



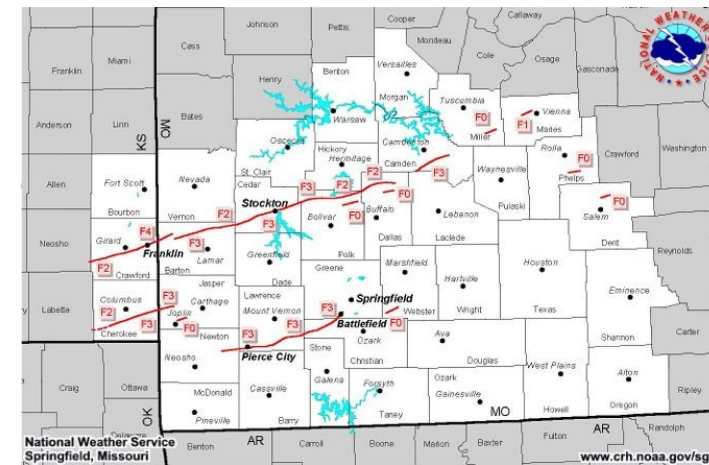
“To provide weather and flood warnings, public forecasts and advisories for all of the United States...and its territories...for the protection of life and property.”

National Weather Service

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National Weather Service

Natural Hazard Risk Assessment Information For: **Laclede County Missouri**



Information Provided By
WFO Springfield, Mo

2009 Update

Includes data and information
through December 2008

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This document is intended to provide general information on severe weather that has affected Laclede County and the communities with in the county.

By Gene Hatch
 Meteorologist Intern WFO Springfield. Mo.

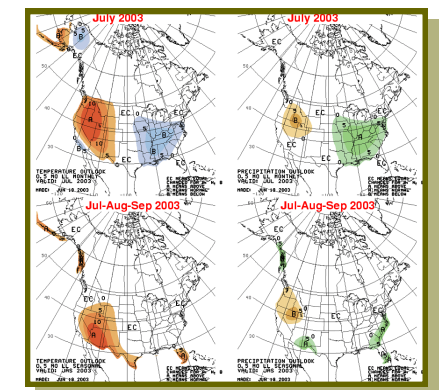
Local Climatology

Averages and records for Lebanon, Missouri in Laclede County

	Normal High	Normal Low	Normal Precip.	Normal Snow	Record High	Record Low	Record Precip.	Record Snow
Jan	41	22	1.83	4.9	79	-21	9.33	20.0
Feb	48	27	2.17	3.1	82	-28	6.00	19.5
Mar	59	35	3.55	1.8	90	-10	10.51	14.2
Apr	69	45	4.40	0.1	93	9	13.17	4.4
May	77	53	4.53	0	101	26	13.65	2.0
Jun	85	62	4.14	0	105	36	15.46	0
Jul	90	67	3.82	0	113	43	10.63	0
Aug	89	65	3.31	0	110	38	12.39	0
Sept	81	57	4.13	0	106	28	15.12	0
Oct	70	46	3.78	0	95	15	13.83	2.0
Nov	56	36	4.31	1.3	86	2	10.54	8.5
Dec	45	26	2.52	2.1	80	-19	12.07	14.0

Links for Climate information

- www.crh.noaa.gov/sgf/
- www.cpc.ncep.noaa.gov/
- www4.ncdc.noaa.gov
- web.missouri.edu/~moclimat/
- mrcc.sws.uiuc.edu/
- agebb.missouri.edu/weather/index.htm



Historic Weather in Southwest Missouri

Jan. 8th-1997...Six inches or more of snow fell over much southwest, south central and central Missouri from noon on the eighth to noon on the ninth. The heaviest snow fell in a band from Cassville to Springfield north to Hermitage where up to ten inches was recorded. Damage estimates at 670K dollars were due to the cost of snow removal.

Mar. 6th-1989...A winter storm in the south central U.S. left parts of Missouri and Arkansas buried under more than a foot of snow. Heavier snowfall totals in Missouri included 14 inches at Springfield and 16 inches at Lebanon. Totals in Benton county Arkansas ranged up to 14 inches.

Apr. 26th-1994...A tornado, rated at F1 strength, affected a 3 mile path near Lebanon MO. The sheriff's office reported signs blown down, flags ripped from poles, and power lines down. Also, an airplane was flipped over at a nearby airport.

May 4th- 2003...Three tornadic supercell thunderstorms formed over southeast Kansas and moved across the Missouri Ozarks, spawning 13 tornadoes. This was a very rare event for this part of Missouri since many of the tornadoes experienced across this area are short lived small tornadoes. This event surpassed the December 17-18, 2002 tornado event in both loss of lives and property



damage, and exceeded tornado events that occurred over the past 100 Years for this part of Missouri. The hardest hit locations included Battlefield, Stockton and Pierce City. 14 tornadoes resulted in extensive damage and 24 deaths. Several of the tornadoes tracked long distances ranging from 15 to 80 miles.

Nov. 11th-1911...A high of 80 and low of 13 were recorded on the same day in Springfield. A cold front, ahead of a very cold airmass, moved through the Ozarks making temperatures fall rapidly.

Nov. 29th-1991...An F4 tornado that developed 3 miles north of Nixa tracked southeast for 10 miles to Springfield and lifted over east Springfield. Extensive damage to homes and businesses was reported. 2 deaths and 64 injuries were directly related to the tornado.

Dec. 12th-2000...A major winter storm was in the works for the Ozarks region this day. An arctic airmass had just moved into the area on Monday and was firmly entrenched over Missouri. Daytime highs Tuesday were only in the teens and lower 20's across southern Missouri. As it turned out, total accumulations included 8-11 inches over southwestern MO, with 12-14 inch amounts along I-44 from Joplin, through Springfield, to Lebanon. Areas near West Plains received a mixture of snow and sleet throughout the storm, with snow/sleet depths of 4 to 8 inches.

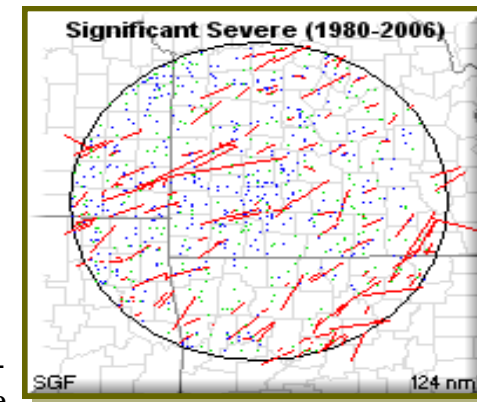


Overview of Weather Hazards in Southwest Missouri & Extreme Southeast Kansas

From 1961 to 2008, 522 tornadoes were reported in the 37 counties that WFO Springfield is responsible for, with an average of 11 occurring each year. There were 71 fatalities from these tornadoes, or near one and a half each year. Tornadoes occurred during every month of the year and at every hour of the day. The majority of these tornadoes are weak, but the occurrence of strong and violent storms is always a possibility and cannot be discounted.

The Ozarks experiences between 50 and 70 thunderstorm days a year. During any given storm, large hail, damaging winds and microbursts are possible. The Ozarks go through three severe thunderstorm seasons during the course of the year. The spring season is the period that supercell thunderstorms are most common, next comes summer as large clusters of storms move across the region, mainly during the overnight hours. Finally fall sees the return of supercells and tornadoes, squall lines and training storms (thunderstorms that form and move over the same area).

The region is affected during the course of any year by flooding, drought, heat and cold extremes and winter storms. Heat extremes and flooding have caused the greatest number of fatalities in the area. Winter storms affect the region in many forms. Ice storms, heavy snow and extreme cold have occurred across the area. Freezing rain is the typical form ice storms in the Ozarks take. Ice storms have deposited 2 to 3 inches of ice during their duration causing power outages, tree damage, and traffic problems.



Weather in the Ozarks

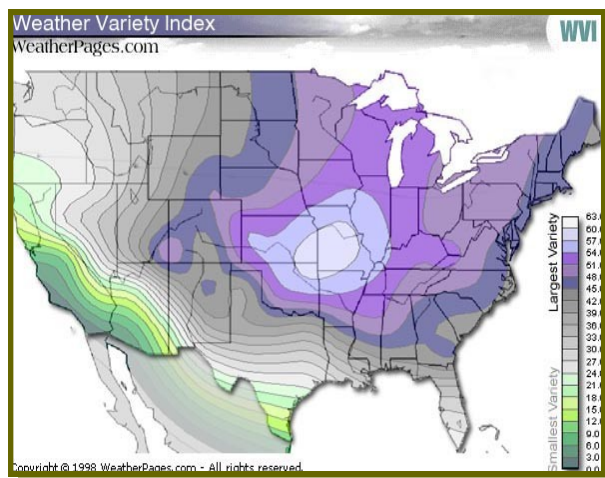
Tornadoes by county for the Springfield County Warning Area from 1950 to June 2003

County	F0/1	F2	F3	F4	F5	County	F0/1	F2	F3	F4	F5	County	F0/1	F2	F3	F4	F5
BARRY	20	7	1	0	0	DOUGLAS	8	6	1	0	0	OREGON	9	4	2	1	0
BARTON	23	1	3	1	0	GREENE	19	10	3	1	0	OZARK	21	2	2	1	0
BENTON	18	2	4	0	0	HICKORY	8	1	1	0	0	PHELPS	15	4	2	0	0
BOURBON,KS	10	5	0	0	0	HOWELL	20	11	3	1	0	POLK	16	3	0	0	0
CAMDEN	15	6	1	0	0	JASPER	30	5	4	1	0	PULASKI	9	4	1	0	0
CEDAR	10	2	3	0	0	LACLEDE	9	6	1	0	0	SHANNON	11	1	1	0	0
CHEROKEE,KS	28	5	2	1	0	LAWRENCE	11	2	3	0	0	ST.CLAIR	13	2	2	0	0
CHRISTIAN	19	2	1	1	0	MARIES	4	3	0	0	0	STONE	10	3	0	0	0
CRAWFORD,KS	19	11	3	1	0	McDONALD	11	5	0	0	0	TANEY	6	1	0	0	0
DADE	11	2	2	0	0	MILLER	22	3	0	0	0	TEXAS	14	8	1	2	0
DALLAS	7	1	1	0	0	MORGAN	11	7	0	0	0	VERNON	20	1	6	0	0
DENT	8	1	1	0	0	NEWTON	30	5	1	2	0	WEBTSE	19	7	2	0	0
												WRIGHT	10	4	0	1	0

Historical information for Laclede County, Missouri

Severe Weather in Laclede County

In 2000, a private company looked at 277 cities across the United States. They rated each city on variations in temperature, precipitation and other factors. Of all the cities in their study Springfield, Missouri rated number one as the city with the most variable weather in the U.S.

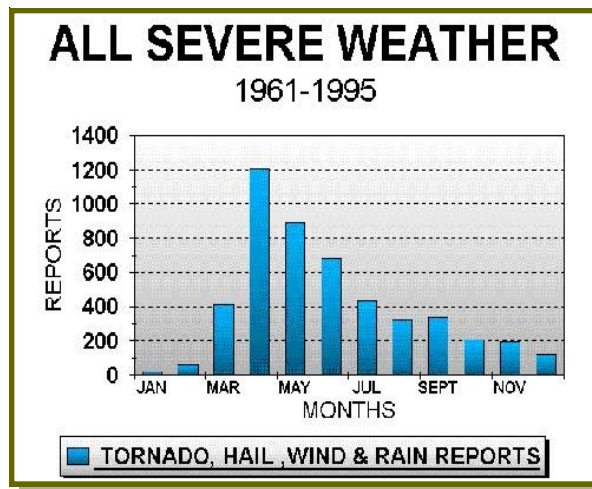


From www.weatherpages.com

Laclede County Missouri is located on the Ozark Plateau along the eastern edge of tornado ally. Because of its location Laclede County is subjected to severe thunderstorms, heavy rainfall, winter storms, flooding, ice storms, droughts, tornadoes and other wind storms.

When does severe weather occur ?

Severe weather in the Ozarks can occur in any month of the year. While the months of April through June are the peak severe weather season, there is a secondary peak from September to November.



Severe thunder storms in Laclede County have dropped hail up to 3” in diameter, created winds in excess of 80 miles an hour and rainfall rates greater than 2.50” in an hour. While southwest Missouri receives nearly 11 tornadoes a year, Laclede County averages an event every 3 1/2 years.

Number of Tornadoes in Laclede Co. (1950 to 2002)

<u>F0/F1</u>	<u>F2</u>	<u>F3</u>	<u>F4</u>	<u>F5</u>
9	6	1	0	0
56%	38%	6%	0%	0%

During the winter season Laclede County averages 13.3 inches of snow. With the most snow in one season at 32.8 inches, falling during the 1975 to 1976 winter season. Ice storms also affect the county during the winter season causing significant damage to homes, trees and utilities.

Dam Failure

Dams in Laclede County

Laclede County contains 17 dams. While the majority of these dams are small and used primarily for storm water management, irrigation and recreation, some are a part of local reservoirs. All of the dams in Laclede County are of earthen construction and there have been no recorded failures.

Where are they Located

- Elam Lake Dam: Mountain Creek, Eldridge
- Capoferri Lake Dam: Goodwin Hollow Creek, Lebanon
- Lake Shore Estates Dam Lower: Goodwin Hollow Creek, Lebanon
- Lake Shore Estates Dam Upper: Goodwin Hollow Creek, Lebanon
- Dunlap Lake Dam: Similin Creek, Stoutland
- Wilderness Lake Dam: Bear Creek, Sleeper
- Pennel Lake Dam: Bennett Springs Creek, Bennett Springs
- Porto Farms Lake Dam: Panther Creek, Conway
- Keen Lake Dam: Dry Auglaize Creek, Lebanon
- Eckland Lake Dam: Goodwin Hollow Creek, Lebanon
- Morris Lake Dam: Osage Fork of the Gasconade, Falcon
- Stohr Lake Dam: Prairie Creek, Stoutland
- Rainey Lake Dam: Davis Creek, Stoutland



- Gillming Lake Dam: Gasconade River, Stoutland
- Vancak Lake Dam: Gasconade River, Stoutland
- Brady Lake Dam: Little Cob Creek, Nebo

Most of the dams in Laclede County are less



than 100 feet high. Many are located on private land and fall under private ownership.

Heat, Drought and Wildfires



Excessive heat is the leading cause of weather fatalities in the nation. With the variability of the weather in southwest Missouri, it is not surprising that excessive heat impacts Laclede county on almost a yearly basis.

Laclede County averages 16 days a year with temperatures at or above 95 degrees. July and August are the two warmest months, which average 6 days at or above 95 degrees.

Year	Days 95* +	Days 100* +	Days in a row
1901	53	23	26
1933	54	11	10
1934	66	48	19
1936	68	41	21
1954	49	27	8
1980	51	24	16
Normal # of Days	16	4	▲ Above 95*

Years with above average summer heat

Drought and wildfires can, and often do accompany excessive heat. Laclede County has gone through dry periods and drought. The latest droughts occurred in 1999 and 2000 when well below normal rainfall and high temperatures combined to produce drought conditions.

Longest periods without rainfall in Laclede County

- 46 days: 25 Dec 1918 ~ 8 Feb 19
- 37 days: 3 Sept 1979 ~ 9 Oct 79
- 36 days: 3 Nov 1999 ~ 8 Dec 99
- 35 days: 3 Dec 1912 ~ 6 Jan 13
- 32 days: 25 Jan 1996 ~ 25 Feb 96
- 32 days: 28 Dec 2000 ~ 28 Jan 01

While no major wildfires have affected Laclede County, small grass fires do pose a hazard.

A twenty year study by the Missouri Department of Conservation, from 1970 to 1989 determined that over 11000 fires occurred during that time in the Lake Ozark fire district which includes Morgan, Miller, Camden, Dallas and Laclede counties. This represented nearly 20% of the wildfires in the state with over 131,000 acres burned.

There are numerous ways wildfires can be started, but when dealing with weather related phenomenon, namely lightning, only 0.8% of the wildfires in the Lake Ozark fire district were the result of lightning.

Tornado Information

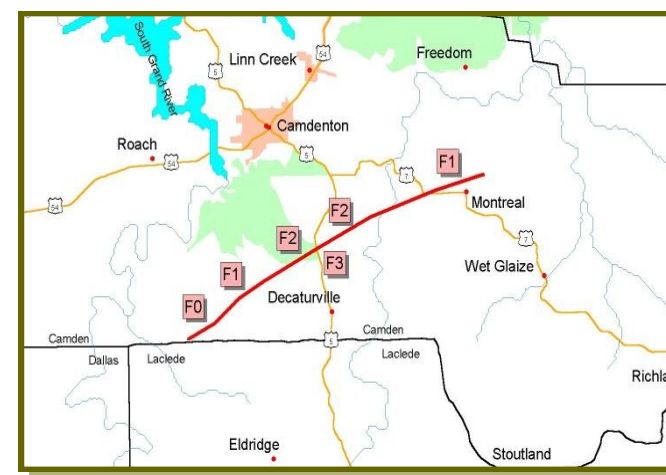
Laclede County lies at the eastern edge of tornado ally and receives on average a tornado every 3 1/2 years. From 1950 to 2008 Laclede county recorded 16 tornadoes from F0 to F3 in strength. The strongest tornado, an F3, passed across the county on the evening of January 7th, 2008. Along its 25 mile track it caused 8 million dollars in damage and produced significant damage near the town of Conway.

Historical Tornadoes of Laclede County

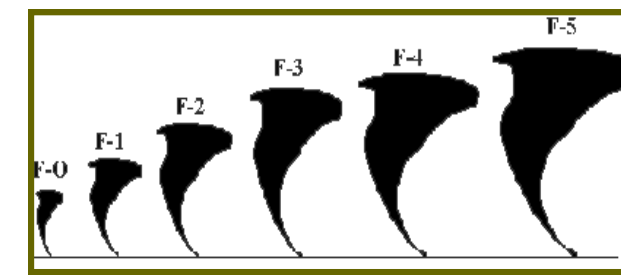
- Apr 18, 1880 (F2) 0 inj, 2 dead
- Nov 25, 1926 (F3) 5 inj, 1 dead
- Mar 23, 1936 (F4) 5 inj, 1 dead
- Nov 15, 1960 (F3) 3 inj, 0 dead
- Apr 24, 1993 (F2) 2 inj, 0 dead
- May 5, 1996 (F1) 1 inj, 0 dead

For the Record Laclede County

- Has experienced one F4 tornado.
- No F5 tornadoes
- Most recent Tornado March 31, 2008 (F2)
- 4 deaths and 28 injuries since 1880.

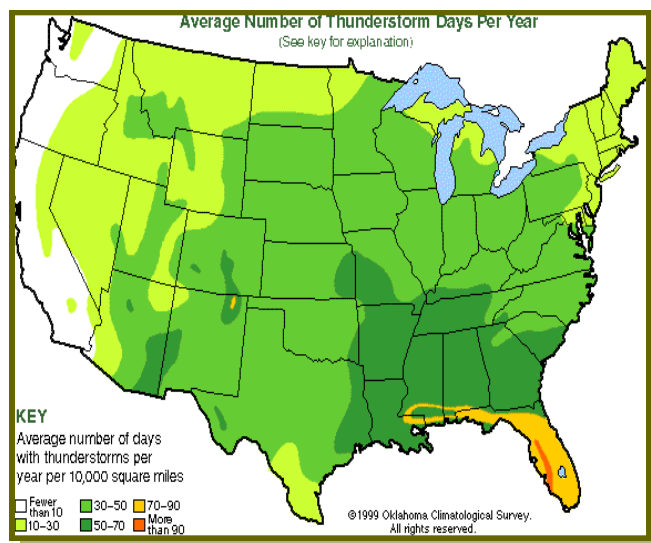


The tornado outbreak of May 4, 2003 was the one of the worst that southwest Missouri has had since the late 1800's. Fourteen tornadoes touched down across the Ozarks during the evening of May 4th one of which was an F3 that struck Just North of Laclede county. This F3 is the latest killer tornado to strike near Laclede county since an F4 that struck Springfield in November of 1991.



- **F-0:** 40-72 mph, chimney damage, tree branches broken
- **F-1:** 73-112 mph, mobile homes pushed off foundation or overturned
- **F-2:** 113-157 mph, considerable damage, mobile homes demolished, trees uprooted
- **F-3:** 158-205 mph, roofs and walls torn down, trains overturned, cars thrown
- **F-4:** 207-260 mph, well-constructed walls leveled
- **F-5:** 261-318 mph, homes lifted off foundation and carried considerable distances, autos thrown as far as 100 meters.

Severe Hail, Lightning, Wind and Winter Weather



Average number of thunderstorm days per year.

Thunderstorms occur in the Ozarks on the average of 50 days per year.

April and May are the two most active hail months in the Ozarks. There is also evidence of a minor secondary peak in September. The greatest number of hail reports over 2 inches occur in the months of April, May and June with the largest report being 3.00 inches in diameter in Laclede county on April 28, 1983. Hail can cause considerable damage to homes, vehicles, and crops.

Severe thunderstorm winds are defined by the NWS as convective wind gusts that reach or exceed 50 knots (58 mph). June is the most active month with April a close second. In general, the most active period for damaging wind events occurs from April to August. This is due in part to the shift from supercell thunderstorms to large clusters of storms and squall lines. The highest wind gust recorded in Laclede county reached 82 mph and occurred in 1956 on the 26th of June. Since 1956 high winds have caused around \$283,000.00 in damages.

With any thunderstorm, lightning will be present and the safest place to be is indoors. In August of 2002, four people were killed near Willard in Greene County during a funeral. As a thunderstorm moved into the area, the victims sought shelter under a tree.



Nationally, Missouri ranks 27th in Lightning fatality rate, 44th in injuries and 38th in property damage related to lightning. During the period from 1960 to 1994, the total number of lightning casualties in Missouri was 165. This is nearly five casualties per year in the state.

Winter weather across the Ozarks comes in many forms. Freezing rain or drizzle, sleet and snow are common occurrences during the winter season. In the past the Ozarks have had up to 54 inches of snow, Sleet storms that produced inches of sleet and ice storms that laid a covering of one to two inches of ice on most surfaces. While the immediate impact of these storms is to travel, winter storms cause hundreds of thousands of dollars in damages across the region on a near yearly basis.

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21 Feb 2001: Sleet, freezing rain and embedded thunderstorms caused ice accumulations from one quarter, up to two inches in places across southwest, central and south central Missouri. The heaviest ice accumulations occurred along and north of Highway 60, and along the I-44 corridor. Howell-Oregon electric cooperative reported numerous power outages due to the ice around the communities of Willow Springs, Birch Tree, Mountain View, Winona, Eminence and Dora.

Flooding

From 1993 to 2002 Flooding has occurred in Laclede County in every year. While usually nuisance flooding such as water on city streets, significant flooding has caused numerous problems in the county. During the previous decade, only one injury and no deaths have been attributed to flooding in Laclede County. Laclede County contains numerous low water crossings.

Typically, flooding in the county is caused by heavy rainfall associated with high rain producing thunderstorms which move very slowly. In towns, rainfall of one to two inches will cause streets and ditches to flood and make some low water crossings impassable. When rainfall rates reach 3 to 4

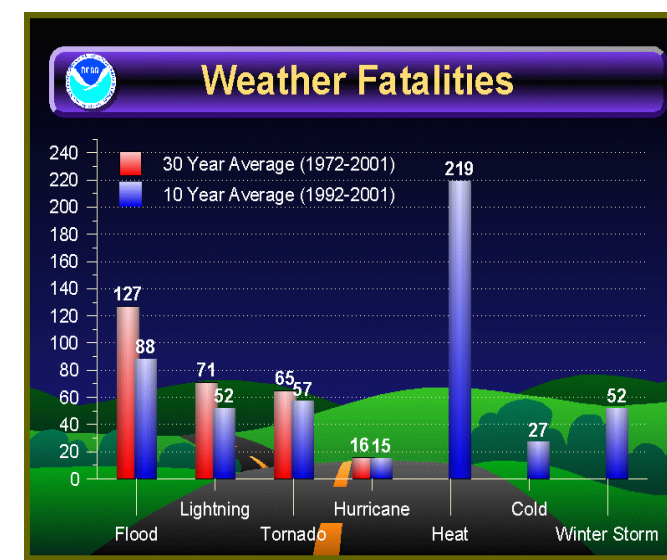
inches, major flooding can occur, and amounts over four inches creates significant flooding that affects most of the county.



Floods in Laclede County

19 Aug 1997: Highway 32 was briefly flooded along the Osage Fork River. A large complex of thunderstorms produced 3 to 5 inches of rain in a band from just north of Nevada to near Rolla. The previous three weeks had been very dry across the region, so flooding problems were minor.

4 May 1999: Thunderstorms produced a large area of 2 to 6 inch rainfall over central, south central, and southwest Missouri. The hardest hit areas were along the Kansas state line from Nevada to Joplin where some damage to roads occurred. A few homes in the Carthage and Joplin areas required



National Weather Fatality Statistics

brief evacuations due to the flooding. About a half dozen homes in Carthage had minor flood damage on the lowest floor. Numerous low lying roads and low water crossings were closed due to the flooding. There was one flash flood related fatality in eastern Camden County on Dry Glaize Creek near Montreal. Early in the morning on May 5th, a women died when she drove into a flooded low water crossing.

12 May 2002: Another in a series of thunderstorm complexes moved across the area producing excessive rainfall on the already saturated soils. Most of the heavy rainfall began across central Missouri Sunday morning May 12th, and then produced another round of torrential rainfall Sunday evening. By Monday morning May 13th, a large area of two inches fell north of Interstate 44, with the heaviest bands of three to six inches from Joplin northeast to Greenfield, Bolivar and Urbana. Another area of excessive rain fell over eastern Texas, northern Shannon, and southern Dent counties where locally three to six