



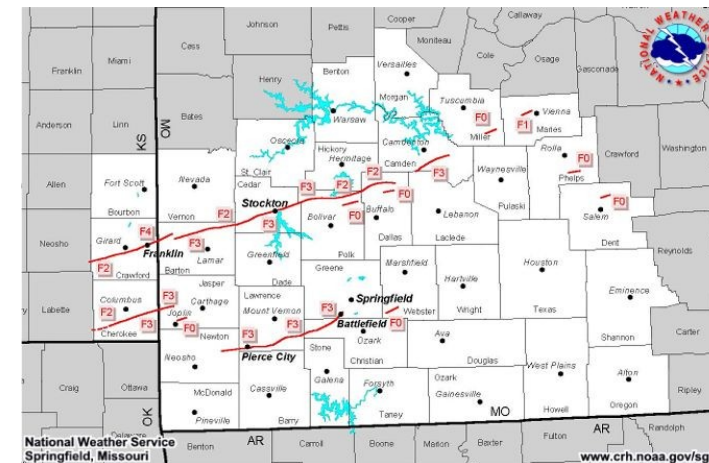
“To provide weather and flood warnings, public forecasts and advisories for all of the United States...and its territories...for the protection of life and property.”

National Weather Service

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National Weather Service

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

By Gene Hatch
 Meteorologist Intern WFO Springfield. Mo.

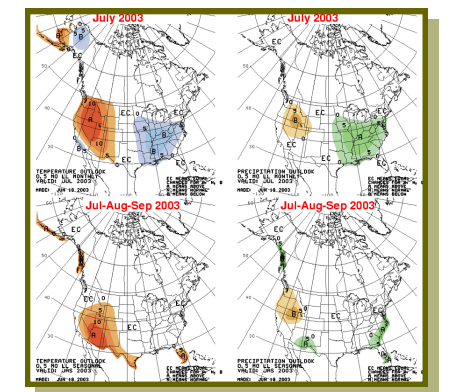
Local Climatology

Averages and records for Waynesville, Missouri in Pulaski County

44	19	7.9	79	-23	42.5
50	24	4.5	85	-23	21.5
61	32	2.4	87	-14	32.0
71	41	0.4	99	-13	6.0
77	51	0	94	25	0
84	60	0	104	35	0
89	65	0	115	42	0
88	63	0	107	36	0
81	55	0	104	24	0
72	43	0	97	11	0
58	33	1.7	85	-3	21.0
48	23	2.4	79	-25	19.8

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. 23rd-1967...A severe thunderstorm formed over the northwest portion of the city of Springfield, MO spawning a tornado. The weather service office measured a wind gust of 63 mph as the tornado moved through the center of the city. Nearly 1000 homes and businesses were destroyed with one fatality and 9 injuries reported.

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.

Jun. 10th-1958...Severe thunderstorms that developed during the early evening hours dropped grapefruit size hail over much of Pulaski county MO.

Jun. 21st-1977...Afternoon thunderstorms pummeled portions of Pulaski county as they moved through the area. Hail to the size of softballs were reported during the height of the storm.

Nov. 18th-1999...From the 18th through the 21st, fires burned 1500 acres in the western sections of the Mark Twain National Forest. Eleven suspected arson fires also burned 1100 acres near Salem in Dent County. Other large fires of over 1000 acres occurred near Roby in northern Texas County and near Fort Leonard Wood in southern Pulaski County. Numerous other smaller fires started over the area on the 18th and continued for two to three days until they were considered under control. The intensity and magnitude of these fires were unusual for the area. Although most of the fires were confined to grassland and near surface material, the high winds and dry conditions caused by several months of below normal rainfall caused some larger scale fires with the burning of larger trees.

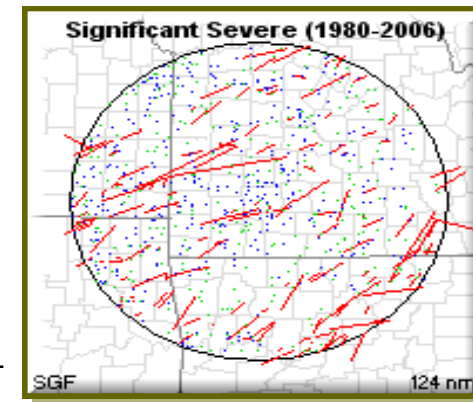


Overview of Weather Hazards in Southwest Missouri & Extreme Southeast Kansas

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

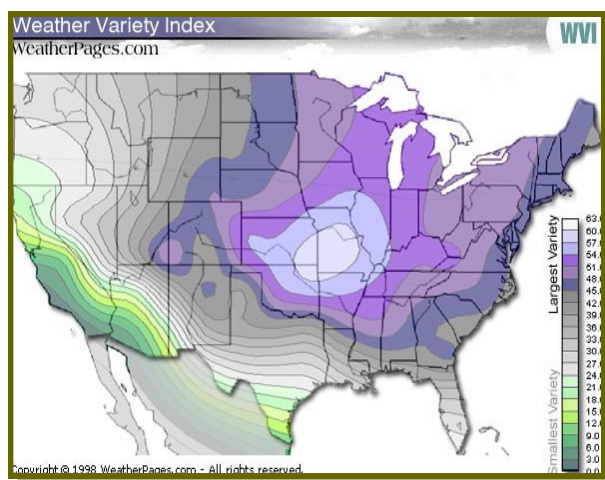
Tornadoes by county for the Springfield County Warning Area from 1950 to 2008

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 Pulaski County, Missouri

Severe Weather in Pulaski 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.

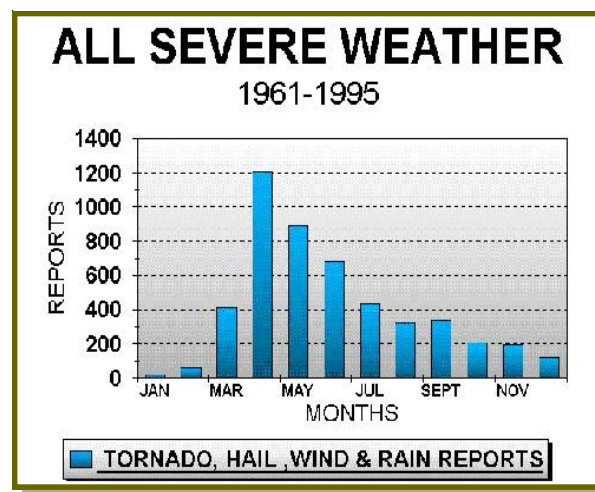


From www.weatherpages.com

Pulaski County Missouri is located on the Ozark Plateau along the eastern edge of tornado ally. Because of its location Pulaski 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 Pulaski County have dropped hail up to 4 1/2” in diameter, created winds in excess of 90 miles an hour and rainfall rates greater than 2” in an hour. While southwest Missouri receives nearly 11 tornadoes a year, Pulaski County averages an event every 4 years.

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

F0/F1	F2	F3	F4	F5
9	4	1	0	0
64%	29%	7%	0%	0%

During the winter season Pulaski County averages 19.3 inches of snow. With the most snow in one season at 62.0 inches, falling during the 1960 to 1961 winter season. Ice storms also affect the county during the winter season causing significant damage to homes, trees and utilities.

Dam Failure

Dams in Pulaski County

Pulaski County contains 12 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 Pulaski County are of earthen construction and there have been no recorded failures.

Where are they Located

- Alexander Farms Dam: Tavern Creek, Iberia
- Cardin Lake Dam: Gasconade River, Jerome
- Penn’s Pond Dam: Roubidoux Creek, Waynesville
- Schultz Lake Dam: Gasconade River, Waynesville
- Bloodland Quad. #1 Dam: Trib. Smith Branch, Waynesville
- Bloodland Quad. #2 Dam: Trib. Smith Branch, Waynesville
- Bloodland Quad. #3 Dam: Trib. Big Piney River, Waynesville
- Bloodland Quad. #4 Dam: Trib. Smith Branch, Waynesville
- Wooldridge Lake Dam: Tavern Creek, Iberia
- Armistead Dam: Duck Creek, Richland
- Missouri State Dam 834: Smith Branch, Waynesville
- Missouri State Dam 835: Smith Branch, Waynesville



All of the dams in Pulaski 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 Pulaski county on almost a yearly basis.

Pulaski County averages 14 days a year with temperatures at or above 95 degrees. July and August are the two warmest months, which average 5 days at or above 95 degrees.

Year	Days 95* +	Days 100* +	Days in a row
1952	38	11	10
1953	52	20	10
1954	66	38	14
1980	61	25	18
1983	31	10	16
2001	29	5	12
Normal # of Days	14	3	▲ Above 95*

Years with above average summer heat

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

- 31 days: 24 Sept 1956 ~ 24 Oct 56
- 31 days: 14 Aug 1998 ~ 13 Sept 98
- 29 days: 27 Sept 1964 ~ 25 Oct 64
- 29 days: 5 Nov 2002 ~ 3 Dec 02
- 28 days: 22 Dec 1956 ~ 18 Jan 57
- 28 days: 21 Dec 1985 ~ 17 Jan 86

While no major wildfires have affected Pulaski 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 4600 fires occurred during that time in the Gasconade Fire district which includes Osage, Maries, Pulaski, Phelps and Dent counties. This represented nearly 8% of the wildfires in the state with over 38,000 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 Gasconade fire district were the result of lightning.

Tornado Information

Pulaski County lies at the eastern edge of tornado ally and receives on average a tornado every four years. From 1950 to 2008 Pulaski county recorded 14 tornadoes from F0 to F3 in strength. The strongest tornado, an F3, struck near the town of hooker on the evening of January 7th, 2008. Along its 2 mile track it caused 1.0 million dollars in damage and injured 3.



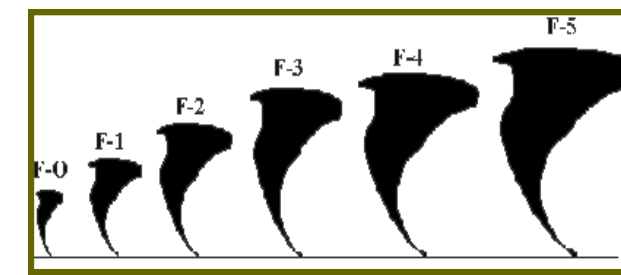
Historical Tornadoes of Pulaski County

- Nov 25, 1926 (F3) 30 inj, 0 dead
- Apr 29, 1937 (F2) 8 inj, 0 dead
- May 12, 1978 (F2) 4 inj, 0 dead
- Oct 14, 1966 (F2) 6 inj, 0 dead
- Apr 7, 1980 (F2) 3 inj, 0 dead
- Nov 15, 1988 (F2) 0 inj, 0 dead
- May 18, 1995 (F1) 2 inj, 0 dead
- May 6, 2003 (F1) 0 inj, 0 dead

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 F1 that struck near the town of Waynesville. This F1 and another F0 that touched down on May 4th are the latest tornadoes to strike Pulaski county since an F0 that struck Crocker in October of 2001.

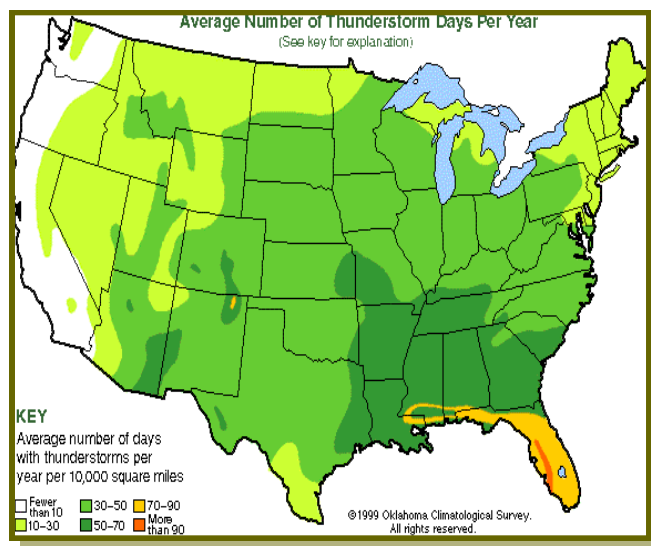
For the Record Pulaski County

- Has experienced two F3 tornadoes.
- No F4 or F5 tornadoes
- Most recent Tornado January 7, 2008 (F3)
- 0 deaths and 53 injuries since 1880.



- **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



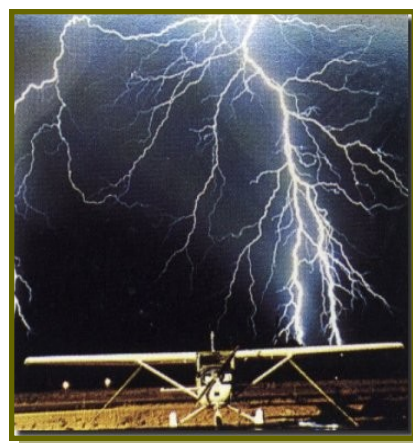
Average number of thunderstorm days per year.

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 4.50 inches in diameter in Pulaski county on June 19, 1977. 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 Pulaski county reached 91 mph and occurred in 1996 on the 5th of May. Since 1957 high winds have caused around \$406,000.00 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.

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 Pulaski 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 Pulaski County. Pulaski 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

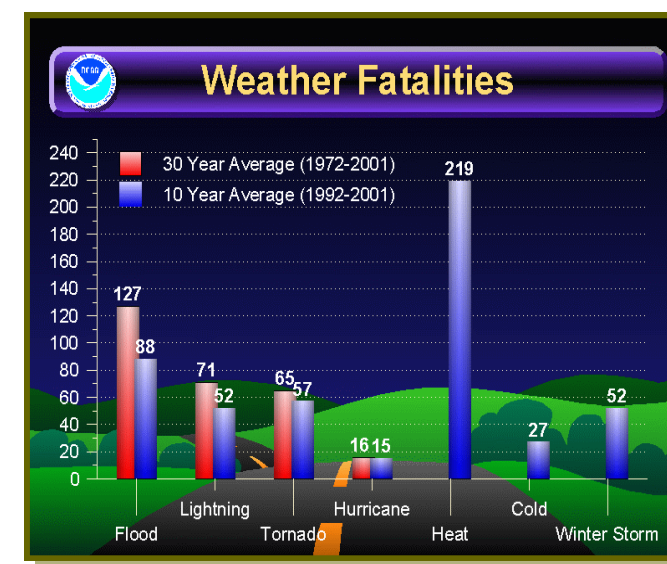
inches, major flooding can occur, and amounts over four inches creates significant flooding that affects most of the county.



Floods in Pulaski County

28 Apr 1994: Runoff from heavy rain poured into the already swollen Gascondade River and caused it to flood Highway 144, south of Richland. A much smaller stream flooded County Road H southeast of Crocker.

12 July 2002: Flooding of low water crossings and low lying areas occurred in many areas of the county. Street flooding was reported in Waynesville. 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.



National Weather Fatality Statistics

19 Apr 2002: A complex of strong to severe thunderstorms developed over the southwestern portions of the Lake of the Ozarks region during the afternoon and early evening of April 19th and moved slowly eastward over Camden, Maries, Miller, Phelps and Pulaski counties. The airmass was very moist which allowed for the storms to produce torrential rainfall in a short period of time. In addition, the storms propagated over the same areas producing rainfall rates of two to four inches per hour. Radar estimated between six to eight inches of rain fell in these areas during the early evening hours. A broad area of two to four inches fell around the six to eight inch band, which allowed for significant flooding to occur. Numerous low water crossings, county and state roads were flooded or closed during the height of the storm. Approximately two major roads and 14 bridges were either damaged or completely washed out in northern Pulaski county where the the highest rainfall totals occurred. In Rolla, Missouri two feet of water was flowing over some city streets.