ID-AIF-318

November 30, 1989

Mr. John Jarowski
Chief, Wine and Beer Branch
Bureau of Alcohol, Tobacco and Firearms
1200 Pennsylvania Avenue
Washington, D. C. 20226

Re: Establishment of "Hill Country" Viticultural Area

Dear Mr. Jarowski:

We the undersigned hereby petition the Bureau of Alcohol, Tobacco and Firearms for establishment of an American viticultural area in Texas known as "Hill Country."

While grape growing and wine making have existed on a small scale in the "Hill Country" region of Texas for the better part of the last 150 years, the growing of vitis vinifera grape varieties and the making of wine therefrom began on an experimental scale in the mid-1970's and has progressed to a commercial scale where ten wineries and forty or so commercial and/or significant experimental vineyards exist today (see Exhibit A, existing vineyards, and Exhibit B, a list of existing wineries). At least three wineries and at least five major vineyards are planned for establishment in 1990.

As the Texas wine industry has developed over the past decade and a half, Hill Country wines have stood and continue to stand at the forefront of the industry's development. Hill Country wines are being marketed successfully in major U. S. and foreign wine markets, and are showing up in the winner's circles in various national and international wine competitions. We believe the numerous viticultural and enological accomplishments of the Hill Country, which come from a distinct region of Texas, justify the Hill Country region's status as an American viticultural area.

In layman's terms, the Hill Country of Texas is the broken or eroded portion of the Edwards Plateau that lies north and west of the Balcones Fault and south of the Low Rolling Plains of Texas (see Exhibit C which is a copy of a map from the Texas Almanac depicting the region). To more fully understand the boundaries of the "Hill Country," some background information is in order, especially on the nature of the Edwards Plateau of which the Hill Country is a part.

The Balcones Fault is a significant geological fault that extends from near the Sierra Madre Mountains in Mexico to near the Hudson Bay region of Canada. The Balcones Fault crosses out of Mexico into Texas at the Rio Grande River just northwest of the city of Del Rio, Texas; then runs generally eastward to the north and west side of San Antonio, Texas; then runs northeastward to the west side of Austin, Texas. The fault is very visible along this stretch from Del Rio to Austin. In fact, its very name, Balcones (for balcony, in Spanish), comes from the elevated status of the land to the north and west of the fault. This elevated land is known as the Edwards Plateau, which geologically speaking, is the southern extension of the Great High Plains of Texas.

The Balcones Fault proceeds northward from Austin to the west of Waco to between Fort Worth and Dallas and across the Red River. Along this stretch of the Balcones Fault, it is sometimes visible, sometimes not. To the west of the Balcones Fault from Austin northward lie the North Central or Low Rolling Plains of Texas, which are bounded on the south by the Edwards Plateau and on the west by the Great High Plains. The Edwards Plateau, therefore, is bounded on the south and east by the Balcones Fault and on the north and northwest by the Low Rolling Plains. The westward boundary of the Edwards Plateau is generally recognized as the Stockton Plateau, another geological region which, for all practical purposes, begins at the Pecos River.

The Edwards Plateau, once a near all flat elevated landform, has been severely eroded on its eastern side by several geological forces. The primary erosive force has been the flow of numerous rivers and streams which have their headwaters in the Edwards Plateau, such as the Nueces, Frio, Medina, Guadalupe, Blanco, Pedernales, Llano, and San Saba Rivers, as well as the Colorado River which has its headwaters in West Texas, all of which traverse the region in a generally south to easterly direction until they cross the Balcones Fault. These and other secondary streams, coupled with ancient volcanic activity and geological upheavals such as the Llano Uplift, have left a broken or eroded part of the Edwards Plateau in their wake as a region of low mountains, hills, canyons, and valleys. This eroded part of the Edwards Plateau is known as the "Hill Country" of Texas, and is the region for which we seek recognition as an American viticultural area.

The "Hill Country" region of Texas has probably been known by that nomenclature from the time that Texas acquired statehood. I have enclosed a copy of a portion of the 1939 Texas Almanac which describes the region in issue and depicts the region as the "Hill Country" of Texas (see Exhibit D). Today the Hill Country is known by that name nationally and internationally for many reasons--its unique geology, unique history, spectacular scenery, and incredible array of wildflowers. Additionally it has long been known for its ranching and mining,

and in recent years has become famous for many forms of outdoor recreation, which include hunting, fishing, world-class golf and tennis facilities, and many forms of water sports. Since the mid-1970's, the Hill Country has been gaining steadily increasing notoriety for its vineyards and wines. Of the ten wineries in the Hill Country, at least five have existed since the early 1980's. This coming April, the Hill Country region will celebrate its fifth annual Texas Hill Country Wine and Food Festival which spotlights, among other things, wines of the Hill Country region.

The Hill Country is geologically distinct from the other regions of Texas that surround it. To the northeast and east of the Hill Country and at lower elevations lie the Blackland Prairies. To the southeast, south, and southwest of the Hill Country and at lower elevations lie the Rio Grande Plains or "brush country" of South Texas. To the west of the Hill Country lie the less eroded, flatter portions of the Edwards Plateau. And to the north and northwest of the Hill Country lie the North Central or Low Rolling Plains of Texas. The Hill Country region varies from about 650 to 2550 feet in elevation above sea level.

The Hill Country itself is a very scenic land, with many clear water, spring-fed streams and numerous man-made lakes. Most of the hills of the region are limestone, sandstone or granite in nature, while the valleys usually contain varying types of sandy and or clay loam, most of a calcareous nature, but many with different underlying characters due to the complex geology of the region. The calcareous soils, coupled with the numerous geological underlying variations, are proving to be soils that successfully grow vinifera grapes which are being successfully vinified into quality wines. These soils are basically different from the soils of the Rio Grande Plains, the Blackland Prairies, and the North Central Plains which surround the Hill Country (see soil descriptions of these regions on Exhibit E).

The climate of the "Hill Country" during the grape growing season is likewise distinct from the climates of the regions of Texas that surround it. The climates of the Blackland Prairies to the northeast and east and the Rio Grande Plains to the south, are classified as "humid subtropical" (i.e., hot days, warm nights, and usually humid) insofar as the growing of grapes is concerned. These regions are heavily influenced by the prevailing warm humid southeasterly winds off the Gulf of Mexico during the growing season. While the Hill Country, which lies to the north of the Rio Grande Plains and west and southwest of the Blackland Prairies, likewise has hot day conditions for the growing of grapes, it almost always experiences cooler and less humid conditions at night than do the Blackland Prairies or the Rio Grande Plains. These lower humidity and cooler temperature conditions at night are extremely important for the growing of quality vinifera grapes. The differences in climate of the Hill Country as

opposed to those of the Blackland Prairies and Rio Grande Plains can be traced in part to the fact that the Hill Country is further removed from the Gulf of Mexico, so the air is less ladened with moisture, a feature that aids cooling at night. Its higher elevation--and, hence, thinner air with a greater proclivity for giving up heat at night--is another contributing factor. A third significant factor, however, and one which not only distinguishes the Hill Country climate from the climates of the Rio Grande Plains and Blackland Prairies but also from the otherwise similar climate of the Low Rolling Plains, is caused by a weather phenomena called the "Bermuda High." During the warmer half of the year (mid-April to mid-October), a very large high pressure area is often anchored near the island of Bermuda. As clockwise winds flow around this high pressure area across the Gulf of Mexico into Texas, quite warm and moist subtropical air is injected into the Rio Grande Plains and Blackland Prairies. Beyond the reach of this high pressure region, however, are winds that flow over the deserts of Chihuahua and Coahuila in Mexico and north into the Edwards Plateau and Hill Country during much of the growing season. The net positive effect on the climate during the day for the growing of grapes is the presence of hot, dry south to southwesterly winds rather than warm, humid southeasterly winds. The positive effect of these winds on grape growing in the Hill Country is even further amplified at night. At night, these desertlike winds subside and yield up their heat much more readily than the humid subtropical air to the east. This relatively cool and much drier air tends to pool in the evenings and then, because the surface elevations of the Edwards Plateau and Hill Country slope gently west to east, begins flowing or draining eastward down the Edwards Plateau and through the Hill Country. The net effect is very rapid evening cooling, with generally cooler nighttime temperatures for the region than those in the humid air of the Rio Grande Plains or Blackland Prairies. This nighttime cooling in the Hill Country is also much more rapid than evening cooling in the Low Rolling Plains to the north and northwest since that area is flat to rolling in nature and does not drain air as readily. Thus, in the Low Rolling Plains, temperatures tend to stay hotter longer in the evenings and at night during the growing season for grapes. The more rapid cooling of Hill Country air in the evening is a favorable, distinct climatic characteristic of the region which is quite conducive to the growing of quality wine grapes (see Exhibit F).

The climate of the rest of the Edwards Plateau to the west of the Hill Country is similar to that of the Hill Country; yet, it features even drier air like that of the Trans Pecos climatic region of Texas to the west. The main difference between the climate of the Hill Country and that of the rest of the Edwards Plateau is the presence of higher average rainfall amounts--24 to 28 inches per year for the Hill Country as opposed to 16 to 22 inches per year for the rest of the Edwards Plateau (see p. 18, Climatic Atlas of Texas).

An exact description of the Hill Country would require extensive survey at astronomical monetary cost. Fortunately, several major highways follow in very close proximity to the recognized geological boundaries of the Hill Country and serve to encircle the area in issue. Beginning in Austin, at the intersection of U.S. Highway 183 and Loop 360, follow U.S. Highway 183 northwestward to the town of Lometa and the intersection of State Highway 190. Then follow State Highway 190 westward through San Saba and Brady on to Menard and to the intersection of U.S. Highway 83. Then follow U.S. Highway 83 south to Junction and to the intersection of U.S. Highway 377. Then follow U.S. Highway 377 to Rocksprings and to the intersection of State Highway 55. Then follow State Highway 55 to Uvalde and to the intersection of U.S. Highway 90. Then follow U.S. Highway 90 east to its intersection with Loop 410 in San Antonio. Then follow Loop 410 north and then east to its intersection with IH 35. Then follow IH 35 northeastward to Austin to the intersection of Ben White Boulevard. Then follow Ben White Boulevard westward to U.S. Highway 290 where it crosses U.S. Highway 290 and becomes Loop 360. Then follow Loop 360 to the place of beginning where Loop 360 intersections U.S.Highway 183.

We have enclosed U.S.G.S. maps as well as a copy of a State of Texas Highway map depicting the area (Exhibit G).

Many of us in the Hill Country are very anxious to see this viticultural area established. To my knowledge there is no opposition to this application. It is also my understanding that those people in the Hill Country region who already have established viticultural area status are willing to have their areas as sub-appellations of the Hill Country.

Please let me know if anything else is needed to support this application.

Very truly yours,

Hugo Edwin Auler

Hugo Edwin Auler, Owner and Winemaker
FALL CREEK VINEYARDS
1111 Guadalupe Street
Austin, Texas 78701
512/476-4477

We the undersigned vineyard and/or winery owners in the Hill Country region of Texas hereby concur in our support of this application.

Name	Address	Vineyard/Winery	Location
O B Jackson Jr	3509 LAWTON AVE. Austin, Texas 78731	Middle Creek Vineyard	Blanco County
Richard Box	711 W. 38th St. Suite D-2 Austin, Tx 78705	Gabriel Mills Vineyard	Williamson County
Robert P. Oberhelmann	HC 61 - Box 22 Fredericksburg TX 78624	OBERHELLMANN VINEYARDS BELL MOUNTAIN WINERY	GILLESPIE
Patricia C. Williams	PO Box 608 San Saba, Tx 76877	GRANITE LAKE VINEYARD	BURNET COUNTY

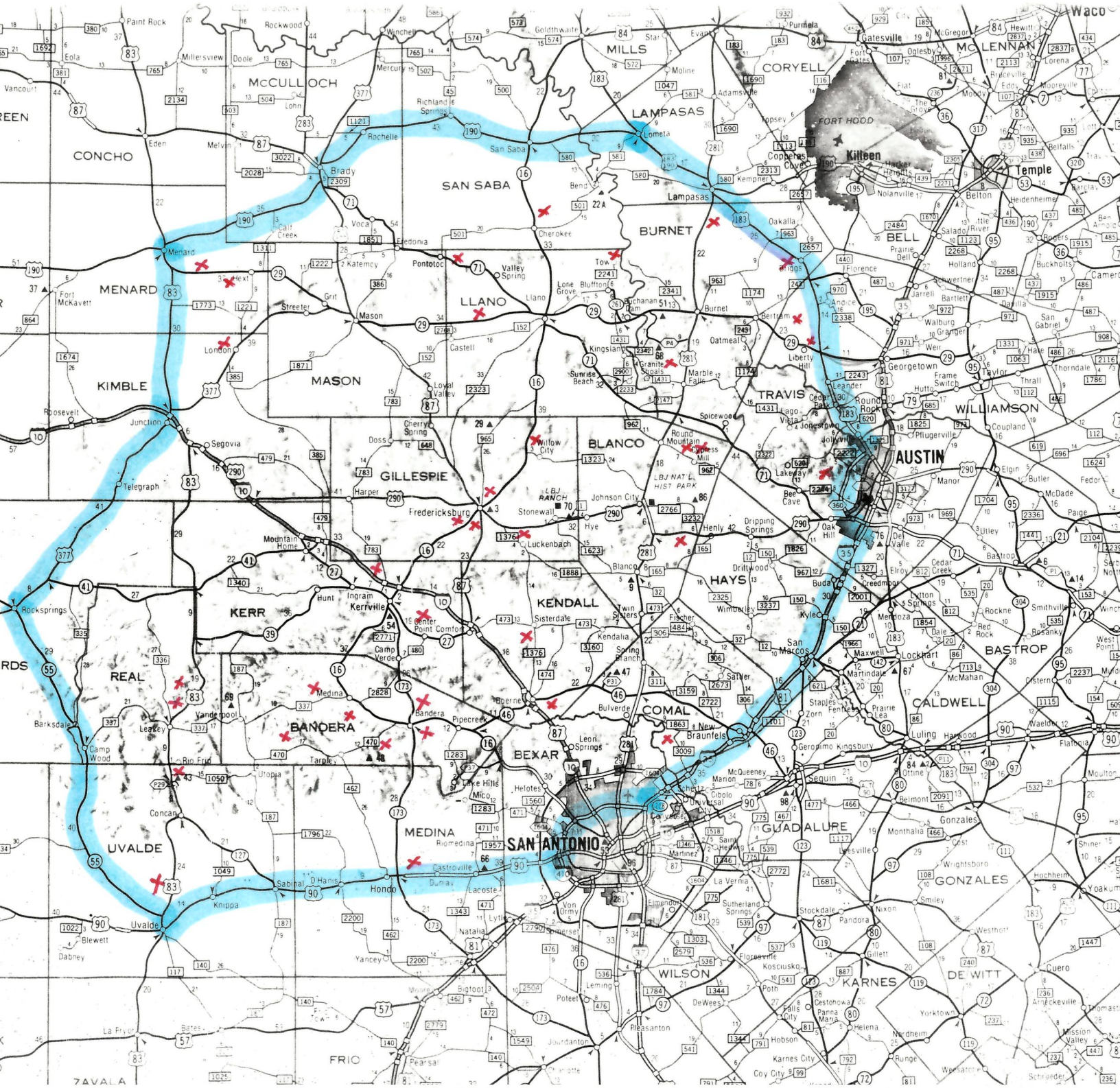

Waco
McLENNAN
MILLS
CORYELL
McCULLOCH
LAMPASAS
FORT HOOD
Killeen
Temple
CONCHO
SAN SABA
BURNET
BELL
MENARD
LLANO
KIMBLE
MASON
TRAVIS
WILLIAMSON
AUSTIN
BLANCO
GILLESPIE
HAYS
KERR
KENDALL
BASTROP
REAL
BANDERA
COMAL
CALDWELL
BEXAR
SAN ANTONIO
UVALDE
MEDINA
GUADALUPE
GONZALES
WILSON
KARNES
DE WITT
FRIO
ZAVALA

EXHIBIT B

Commercial Wineries in Existence in 1989

Cypress Valley Winery

Fall Creek Vineyards

Grape Creek Winery

Guadalupe Valley Winery

Moyer Texas Champagne Co.

Oberhellmann Vineyards

Pedernales Valley Winery

Sister Creek Vineyards

Slaughter-Leftwich Winery

Wimberley Valley Winery

EXHIBIT C

places this escarpment is a striking physical feature, rising abruptly 200, 500 and in some places almost 1,000 feet above the plains at its base. Where rivers issue from the eastern face of this escarpment there frequently are notable canyons such as the **Palo Duro Canyon** on the Prairie Dog Town Fork (main channel) of the Red River and the gorge along the Canadian as it crosses the Panhandle north of Amarillo.

Along the eastern edge of the Panhandle there is a gradual descent of the earth's surface from high to low plains, but at the Red River the Cap Rock Escarpment becomes a striking surface feature. It continues as an east-facing mountain wall south through Briscoe, Floyd, Motley, Dickens, Crosby, Garza and Borden Counties, gradually decreasing in elevation. South of Border County the escarpment turns west to the vicinity of Winkler County, then turns north through the eastern part of New Mexico.

Stretching over the largest level plain of its kind in the United States, the Great High Plains rise gradually from about 2,700 feet on the east to more than 4,000 in spots along the New Mexico border.

Chiefly because of climate and the resultant agriculture, subdivisions are called the **North Plains** and **South Plains.** The North Plains, from Hale County north, has primarily wheat and grain sorghum farming, but with significant ranching and petroleum developments. Amarillo is the largest city, with Plainview, Borger and others as important commercial centers. The South Plains, also a leading grain sorghum region, leads Texas in cotton production. Lubbock is the principal city, and Lubbock County the state's largest cotton producer. Irrigation, centered around Lubbock and Plainview, from underground reservoirs, waters much of the crop acreage. (See agricultural section.)

Edwards Plateau

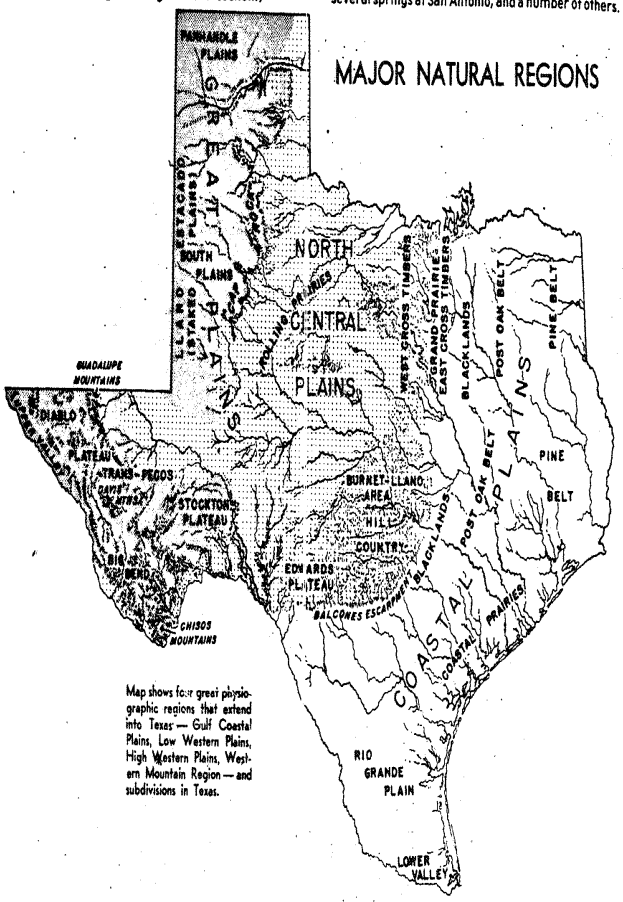
Geographers usually consider that the great plains at the foot of the Rocky Mountains actually continue southeastward from the High Plains of Northwest Texas to the Rio Grande and the line of the Balcones Escarpment. This southern and lower extension of the Great Plains in Texas is known as the Edwards Plateau.

It lies between the Rio Grande and the Colorado River. Its southeastern border is the Balcones Escarpment from the Rio Grande at Del Rio eastward to San Antonio and thence to Austin on the Colorado. Its upper boundary is the Pecos River, though the **Stockton Plateau** in the Trans-Pecos region is geologically and topographically classed with the Edwards Plateau. The Edwards Plateau varies from about 750 feet high at its southern and eastern borders to about 2,700 feet in places. Almost the entire surface is a thin, limestone-based soil covered with a medium to thick growth of cedar, small oak and mesquite with a varying growth of prickly pear. Grass for cattle, weeds for sheep and tree foliage for the browsing goats, support three industries—cattle, goat and sheep raising—upon which the area's economy depends. It is the nation's leading Angora goat and mohair producing region and one of the nation's leading sheep and wool areas. A few crops are grown.

The Hill Country

The Hill Country is a popular name for an area of hills and spring-fed streams along the edge of the Balcones Escarpment. It is popular with tourists who visit the dude ranches and other attractions. Notable large springs include **Barton Springs** at Austin, **San Marcos Springs** at San Marcos, **Comal Springs** at New Braunfels, several springs at San Antonio, and a number of others.

MAJOR NATURAL REGIONS



Map shows four great physiographic regions that extend into Texas — Gulf Coastal Plains, Low Western Plains, High Western Plains, Western Mountain Region — and subdivisions in Texas.

The McDonald Observatory of the University of Texas atop Mount Locke is also a point of interest for tourists. A state park has been established at **Fort Davis**, situated at the entrance to a pass through the mountains, where the old buildings of historic Fort Davis are situated.

Big Bend Park Project.

One other point of great interest in the Trans-Pecos region is the Big Bend area, so called because it lies in the great curve of the Rio Grande. **Los Chisos Mountains** and the several canyons along the Rio Grande, notably **Santa Helena**, are the principal attractions of this area. Los Chisos in Spanish means "the spirits" or "the ghosts," the mountains being so named because of their changing, shadowy hues. It is proposed to establish in this region, which has been called "the last frontier of the United States," a great national park, and the Federal Government has offered to take over the area and maintain it if the state will donate as much as 788,000 acres. Approximately 225,000 acres have been obtained by the state through action of the Legislature in ceding for the purpose all land that has reverted to the state through tax delinquency and certain original school lands that were purchased by the state at a nominal price from the school fund, leaving to the fund all mineral rights. Early in 1939 there remained the task of acquiring the remainder of the area required as the minimum for the establishment of a national park. Mexico has agreed to establish a park of about 400,000 acres on its side of the Rio Grande, making a great international playground.

The area is notable, not only for its scenic beauty, but for its interesting geologic formations and its varied flora and fauna. Although the Trans-Pecos table land is without vegetation except grasses, small shrubs, cacti and other plants characteristic of arid regions, the high mountain sides and valleys, where there is a greater rainfall, are green with forest growths of pine, oak, juniper, maple and other timbers, largely those of the Rocky Mountain and Pacific Coast varieties. In the Big Bend area there are also points of interest in the silver mine at Shafter and the quicksilver mines near Terlingua. Although the establishment of a national park had not been consummated early in 1939, a small area in Los Chisos Mountains had been developed by CCC labor, and a good road opens the area to tourist travel.

The Hill Country.

The Edwards Plateau of Southwest Texas, though lacking the high mountains of the Trans-Pecos, has great potentialities as a tourist resort and has developed rapidly as such in recent years. The cedar-covered mountains, the numberless spring-fed streams and the canyons—among which the Nueces, two branches of the Frio, the Medina and the Guadalupe are noteworthy—are gaining increasing popularity with vacationists. It is one of the best hunting grounds in America, the annual deer kill in this and adjacent area in Southwest Texas being about 30,000. This region is known as "the Hill Country."

The woods of East Texas hold many attractions for tourists, and the establishment of the great national forests here in recent years will increase their utilization by the public for recreational purposes. (See page 152.) From Brownsville to Port Arthur along the Gulf Coast there are fine bathing beaches and the area has acquired a national reputation among fishermen. Because of its position on the great north-south route of migratory birds it has been known as a bird wonderland since **John James Audubon** visited it the year after the Texas Revolution.

Places of Historic Interest.

Other points of interest include the Palo Duro Canyon near Amarillo, now a state park; Caddo Lake Park on the Texas-Louisiana border, also a state park; the border gateways along the Rio Grande with the charm of Latin America just beyond the end of the bridge, and the many places of historic interest. Among the latter, San Antonio with its **Alamo, "Cradle of Texas Liberty,"** and the other old missions stands first. However, the tourist will find interest in the old frontier forts, the San Jacinto Battlefield and monument at Houston and many quaint towns and villages which typify the varied development of Texas culture, among which may be mentioned **Castroville** west of San Antonio, settled by Alsatian colonists, and **Bandera**, settled first by Mormons and later by Polish refugees.

For a more detailed list of points of interest the reader is referred to the folded highway map between pages 384 and 385 of this volume, and the list in the lower left-hand corner which is keyed to numbers on the map.

The most significant development in Texas cultural progress in recent years has been the movement for state parks.

State Parks.

The following brief summary of park development in Texas, and the data on present state parks, are from William J. Lawson, executive secretary of the Texas State Parks Board, Austin:

When **Mrs. Isabella Neff**, in 1922, wished to deed a small tract of land on the banks of the Leon River to the State of Texas to be used by the general public perpetually, as a picnicking and religious meeting place, her son, then Gov. Pat M. Neff, discovered that Texas had no state park system and no department or division of the state authorized to hold title to park lands for the general public. He caused a bill to be introduced and passed by the Thirty-Eighth Legislature at its second called session in 1923, creating a State Parks Board, to be composed of members serving without pay, who were instructed to solicit donations to the state of tracts of land to be used as public parks and to investigate and report to the Legislature on the advisability and suitability of park sites. This act was the beginning of the state park movement in Texas.

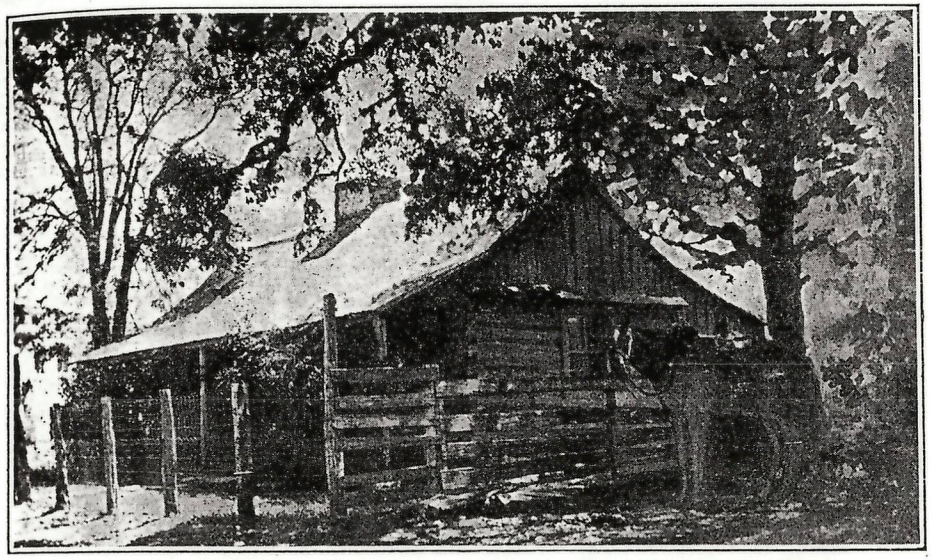
For a period of ten years, or until the advent of the CCC, Texas state parks consisted largely of small tracts of from two to fifty acres in area, which public-spirited citizens donated to the state. Practically no construction was attempted, other than a few cheaply built picnic units or benches, also donated by private persons.

With their chairman, the late **D. E. Colp**, Park Board members worked diligently, and with no appropriation from the Legislature acquired many beautiful sites.

In 1931 the Legislature authorized the Parks Board to lease the concessions and make concession contracts in the state parks and to use convict labor in the parks where practical.

Minimum Acreage Established.

The CCC came into existence in 1933, and was authorizet to assist the states in the construction and development of state parks. For the purpose of obtaining a CCC camp, a state park was defined as having a minimum of 500 acres. Parks that were already under the jurisdiction of the Park Board were too small to meet this requirement, and either had to be expanded to include 500 acres or had to depend upon WPA or some other government agency for their development. Localities interested in obtaining CCC camps and the benefits attendant thereon, acquired the large tracts of land and donated them to the State of Texas for park purposes. With two notable exceptions, Longhorn Cavern and Palo Duro Parks, all of the more important state parks have been donated without costing the state anything.



An old home at Bandera, Texas, built soon after the arrival of the Polish immigrants who settled in the colony originally established by Mormons and later abandoned by them. Bandera is one of many Texas communities with an interesting local history.

ROADSIDE IMPROVEMENT.

The roadside improvement division of the State Highway Department was inaugurated in April 1, 1933, for the preservation of existing growth and for planting on barren roadsides where no vegetation was growing. Two million young sprouts from old stumps of trees, which were cut before this program of roadside preservation was begun, and 320,000 large trees have been preserved in the rights of way.

The planting of roadsides is intended primarily for safety, by placing plants where they accentuate outside curves, hilltops, culvert and bridge ends, cross-roads, county roads, and highway direction signs by planting behind them. For these safety measures 500,000 trees and 600,000 shrubs and numerous vines had already been planted along the roadsides to the close of this fiscal year ended Aug. 31, 1938. Eighty tons of wild flower seeds and 100 tons of grass seeds had been planted to aid in the control of erosion and add to the appearance of the highways.

Recent State Legislatures have passed stock laws for fenced highways, making it a misdemeanor to permit loose stock along such highways; also a dumping law which prohibits dumping trash within 300 feet of any highway right of way.

For the comfort and convenience of travelers, there have been established at intervals along the highways:

Roadside parks larger than ½ acre (total acreage approximately 940 a.)	363
Turnouts and small parks (less than ½ acre)	311
Park tables on usual right of way	131
Centennial historical markers have been erected to the number of	264
Extra right of way for tree preservation	81.24 miles
Completed miles of federal aid planting projects	332.5 miles

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EXHIBIT E

SOIL CONSERVATION AND USE

The following discussion was prepared especially for the Texas Almanac by the **Soil Conservation Service**, U. S. Department of Agriculture, Temple, Texas. Additional information may be obtained from that source.

The vast expanse of Texas soils encouraged wasteful use of soil and water throughout much of the state's history. Some **1,000 different soils series** are recognized in the state. Settlers were attracted by these rich soils and the abundant water of the eastern half of the region, used them to build an agriculture and agribusiness of vast proportions, then found their abuse had created critical problems.

In the 1930s, interest in soil and water conservation began to mount. In 1935, the Soil Conservation Service was created in the U. S. Department of Agriculture. In 1939, the **Texas Soil Conservation Law** made it possible for landowners to organize local soil and water conservation districts.

The state as of Jan. 1, 1983, had **201 conservation districts** which manage the various conservation functions within the district. A subdivision of state government, each district is governed by a board of 5 elected landowners. Technical assistance in planning and applying conservation work is provided through the USDA Soil Conservation Service. State funds for districts are administered through the **Texas State Soil and Water Conservation Board.** (See Index.)

A recent national erosion inventory showed that more than twice as much soil is being lost to wind erosion each year than to sheet and rill erosion. The inventory also showed that about one-fourth of all land in Texas is "prime farmland."

The inventory showed this breakdown of land use:

Use	Acres
Non-Federal	
Cropland	30,430,000
Pastureland	18,773,000
Rangeland	95,401,000
Forestland	9,240,000
Urban and transportation	7,310,000
Other Land	3,725,000
Federal	
All land uses	2,887,000
Total Texas Land Area	167,766,000

Soil Subdivisions

Most authorities divide Texas into 20 major subdivisions that have similar or related soils, vegetation, topography, climate and land uses. These are called Major Land Resource Areas. Brief descriptions of these subdivisions follow.

1. TRANS-PECOS SOILS

The 18 million acres of the Trans-Pecos, mostly west of the Pecos River, are diverse plains and valleys intermixed with mountains — quite different from other Texas areas. (See also section on physiography.)

Upland soils are light reddish brown to brown clay loams, clays and sands, (mostly high in lime, some saline) and many areas of shallow soils and rock lands. Main series: Hoban, Reeves, Reagan (lower basins); Brewster, Lozier, Verhalen, Musquiz (mountains and valleys); Hueco, Wink, Kermit (sandy soils); Orla (gypsic soils). Bottomland soils are dark grayish brown to reddish brown, silt loams to clayey, alluvial soils (some saline). Main series: Harkey, Glendale, Saneli (Rio Grande); Pecos, Arno (Pecos River).

Rainfall is sparse, and vegetative cover is as thin and as variable as the topography, soils and drainage conditions. In general it is of two types: short grasses and shrubs on the flat soils of the basins and valleys, and a mixture of mid and short grasses and species of oak, pine, juniper and semiarid plants and shrubs on the rough and mountainous lands. Alkali sacaton and other salt tolerant plants occur in the basin.

2. HIGH PLAINS SOILS

The High Plains area comprises the vast high plateau of more than 19 million acres in Northwestern Texas. It lies in the southern part of the Great Plains province that includes large similar areas in Oklahoma and New Mexico. The flat, nearly level surface of very large areas has few streams of any dissection to cause local relief. However, several major rivers originate in the High Plains or cross the area. The largest is the Canadian River which has cut a deep valley across the Panhandle section.

Playas, small intermittent lakes scattered through the area, lie up to 20 feet below the surrounding flat plains. Early estimates were that playas numbered 37,000; a 1965 survey indicated more than 19,000 in 44 counties, occupying some 340,000 acres. They receive most of the runoff, with less than 10 percent of this water percolating back to the aquifer. In 1969 there were only limited numbers being utilized for recharge wells to return water to aquifers.

Soils are brown to reddish, mostly deep, clay loams, sandy loams and sands. Free lime is present under many soils at various depths. Main series: Pullman, Olton, Sherm (hardlands); Amarillo, Portales (mixed lands); Brownfield, Tivoli (sandy lands); Potter (loamy soils, shallow over caliche). The Guadalupe, Spur and Bippus series are the main soils of bottomlands, but are minor in extent.

The soils are moderately productive and the flat surface encourages irrigation and mechanization. Limited rainfall and constant danger of wind erosion are handicaps; but the region is Texas' leading producer of three most important crops — cotton, grain sorghums and wheat.

The native vegetation is of three distinct kinds. In the northern part and on the fine-textured soils south of the Canadian River, the vegetation is short grasses, mainly **buffalo** with some **grama.** In the southern part on the sandy loam soils it is largely **grama** and **threeawn.** On the deep sands it is mainly **little bluestem, sand dropseed, sideoats grama** and **threeawn grasses.** In places these sands support a thick growth of **shinoak** and **sand sage** (Artemisia).

3. ROLLING PLAINS SOILS

The Rolling Plains comprise an eastern section of the Great Plains in Northwestern Texas. The area lies west of the North Central Prairies and extends from the edge of the Edwards Plateau in Tom Green County northward into Oklahoma. It includes about 23 million acres. The **Red Beds** and associated reddish soils led to use of the name **Red Plains** by some.

Upland soils are pale brown through reddish brown to dark grayish brown; sandy loams, clay loams and clays. Most soils have free lime in the lower part and are saline in places; some are shallow and stony; some are deep sands. Main series: Miles, Woodward, Springer, Vernon, Tillman (northern two-thirds); Abilene, Rowena, Mereta, Lueders (southern one-third).

Bottomland soils include minor areas of reddish brown, sandy to clayey, alluvial soils. Main series: Lincoln, Yahola, Guadalupe, Clairemont, Spur, Bippus and Mangum.

The native vegetation varies with soils and surface conditions. On the finer textured soils **curly mesquite, buffalo** and **grama grasses** are dominant with some scattered shrubs in places. On the coarser-textured soils the principal grasses are **little bluestem, sideoats grama** and **threeawn grasses** with **sand sage** and **shinnery** on areas of deep sand.

4. ROLLING RED PRAIRIES SOILS

The Rolling Red Prairies occupy about 1 million acres in North Central Texas adjoining Oklahoma. The area is dominantly prairie. The principal soils are of the Anocon, Bluegrove, Kamay, Kirkland and Stoneburg series. Bottomland soils are of the Gaddy, Yomont and Mangum.

Native vegatation is mainly **little bluestem, sideoats, hairy** and **blue grama, Indian** and **buffalo grass.** The area is mainly used for cattle ranching and growing small grains.

5. NORTH CENTRAL PRAIRIE SOILS

The North Central Prairies occupy about 5 million acres in Central North Texas. The area lies between the Western Cross Timbers and Rolling Plains and was heretofore often referred to as the Reddish Prairie. The area is dominantly prairie, but numerous small wooded areas are intermixed. The principal soils are of the Truce, Thurber, Bonti, and Owens series. Narrow strips of alluvial soils, mainly of the Elandco and Frio series, occur in the flood plains of local streams. Small areas of other soils similar to those of the West Cross Timbers and Grand Prairie are intermixed. They are best suited for growing small grains and native grasses.

Native vegetation is mainly **little bluestem, sideoats, hairy** and **blue grama, Indian** and **buffalo grass.** Scrubby trees and shrubs, mainly **post oak** and **mesquite,** and **cacti** grow rather thickly in places.

6. EDWARDS PLATEAU SOILS

The 23 million acres of the Edwards Plateau are on an extensive tableland of Southwest Texas. Many of the soils are shallow over limestone, and streams have cut many valleys and canyons. Upland soils are dark, calcareous clays and clay loams, mostly gravelly and stony. Some deeper, less stony soils occur on the flat divides. Main series: Tarrant, Eckrant, Brackett and Tobosa (eastern two-thirds); Ector, Upton, Reagan (western one-third). Bottomland soils include minor areas of dark, calcareous, clayey alluvial soils. Main series: Frio, Oakalla and Dev.

This is principally a livestock, ranching region, the center of Texas' and the nation's mohair and wool production. Except where there is limited irrigation, cropping is largely confined to such drought-resistant crops as grain sorghums and grasses. Grasses, shrubs and scrubby trees dominate the native vegetation. There are many **cedar brakes.**

7. CENTRAL BASIN SOILS

The Central Basin, also known as the **Llano Basin,** occupies a relatively small area in Central Texas. It includes parts or all of Llano, Mason, Gillespie and adjoining counties. The total area is about 1.5 million acres.

Upland soils are reddish brown to brown, mostly gravelly and stony, sandy loams shallow over granite, limestone, gneiss and schist; deeper, less stony, sandy loam soils in the valleys. Main series: Pontotoc, Pedernales, Ligon, Castell, Katemcy, Hensley and Voca. Bottomland soils are minor areas of dark gray, alluvial soils. Main series: Frio, Gowen and Okalla.

The native vegetation is grass and small **oak** and **mesquite trees.** On some rocky slopes, **juniper** forms the principal growth. Ranching is the main enterprise, with some farms producing peaches, grain sorghum and wheat.

8. NORTHERN RIO GRANDE PLAIN SOILS

The Northern Rio Grande Plain comprises about 5 million acres in an area of Southern Texas extending from Uvalde to Beeville. The main soils are deep, reddish brown or dark grayish brown, loamy, and of the Cloverville, Elmendorf, Floresville, Miguel and Webb series in the eastern part. Native range is grassland, thorny brush and cacti. Most of the area is range grazed by beef cattle. Grain sorghum, cotton, corn, flax and small grains are grown in the eastern part. Irrigated crops are in the Winter Garden area of the western part and produces corn, cotton, grain sorghum, and truck crops such as spinach, carrots and cabbage.

9. WESTERN RIO GRANDE PLAIN SOILS

The Western Rio Grande Plain comprises about 6 million acres in an area of Southwestern Texas from Del Rio to Rio Grande City. The main upland soils are clayey, saline and of the Catarina and Montell series. The vegetation is mid and short grasses with low thorny brush and **cacti.** Soils along the Rio Grande are mainly the Laredo, Rio Grande and Zalla series. Most of the soils along the river are used for growing vegetables and sorghums. The upland soils are used for grazing beef cattle.

10. CENTRAL RIO GRANDE PLAIN SOILS

The Central Rio Grande Plain comprises about 6 million acres in an area of Southern Texas from Live Oak to Hidalgo County. The main soils are Nueces and Sarita series (sandy); Delfina, Delmita and Duval (loamy); Randado and Zapata series (shallow). The vegetation is tall and mid grasses with scattered trees and shrubs. Much of the area is in large ranches used for raising beef cattle. A few areas are used for growing grain sorghum, cotton and small grain.

11. LOWER RIO GRANDE VALLEY SOILS

The Lower Rio Grande Valley comprises about 1.5 million acres in extreme Southern Texas. The main soils are deep, loamy and clayey, and of the Brennan, Hidalgo, Harlingen, Raymondville and Rio Grande series. Most of the soils are used for growing irrigated vegetables and citrus, along with cotton, grain sorghum and sugar cane. Some areas are in range and used for growing beef cattle.

12. WEST CROSS TIMBERS SOILS

The West Cross Timbers comprises a total of about 2.7 million acres. The area includes the wooded section west of the Grand Prairie and extends from the Red River southward to the north edge of Brown County. Small areas also occur intermixed or interlaced with soils of the western part of the Grand Prairie. The principal series are Windthorst, Nimrod and Duffau. Narrow areas of alluvial soils, mainly of the Gowen series occur in the flood plains of local streams. Soils of the Ships, Yahola and Weswood series occur in the flood plains of the through-flowing rivers.

The native vegetation is mainly **shinnery oak** and **post oak** trees and a few other hardwoods. The trees are scrubby, of small size and unsuited for most uses other than **firewood** or **fence posts.** In places, grasses, including **little bluestem, grama** and **threeawn,** and scattered **mesquite** trees form a thick ground cover where the oak overstory is thin. Rangeland and pastures are used for grazing beef and dairy cattle. Crops are peanuts, grain sorghum, small grains, peaches, pecans and vegetables.

13. EAST CROSS TIMBERS SOILS

The East Cross Timbers includes a long narrow strip of wooded soils that separates the northern parts of the Blackland Prairie and Grand Prairie. This strip is only a few miles wide and extends from the Red River southward into Hill County and includes a total area of about 1 million acres. The soils are mainly of the Callisburg, Crossteil, Silstid and Gasil series

The native vegetation is mainly **post oak** trees and a few other hardwoods. The trees are scrubby, of small size and unsuited for most uses other than firewood or fence posts. In places, grasses, including **little bluestem, grama** and **threeawn,** and scattered **mesquite** trees form a thick ground cover where the oak overstory is thin. Rangelands and pastures are used for grazing beef and dairy cattle. Crops are peanuts, grain sorghums, small grains, peaches, pecans and vegetables

14. GRAND PRAIRIE SOILS

The Grand Prairie includes the prairie just west of the Blackland Prairie in North Central Texas. It extends south from the Red River to about the Colorado River and comprises about 7 million acres.

The principal soils of the Grand Prairie are of the Eckrant, Slidell and Denton series. Small areas of soils of the Crawford, Brackett, Krum and Lewisville series occur also on the uplands. Alluvial soils, mainly of the Frio and Bosque series, occur in the flood plains of streams.

The native vegetation is mainly short grasses with some mid and tall grasses on the deeper soils. **Buffalo** and **grama grasses, little bluestem** and **Indian grass** are the most widespread. In many places, especially on rocky slopes of shallow soils, small **oak** and **juniper trees** form a thick cover, and scattered **mesquite trees** occur throughout the area. The area is mainly used for growing beef cattle. Some small grain, grain sorghum and corn are grown.

15. BLACKLAND PRAIRIE SOILS

An almost treeless area, the Blackland Prairies consist of about 13 million acres of East Central Texas extending southwesterly from the Red River to Bexar County. There are smaller, similar areas to the southeast.

The soils of the greater portion of the Blackland Prairie proper are mainly of the Houston Black, Heiden and Austin series with smaller areas of Lewisville, Altoga and Eddy soils. Bottomland soils are mainly Tinn and Trinity clays.

The native vegetation consists of bunch and short grasses. The main species are little and big **bluestems, grama, Indian, buffalo** and **threeawn grasses.** In places, scattered **mesquite trees, cacti** and other shrubs form a rather thick cover. Hardwood trees — mainly **elm, hackberry** and **pecan** — occur in stream bottoms. The main crops are grain sorghum, wheat, cotton, corn and hay. Pastures are used for beef and dairy cattle.

16. CLAYPAN AREA SOILS

The Claypan Area is a nearly level to gently rolling moderately dissected woodland savannah to brushy area (**Post Oak Belt**) with moderate surface drainage. The area is more than 3.5 million acres.

Upland soils are sandy loams, commonly thin over gray, mottled or red, firm, clayey subsoils. Some deep, sandy soils with less clayey subsoils exist. Main series: Lufkin, Axtell, Tabor (thin-surface claypan soils); Freestone and Padina (thick-surface sandy and loamy soils). Bottomlands are reddish brown to dark gray, to loamy to clayey alluvial soils. Main series: Ships, Weswood (Brazos and Colorado Rivers); Kaufman, Trinity, Gladewater, Nahatche (Trinity River and other smaller streams).

Vegetation consists of scattered stands of **post oak** and **blackjack oak** with tall bunch grasses in the uplands; **yaupon** and other underbrush prevalent in places. In the bottomlands, hardwoods are predominant but **pecans** occur in some areas. The land is woodland and

EXHIBIT F

There are no fully operative weather data recording stations in the Texas Hill Country, as Austin, San Antonio, Del Rio, San Angelo, Abilene, and Waco are either on the perimeter or outside the Hill Country. Consequently, the descriptions of the climates in the text of the letter are based largely on the personal observations of myself and numerous other people. These observations are confirmed by Mr. George W. Bomar, one of Texas' foremost meteorologists, whose credentials are attached hereto and who is available to answer questions the Bureau of Alcohol, Tobacco and Firearms may have on the subject.