

Natural Hazards Assessment

Fillmore County, MN

Prepared by: NOAA / National Weather Service La Crosse, WI



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Prepared by National Weather Service – La Crosse

Overview

Fillmore County is in the Upper Mississippi River Valley of the Midwest with terrain that ranges from relatively flat farm land in the west to steep hills and bluffs in the central and eastern parts. It is bordered by the Iowa state line to the south.

The area experiences a temperate climate with both warm and cold season extremes.

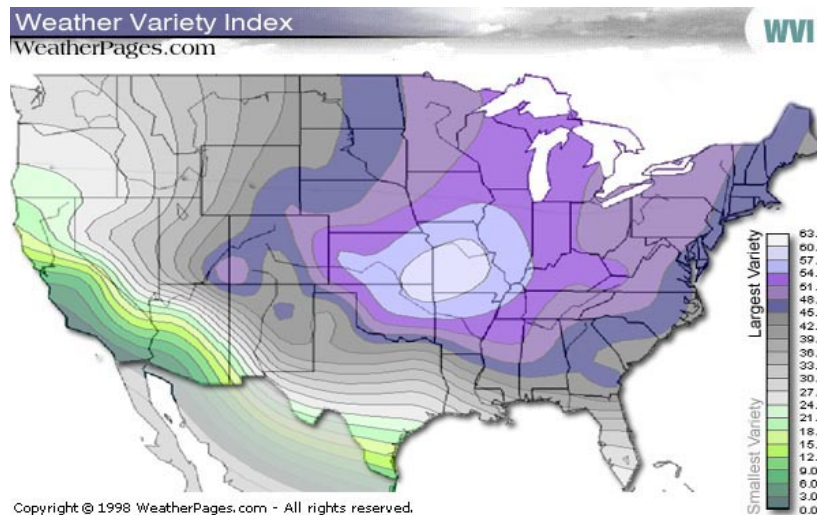
Winter months can bring occasional heavy snows, intermittent freezing precipitation or ice, and prolonged periods of cloudiness. While true blizzards are rare, winter storms impact the area on average about 3 to 4 times per season. Occasional arctic outbreaks bring extreme cold and dangerous wind chills.

Temperatures between river valleys and surrounding ridges can vary by as much as 3° to 5°F.

Thunderstorms occur on average 30 to 50 times a year, mainly in the spring and summer months. The strongest storms can produce associated severe weather like tornadoes, large hail, or damaging wind. Both river flooding and flash flooding can occur. The terrain can lead to mud slides and generally increases the flash flood threat. Heat and high humidity is occasionally observed in June, July, or August.

The autumn season usually has the quietest weather. Valley fog is most common in the late summer and early fall months. On calm nights, colder air settles into valleys leading to colder low temperatures compared to ridge top locations. High wind events can also occur occasionally, usually in the spring or fall.

The variability in weather can be seen in the following graphic, created by a private company (weatherpages.com) that rated each city on variations in temperature, precipitation, and other factors. Rochester, MN ranked 3rd and La Crosse, WI ranked 27th highest in variability out of 277 cities.

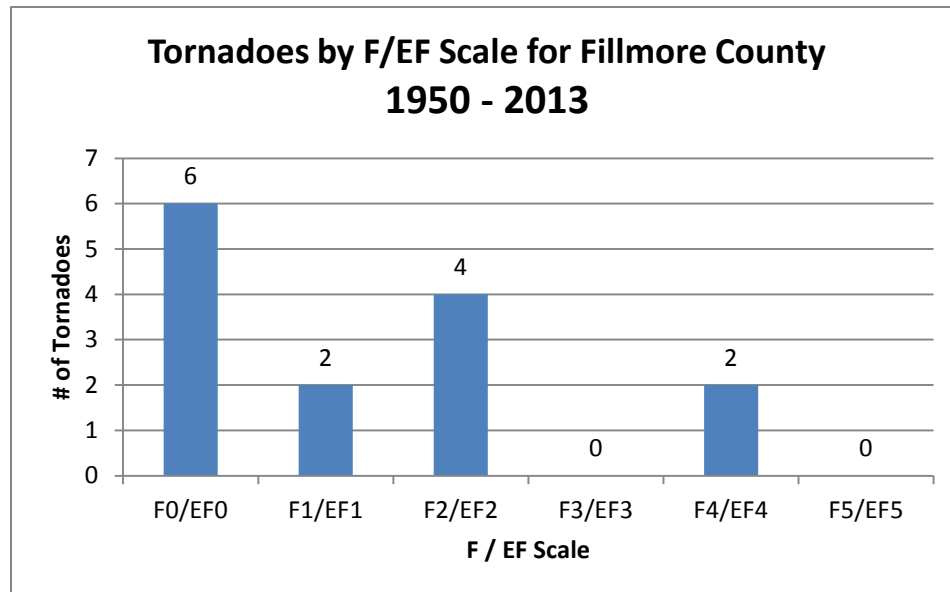


Since 1998, Fillmore County has been included in a FEMA Federal Disaster Declaration 5 times:

- 1998 – Severe storms
- 2000 – Severe storms / flooding
- 2007 – Severe storms / flooding
- 2008 – Severe storms / flooding
- 2013 – Severe storms / flooding

Tornadoes

Even though Minnesota averages about 24 tornadoes per year, Fillmore County has only had 14 documented tornadoes since 1950, averaging about one tornado every 4-5 years. Most tornadoes are short-lived and small. May and June are the peak months and most occur between 3 and 9 p.m., but they can occur nearly any time of year and at all times of the day.



Most recent tornadoes:

- May 22, 2011 (EF2)
- June 16, 2004 (F0)
- June 11, 2004 (F0)
- June 19, 1997 (F0)
- June 8, 1993 (F0)
- May 17, 1982 (F2)
- July 14, 1977 (F2)
- July 23, 1973 (F0)
- May 15, 1968 (F1)
- Apr.20, 1968 (F1)
- May 5, 1965 (F2)
- May 5, 1965 (F4)

Tornado frequency is higher in the relatively flat terrain of western Fillmore County. One of the stronger tornadoes to hit Fillmore County occurred in September 1894 hitting Spring Valley, MN. Five people were killed and numerous farms and homes were destroyed. Another large tornado (F4) hit in 1953 damaging and destroying barns before killing a man just southeast of Wykoff, MN. Another F4 tornado hit in 1964 that injured people and destroyed buildings near Canton, Lenora, and Newburg. And most recent an EF2 tornado crossed out of northern Iowa and nearly hit the community of Harmony in May 2011.

Strongest tornadoes: (1850-2013)

- Sept.21, 1894 (F4) – 70 inj, 5 dead
- May 10, 1953 (F4) – 8 inj, 1 dead
- May 5, 1965 (F4) – 17 inj, 0 dead
- June 4, 1980 (F3) – 18 inj, 0 dead
- July 14, 1977 (F2) – 10 inj, 0 dead

Fillmore County Tornado Facts:

- No F5 or EF5* tornadoes
- Three F4 tornadoes and one F3
- 7 deaths and 136 injuries since 1850
- Tornadoes have occurred April – Sept.
- Most have occurred in June (8 times)

Tornado Watches		Tornado Warnings	
Year		Year	
2013	4	2013	1
2012	2	2012	0
2011	3	2011	3
2010	5	2010	0
2009	4	2009	0
2008	7	2008	3
2007	4	2007	1
2006	5	2006	0
2005	11	2005	1
2004	10	2004	4

Enhanced Fujita (EF*) Scale	
EF0	65-85 mph
EF1	86-110 mph
EF2	111-135 mph
EF3	136-165 mph
EF4	166-200 mph
EF5	>200 mph

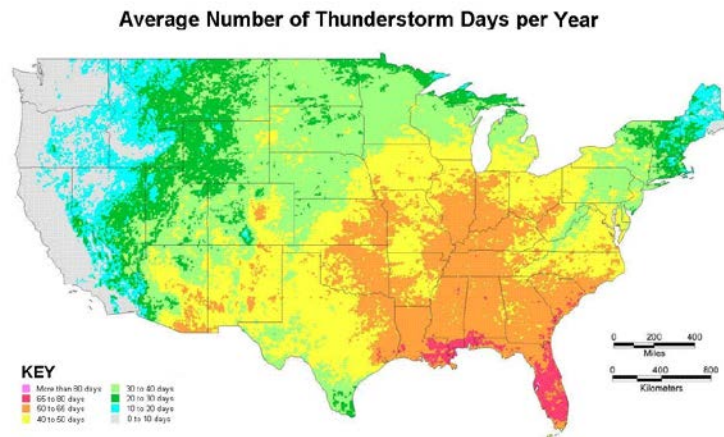
* Started February 1, 2007

Severe Thunderstorms / Lightning

Fillmore County averages 40 thunderstorm days per year. The National Weather Service (NWS) considers a thunderstorm severe when it produces wind gusts of 58 mph (50 knots) or higher, 1 inch diameter hail or larger, or a tornado.

Downdraft winds from a severe thunderstorm can produce local or widespread damage, even tornado-like damage if strong enough. Most severe thunderstorm winds occur in June or July and between the hours of 4 and 8 p.m., but can occur at other times. Most damage involves blown down trees, power lines, and damage to weaker structures (i.e. barns, outbuildings, garages)

with occasional related injuries. In June 1998, several squall lines impacted the county with wind gusts in excess of 100 mph knocking down hundreds of trees and damaging buildings. Power was also out in many communities. On July 1, 2011 winds gusted to 72 mph at Preston. Overall there have been 89 damaging wind reports since 1982 in the county.



Large hail can also occur in a severe thunderstorm. June is the peak month with the most common time between 1 and 9 p.m., but it can occur in other warm season months and at any time of day. Hail is typically a crop damaging hazard but can damage roofs, windows, and vehicles if large enough (> 1"). Expenses can be high. Injuries or fatalities are rare for hail. In April 2004, two inch diameter size hail fell in the Spring Valley, MN area accompanied by high winds. In May and June 1998, there were numerous reports of golf ball size hail or larger. There have been 101 large hail ($\geq \frac{3}{4}$ ") reports since 1982.

Non-severe thunderstorms still pose a lightning risk. According to the Vaisala Group, an average of nearly 400,000 cloud-to-ground strikes hit Minnesota each year based on data from 1997 to 2010. Nationally, Minnesota ranks 28th in lightning related fatalities with 64 deaths reported between 1959 and 2013. There have been lightning fatalities in Minnesota in 2007, 2009, 2012, and 2013.



(Wind damage to buildings in southern Minnesota – June 1998)

Severe Thunderstorm Watches		Severe Thunderstorm Warnings	
Year		Year	
2013	6	2013	18
2012	6	2012	10
2011	9	2011	14
2010	14	2010	14
2009	7	2009	5
2008	11	2008	16
2007	16	2007	9
2006	13	2006	9
2005	14	2005	4
2004	13	2004	12

Flooding and Hydrologic Concerns

On occasion intense, heavy rain producing thunderstorms or consecutive thunderstorms (“training”) can bring excessive rainfall leading to flash flooding in Fillmore County. The hilly terrain promotes rapid runoff and enhances the threat. Mudslides can occur in extreme cases. Intense rainfall rates also lead to occasional urban style street flooding.

June is the most common month for flash floods, but they can occur from May through September. They are most common in the evening hours, between 8-10 p.m., but can occur at other times and typically last from 3-6 hours. From 1995 to 2013 there were 18 flood related fatalities in Minnesota.

In August 2007, a major flash flood event hit the region with as much as 17 inches of rain falling across southeast Minnesota. Runoff into Rush Creek caused extensive flooding in Rushford when the levee system was topped. Two thirds of the town was under water with about 300 rescues reported. Roughly 766



homes were flooded and damage estimates across the county topped \$50 million. Numerous highways were closed, with bridges and infrastructure destroyed, which led to a federal disaster area declaration. (Photo left: Rushford, MN – August 2007)

Flash Flood Warnings	
Year	
2013	6
2012	0
2011	0
2010	2
2009	1
2008	3
2007	3
2006	0
2005	1
2004	7
2003	0

Flash flooding also hit the county hard in June 2008 when 4-8” rainfalls were reported over one weekend. Many roads were washed out again and mudslides reoccurred.

Spring Valley, MN experiences flash flooding from Spring Valley Creek quite often as well, with four floods dating back to 2000.

Since 1998, flash flooding has occurred in Fillmore County every year except two (2002 and 2003).

One main river impacts Fillmore County – the Root River – although there are numerous creeks and watersheds. Flooding can occur from snowmelt or ice jams in the early spring, but more commonly from heavy rain patterns anytime from spring to fall. Some record crests occurred in 2000 but many were set from early spring flooding in 1950.

Root River @ Lanesboro Top 5 Crests (FS: 12 feet)	
Date	Crest
3/26/1950	19.20'
6/29/1942	17.23'
7/11/1981	14.35'
6/9/2008	14.17'
3/26/1961	13.73'



(Flooding from Lanesboro, MN area – June 2008)

Winter Storms and Extreme Cold

Hazardous winter weather can bring a variety of conditions to Fillmore County. An average of 3-4 winter storms impact the area each season. The terrain in parts of the county does limit the number of true blizzards (only 4 since 1982) but heavy snow, blowing snow, ice, and sleet all occur.

The 30-year average seasonal snowfall at Preston is 44.0 inches, although snowfall can vary by a few inches between ridge tops and valleys. Blowing snow and blizzard conditions are more common on ridge tops and flat areas. The all-time record one-day snowfall at Preston was 14.3 inches set on March 18, 2005. The bulk of snow falls between December and March. The largest winter storms tend to form over the central or southern Plains, then move northeast towards the western Great Lakes.

On February 23-25, 2007, a major winter storm impacted Fillmore County. Heavy snow, including lightning, brought nearly a foot of snow the first night. Winds later increased and created major blowing and drifting. Sleet and freezing rain fell the next day, followed by another round of heavy snow and blizzard conditions later that evening. When the storm finally moved out, 20 inches of snow or more had fallen over a large part of the county, including 25" at Lanesboro and 20" at Harmony. Another major storm hit less than a week later dropping 10" of snow on Spring Valley and another 7.8" at Preston leading to one of the snowiest weeks on record.

Top 5 Seasonal Snowfalls at Preston	
Years	Snowfall
1961-62	75.5"
1996-97	68.7"
2010-11	64.7"
2012-13	63.5"
1958-59	61.0"

March can often be a snowy month. Even though snowfall may be less frequent, heavy wet snow can form from large spring storms. In 2005, a large winter storm dropped 23.3" at Preston, 22" at Peterson, and 20" at Spring Valley on March 18-19th. Nearly 13 inches of snow fell March 13-14, 1997 as well.

Ice storms (1/4" of ice or more) can occur but are relatively rare with only 4 occurrences since 1982.



Arctic cold outbreaks can occur in the upper Midwest as well. Snow depth can modify these cold temperatures leading to sub-zero readings on average 31 times a winter. Occasionally strong northwest winds will combine with arctic outbreaks to create dangerous wind chill conditions as well. The

coldest temperatures are usually in January and February with average lows in the single digits and record lows colder than -25°F most days. Since 1993 there have been 7 fatalities reported due to extreme cold in Minnesota.

Coldest Lows at Preston, MN	
Low	Date
-45°F	2/3/1996
-39°F	1/31/1996
-39°F	1/21/1970
-38°F	1/19/1970
-38°F	1/18/1967

In 1996, Preston went 6 consecutive days with temperatures below zero degrees (F) following a blizzard about a week earlier. Low temperatures of -39°F, -37°F, -36°F, -45°F, -37°F, and -28°F were set on six straight mornings.

The La Crosse National Weather Service issues Wind Chill Advisories when wind chill readings of -20°F to -34°F are expected. Wind Chill Warnings are issued when wind chill values at or below -35°F are expected or occurring. In late January 2008, wind chill values hit -40°F at Preston, MN. It was also bitterly cold from January 13-16, 2009 with record wind chills.

Heat, Drought, and Wildfires

On occasion the weather pattern across the upper Midwest favors prolonged heat and humidity, leading to heat waves. June through August are the warmest months with average high temperatures in the 80s and record highs above 100°F most days. The warmest temperature on record at Preston is 101°F set on July 14, 1995 and two dates in 1964.

In Fillmore County, there have been 8 heat waves since 1993. During that same time period, there were 16 fatalities directly related to heat waves in Minnesota.

One of the longest heat waves on record occurred in July 1936 when the area hit 90°F or higher for 14 consecutive days, including numerous days at or above 100°F (Note: Data for Preston, MN was not available before 1952). A short heat wave hit in late July and early August 2001 with high temperatures in the 90s and heat indices near 110°F. And more recently heat index values were above 105 for several days in mid July 2011 and July 2013.

Warmest Highs at Preston, MN	
High	Date
101°F	7/7/2012
101°F	7/14/1995
101°F	8/2/1964
101°F	7/18/1964
100°F	6/22/1988



Prolonged dry spells can also lead to drought causing extreme damage to crops. Droughts vary in length and intensity but abnormally dry to moderate drought conditions can occur quite frequently. Severe to extreme droughts occur far less frequently.

severe in 2012.

Droughts have occurred in Minnesota as recently as 1999, 2000, and 2006 through 2008. A mild drought returned in 2011 and became

Dry weather can also lead to a wildfire threat, especially in the spring before foliage has emerged (i.e. before green up) or in the fall after vegetation has started to die off. Warm, dry (i.e. lower relative humidities), and windy conditions all favor higher fire danger and can lead to sporadic grass fires in Fillmore County. Thick, wooded areas also pose a threat for wildfires under extremely dry conditions but occur far less frequently.



Local Climatology

Here are some basic climatology figures for the Fillmore County area. Data is valid for Preston, MN based on averages or “normal” from a 30-year period (1981-2010).

Month	Normal Maximum Temperature	Normal Minimum Temperature	Average Temperature	Precipitation	Snowfall
JAN	25.0	5.5	15.3	0.99"	10.9"
FEB	30.2	9.9	20.0	1.02"	7.5"
MAR	42.0	22.0	32.0	1.89"	6.8"
APR	57.7	34.0	45.8	3.61"	1.8"
MAY	68.7	44.6	56.7	3.92"	0.0"
JUN	78.4	54.2	66.3	5.18"	0.0"
JUL	82.7	58.9	70.8	4.36"	0.0"
AUG	80.2	56.6	68.4	4.81"	0.0"
SEP	72.7	47.7	60.2	3.76"	0.0"
OCT	60.0	35.3	47.6	2.32"	0.2"
NOV	43.1	24.1	33.6	2.20"	3.6"
DEC	28.5	10.2	19.3	1.52"	10.9"
Year	55.5	33.7	44.6	35.58"	41.7"

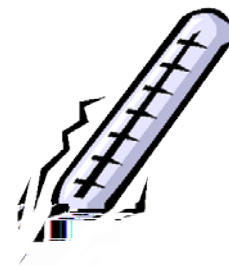
NOTE: Climate information for Preston, MN begins in 1952.

Miscellaneous facts:

- Warmest year on record – 2012 (48.9°F)
- Warmest month on record – July 1955 (77.3°F)
- Warmest day on record – July 7, 2012 (101°F)
- Greatest number of days with 90°F or warmer – 1955 (37 times)

- Coldest year on record – 1996 (41.3°F)
- Coldest month on record – January 1977 (1.8°F)
- Coldest day on record – February 3, 1996 (-45°F)
- Greatest number of days at 0°F or colder – 1978 (60 times)

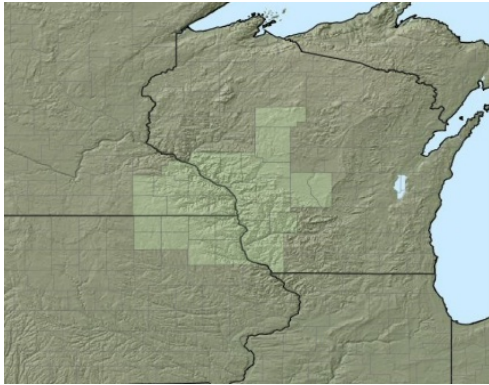
- Wettest year on record – 1983 (49.15")
- Wettest month on record – August 2007 (14.88")
- Wettest day on record – July 11, 1981 (7.30")
- Driest year on record – 1958 (17.74")
- Driest month on record – Jan/Feb 1986 and February 1969
-
- Highest seasonal snowfall on record – 1961/62 (75.5")
- Highest monthly snowfall on record – December 2010 (37.7")
- Highest one-day snowfall on record – March 18, 2005 (14.3")
- Least seasonal snowfall on record – 1953/54 (2.5")



NOAA/National Weather Service Support and Weather Monitoring



NOAA's National Weather Service (NWS) forecast office at La Crosse, WI serves Fillmore County with weather information and support on a continuous basis. Operating 24 hours a day, a staff of 23 issues routine and non-routine informational products for the area, including all watches, warnings, and advisories related to natural hazards. Doppler radar (WSR-88D) is co-located with the La Crosse NWS office and covers the region.



NWS La Crosse has a web site at:
www.weather.gov/lacrosse

Normal communication during hazardous weather scenarios is via telephone, 800 MHz (MN ARMER) radio, and amateur radio.

NOAA Weather Radio coverage in Fillmore County includes two stations:

- WXK41 (Rochester) on 162.475 MHz
- KXI60 (Decorah) on 162.525 MHz

Storm spotter groups consist of a mix of amateur radio operators, fire departments, law enforcement, and the general public. Spotter training is held nearly every year with an average attendance over the past five years of 48.

There is a variety of weather monitoring sources in Fillmore County, including:

Automated weather station(s):

- Preston (KFKA)

River Gauge(s):

- Root River @ Pilot Mound
- South Branch of Root River @ Carimona
- South Branch of Root River @ Lanesboro
- South Branch of Root River @ Preston

Cooperative Observers:

- Harmony
- Lanesboro
- Preston
- Rushford
- Spring Valley



In addition, other volunteer reports from around the county are received at the La Crosse NWS office including rainfall, snowfall, and temperatures, on a routine basis.

Resources

National Weather Service – La Crosse	www.weather.gov/lacrosse
NWS La Crosse Tornado Database	www.weather.gov/lacrosse/?n=tornadomain
NWS La Crosse River Monitoring	http://www.crh.noaa.gov/ahps2/index.php?wfo=arx
NWS La Crosse Climate	www.weather.gov/climate/index.php?wfo=arx
NWS La Crosse Drought information	www.weather.gov/lacrosse/?n=drought
NWS La Crosse Storm Summaries	www.weather.gov/lacrosse/?n=events
NWS La Crosse NOAA Weather Radio page	www.weather.gov/lacrosse/?n=nwr
Midwest Climate Center	http://mcc.sws.uiuc.edu/
Minnesota Climatology Working Group	http://climate.umn.edu/
Wisconsin State Climatology Office	http://www.aos.wisc.edu/~sco/
Iowa Climatology	http://www.iowaagriculture.gov/climatology.asp
NWS Storm Prediction Center	http://www.spc.noaa.gov/
SPC Online Severe Weather Climatology	http://www.spc.nssl.noaa.gov/climo/online/grids/ http://www.spc.noaa.gov/climo/online/rda/ARX.html

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