



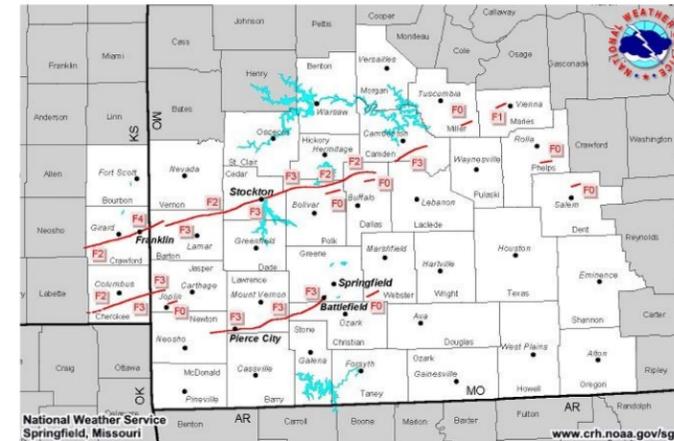
“To provide weather and flood warnings, public forecasts and advisories for all of the United States...and its territories...for the protection of life and property.”

National Weather Service

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National Weather Service

Natural Hazard Risk Assessment Information For: **Morgan 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 Morgan County and the communities with in the county.

By Gene Hatch
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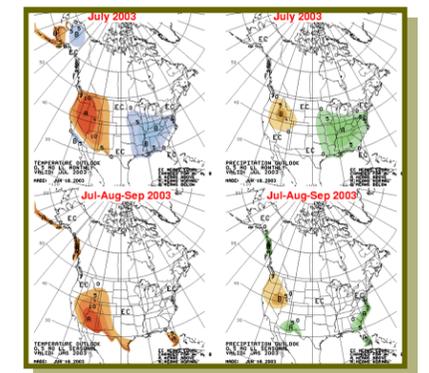
Local Climatology

Averages and records for Versailles, Missouri in Morgan County

40	20	0.5	77	-18	4.3
47	25	1.8	83	-18	17.0
58	34	0.5	85	-15	6.6
68	44	0	92	18	0
76	53	0	93	28	0
83	62	0	104	42	0
89	67	0	115	46	0
87	65	0	106	43	0
79	57	0	102	30	0
70	46	0	94	20	0
56	35	1.1	83	0	9.5
44	24	1.7	75	-23	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.

Apr. 16th-1995...A tornado touched down briefly between one and two miles east of Gravois Mills MO near the 6.5 mile marker along the Gravois Arm of the Lake Of The Ozarks. A report made by an officer of the Missouri State Water Patrol indicated that the tornado turned over 20 boat docks and damaged or sank between 20 and 25 boats. At least one house was damaged and eyewitnesses said that trees were uprooted with some of the debris left floating on the water.

Jun. 25th-1994...Late evening thunderstorms produced walnut sized hail which damaged area crops and wind gusts which knocked down large trees south of Versailles near Stover MO.

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.

Jul. 19th-1950...An F1 tornado 3/4 of a mile wide left a swath of damage 2 miles long through Morgan county Missouri.

Jul. 29th-1996...A woman was killed while attempting to cross a low water bridge over Haw Creek in her vehicle in Morgan county Missouri after thunderstorms dropped heavy rain causing flash flooding to occur.

Sept. 20th-1996...A line of severe thunderstorms developed ahead of a strong cold front. Baseball size hail fell near the town of Laurie in Morgan County, MO.

Dec. 17-18th-2002...At approximately 1118 pm a tornado struck near Chesapeake Mo. The F2 tornado hit the Lucky Lady trailer park in addition to 1 home northeast and 3 homes southwest of the trailer park. The tornado resulted in 1 fatality and 15 injuries.

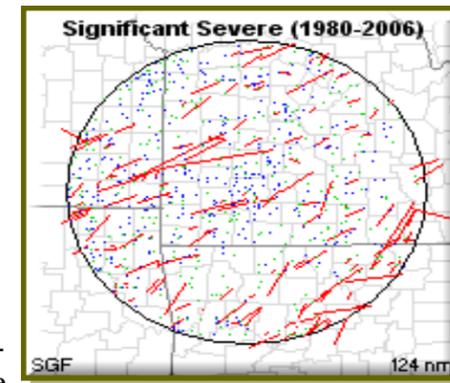


Overview of Weather Hazards in Southwest Missouri & Extreme Southeast Kansas

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

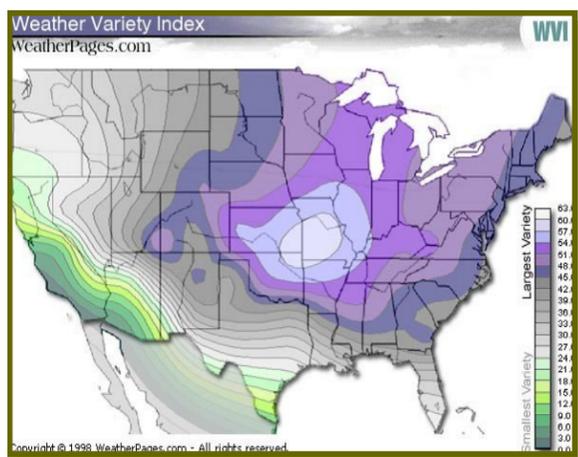
Tornadoes by county for the Springfield County Warning Area from 1950 to 2008

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 Morgan County, Missouri

Severe Weather in Morgan 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.

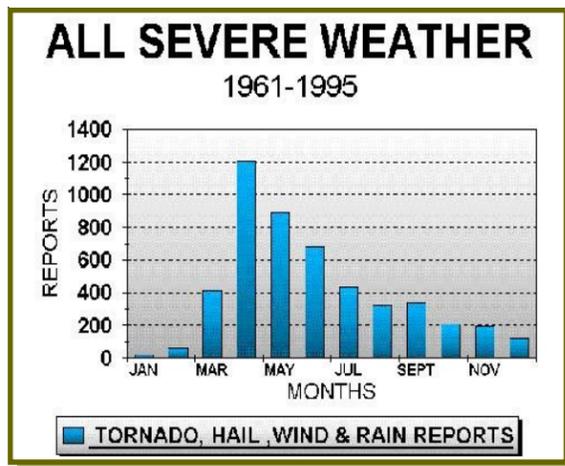


From www.weatherpages.com

Morgan County Missouri is located on the Ozark Plateau along the eastern edge of tornado ally. Because of its location Morgan 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 Morgan County have dropped hail up to 2 3/4” in diameter, created winds in excess of 80 miles an hour and rainfall rates greater than 2” in an hour. While southwest Missouri receives nearly 11 tornadoes a year, Morgan County averages an event every 3 years.

Number of Tornadoes in Morgan Co. (1950 to 2008)

<u>F0/F1</u>	<u>F2</u>	<u>F3</u>	<u>F4</u>	<u>F5</u>
11	7	0	0	0
61%	39%	0%	0%	0%

During the winter season Morgan County averages 5.6 inches of snow. With the most snow in one season at 29.5 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 Morgan County

Morgan County contains 6 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 Morgan County are of earthen construction and there have been no recorded failures.

Where are they Located

- West Fork Lake Dam: Messer Creek, Syracuse
- Indian Creek Hills Lake Dam: Indian Creek, Lakeland
- Yager Lake Dam: Soap Creek, Laurie
- Dennis Lake Dam: Little Buffalo Creek, Climax Springs
- Yows Lake Dam: Wilkes Creek, Eldon
- Lafayette Lake Dam: Mill Creek, Laurie

Most of the dams in Morgan County are less than 100 feet high. Many are located on private land and fall under private ownership.



Spillway gates open to relieve water levels after heavy rainfall.



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 Morgan county on almost a yearly basis.

Morgan County averages 9 days a year with temperatures at or above 95 degrees. July and August are the two warmest months, which average 4 days at or above 95 degrees.

Year	Days 95* +	Days 100* +	Days in a row
1952	38	15	15
1954	48	21	13
1980	37	21	18
1983	33	10	8
1991	14	1	4
2000	14	5	9
Normal # of Days	9	2	▲ Above 95*

Years with above average summer heat

Drought and wildfires can, and often do accompany excessive heat. Morgan 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 Morgan County

- 54 days: 2 Dec 1955 ~ 24 Jan 56
- 45 days: 28 Sept 1964 ~ 11 Nov 64
- 39 days: 1 Feb 2001 ~ 11 Mar 01
- 38 days: 2 Sept 1979 ~ 9 Oct 79
- 37 days: 11 Jul 1957 ~ 16 Aug 57
- 36 days: 26 Nov 2000 ~ 31 Dec 00

While no major wildfires have affected Morgan 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 11,000 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

Morgan County lies at the eastern edge of tornado ally and receives on average a tornado every three and a half years. From 1950 to 2008 Morgan county recorded 18 tornadoes from F0 to F2 in strength. The strongest tornado, an F2, passed across the county on the evening of March 15th, 1982. Along its 5 mile track it caused 25 thousand dollars in damage.

Historical Tornadoes of Morgan County

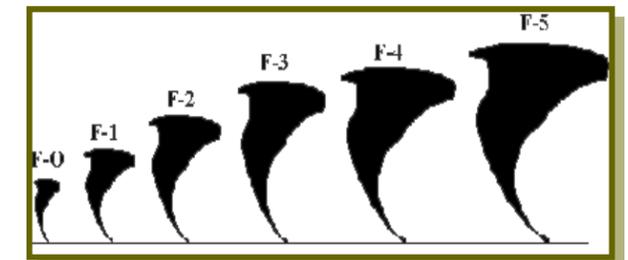
- Apr 18, 1880 (F4) 5 inj, 5 dead
- Apr 19, 1916 (F3) 5 inj, 3 dead
- May 15, 1943 (F4) 5 inj, 3 dead
- Apr 30, 1954 (F2) 1 inj, 0 dead
- May 28, 1958 (F2) 0 inj, 0 dead
- Mar 15, 1982 (F2) 0 inj, 0 dead
- Apr 16, 1995 (F1) 0 inj, 0 dead
- May 6, 2003 (F0) 0 inj, 0 dead

For the Record Morgan County

- Has experienced two F4 tornadoes.
- No F5 tornadoes
- Most recent Tornado March 12, 2006 (F0)
- 16 deaths and 18 injuries since 1880.

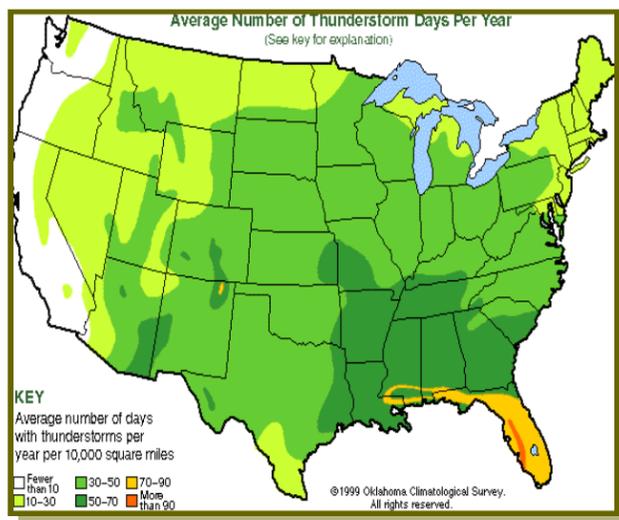


The tornado outbreaks of May 4 & 6, 2003 was one of the worst that southwest Missouri has had since the late 1800's. Thirty tornadoes touched down across the Ozarks between May 4th and 6th, one of which was an F0 that struck near the town of Gravois Mills. This F0 touched down on May 6th and is the latest tornado to strike Morgan county since an F0 that struck Rocky Mount in October of 2001.



- **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



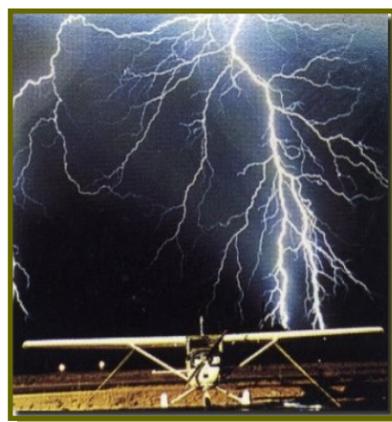
Average number of thunderstorm days per year.

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 2.75 inches in diameter in Morgan county on September 20, 2001. 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 Morgan county reached 81 mph and occurred in 1971 on the 15th of December. Since 1955 high winds have caused around \$1,402,000.00 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 Morgan 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 Morgan County. Morgan 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

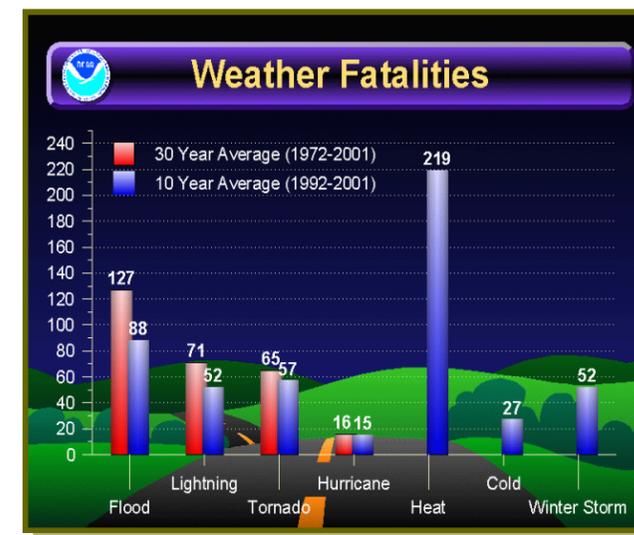
inches, major flooding can occur, and amounts over four inches creates significant flooding that affects most of the county.



Floods in Morgan County

11 Apr 1994: The strong current of a swollen stream washed a small truck off County Road JJ near Highway 135 North. The report was received by the sheriff's office shortly before 0419 CST. The man driving the truck grasped a tree limb and pulled himself to safety. Swollen creeks flooded several other county roads as well.

17 May 1995: Several periods of heavy rain caused widespread flooding with the flooding most persistent in and near Versailles. Flooding occurred on many low bridges in the county. A few were washed out. Flooded roads included Highway 5 in



National Weather Fatality Statistics

Gravois Mills, County Route T four miles south of Versailles, and County Route zero between two and four miles northeast of Laurie.

25 Aug 1997: Four to six inches of rain fell across the northwest corner of the county during the morning hours causing flooding along Highway 135, north of Florence. Flooding was also reported at a gas station near the junction of Highways 135 and 50.

30 May 2001: Two to four inches of rain fell across portions of southern Benton through northwest Camden and into southern Morgan County in less than two hours. Numerous low water crossings and county roads were impassable, especially from Warsaw, east and northeast across Climax Springs, and into the Gravois Mills area.

3 Apr 2001: Significant street flooding occurred around the Versailles area, with rainfall amounts averaging between two and three inches across the northern portion of the county. Some isolated four inch totals were near the communities of Versailles and Pymont.