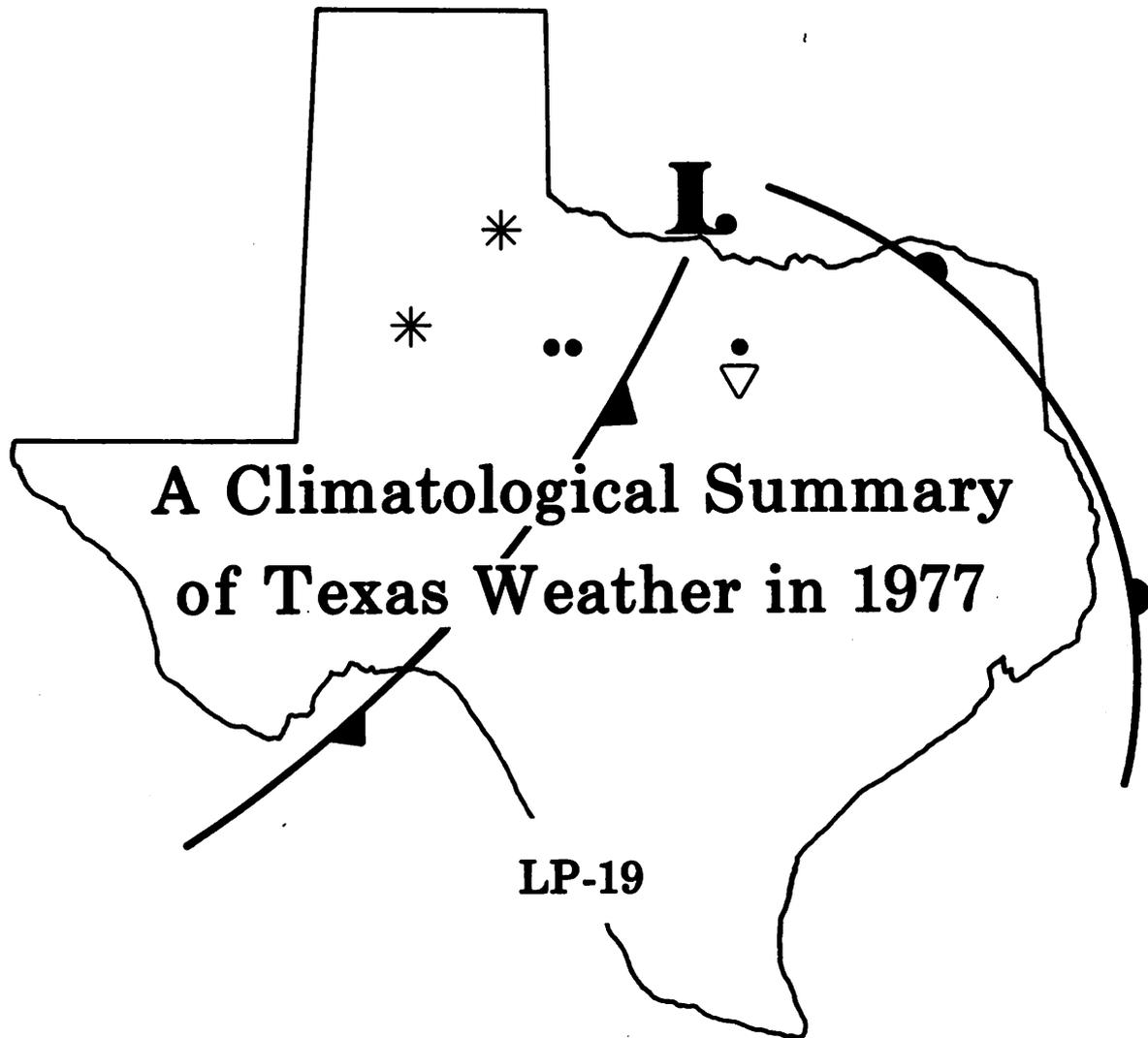


# 1977: FROM ONE EXTREME TO THE OTHER



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A Summary of Texas Weather During the Year

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An extraordinarily cold and rather wet winter gave way to a scorchingly dry summer in Texas in 1977, making the year one of marked transition weatherwise. With the late winter and early spring rains ceasing abruptly in May, a prolonged period of abnormally dry weather culminated in the spread of moderate drought over nearly half of the State as the year came to an end.

The year was not a "typical" one in several respects. No tropical storm made landfall in Texas during the "hurricane" season of the year, although Hurricane Anita did give the Lower Valley appreciable rains before it smashed into the Mexican coast in early September. The year will also be remembered for the occurrence of a number of massive dust and windstorms, several of which carried precious West Texas topsoil hundreds of miles eastward. Although some damage was sustained in isolated areas by spring and summer tornadoes (and one bizarre "twister" in December), the number of tornadoes reported in Texas during the year was somewhat less than that observed during the phenomenal year of 1976. For the second consecutive year, the State witnessed another strange event: the Trans-Pecos region received rain, albeit in small amounts, from a hurricane that struck Baja California in mid-August. Although the year was a "normal" one in that significant snowfalls occurred over the northern half of the State in January, an atypical feature of the 1977 winter was the very heavy snowfall accumulations--a foot or more--which occurred in parts of the middle Red River Valley. An unusually

late spell of 100-plus temperature readings in September helped make the summer of 1977 in much of the State one of the hottest in memory.

#### RAINFALL

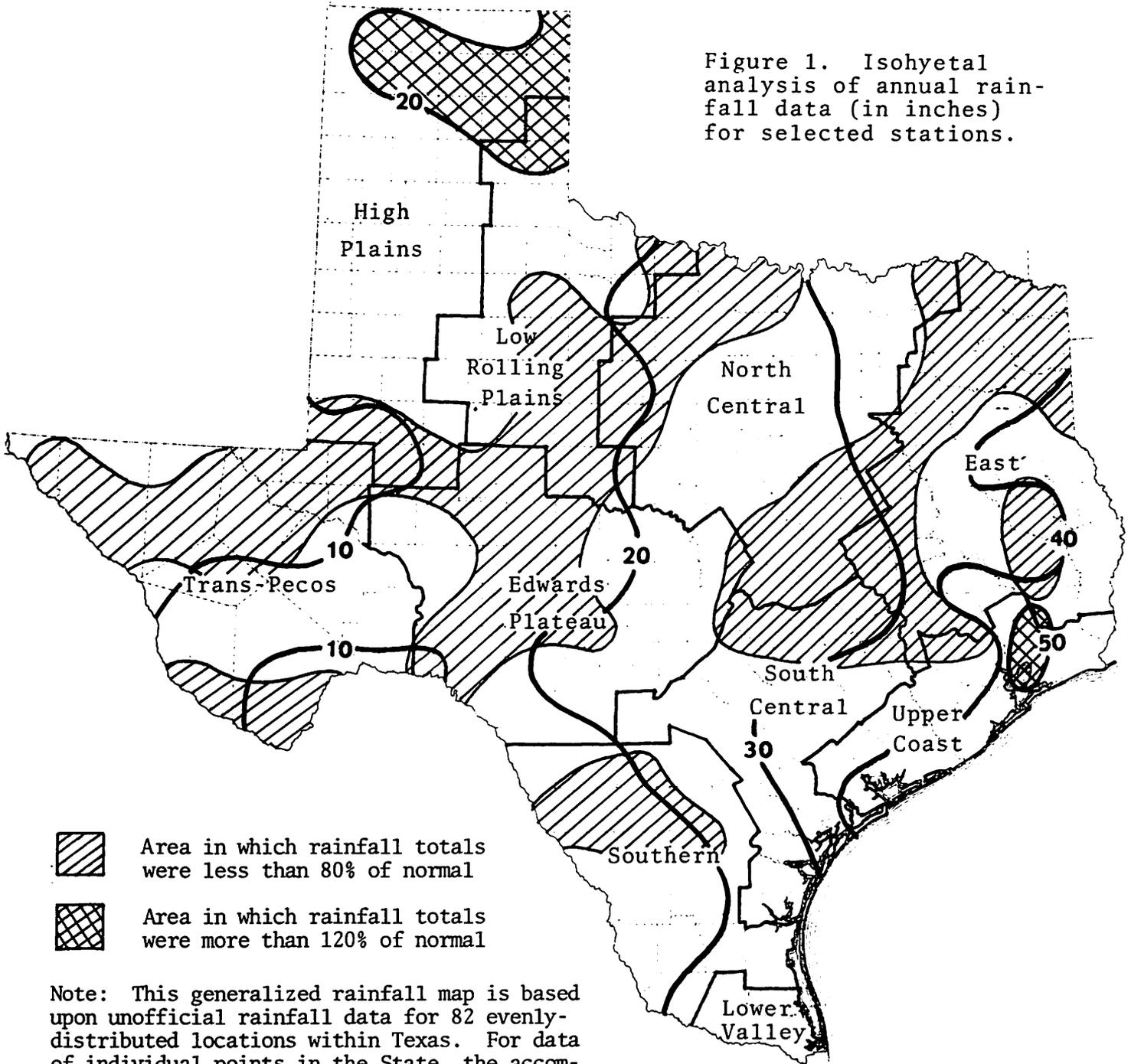
Below-normal rainfall occurred within at least three-fourths of Texas during 1977.<sup>1/</sup> When averaged over the entire year, significantly drier-than-normal conditions prevailed in most of the Low Rolling Plains, the Edwards Plateau, and the northern half of East Texas (Figure 1). A sizeable portion of the Trans-Pecos and North Central Texas also sustained appreciable rainfall deficits. The driest weather in the State occurred from the Permian Basin of the southern High Plains region westward into the northern half of the Trans-Pecos; in these areas rainfall totals barely exceeded half of the usual yearly amounts. Other very dry regions included the extreme northeastern corner of the State and the triangular area bounded by Waco, Austin, and Houston. Annual totals ranged from about 60 to 79 percent of normal in these regions.

Although 1977 may be categorized generally as a dry one, a

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<sup>1/</sup> Rainfall and temperature data for 1977 were obtained from National Weather Service teletype reports and may vary slightly from the official NWS records, to be published in the spring of 1978. Other data were taken from official publications of the National Oceanic and Atmospheric Administration (NOAA). "Normal" precipitation amounts, taken from official NWS records, refer to the average precipitation as determined from records of the period 1941-70.

Figure 1. Isohyetal analysis of annual rainfall data (in inches) for selected stations.



-  Area in which rainfall totals were less than 80% of normal
-  Area in which rainfall totals were more than 120% of normal

Note: This generalized rainfall map is based upon unofficial rainfall data for 82 evenly-distributed locations within Texas. For data of individual points in the State, the accompanying table or NWS publications should be consulted.

few scattered areas received wetter-than-normal weather during the course of the year. Rainfall totals up to 1½ times the normal annual amount were reported in a narrow band stretching across the Panhandle region of the High Plains. The area along the Texas coastline from Refugio to Galveston, as well as the Lower Valley, observed slightly more rain during the year than usual.

A comparison of the observed rainfall totals for the year with 30-year average rainfall values for the 18 National Weather Service (NWS) forecast centers in Texas illustrates the fact that, in most areas of the Lone Star State, 1977 was a moderately dry year (Table 1).

Abundant rains fell over much of the State as the winter of 1977 ended and the spring began. Much of North Central Texas and the Low Rolling Plains recorded from two to three times as much rainfall as is usually measured in March; Mineral Wells, with nearly 8 inches of rain, experienced the wettest March in the 42-year history of the weather station there.

April, however, was even wetter. April showers and thunderstorms drenched virtually all of the Lone Star State with rainfall far in excess of the typical amount for the first full month of spring. Widespread stream and river flooding in the central third of the State prompted the issuance of numerous watches and warnings. With a total of 6.62 inches, Brownsville observed the wettest April in more than 100 years, and San Angelo's total of 5.10 inches marked the wettest April in that plateau city since 1922.

TABLE 1. Rainfall Data for Selected Stations in Texas.

CITY	1977 TOTAL (Inches)	NORMAL AMOUNT (Inches) (1941-70)	PERCENTAGE OF NORMAL
Abilene	16.27	23.59	69%
Amarillo	19.18	20.28	95%
Austin	22.14	32.49	68%
Beaumont-Port Arthur	48.88	55.07	89%
Brownsville	26.30	25.09	105%
Corpus Christi	26.25	28.53	92%
Dallas-Fort Worth	27.19	32.30	84%
Del Rio	16.36	16.88	97%
El Paso	5.50	7.77	71%
Galveston	42.07	42.20	100%
Houston	34.94	48.19	73%
Lubbock	16.15	18.41	88%
Midland	6.84	13.51	51%
San Angelo	12.95	17.53	74%
San Antonio	29.64	27.54	108%
Victoria	39.21	34.29	114%
Waco	24.78	31.26	79%
Wichita Falls	20.93	27.22	77%

When May arrived, the plenteous rains disappeared. The dry-weather trend continued during the remainder of the spring and throughout the summer, although August did bring near-normal rainfall to many areas (Figure 2). Yet, since August typically is one of the driest months of the year in most areas of the State, the near-normal rains only momentarily interrupted a continuing and worsening trend in drought. While April was the wettest month statewide in 1977, December was the driest of all months. The greatest departure of average rainfall from normal occurred during the wettest month of 1977--April--with September a close second.

Among the extremes in daily rainfall amounts measured during 1977, 11.30 inches of rain was produced at Liberty (Upper Coast) by thunderstorms spawned by a rapidly moving cold front on November 21. Additional heavy rains at other times in November gave Liberty more than 22 inches for the month--the heaviest monthly total for any Texas city in 1977. On June 15 at Victoria, a series of torrential downpours produced a 13-hour total of 9.30 inches, 5.90 inches of which fell in a 4-hour period before dawn. Other heavy rains over short periods of time occurred at Dickens (Low Rolling Plains) on May 19, where spring thunderstorms yielded 6.69 inches. Late summer thunderstorms poured 9.67 inches of rain on Lytle (Southern) on September 14. By contrast, from January 7 to April 5--or a period of 99 days--no measurable rainfall fell at Zapata (Southern).

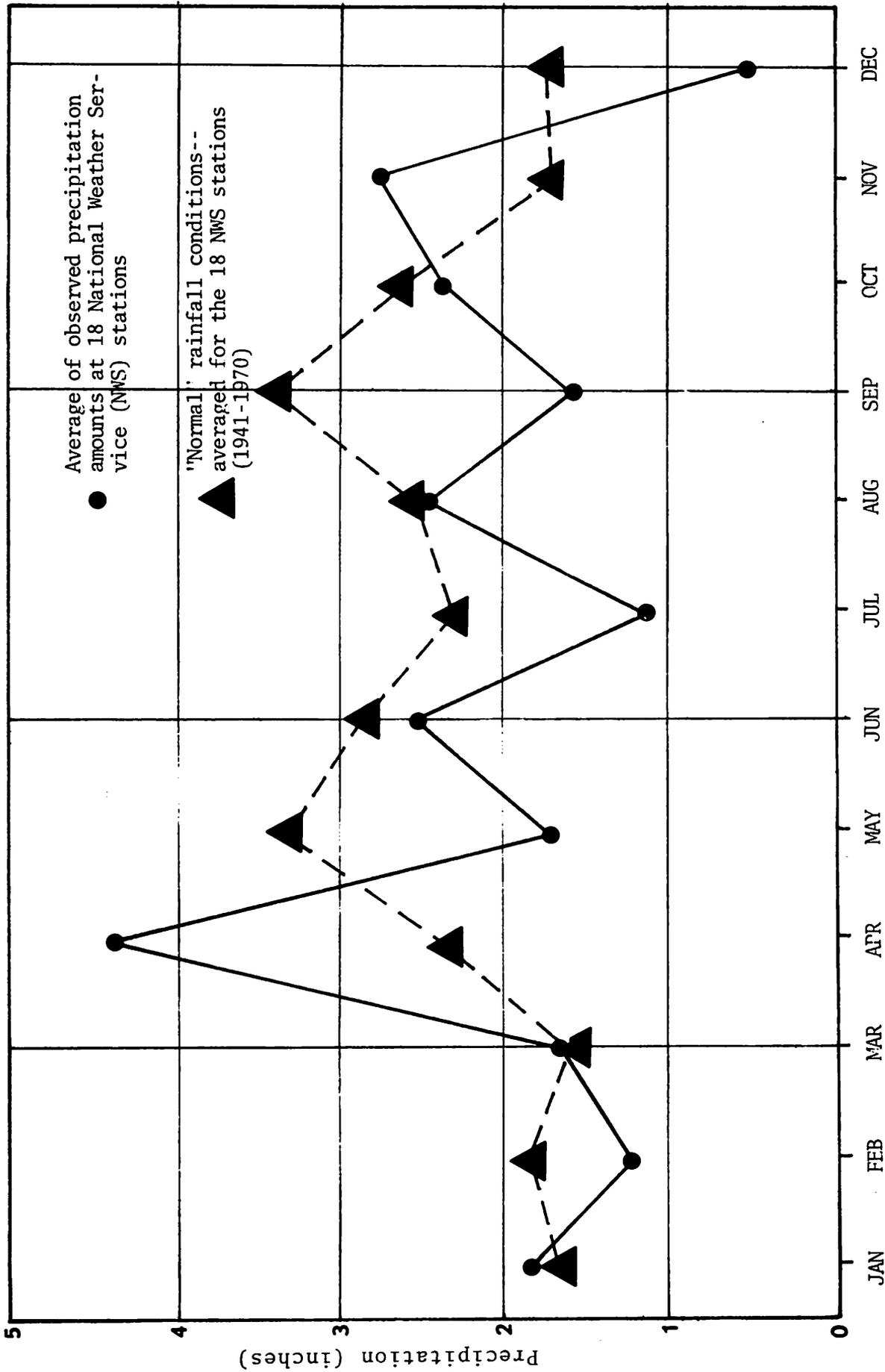


Figure 2. Average precipitation statewide by month in Texas during 1977.

## DROUGHT

Although abundant rain fell in much of Texas during several of the winter and spring months of 1977, too little rainfall was far too prominent a weather topic in virtually every section of the State as the latter two-thirds of the year elapsed. Persistent patterns of deficit monthly rainfall brought about a widespread reversal in the soil-moisture picture as the year wore on (Figure 3). Whereas the southern two-thirds of the State experienced wetter-than-normal weather during the late winter and early spring, a marked diminution in rainfall in May and June initiated the onset of drought conditions that covered nearly half of the Lone Star State as the year ended. Very dry conditions in the late summer and autumn aggravated the situation, such that a mild drought confined to the Trans-Pecos intensified into a moderate drought and spread into the central portion of the State as the autumn ended.

The spell of very wet weather which typified April in most areas of the State was abruptly ended in May by a month-long spell of much lesser-than-normal rainfall. Although May is normally one of the two or three wettest months of the year in most sections of Texas, May 1977 passed with rainfall totals far below the expected amounts. In most of North Central and East Texas, monthly totals were only from one-tenth to one-fourth of the normal amounts. The Dallas-Fort Worth area observed the driest May since 1934, and Abilene's total of 0.15 inch for the

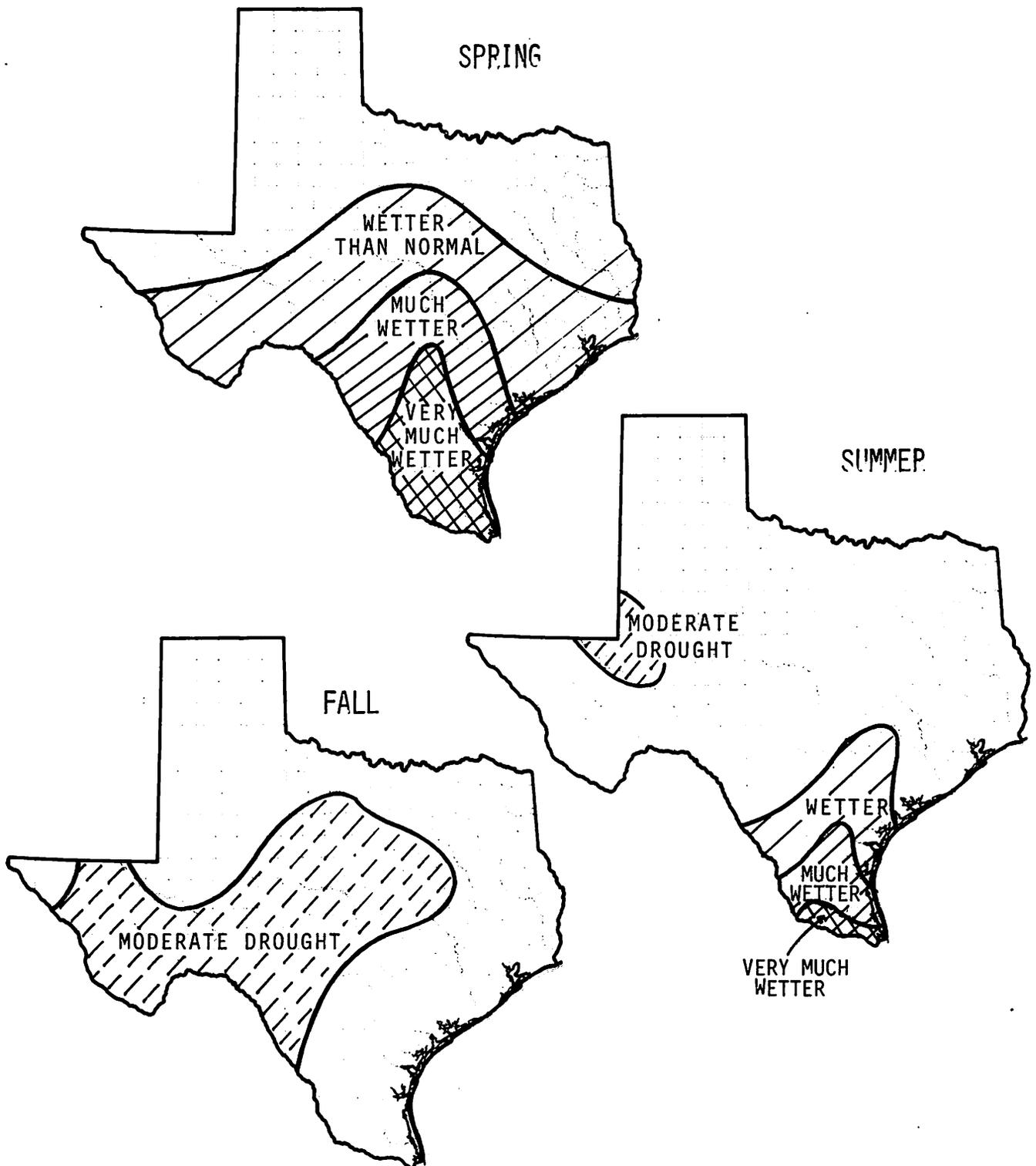


Figure 3. Areal distribution by season of the year of prolonged spells of abnormally dry and wet weather (based upon values of the Palmer Drought Index).

month was the least for May in that city in 21 years. In fact, the summer seemed to have arrived early in the Lone Star State, for weather patterns more reminiscent of those usually prevalent in late June and July--including a reduction in occurrences of severe weather phenomena--were dominant.

Even though the highly erratic rainfall pattern of summer gave some scattered areas near-normal rainfall during the hottest season of the year, most of Texas wilted in the presence of torrid temperatures and scarce precipitation, even into September. A stagnated circulation pattern that blocked the entry of cooler air from the north was largely responsible for the absence of significant rain-producing systems. A minimum of tropical weather systems of substance during most of the summer aggravated the already-dry conditions. Austin typified the fate of many Texas cities in reporting the driest summer (June-August) since the notable drought of the 1930's. When rainfall totals for September were tallied, nearly half of the State had sustained the driest September since the infamous drought of the 1950's, and Midland's total of 0.09 inch was the least in September since 1939. Rainfall totals of from 10 to 25 percent of normal were common in more than half of the State.

Near normal rainfall in the southern quarter of the State during the fall helped to impede the spread of moderate drought into that section of the State, but in most areas from the Trans-Pecos to North and South Central Texas, conditions worsened

from "mild" to "moderate" drought. December was an extremely dry month in a vast expanse of the State encompassing all but portions of East Texas and the Upper Coast.

An analysis of the Palmer Drought Severity Index for the ten climatic regions of Texas for each month of 1977 reveals that the trend from wetter-than-normal conditions to mild and moderate drought was widespread during the year (Figure 4). The most distinguishable reversal occurred in North Central Texas, where "much wetter than normal" weather conditions in March and April abruptly changed into "incipient" drought in May. Too-little rain during the summer and autumn brought about a reclassification of the region from mild to moderate drought during the last four months of 1977.

Although less rainfall fell in the High Plains than in North Central Texas during the summer and autumn, drought conditions on the plains were not as severe. A wet spring and a wet August there momentarily helped to offset mild drought begun in the winter and again in the early summer, but as the year ended the region found itself once again in the throes of a mild-to-moderate drought.

The Trans-Pecos and Southern Texas regions present marked contrasts in rainfall conditions. The Trans-Pecos was at no time during the year wetter than normal, and drought conditions gradually but incessantly deteriorated from incipient drought in the first few months of 1977 to a moderate drought bordering

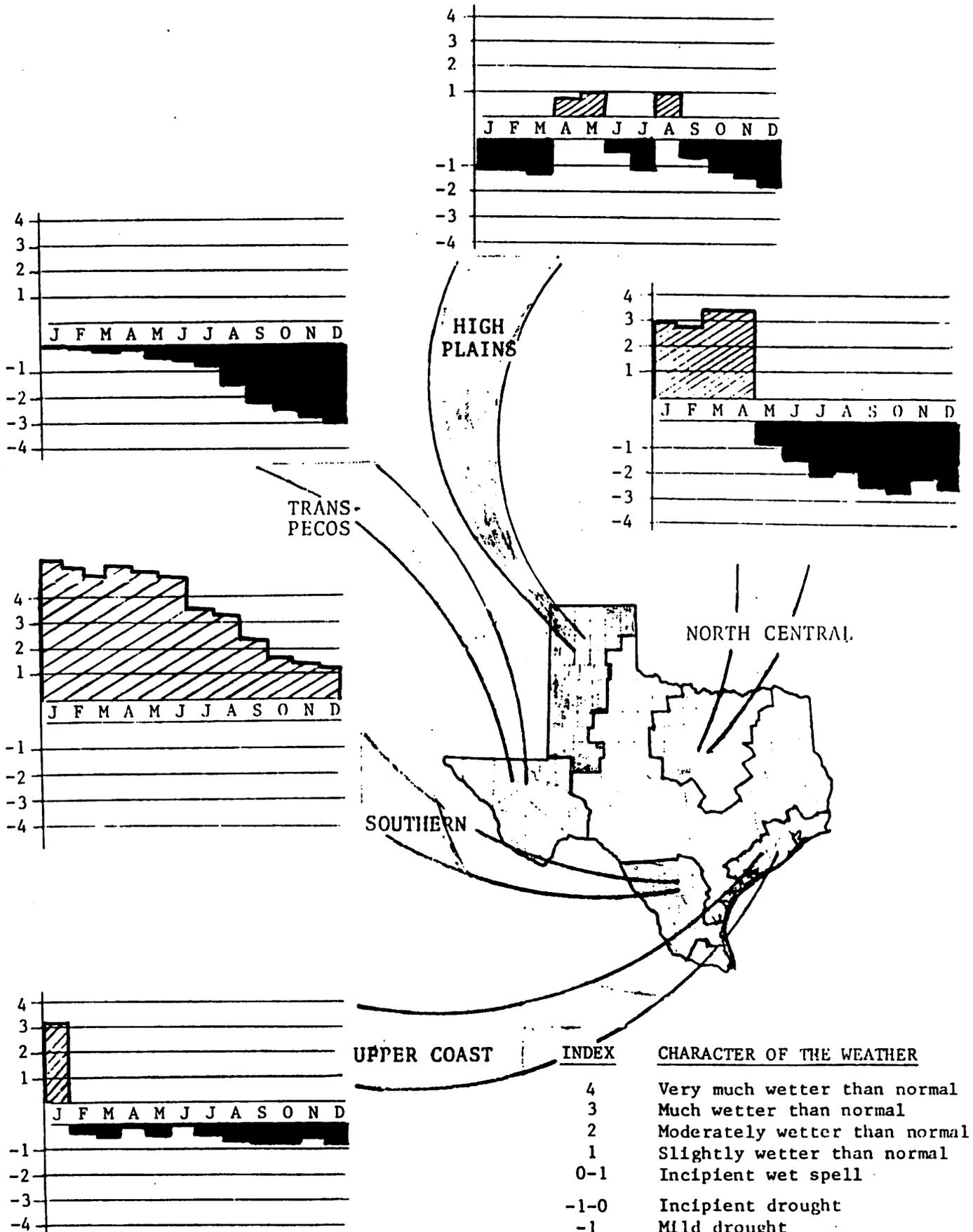


Figure 4. Monthly distribution of the Palmer Drought Severity Index

INDEX	CHARACTER OF THE WEATHER
4	Very much wetter than normal
3	Much wetter than normal
2	Moderately wetter than normal
1	Slightly wetter than normal
0-1	Incipient wet spell
-1-0	Incipient drought
-1	Mild drought
-2	Moderate drought
-3	Severe drought
-4	Extreme drought

on "severe" as the year ended. Although Southern Texas was wetter-than-normal at all times during the year, that region too experienced a downward trend in rainfall as the year progressed; very much wetter-than-normal rainfall there for the first half of the year was diluted to only "slightly wetter-than-normal" by the relatively dry months of summer and autumn.

#### SNOWFALL

Two to three times the normal amount of snow fell during the winter of 1977 in the northern halves of North Central and East Texas. Elsewhere, snowfall totals were near or only slightly below normal for the year. Two January snowstorms left from 5 to 8 inches of snow on the ground in many areas from the Dallas-Fort Worth area eastward to the Texas-Louisiana border (Figure 5). For many localities in this region, the winter (January-March) was the snowiest since the winter of 1966. Heaviest accumulations resulting from the January snowstorms were observed along the Red River from Archer County eastward to Grayson County; there from 8 to 12 inches of snow was commonplace, with Forestburg (Montague County) reporting a January snowfall total of 15.0 inches.

Somewhat less-than-normal amounts of snow fell in the High Plains region during the winter of 1977. Seasonal totals of from 7 to 11 inches were about 75 percent of the amount normally observed during the winter. Canadian reported the heaviest seasonal total for any Texas Panhandle city with 11.5 inches.

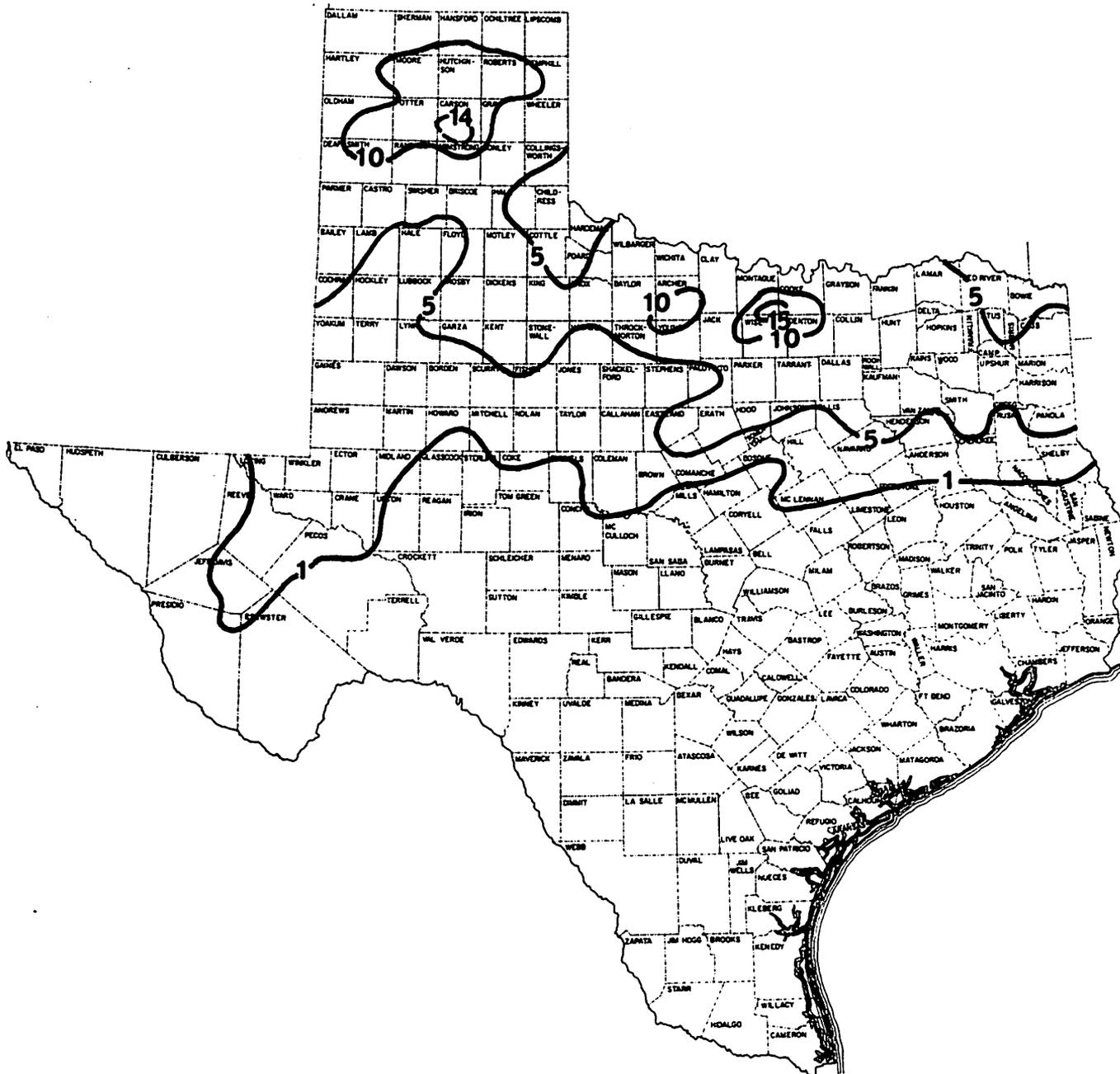


Figure 5. Distribution of observed snowfall accumulations (in inches) during the winter (January-March) of 1977.

Nor were snowfalls as heavy in the mountains of the Trans-Pecos region. While most of that area normally observes at least 5 inches during the winter months, most stations in the Trans-Pecos observed no more than 1 inch.

The snowline—the southern boundary of snowfall accumulations of at least 1 inch—extended as far as near Lufkin, Waco, San Angelo, and Pecos. Traces of snow were observed as far south as Anahuac and Houston (Upper Coast), Jeddo (South Central), and Fredericksburg and Langtry (Edwards Plateau).

Unlike the fall of 1976, when record-breaking snowfalls dumped more than a foot of snow on the South Plains in early November, the autumn of 1977 passed with virtually no snow of consequence.

#### TEMPERATURE

A torrid summer, in conjunction with near-normal temperatures in the spring and autumn, offset the effects of a bitterly cold winter, such that mean annual temperatures at most points in Texas during 1977 were within 2 degrees of normal (Table 2). With daily temperatures averaged over the whole year, slightly-warmer-than-usual weather occurred over the northern two-thirds of the State north of a Presidio (Trans-Pecos)--San Angelo--Waco--Lufkin line. A band of slightly cooler-than-normal weather extended from Southern Texas across South Central Texas to the Upper Coast region. Mean daily temperatures for most observing stations in the Lower Valley were near normal.

TABLE 2. Observed Temperatures (°F) at Selected Stations in Texas during 1977.

CITY	ANNUAL AVERAGE	DEPARTURE FROM NORMAL (1941-70)	EXTREMES	
			LOWEST	HIGHEST
Abilene	65	0	8	105
Amarillo	59	+1	-1	100
Austin	68	0	19	101
Beaumont-Port Arthur	69	+1	17	99
Brownsville	74	0	30	100
Corpus Christi	72	0	26	103
Dallas-Fort Worth	66	+1	10	108
Del Rio	69	-1	20	105
El Paso	64	0	18	107
Galveston	69	0	21	92
Houston	67	-2	18	100
Lubbock	62	+2	0	105
Midland	66	+2	8	106
San Angelo	67	+1	16	106
San Antonio	68	-1	20	99
Victoria	70	0	20	99
Waco	69	+2	11	106
Wichita Falls	64	0	-1	108

The lowest temperatures observed statewide during 1977 occurred on January 9 and 10, when morning readings dipped below zero across most of the northern half of the High Plains and into the teens in all but Southern Texas, the Lower Valley, and coastal sections of the Upper Coast region of the State. However, a blast of frigid Arctic air on January 30-31 brought the Red River Valley of North Central Texas its coldest siege of the winter; morning temperatures plunged into the single digit numbers as far south as Kaufman and Throckmorton, and Gainesville reported a phenominally low reading of -1 degree. This cold spell coincided with a snowfall of 10 to 15 inches seldom seen in the mid-Red River Valley region.

No portion of the Lone Star State escaped freezing temperatures during the first three months of 1977. Two mild freezes of comparable severity struck the Lower Valley region on January 10 and 19. All weather-observing stations in the southernmost Texas region reported low readings ranging from 27 to 31 degrees. Freezing weather was much more commonplace in the High Plains region, where Stratford was distinguished for having sustained the longest string of consecutive days when the morning temperature dipped to or below the freezing level. That Panhandle city observed low readings at or below 32 degrees for the first 67 days of 1977! Stratford also reported the most freeze days-- 87--of any Texas city during the winter of 1977. The last spring freeze occurred at Garden City (High Plains) and Junction (Edwards Plateau) on April 6, while freezing weather was first

observed in the autumn in the High Plains at Bootleg Corner, Dimmitt, and Vega on October 11.

The summer of 1977 was belatedly hot. Temperatures averaged from 1 to 3 degrees above normal in most sections during June, July, and August, but the most memorable aspect of the summer other than the prevalence of drought was the extraordinarily hot temperatures observed in most regions in September. Afternoon readings during much of the first half of that month were at least as warm as those which occurred during the traditionally hot months of July and August. Indeed, many points in the eastern two-thirds of the State registered the highest temperatures of the summer in September. Mean temperatures for the month were from 5 to 9 degrees above normal for a vast expanse of Texas from the Trans-Pecos to North and South Central Texas.

The first spell of 100-plus readings occurred as early as May 30-31 in the High and Low Rolling Plains and the Trans-Pecos regions of the State. Even hotter temperatures--ranging from 102 to 110 degrees--occurred later in the summer in these regions as well as in North Central Texas and the Edwards Plateau. Pecos (Trans-Pecos) registered temperatures of at least 100 degrees on each of the first 28 days of August. In general, readings at or above the century mark were much more numerous than in 1976, and the number was significantly greater than that observed during a "normal" summer.

Temperature extremes for 1977 were -8 degrees at Lipscomb

(High Plains) on January 10 and 12 and 114 degrees at Pecos on June 18.

As in most years, temperatures varied such that numerous records were broken. In the Dallas-Fort Worth area, January--with an average daily temperature of 34.7 degrees--was the coldest first month of the year on record, and weather annals for that metropolitan area date back to 1898. Mean temperatures statewide of from 4 to 10 degrees below normal made January one of the coldest months the State of Texas has ever experienced. On the other hand, especially in coastal regions of the State, September was more than a prolongation of the searing Texas summer; September 1977 was the warmest September ever observed at Corpus Christi, and records for that South Central Texas city date to 1887. Brownsville registered the warmest September in 57 years, and mean monthly temperatures of from 5 to 9 degrees above normal in many sections of the State categorize September as one of the warmest periods ever seen by most Texans for so late in the summer season.

#### HURRICANES AND TROPICAL STORMS

Somewhat like 1976--when no tropical storms were observed anywhere in the Gulf of Mexico or Caribbean Sea--the hurricane season of 1977 passed with the Texas coastline escaping major damage from winds and high water. The first hurricane of the season, Anita, moved into the western Gulf as August ended and

appeared headed for landfall along the southern Texas coastline. The moderately severe storm veered southward, however, and slammed into the Mexican coast 125 miles south of Brownsville on September 2. Most of the Lower Valley and southernmost Southern Texas received from 1 to 3 inches of rain from the storm over a 3-day period; Rio Grande City reported the heaviest amount--5.13 inches--from Anita.

The only other major tropical disturbance at the surface to affect the Texas coast during 1977 was Hurricane Babe, which made landfall near Morgan City, Louisiana on September 5. Effects from Babe were limited to a few light rain showers in the easternmost extremity of the Upper Coast region.

Another peculiarity of the 1977 Texas hurricane season was the effects on weather in the Trans-Pecos region caused by a typhoon which struck Baja California in mid-August. Scattered thunderstorms that produced up to one-half inch of rain in many areas west of the Pecos were spawned by the Pacific storm as it edged along the coastline of Baja California on August 16. Doreen was the third Pacific hurricane to affect Texas weather during the past two years--a phenomenon seldom seen in the southwestern States.

#### OTHER UNUSUAL WEATHER EVENTS

Two of the most memorable characteristics of the weather in Texas during 1977 were the frequency and intensity of dust and

windstorms. Hurricane-force winds whipped giant clouds of dust throughout the western third of the State on February 22-23 and then transported the precious topsoil eastward, darkening skies and reducing visibilities to less than one mile from Wichita Falls to Lufkin. Twenty injuries and an estimated \$655 thousand dollars were sustained to real and personal property in the El Paso area alone. Tractor-trailer trucks were blown off the highway at Guadalupe Pass (Trans-Pecos), and low humidities accompanying the high winds in North Texas prompted the issuance of fire-danger advisories.

A second severe duststorm preceded the invasion of a snow-storm into the High Plains region on March 11. One-fourth of the winter wheat crop, having an estimated value of 25 million dollars, was destroyed in the High Plains, and property damages of one-quarter million dollars were sustained in the El Paso area. The dust moved eastward into other sections of the State and reduced visibilities to one mile or less at many points. A third dust-storm pounded southern portions of the High Plains region on March 17, building up sand drifts as high as 10 feet near Littlefield.

Very heavy rains--from 3 to 8 inches--deluged much of North Central and East Texas on March 27. The flash rains caused the worst flooding in the Dallas-Fort Worth area in 20 years. Three drownings and property damage in excess of one million dollars were reported in Tarrant County. In Arlington, 200 homes were flooded and heavy water-damage occurred to Six Flags Amusement Park.

Tornadoes were not as numerous during 1977 as during the previous year, but considerable destruction resulted nonetheless from several of the "cyclones" when they struck at random in various parts of the State. One of the most costly tornadoes of the year struck near downtown Houston on December 13, leaving one man dead and at least 37 injuries were reported. The violent "twister" touched down at mid-morning and travelled a 500-foot path for 5 miles, snapping 3-foot thick pine trees, crushing mobile homes, and ripping roofs off other homes in the Houston metropolitan area. It was also one of the most bizarre tornadoes of the year, too, for it struck during one of the least active months of the year for tornadoes.

Two tornadoes struck Monahans (Trans-Pecos) on April 19, destroying a hospital, convalescent center, and more than three dozen homes. No deaths resulted from the storms, although nearly a score of people were injured. Another damaging tornado hit the community of Quail (Low Rolling Plains) on May 16. Damages totalling nearly three-quarters of a million dollars were incurred from the storm; the Quail school and cafeteria, three homes, and ten vehicles were destroyed. On the following day, a one-half mile section of Plainview (High Plains) was struck by a tornado which damaged a school and more than two dozen homes.

As in most years, fierce thunderstorms intermittently dumped very heavy rains and damaging hail in various sections of Texas during the year, particularly during the spring. Jourdanon

(Southern) received 8.54 inches in one 24-hour period in mid-April, baseball-size hail pelted Charlotte (Southern), and 3 inches of rain fell in 30 minutes at Mountain Home (Edwards Plateau) in mid-April. Torrential rains raised the level of the Devils River 8 feet in just more than one day, and Interstate Highway 10 near Kerrville was nearly blocked by logs and stones transported by the high water. Five-inch rains were measured in the Miami-Canadian area of the High Plains region on May 15, causing the Canadian River to crest at over 8 feet. Softball-size hail pounded the community of Afton (Low Rolling Plains) four days later, while persistently heavy rains of as much as six inches caused highway, creek, and river flooding in parts of both the Low Rolling and High Plains regions.

If the long-range outlook provided by the National Weather Service is an indication of what Texans may expect early in 1978, no improvement in the worsening drought conditions that highlighted the end of 1977 is in the offing. The forecast for the winter of 1978 (January-March) calls for a continuation of drier-than-normal weather in all portions of the State. However, the three winter months of the new year are not likely to be as cold as the record-breaking spell experienced early in 1977. The extended outlook says West Texans may expect warmer-than-normal weather, while the eastern half of the State is due to have near-normal temperatures.

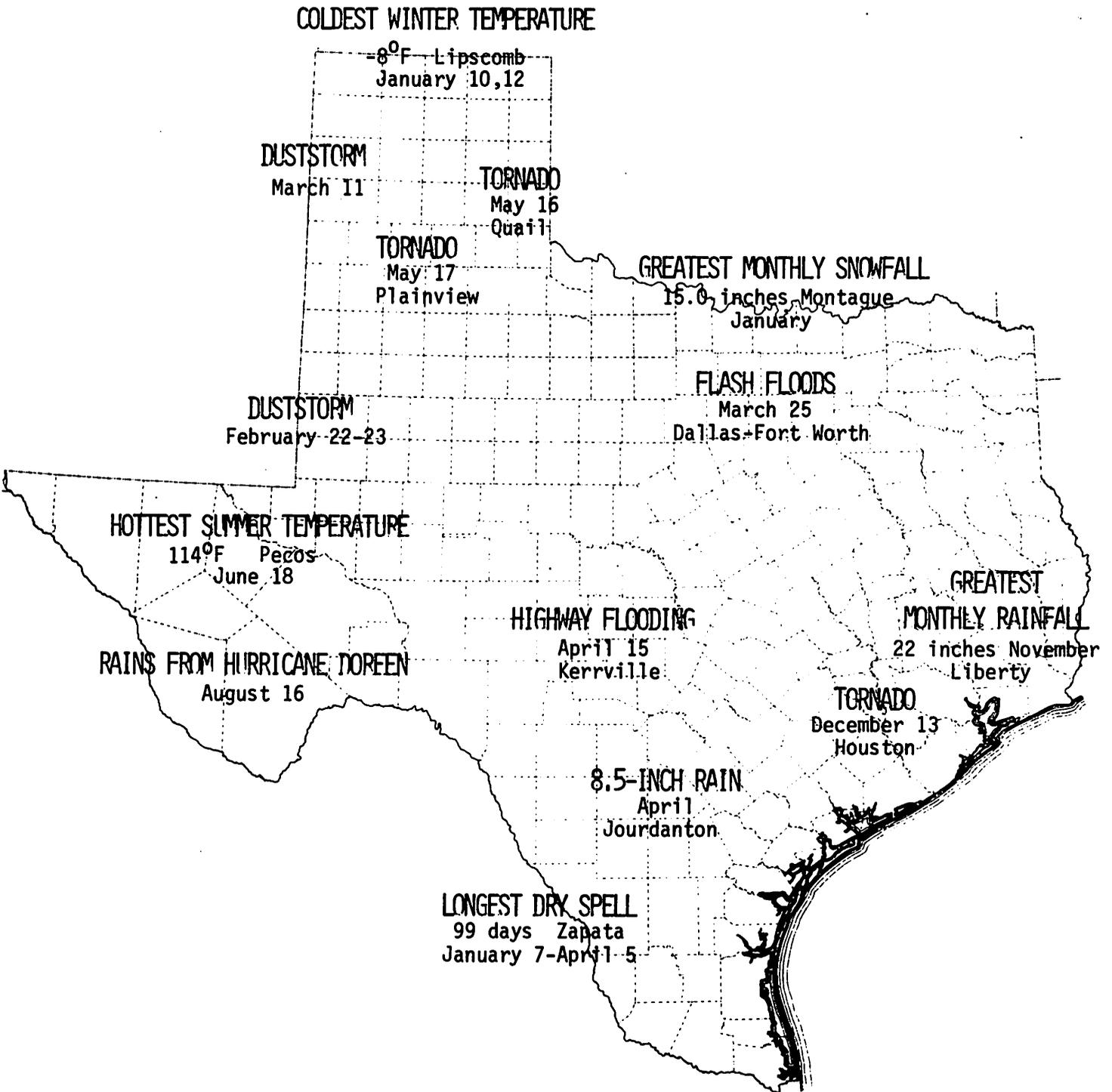


Figure 6. Phenomenal weather events of 1977