9,10,14,19,21,25	
Freemantle Energy LLC.	5,6	
Horizon Wind Energy LLC.	2,5,18	
FPL Energy LLC.	9,10	includes some areas between zones 9&10 (see attached map)
Eurus Energy America Corp., Clipper Windpower Development, and Floydada Economic Development Corp.	2	

4200 SMITH SCHOOL ROAD
AUSTIN, TEXAS 78744-3291
512.389.4800

www.tpwd.state.tx.us

BP Wind Energy North America Inc.	2,4,5,6,7,9,10,12,14	amended to add Hardeman, Wichita, Archer, Young, Childress, Eastland, and Erath counties (see attached map of additional counties)
AES SeaWest Inc.	9,10,11,20	amended zone 9 to include portions of Coke and Tom Green counties (no map was included with petition to show amended area – see BP map for extended zone 9 information)
Invenergy Wind North America LLC.	2,9,10	
Penn Real Estate Group	19	
PPM Energy, Inc.	4	
RES America Developments, Inc.	2,6,12	only portion of zone 2 in Briscoe and Floyd Counties nominated
Shell WindEnergy, Inc.	2	Only portion of Zone 2 in Briscoe County nominated
Panhandle Loop Intervenors	4,25	

Limitations of Information Provided

The information provided in this letter is not a complete or comprehensive analysis of the natural environment in the nominated zones. This information is based on data maintained by this and other natural resource agencies in various databases and GIS applications. Only the zones nominated for CREZ designation are addressed below. Zones 8, 13, 15, 16, 17, 22, 23, and 24 from the ERCOT study referenced above were not nominated and therefore were not examined. The locations of associated new or upgraded transmission facilities are also not included in the information provided below. TPWD recommends that transmission projects (both new and proposed upgrades) be sent to this office for review and comment on a project-by-project basis.

Rare and Protected Species

Data Represented in the TPWD Natural Diversity Database

The attached information regarding rare and protected species is based on records of occurrences maintained by TPWD in the Natural Diversity Database (NDD). Given the small proportion of public versus private land in Texas, the NDD does not include a representative inventory of rare resources in the state. Although it is based on the best data available to TPWD regarding rare species, the data from the NDD do not provide a definitive statement as to the presence, absence, or condition of special species, natural communities, or other

significant features within your project area. These data cannot substitute for an on-site evaluation by qualified biologists. The NDD information is intended to assist you in avoiding harm to species that may occur on project sites.

The attached lists of NDD records show rare and protected species documented within each nominated zone and within 1 mile outside of the zonal boundary. These lists are generally organized in order of descending legal protection. Given the scope of the areas studied, records from the NDD are shown on the maps provided at coarse scale and occurrences are labeled using a unique identifying number known as the Element Occurrence ID (EOID). These maps are intended to provide an overview of the NDD records in the nominated zones. Because much of the data in the NDD overlaps, maps showing labeled records in large areas such as these zones can often become cluttered and unclear. Clarification for specific areas or records (shapefiles and detailed descriptions for each record) is available in digital format from Stephanie Shelton of the Wildlife Diversity Program at (512) 912-7053.

State and Federal Managed Areas

The EOIDs also include information on state or federal managed lands that occur in the proposed CREZs. If information is needed regarding specific state managed areas, please contact Dennis Gissell at (512) 389-4407. Information on state-owned lands can also be found on the TPWD website under "State Parks and Destinations" or "Hunting and Wildlife."

Data Not Represented in the TPWD Natural Diversity Database

Due to the limitations in the NDD discussed above, some rare and protected species are poorly represented in the NDD although they may have substantial populations in the nominated zones. A compact disc containing lists of rare, threatened, and endangered species with the potential to occur in each of the nominated zones is attached for your reference.

One species that is poorly represented in the NDD is the federal candidate for listing Lesser Prairie Chicken (*Tympanuchus pallidicinctus*). An estimated current distribution map for this species is attached for your reference. Development in zones 2,3,4,10,19, and 25 could adversely impact occupied and/or potential habitat for this species. Recent research in Kansas concludes that Greater Prairie Chickens avoid using areas near tall structures such as electrical transmission lines, oil and gas pumps, wind turbines, etc. TPWD recommends avoiding construction of tall structures in areas that contain potential habitat for the Lesser Prairie Chicken. TPWD

recommends wind farm and transmission line developers contact Heather Whitlaw, TPWD Diversity Biologist, at (806) 742-4968 if their proposed wind power project could adversely impact the Lesser Prairie Chicken.

Several large colonies of the Mexican free-tailed bat (*Tadarida brasiliensis*) are known to exist in and around zone 20. More than 20 million bats may reside within the boundaries of this zone. A map of major Mexican free-tailed bat colonies is attached for your reference. Although the Mexican free-tailed bat is not considered rare, some rare bat species such as the species of concern Cave myotis bat (*Myotis velifer*) may also be present in the nominated zones. TPWD recommends developers contact Ed Arnett of Bat Conservation International at (512) 327-9721 for more information regarding potential impacts of wind power development on bats.

Ecologically Significant Stream Segments

The following table lists stream segments have been designated by TPWD as ecologically significant based on criteria listed in 31 TAC 357.8 and are entirely or partially located within the nominated zones. Information on stream segments designated as ecologically significant can be found at http://www.tpwd.state.tx.us/landwater/water/environconcerns/water_quality/sigsegs/ Although the information provided in this section discusses only waterways which TPWD has designated as significant for the reasons discussed below, all waterways and associated floodplains, riparian corridors, and wetlands in the nominated zones provide valuable wildlife habitat and should be protected to the maximum extent possible.

No designated Ecologically Significant Stream Segments are located within nominated zones 7, 14, 19, or 25.

Zone	Name of Waterway	Limits of Segment	Reason for Designation as Ecologically Significant
1	Tierra Blanca Creek	from the confluence with Prairie Dog Town Fork of the Red River upstream to Buffalo Lake in Randall County	bordered by Buffalo Lake National Wildlife Refuge within this zone

1	Prairie Dog Town Fork of the Red River	from the Armstrong/Briscoe County line upstream to Lake Tanglewood in Randall County	high water quality, exceptional aquatic life, high aesthetic value, recorded occurrences of the federal and state listed endangered Interior Least Tern (*Sterna antillarum athalassos*), bordered by Palo Duro Canyon State Park within this zone
2	South Prong of the Little Red River and North Prong of the Little Red River	from their confluence with the Little Red River upstream to their headwaters in Briscoe County	bordered by Caprock Canyons State Park within this zone
2	Prairie Dog Town Fork of the Red River	from the SH 70 crossing at the Briscoe/Hall County line upstream to the Briscoe/Armstrong County line	recorded occurrences of the federal and state listed endangered Interior Least Tern
3	Wolf Creek	from the Oklahoma State line in Lipscomb County to a point 1.2 miles upstream of FM 3045 in Ochiltree County	high water quality, exceptional aquatic life, and high aesthetic value, designated as an ecoregion reference stream by the TPWD River Studies Program due to high water quality and diverse benthic macroinvertebrate and fish communities.
4	Canadian River	from the Oklahoma State line in Hemphill County upstream to Sanford Dam in Hutchinson County	recorded occurrences of the federal and state listed endangered Interior Least Tern and federal and state listed threatened Arkansas river shiner (*Notropis giardi*), bordered by the Gene Howe Wildlife Management Area within this zone
4	McClellan Creek	from the confluence with the North Fork of the Red River in east Gray County upstream to its headwaters in the southwestern part of Gray County	high water quality, exceptional aquatic life, high aesthetic value, diverse benthic macroinvertebrate and fish communities, designated ecoregion reference stream

4	Graham Creek	From the confluence with Sweetwater Creek east of Mobeetie in Wheeler County upstream to SH 152 in northeast Gray County	unique wetland habitat
4	Sweetwater Creek	From the Oklahoma State line in Wheeler County upstream to its headwaters in northwest Wheeler County	high water quality, exceptional aquatic life, high aesthetic value, designated as an ecoregion reference stream, unique wetlands community
5	Live Oak Creek	From the confluence with the Pecos River about seven miles southeast of Sheffield in Crockett County to its headwaters about six miles north of Old Fort Lancaster in Crockett County.	high water quality, exceptional aquatic life, high aesthetic value, ecoregion reference stream, diverse benthic macroinvertebrate community, documented records of the state listed threatened Proserpine shiner (*Cyprinella proserpina*)
5	Pecos River	From the Val Verde/Crockett County line upstream to the FM 11 bridge on the Pecos/Crane County line	Texas Natural Rivers System nominee for outstandingly remarkable fish and wildlife values, high water quality, exceptional aquatic life, exceptional aesthetic value, documented records of the Proserpine shiner
5	Spring Creek	From the FM 2335 crossing in Tom Green County to its headwaters located four miles south of the corner common to Schleicher, Irion, and Crockett counties.	high water quality, exceptional aquatic life, high aesthetic value, ecoregion reference stream, diverse benthic macroinvertebrate community, one of only four known remaining populations of species of concern freshwater mussel Texas fatmucket (*Lampsilis bracteata)*
6	Pecos River	See above	See above

9	West Rocky Creek	From the confluence with the Middle Concho River in northeast Irion County upstream to its headwaters in south Sterling County.	high water quality, exceptional aquatic life, high aesthetic value, ecoregion reference stream, diverse benthic macroinvertebrate community
10	Double Mountain Fork of the Brazos River	From the confluence with Salt Fork Brazos River in Haskell County upstream to Kent/Garza county line.	prairie stream ecosystem displays significant overall habitat value, exemplary native prarie-stream fish community, including the federal candidate for listing Sharpnose shiner (*Notropis oxyrhynchus*) and Smalleye shiner (*Notropis buccula*)
11	San Saba River	From FM 864 in Menard County upstream to Fort McKavett in Menard County	bordered by Fort McKavett State Historical Site, one of only four known remaining populations of species of concern freshwater mussels Texas fatmucket and Texas pimpleback (*Quadrula petrina*)
12	Colony Creek	From the confluence with the Leon River 4.5 miles southeast of Merriman in Eastland County upstream to the headwaters in north Eastland County	high water quality, exceptional aquatic life, high aesthetic value, ecoregion reference stream, diverse benthic macroinvertebrate community
18	Red River	From the Wichita/Clay County line upstream to a point immediately upstream of the confluence of Buck Creek in Hardeman County	recorded occurrences of the federal and state listed endangered Interior Least Tern
18	Salt Fork of the Brazos River	From the Baylor/Throckmorton County line upstream to the Baylor/Knox County line	prairie stream ecosystem displays significant overall habitat value, exemplary native prairie-stream fish community, including the Sharpnose shiner, and Smalleye shiner
20	Blanco River	From the Blanco/Hays County line to the Blanco/Kendall County line	bordered by Blanco State Park within this zone, high water quality, exceptional aquatic life

20	James River	From the confluence with the Llano River in the central part of Mason County to its headwaters south of Noxville in the southeastern part of Kimble County.	high water quality, exceptional aquatic life, high aesthetic value, ecoregion reference stream, overall use
20	Johnson Creek	From the confluence with the Guadalupe River in Kerr County to a point 0.7 mile upstream of the most upstream crossing of SH 41 in Kerr County (TNRCC classified stream segment 1816).	high water quality, exceptional aquatic life, high aesthetic value
20	North Fork of the Guadalupe River	From the confluence with the Guadalupe River in Kerr County to a point 11.3 miles upstream of Boneyard Draw in Kerr County	valuable hydrologic function relating to groundwater discharge of the Edwards Aquifer, bordered by the Kerr Wildlife Management Area within this zone, high water quality, exceptional aquatic life, high aesthetic value
20	Onion Creek	From the confluence with the Colorado River in Travis County to the most upstream crossing of FM 165 in Blanco County	bordered by McKinney Falls State Park downstream from this zone, high water quality, exceptional aquatic life, high aesthetic value, ecoregion reference stream, diverse benthic macroinvertebrate community
20	Pedernales River	From a point immediately upstream of the confluence of Fall Creek in Travis County to FM 385 in Kimble County	National Wild and Scenic Rivers System nominee for outstandingly remarkable wildlife values and significant natural areas, bordered by Pedernales Falls State Park, Stonewall Park, LBJ State Park, LBJ National Park; High water quality, exceptional aquatic life, high aesthetic value
20	Sabinal River	From the Bandera/Uvalde County line upstream to the most upstream crossing of RR 187 in Bandera County	Texas Natural Rivers System nominee for outstandingly remarkable wildlife values, bordered by Lost Maples State Park (National Natural Landmark) within this zone, high water quality, exceptional aquatic life, exceptional aesthetic value, genetic refuge for pure strain of species of concern Guadalupe bass (*Micropterus treculii*)

21	Rita Blanca Creek	From the headwaters of Lake Rita Blanca in Hartley County upstream to US 87 in Dallam County.	bordered by Rita Blanca Conservation Area within this zone
21	West Fork of Rita Blanca Creek	From the confluence with Rita Blanca Creek in Dallam County upstream to the New Mexico state line.	bordered by Rita Blanca National Grassland within this zone

Voluntary Guidelines to Minimize Impacts to Fish and Wildlife

Voluntary guidelines for wind energy development in Texas are being developed by TPWD in cooperation with members of industry and non-governmental organizations (environmental groups, birding groups, etc.). It is estimated that these guidelines will be complete within approximately 6 months. Once available, TPWD recommends that developers use these guidelines to locate and operate wind power facilities in a manner that will minimize adverse impacts to wildlife. Please contact Kathy Boydston at (512) 389-4638 for specific information on development guidelines in the proposed development zones or any other onshore or offshore locations.

I appreciate the opportunity to provide preliminary input on the designation of CREZ. Please contact me at (512) 389-4579 if you have any questions.

Sincerely,

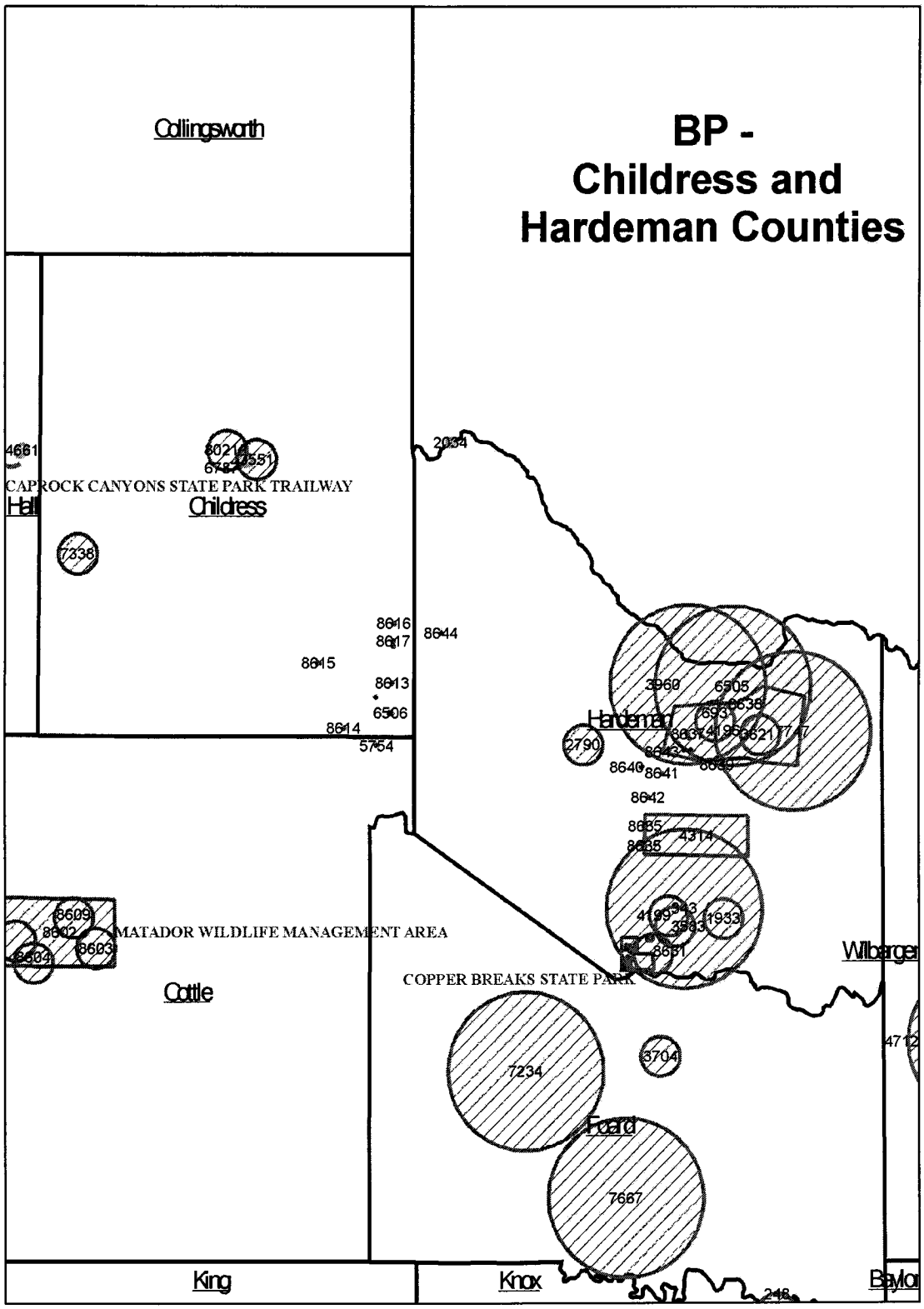
Kathy Boydston for

Julie C. Wicker
Wildlife Habitat Assessment Program
Wildlife Division

JCW:gg.12316

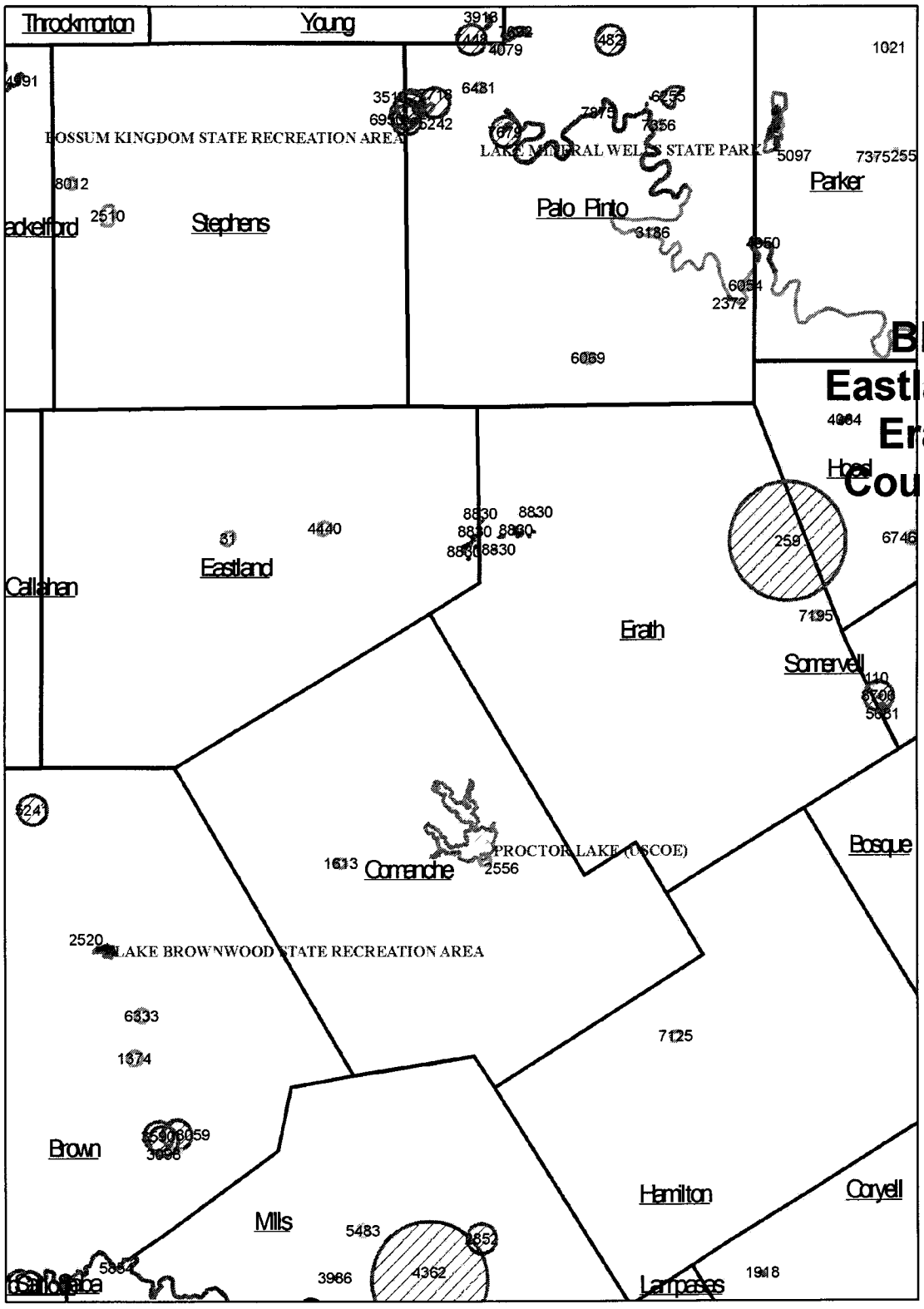
Attachments

cc (w/attachments): Ed Arnett, Bat Conservation International
Heather Whitlaw, TPWD
Stephanie Shelton, TPWD



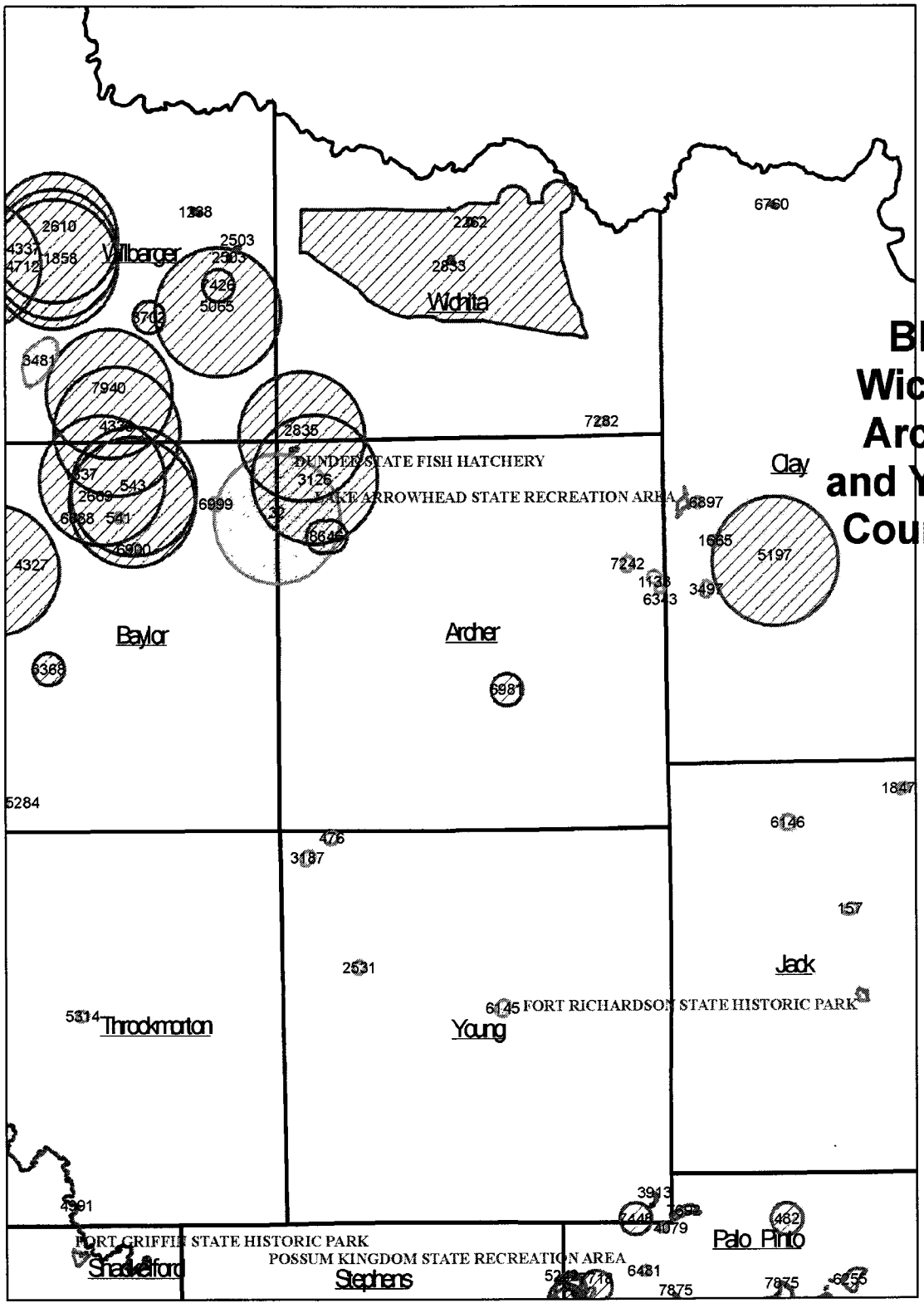
Legend

- Animal Assemblage
- Invertebrate Animal
- Nonvascular Plant
- Terrestrial Community - Other Classification
- Vascular Plant
- Vertebrate Animal
- Managed Area



Legend

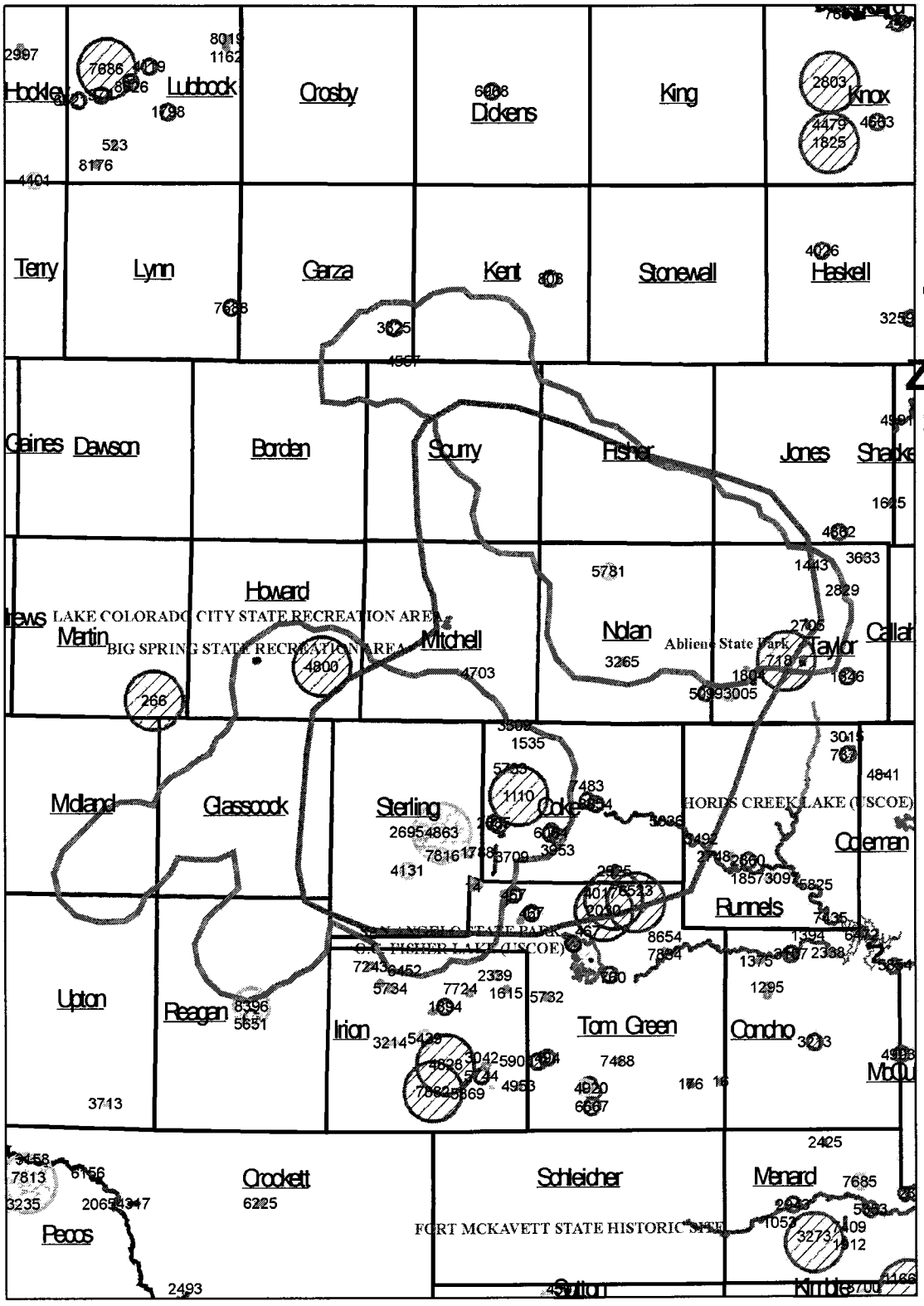
- Animal Assemblage
- Invertebrate Animal
- Nonvascular Plant
- Terrestrial Community - Other Classification
- Vascular Plant
- Vertebrate Animal
- Managed Area



BP - Wichita Archer and Young Counties

Legend

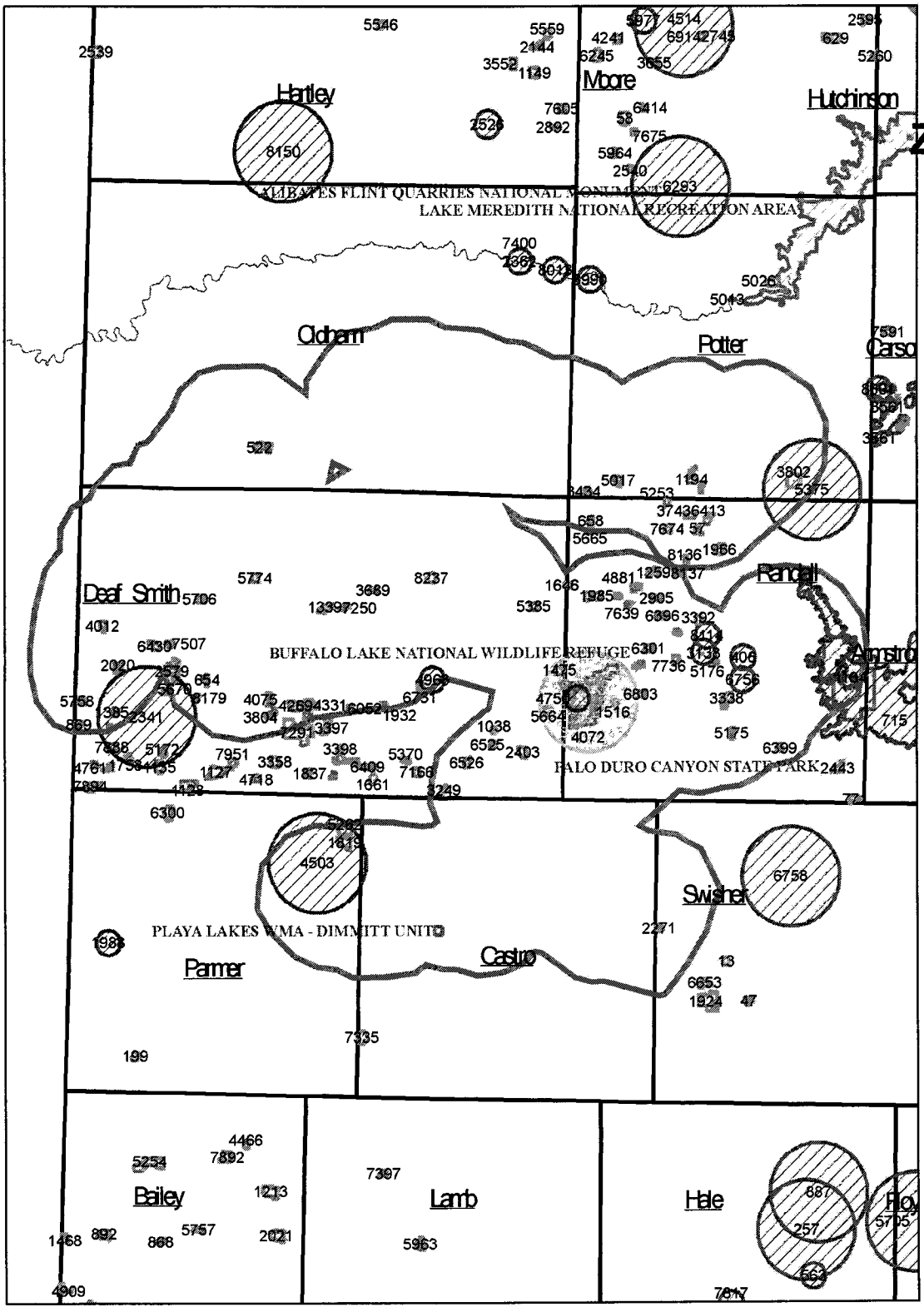
- Animal Assemblage
- Invertebrate Animal
- Nonvascular Plant
- Terrestrial Community - Other Classification
- Vascular Plant
- Vertebrate Animal
- Managed Area



FPL - with Zone 9 & Zone 10 Shown

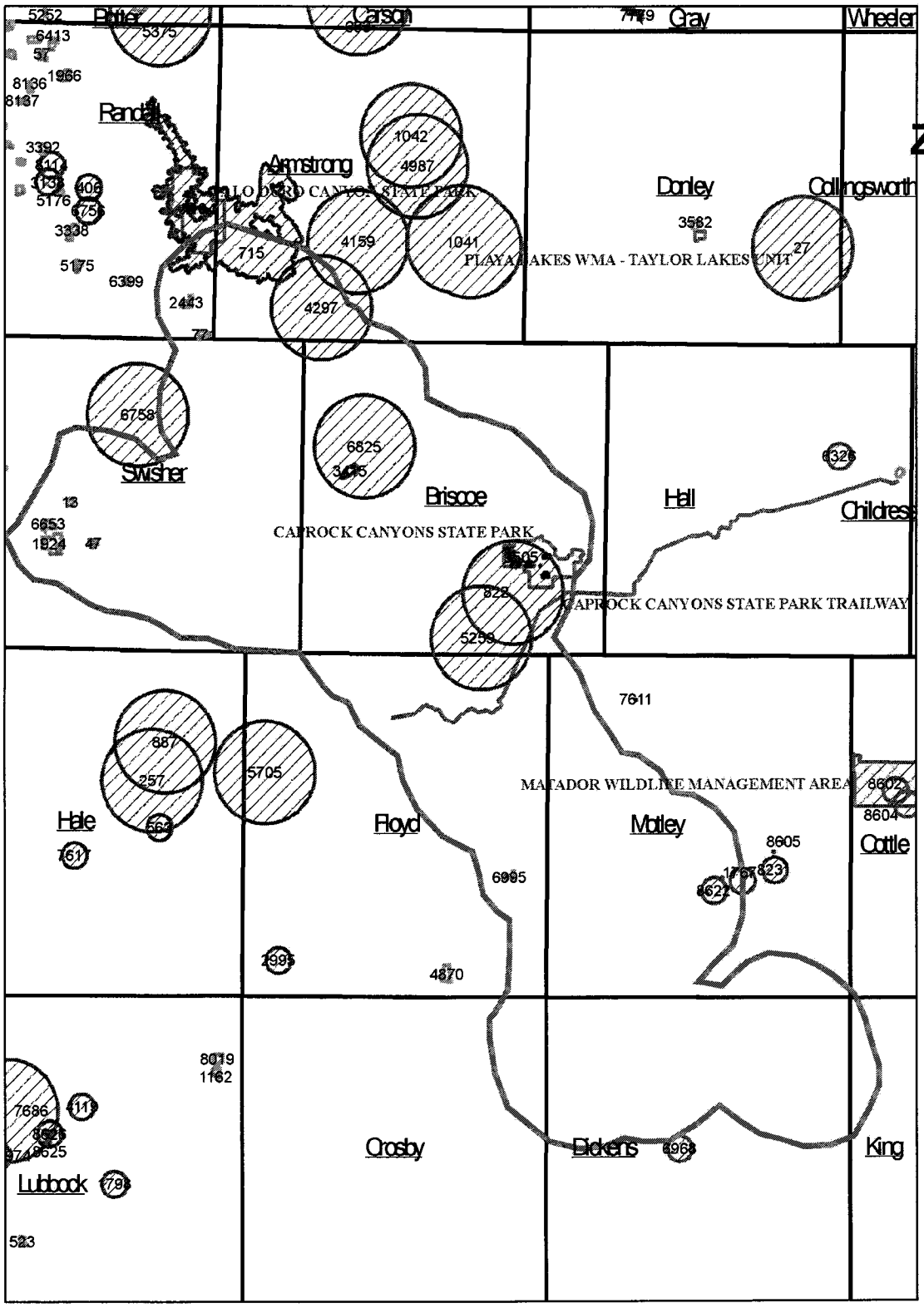
Legend

- Animal Assemblage
- Invertebrate Animal
- Nonvascular Plant
- Terrestrial Community - Other Classification
- Vascular Plant
- Vertebrate Animal
- Managed Area

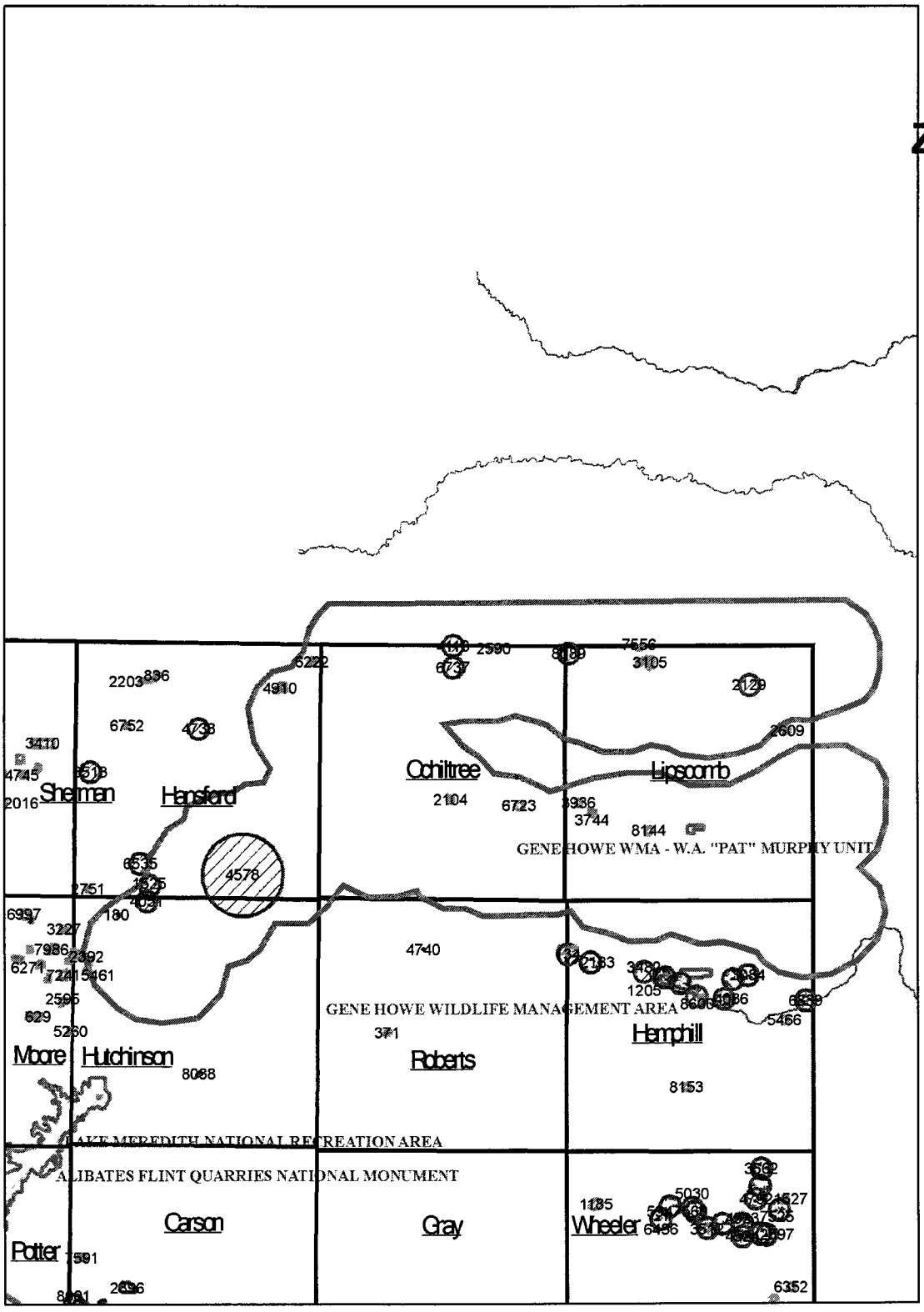


Legend

- Animal Assemblage
- Invertebrate Animal
- Nonvascular Plant
- Terrestrial Community - Other Classification
- Vascular Plant
- Vertebrate Animal
- Managed Area


Zone 2
Potter
Carson
Gray
Wheeler
Randall
Armstrong
PALO DURO CANYON STATE PARK
Donley
Collingsworth
PLAYA LAKES WMA - TAYLOR LAKES UNIT
Swisher
Briscoe
CAPROCK CANYONS STATE PARK
Hall
Childress
CAPROCK CANYONS STATE PARK TRAILWAY
Hale
Floyd
MATADOR WILDLIFE MANAGEMENT AREA
Motley
Cottle
Crosby
Dickens
King
Lubbock
5 2.5 0 5 Miles
Legend
Animal Assemblage
Invertebrate Animal
Nonvascular Plant
Terrestrial Community - Other Classification
Vascular Plant
Vertebrate Animal
Managed Area

Zone 3

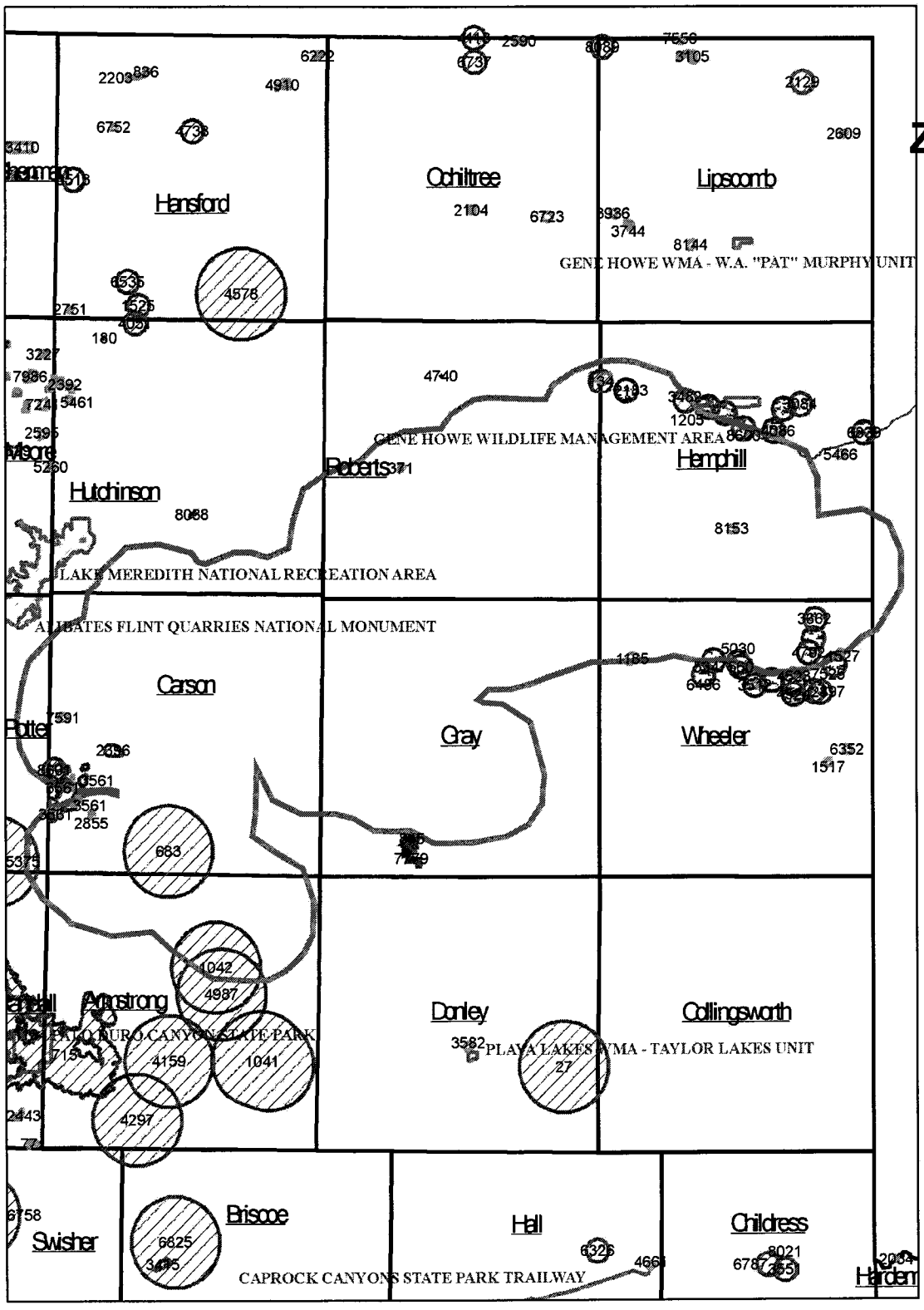


6 3 0 6 Miles

Legend

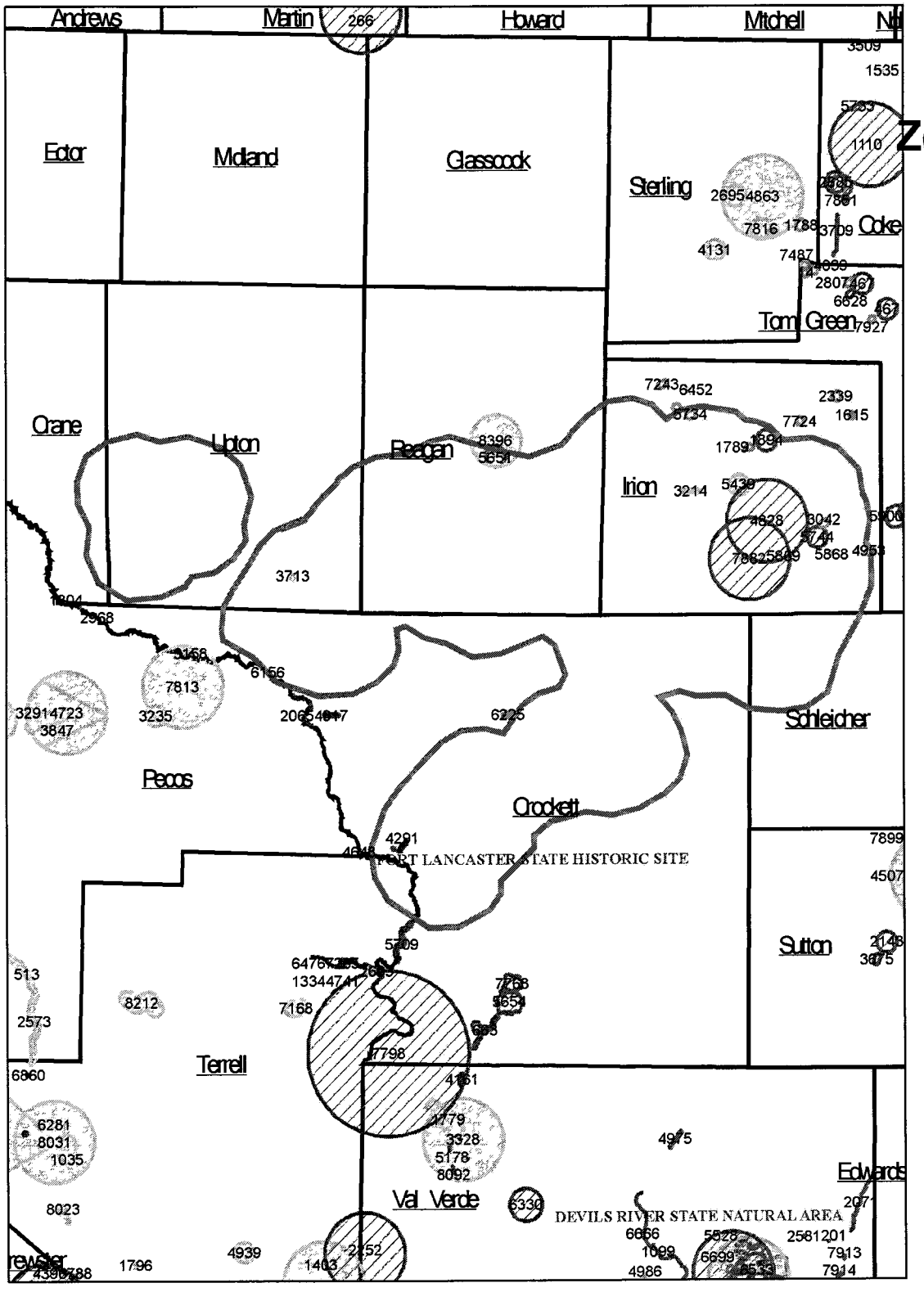
- Animal Assemblage
- Invertebrate Animal
- Nonvascular Plant
- Terrestrial Community - Other Classification
- Vascular Plant
- Vertebrate Animal
- Managed Area

Zone 4



Legend

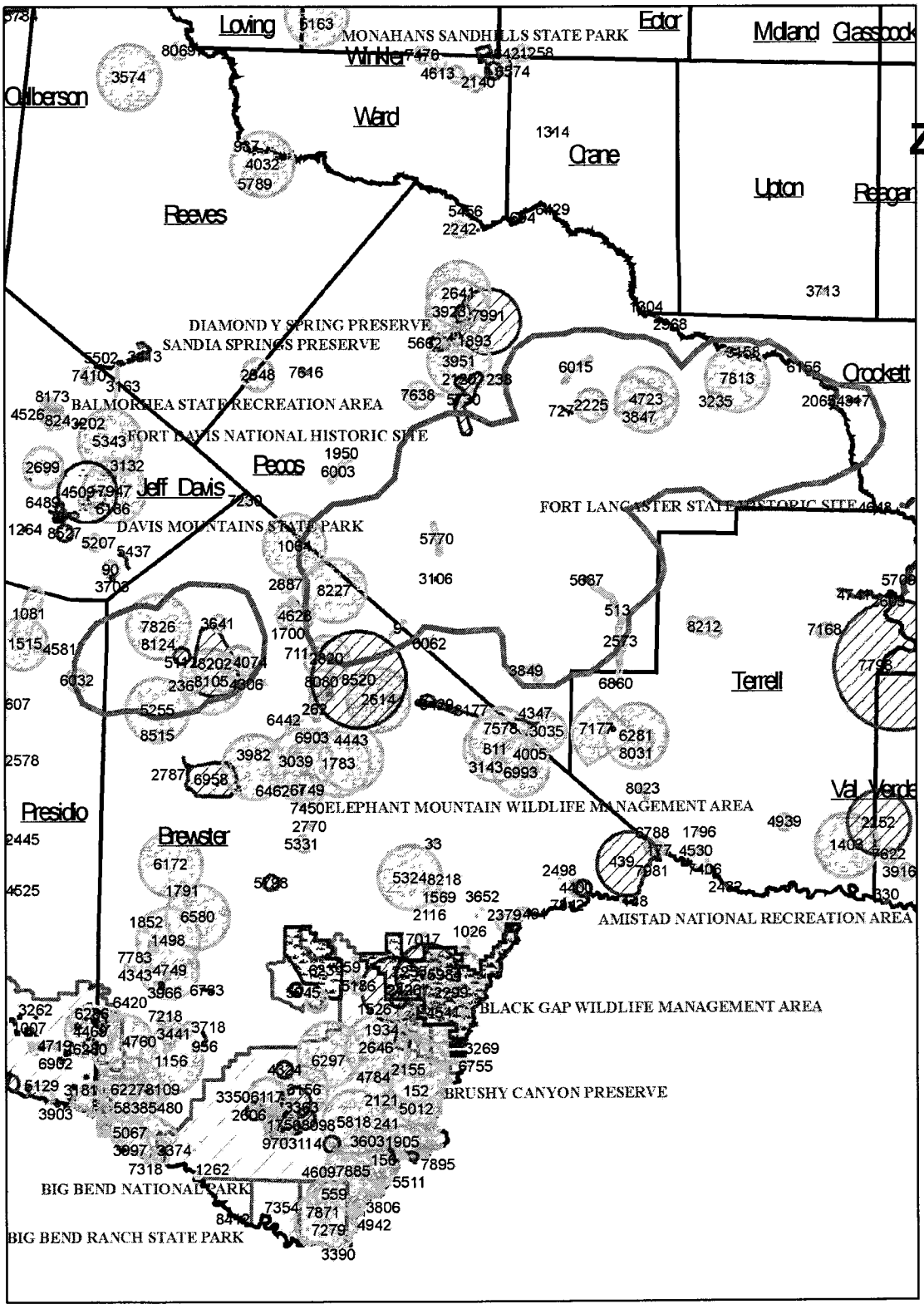
- Animal Assemblage
- Invertebrate Animal
- Nonvascular Plant
- Terrestrial Community - Other Classification
- Vascular Plant
- Vertebrate Animal
- Managed Area



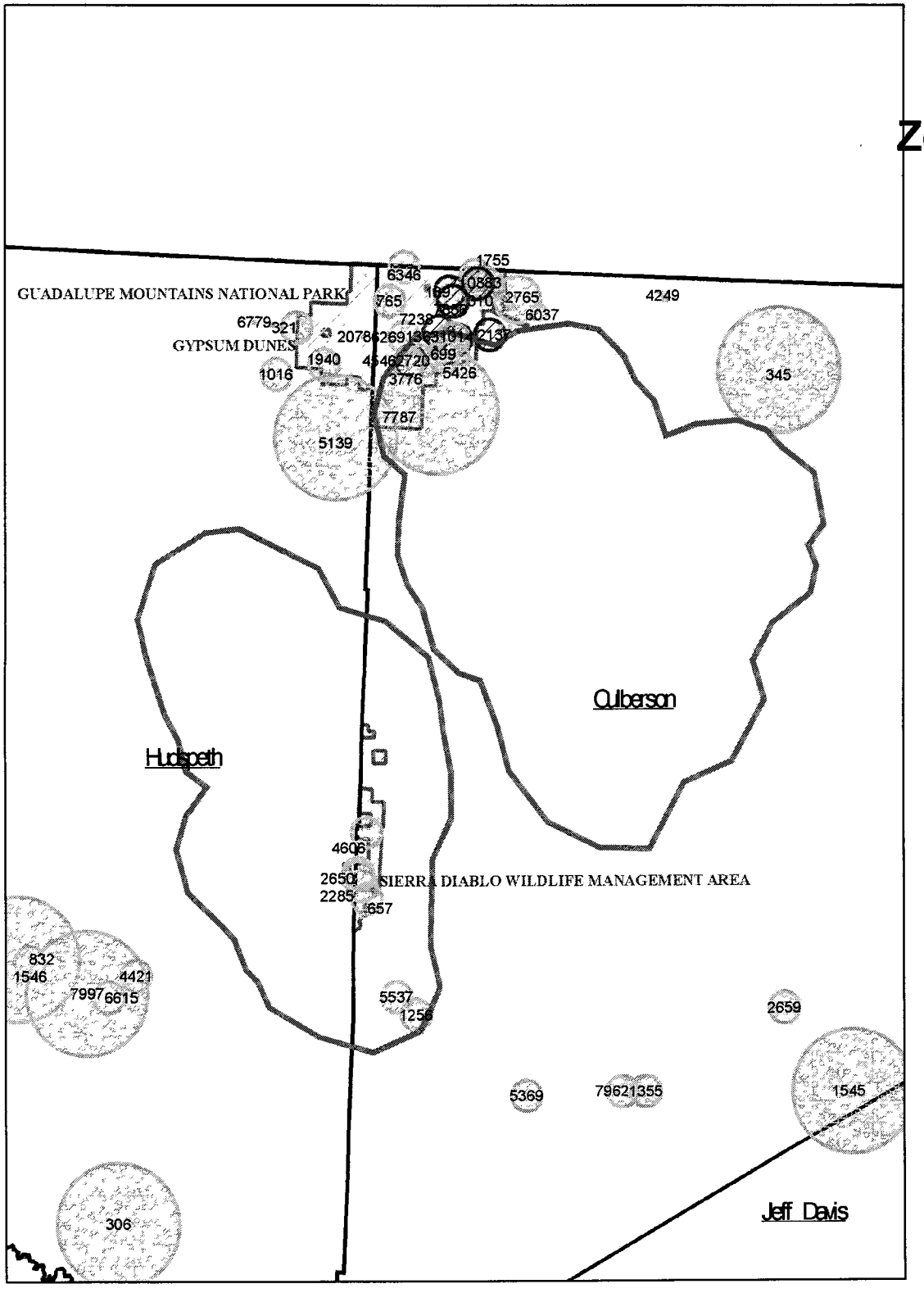
Zone 5

Legend

- Animal Assemblage
- Invertebrate Animal
- Nonvascular Plant
- Terrestrial Community - Other Classification
- Vascular Plant
- Vertebrate Animal
- Managed Area


Zone 6
Loving
Winkler
Ector
Midland
Glasscock
Culberson
Ward
Crane
Upton
Reagan
Reeves
Pecos
Crockett
Jeff Davis
Terrell
Presidio
Brewster
Val Verde
MONAHANS SANDHILLS STATE PARK
DIAMOND Y SPRING PRESERVE
SANDIA SPRINGS PRESERVE
BALMORHEA STATE RECREATION AREA
FORT DAVIS NATIONAL HISTORIC SITE
DAVIS MOUNTAINS STATE PARK
FORT LANCASTER STATE HISTORIC SITE
ELEPHANT MOUNTAIN WILDLIFE MANAGEMENT AREA
AMISTAD NATIONAL RECREATION AREA
BLACK GAP WILDLIFE MANAGEMENT AREA
BRUSHY CANYON PRESERVE
BIG BEND NATIONAL PARK
BIG BEND RANCH STATE PARK
9 4.5 0 9 Miles
Legend
Animal Assemblage
Invertebrate Animal
Nonvascular Plant
Terrestrial Community - Other Classification
Vascular Plant
Vertebrate Animal
Managed Area

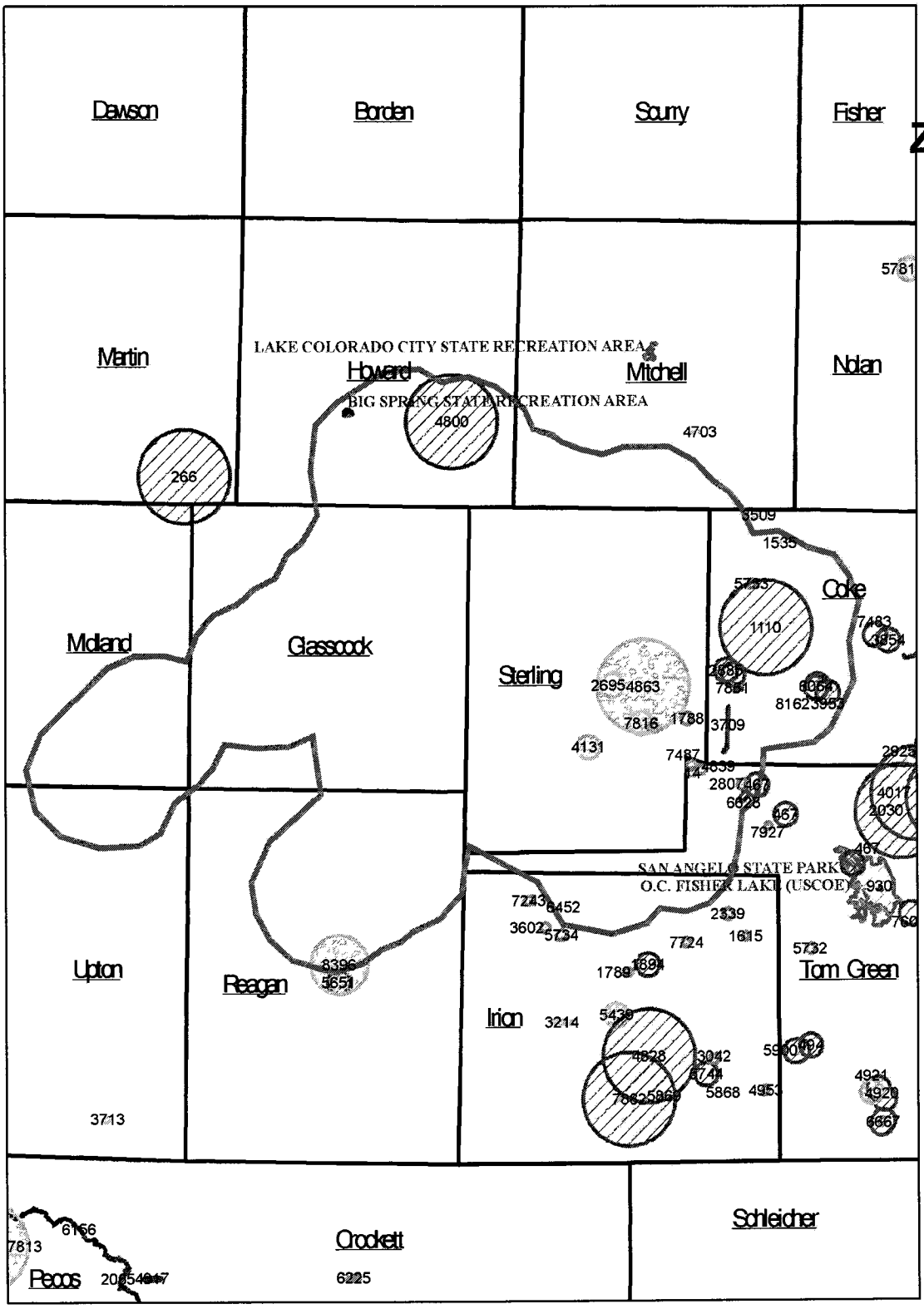
Zone 7



Legend

- Animal Assemblage
- Invertebrate Animal
- Nonvascular Plant
- Terrestrial Community - Other Classification
- Vascular Plant
- Vertebrate Animal
- Managed Area

Zone 9

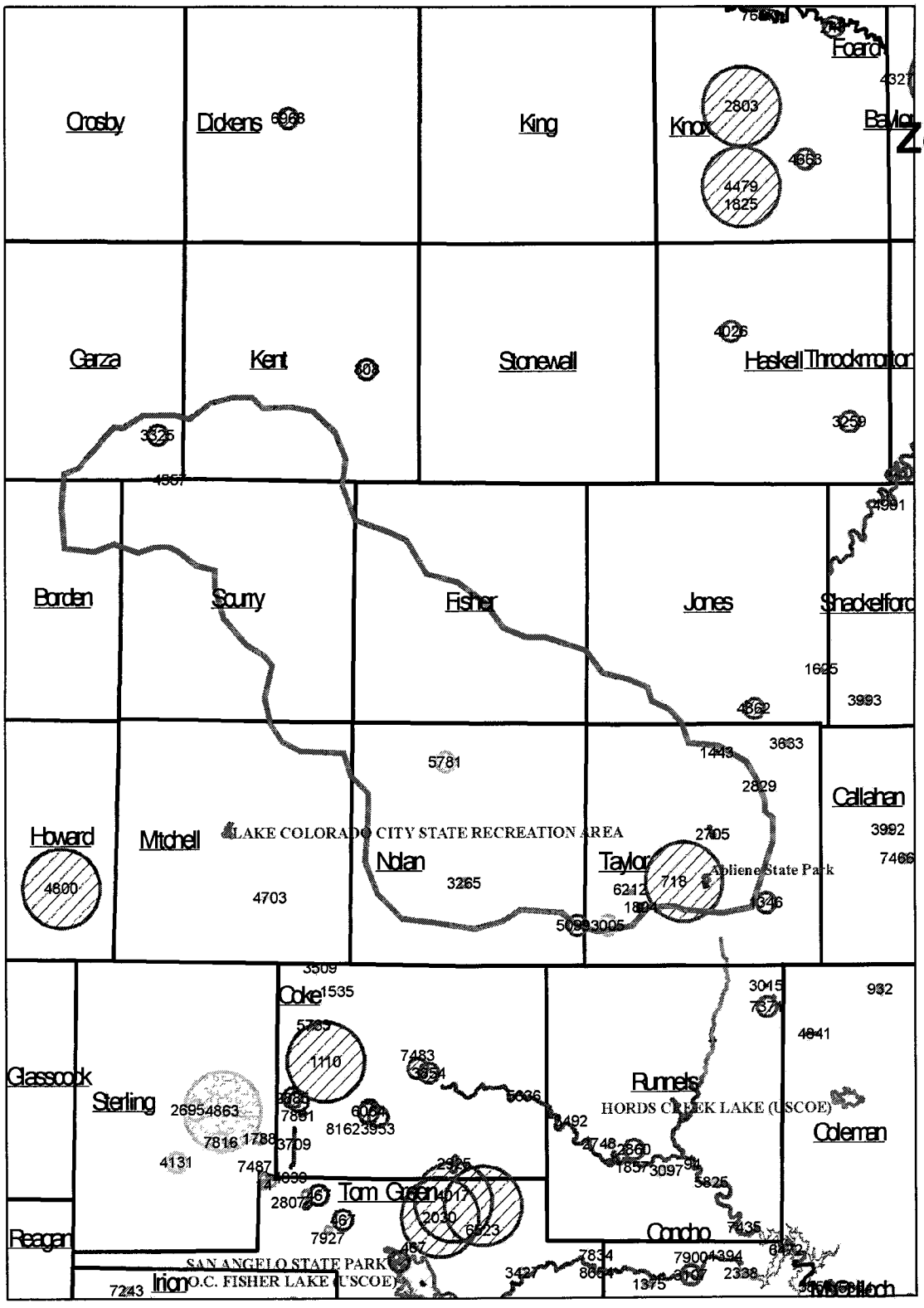


5 2.5 0 5 Miles

Legend

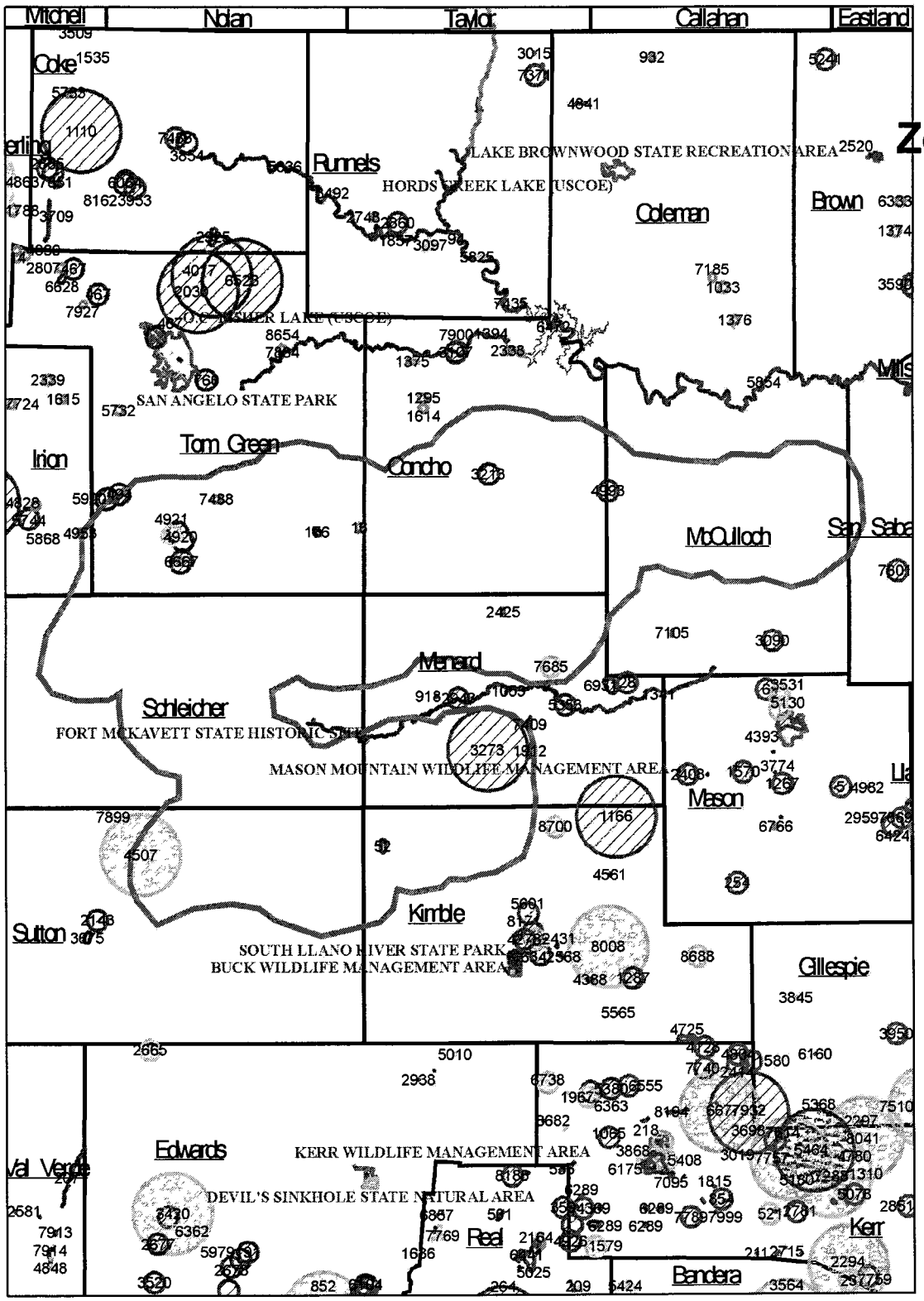
- Animal Assemblage
- Invertebrate Animal
- Nonvascular Plant
- Terrestrial Community - Other Classification
- Vascular Plant
- Vertebrate Animal
- Managed Area

Zone 10

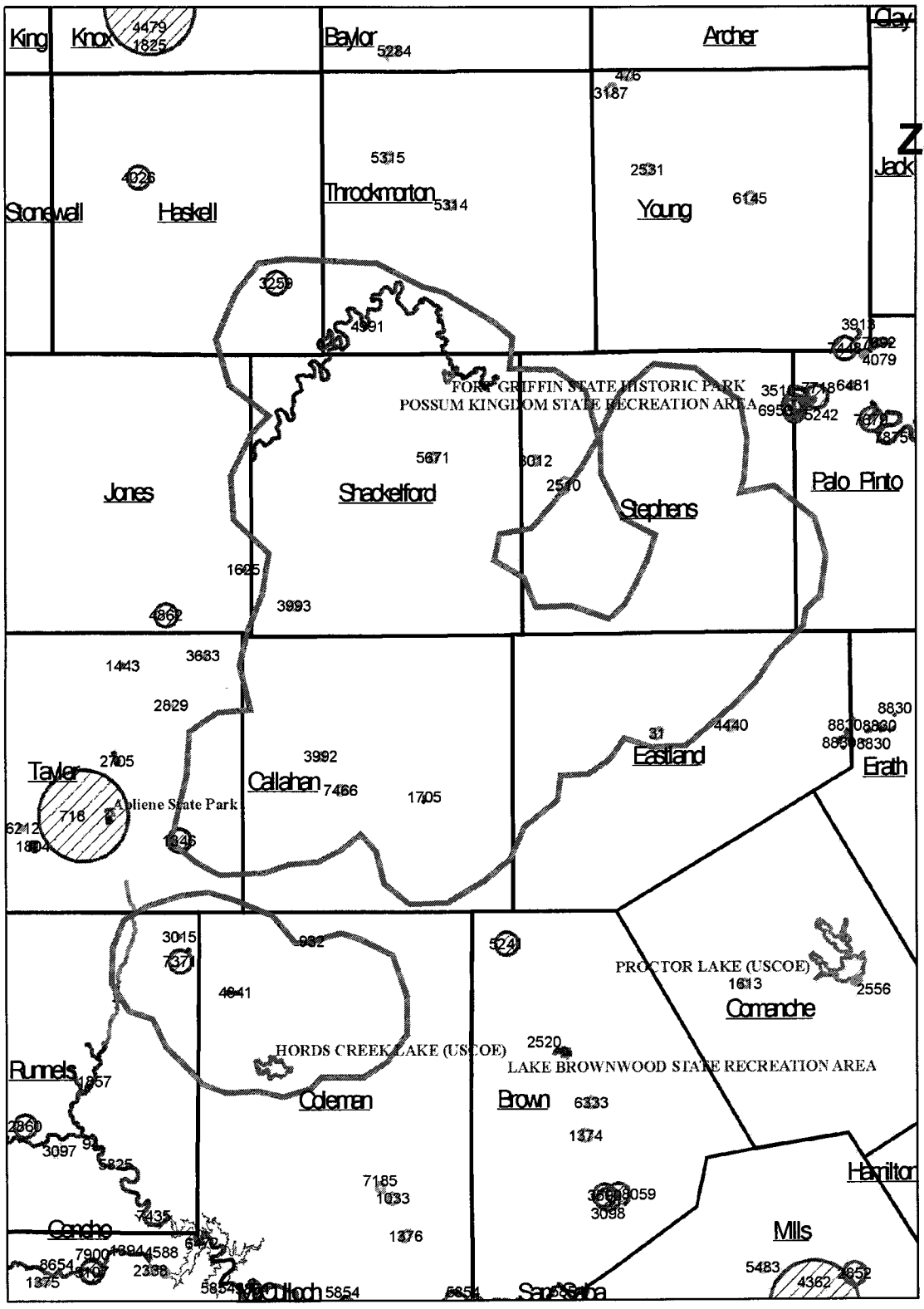


Legend

- Animal Assemblage
- Invertebrate Animal
- Nonvascular Plant
- Terrestrial Community - Other Classification
- Vascular Plant
- Vertebrate Animal
- Managed Area

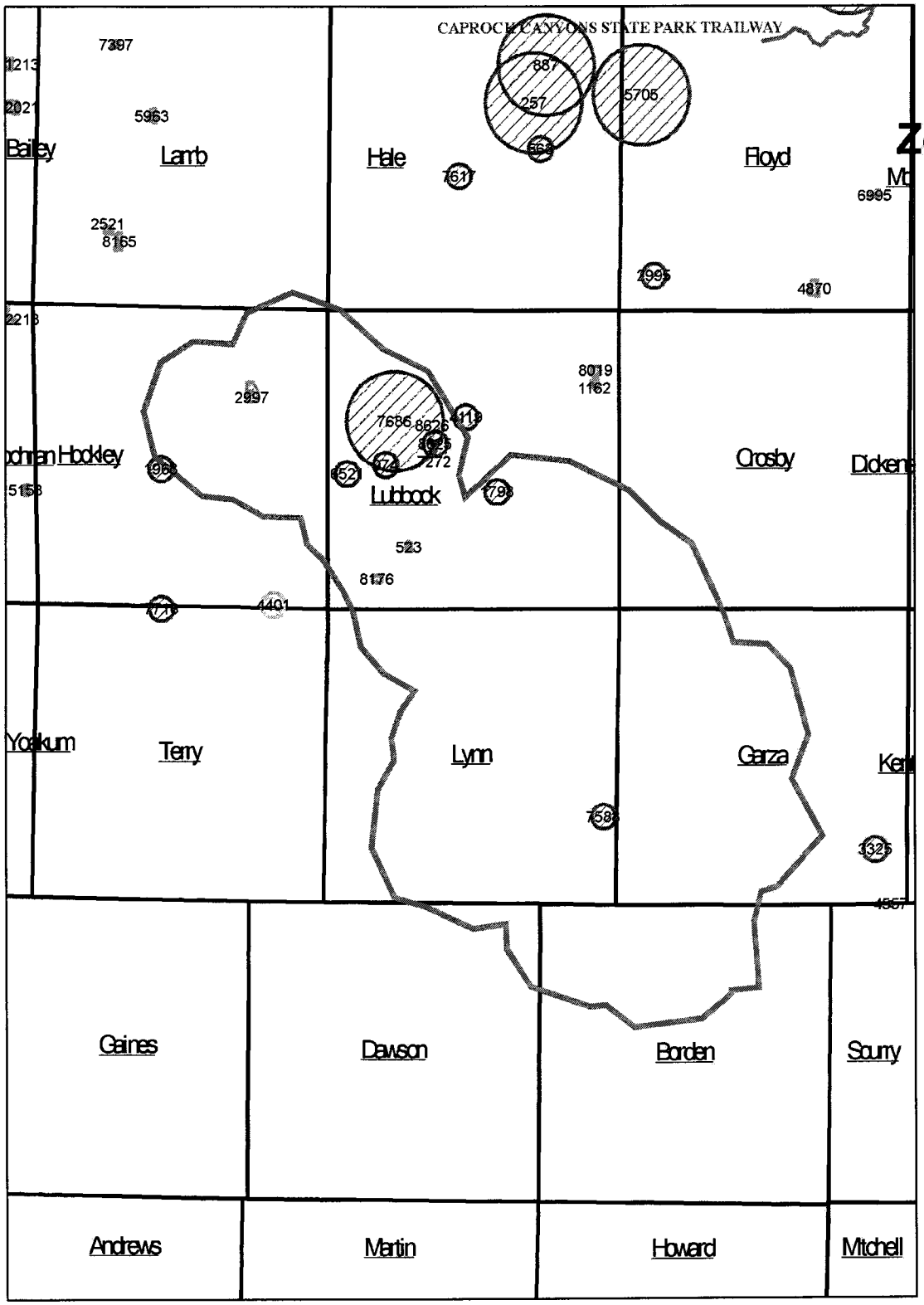

Mitchell
Nolan
Taylor
Callahan
Eastland
Coke
Runnels
Coleman
Brown
Concho
Tom Green
Irion
McCulloch
San Saba
Menard
Schleicher
Mason
Kimble
Sutton
Gillespie
Edwards
Real
Kerr
Bandera
Val Verde
LAKE BROWNWOOD STATE RECREATION AREA
HORDS CREEK LAKE (USCOE)
O.C. FISHER LAKE (USCOE)
SAN ANGELO STATE PARK
FORT MCKAVETT STATE HISTORIC SITE
MASON MOUNTAIN WILDLIFE MANAGEMENT AREA
SOUTH LLANO RIVER STATE PARK
BUCK WILDLIFE MANAGEMENT AREA
KERR WILDLIFE MANAGEMENT AREA
DEVIL'S SINKHOLE STATE NATURAL AREA
Zone 11
6 3 0 6 Miles
Legend
Animal Assemblage
Invertebrate Animal
Nonvascular Plant
Terrestrial Community - Other Classification
Vascular Plant
Vertebrate Animal
Managed Area

Zone 12



Legend

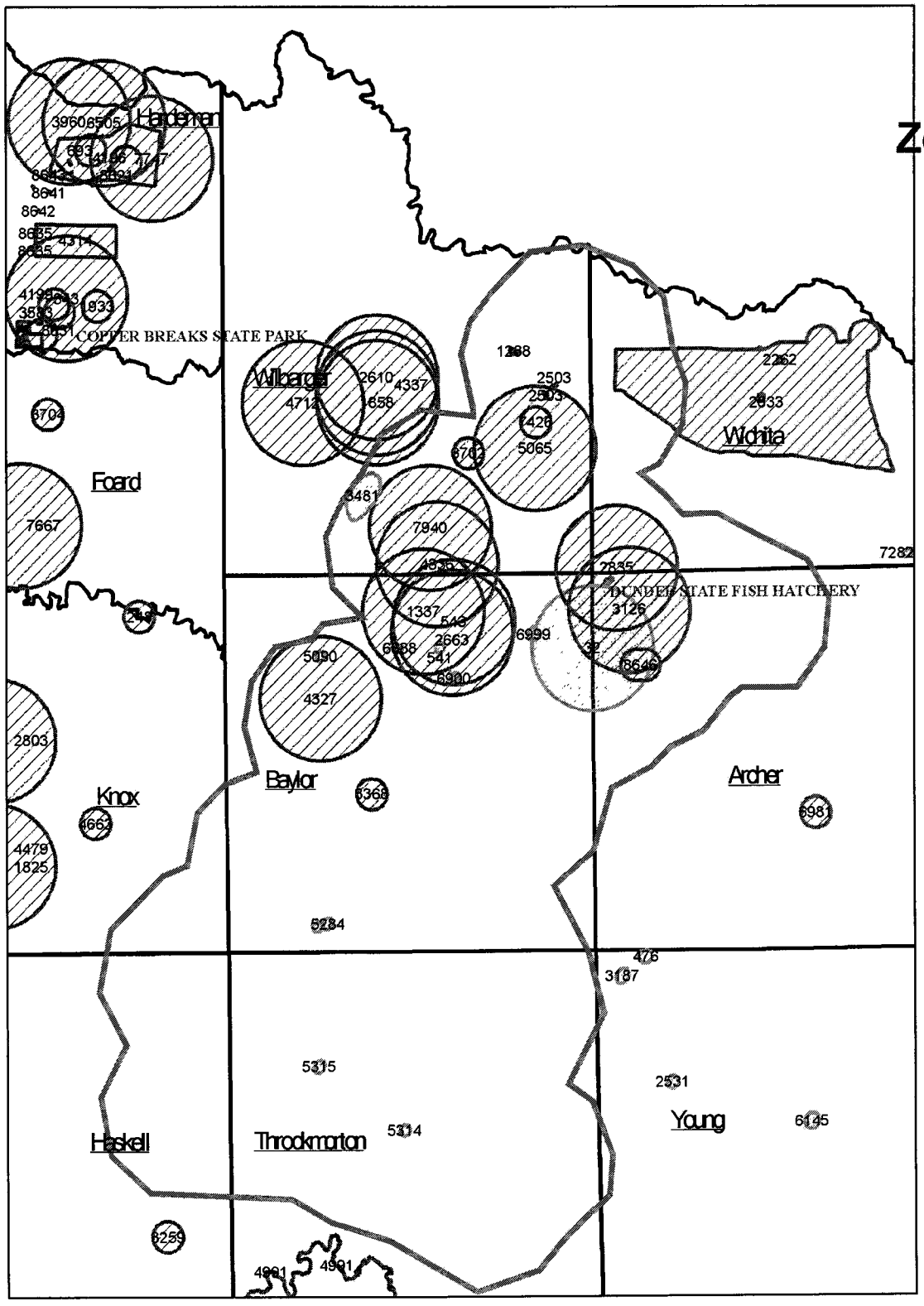
- Animal Assemblage
- Invertebrate Animal
- Nonvascular Plant
- Terrestrial Community - Other Classification
- Vascular Plant
- Vertebrate Animal
- Managed Area



Legend

- Animal Assemblage
- Invertebrate Animal
- Nonvascular Plant
- Terrestrial Community - Other Classification
- Vascular Plant
- Vertebrate Animal
- Managed Area

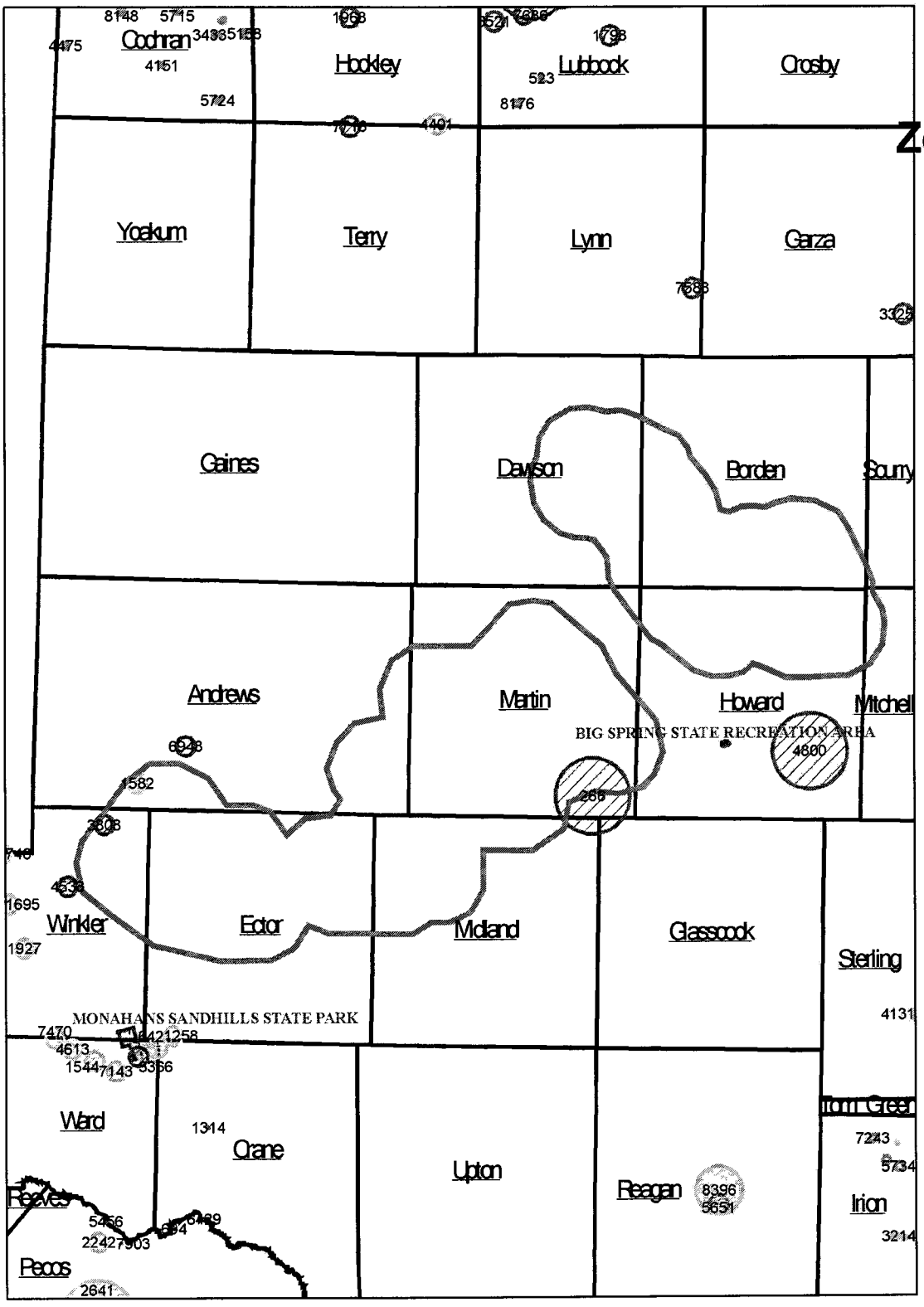
Zone 18



Legend

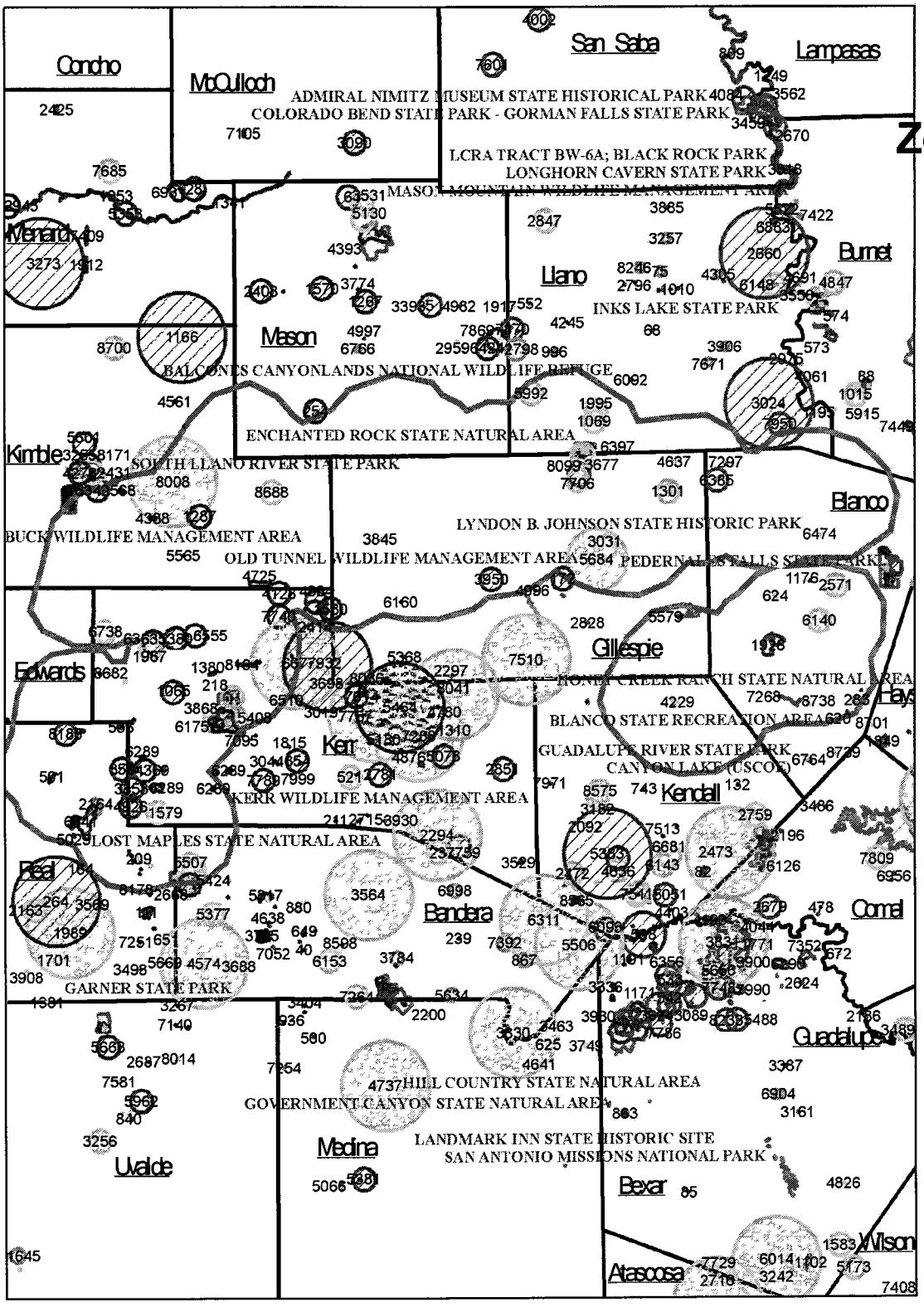
- Animal Assemblage
- Invertebrate Animal
- Nonvascular Plant
- Terrestrial Community - Other Classification
- Vascular Plant
- Vertebrate Animal
- Managed Area

Zone 19

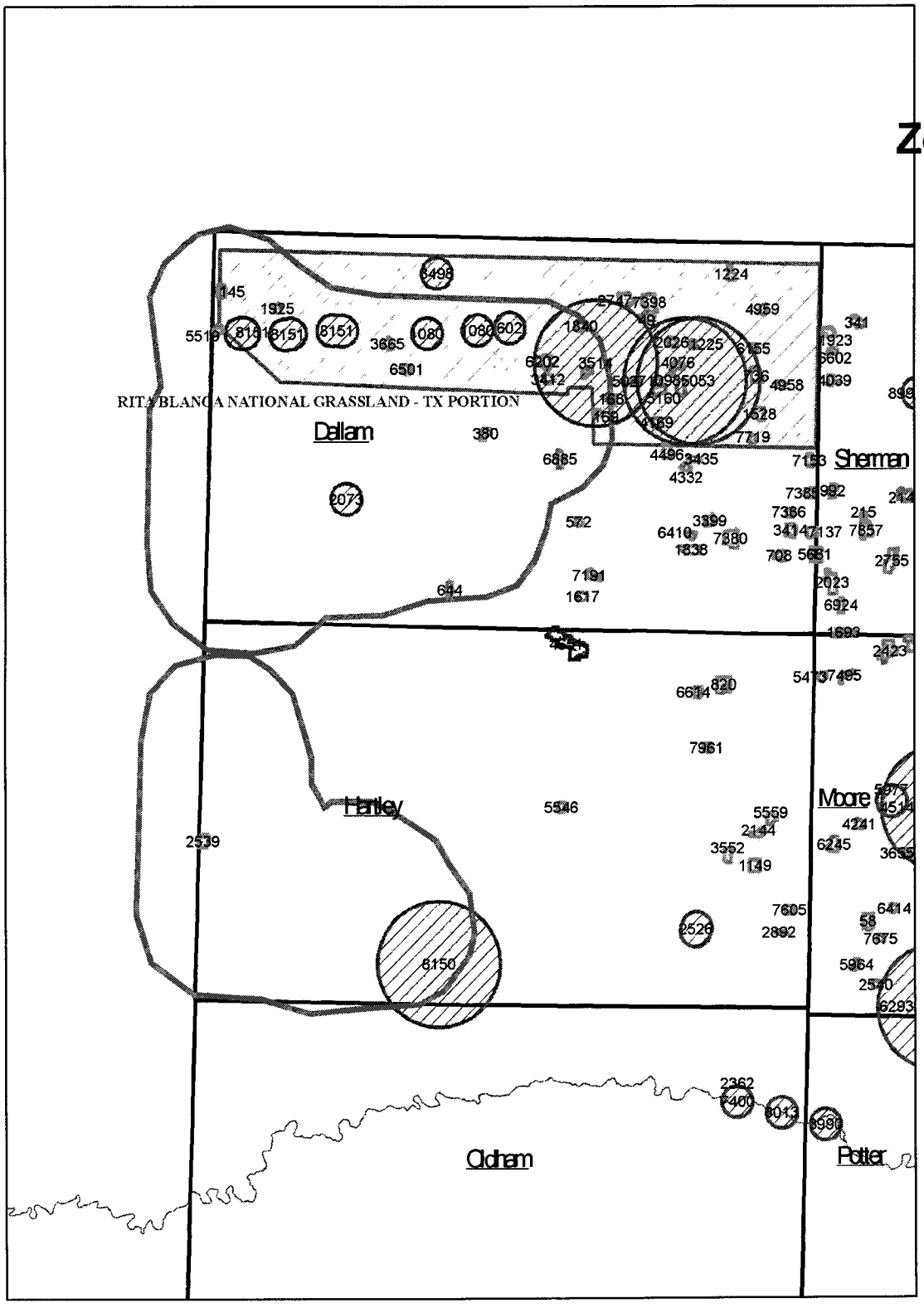


Legend

- Animal Assemblage
- Invertebrate Animal
- Nonvascular Plant
- Terrestrial Community - Other Classification
- Vascular Plant
- Vertebrate Animal
- Managed Area


Zone 20
Concho
McCulloch
San Saba
Lampasas
ADMIRAL NIMITZ MUSEUM STATE HISTORICAL PARK
COLORADO BEND STATE PARK - GORMAN FALLS STATE PARK
LCRA TRACT BW-6A; BLACK ROCK PARK
LONGHORN CAVERN STATE PARK
Menard
Llano
Burnet
INKS LAKE STATE PARK
Mason
BALCONES CANYONLANDS NATIONAL WILDLIFE REFUGE
ENCHANTED ROCK STATE NATURAL AREA
Kimble
SOUTH LLANO RIVER STATE PARK
Blanco
LYNDON B. JOHNSON STATE HISTORIC PARK
BUCK WILDLIFE MANAGEMENT AREA
OLD TUNNEL WILDLIFE MANAGEMENT AREA
Gillespie
Edwards
Kerr
BLANCO STATE RECREATION AREA
GUADALUPE RIVER STATE PARK
CANYON LAKE (USCOE)
Kendall
KERR WILDLIFE MANAGEMENT AREA
LOST MAPLES STATE NATURAL AREA
Real
Bandera
Comal
GARNER STATE PARK
Guadalupe
HILL COUNTRY STATE NATURAL AREA
GOVERNMENT CANYON STATE NATURAL AREA
LANDMARK INN STATE HISTORIC SITE
SAN ANTONIO MISSIONS NATIONAL PARK
Medina
Uvalde
Bexar
Atascosa
Wilson
6 3 0 6 Miles
Legend
Animal Assemblage
Nonvascular Plant
Vascular Plant
Invertebrate Animal
Terrestrial Community - Other Classification
Vertebrate Animal
Managed Area

Zone 21



Legend

- Animal Assemblage
- Invertebrate Animal
- Nonvascular Plant
- Terrestrial Community - Other Classification
- Vascular Plant
- Vertebrate Animal
- Managed Area