

Natural Hazards Assessment

Monroe County, WI

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



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Table of Contents:

Overview..... 3

Tornadoes.....4

Severe Thunderstorms / Lightning.....5

Flooding and Hydrologic Concerns.....6

Winter Storms and Extreme Cold.....7

Heat, Drought, and Wildfires.....8

Local Climatology.....9

**National Weather Service &
Weather Monitoring..... 10**

Resources..... 11

Natural Hazards Assessment

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Prepared by National Weather Service – La Crosse

Overview

Monroe County is in the Upper Mississippi River Valley of the Midwest with relatively hilly terrain and bluffs. Eastern sections of the county do transition into relatively flat ground and bogs.

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

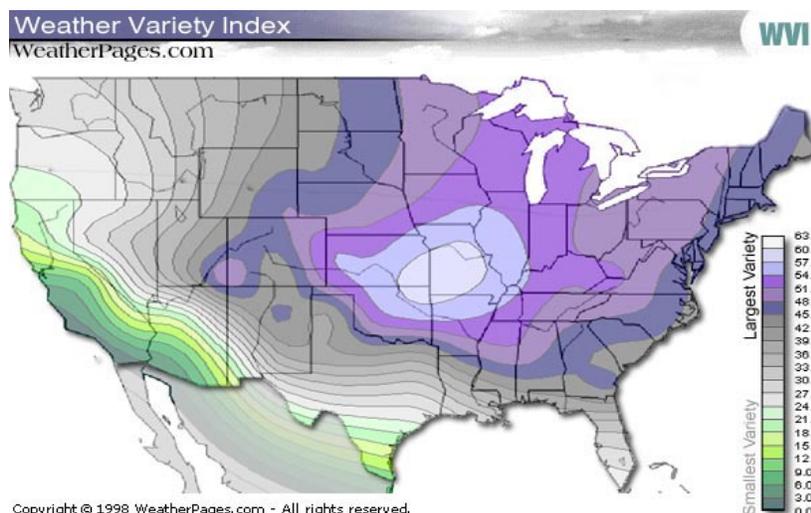
Winter months can bring occasional heavy snows, intermittent freezing precipitation or ice, and prolonged periods of cloudiness. While true blizzards are rare, winter storms impact the area on average about 3 to 4 times per season. Occasional arctic outbreaks bring extreme cold and dangerous wind chills.

Temperatures between river valleys and surrounding ridges can vary greatly. Typically high temperatures on ridges are 3° to 5°F colder than valleys. This can lead to slightly more average snowfall on ridge tops and occasionally a difference in winter precipitation types from ridge to valley. Temperatures in lowlands, or bogs, are often 10 to 15 degrees colder at night and can even freeze in summer.

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, along with urban-related flood problems. 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. La Crosse, WI ranked 27th highest in variability out of 277 cities.

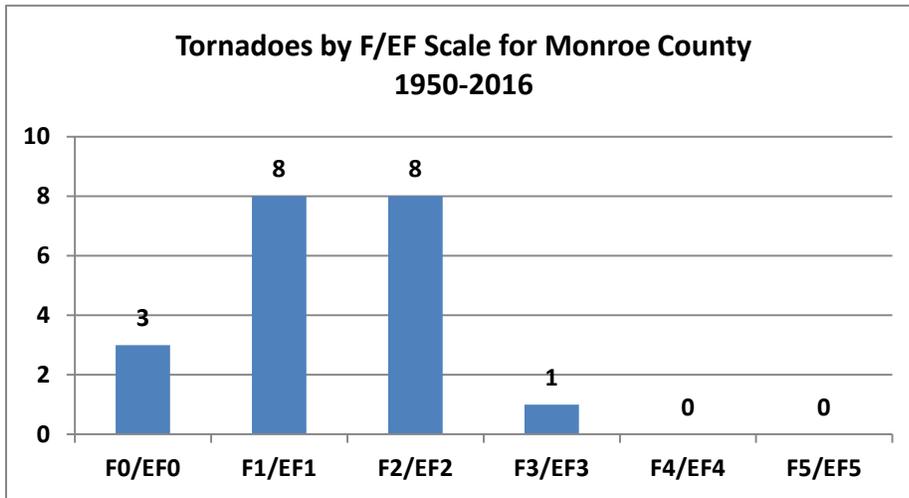


Since 1998, Monroe County has been included in a FEMA Federal Disaster Declaration 5 times:

- 1998 – Severe storms
- 2000 – Severe storms / flooding
- 2004 – Severe storms / flooding
- 2008 – Severe storms / flooding
- 2016 – Severe storms / flooding

Tornadoes

Even though Wisconsin averages about 23 tornadoes per year, Monroe County has only had 20 tornadoes since 1950, averaging about one tornado every 1-2 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)
- May 22, 2011 (EF1)
- Aug.18, 2005 (F1)
- June 23, 2004 (F1)
- Sept.7, 2001 (F0)
- July 9, 2000 (F1)
- June 1, 2000 (F1)
- Apr.24, 1994 (F1)
- May 8, 1988 (F2)
- June 26, 1986 (F2)
- Aug.12, 1985 (F2)
- May 10, 1979 (F2)

One storm dropped two tornadoes in Monroe County on May 22, 2011 crossing the southern part of Sparta and hitting homes north and northeast of Tomah. In August 1985, a significant tornado (F2) set down in Kendall, WI destroying a barn and damaging a home before becoming a killer as it moved into neighboring Juneau County. In July 1907, a violent tornado (F4) struck near Oakdale, WI killing three and leaving a hundred people homeless. More recently, a squall line produced a quick F1 tornado that struck a busy campground in the Warrens area injuring several people.

Strongest tornadoes: (1850-2016)

- July 3, 1907 (F4) – 40 inj, 11 dead
- May 1, 1930 (F3) – 15 inj, 0 dead
- Apr. 19, 1957 (F3) – 0 inj, 0 dead
- Aug. 12, 1985 (F2) – 22 inj, 0 dead
- May 23, 1933 (F2) – 3 inj, 0 dead

Monroe County Tornado Facts:

- No F5 or EF5 tornadoes
- Only one F4 tornado and two F3s
- 2 deaths and 86 injuries since 1850
- Tornadoes have occurred April – Sept.
- Most have occurred in June and August (7)

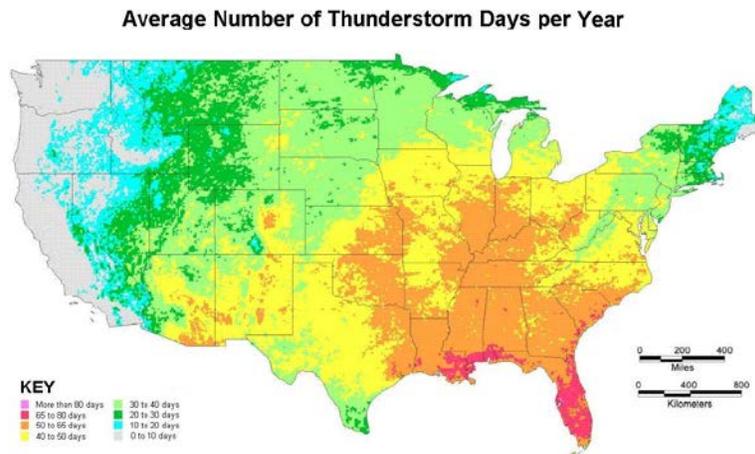
Tornado Watches		Tornado Warnings	
Year		Year	
2016	0	2016	0
2015	1	2015	0
2014	1	2014	0
2013	3	2013	0
2012	1	2012	0
2011	5	2011	3
2010	4	2010	1
2009	2	2009	0
2008	8	2008	3
2007	6	2007	1
2006	2	2006	0

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

Severe Thunderstorms / Lightning

Monroe County averages 39 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, a large squall line moved through the region with wind gusts in excess of 100 mph knocking down hundreds of trees and damaging buildings. The Cataract area and Highway 71 were hardest hit. There have been 103 damaging wind reports since 2000 in the county, including 1 injury (on 8/11/2007).



Large hail can also occur in a severe thunderstorm. June is the peak month, 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. On June 1, 2000 hail the size of softballs hit Oakdale, WI damaging siding, roofs, and numerous vehicles (see below) while in 2011 baseball sized or larger hail fell in May and June. There have been 124 large hail ($\geq 3/4"$) reports in the county since 2000.

Non-severe thunderstorms still pose a lightning risk. According to the Vaisala Group, an average of just under 300,000 cloud-to-ground strikes hit Wisconsin each year based on data from 2006 to 2015. Nationally, Wisconsin ranks 11th in lightning related fatalities with 8 deaths reported between 2006 and 2015. There were lightning fatalities in Wisconsin 2007, 2008, 2011, 2016, and there have been 23 injuries in Monroe County from lightning since 1982.



Severe Thunderstorm Watches		Severe Thunderstorm Warnings	
Year		Year	
2016	6	2016	11
2015	6	2015	5
2014	4	2014	14
2013	8	2013	8
2012	9	2012	3
2011	12	2011	19
2010	13	2010	10
2009	3	2009	6
2008	12	2008	9
2007	14	2007	9

Flooding and Hydrologic Concerns

On occasion intense, heavy rain producing thunderstorms or consecutive thunderstorms (“training”) can bring excessive rainfall leading to flash flooding in Monroe 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 street flooding, especially in/around Sparta and Tomah.

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. Between 1982-2016, there were 11 deaths from flooding in Wisconsin.

In June 2004, 3 to 5 inches of rain fell during one night that led to flash flooding across northern and central parts of the county. Several roads became impassable and residents in sections of Sparta, WI were evacuated because of rising water.

In early June 2008, a weekend of heavy rain and storms brought flash flooding to mainly southern parts of the county, including the communities of Leon, Sparta, and Melvina. Many roads were washed out with nearly a million dollars in damage to infrastructure. Mudslides were also common, especially in hilly terrain.

Monroe County contains the head waters for several regional rivers, including the La Crosse, Kickapoo, Baraboo, and Lemonweir. These rivers can experience flooding with seasonal spring snowmelt but may also rise quickly during the summer from heavy rain patterns. Other creeks and drainage areas in the county respond in the same fashion, but can certainly flood quickly when excessive rain has fallen. Often the flooding retreats about as fast as it started.

There are also several small manually level controlled lakes including Lake Tomah, Angelo Pond, Perch Lake, and bog flowages.

Flash Flood Warnings	
Year	
2016	2
2015	0
2014	1
2013	1
2012	0
2011	0
2010	2
2009	1
2008	4
2007	1
2006	0



Winter Storms and Extreme Cold

Hazardous winter weather can bring a variety of conditions to Monroe County. Since 1982, an average of 3-4 winter storms impact the area each season. The terrain in the county does limit the number of true blizzards (only 3 since 1982) but heavy snow, blowing snow, ice, and sleet all occur. There have been a total of 6 documented deaths and 51 injuries as a direct result from winter storms in Wisconsin since 1982.

The 30-year average seasonal snowfall at Sparta is 40.1 inches, but nearby ridge tops can receive several more inches per year. There are occasions where milder daytime temperatures in valleys produce rain when a wintry mix or snow is falling on ridges, including Jackson Pass. Blowing snow is more common on ridge tops as well. The all-time record one-day snowfall in Sparta, WI was 18.0 inches set on January 4, 1971. 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 western Wisconsin. Heavy snow, including lightning, brought nearly a foot of snow the first night. Winds later increased and created major blowing and drifting. Some sleet and freezing rain fell next, followed by another round of heavy snow and blizzard conditions the next night. When the storm finally moved out, 16.2 inches of snow had fallen in parts of the county. Another big multi-day snowfall occurred in early December 1985 when over 20" of snow fell in a two-day period, including 15 inches on the 2nd.

Top 5 Seasonal Snowfalls in Sparta	
Years	Snowfall
1996-97	72.4"
1985-86	69.3"
1951-52	69.1"
1958-59	68.7"
1961-62	67.9"

March can often be a snowy month. Even though snowfall may be less frequent, heavy wet snow can form from large spring storms. In 1997, a large winter storm dropped 21.3 inches of wet snow in Monroe County on March 13-14th.



Ice storms (1/4" of ice or more) can occur but are relatively rare with only 8 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 19 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. The all-time record low at Sparta is -48°F set in 1951. Temperatures can get much colder in favored low areas – like cranberry bogs as well.

Coldest Lows at Sparta, WI	
Low	Date
-48°F	1/30/1951
-43°F	1/15/1963
-41°F	2/3/1996
-40°F	1/16/1982
-40°F	2/2/1951

In late January and early February 1996, Sparta went 8 consecutive mornings with lows at or below -16°F, including lows of -35°F, -34°F, -30°F, -41°F, -39°F, and -36°F six days in a row. January 1977 was also an extremely cold month with 26 days below zero degrees.

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 January 2008, a wind chill value of -35°F occurred in Tomah, WI.

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 Sparta, WI is 106°F which was set twice on back to back days - July 12-13, 1936. The record high temperature at Cashton, WI is 102°F set twice in 1988.

Since 1982, there have been 121 fatalities directly related to heat waves and another 95 indirectly, in Wisconsin. In Monroe County, there have been 17 heat waves since 1982, including one fatality in July 2011.

One of the longest heat waves on record occurred in July 1936 when Sparta hit 99°F or higher for 11 consecutive days, including 9 days at or above 100°F and an all-time record of high of 106°F as noted above. In more recent years, heat waves with high temperatures above 100°F hit in July 1995, August 1988, and July 2012. The heat index hit 106 on July 17, 2011 followed by 108 on July 18, 2011.

Warmest Highs at Sparta, WI	
High	Date
106°F	7/13/1936
106°F	7/12/1936
105°F	7/14/1995
104°F	7/11/1936
103°F	7/5/2012



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. An official drought designation was declared in 2012.

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 Monroe County. Thick, wooded areas also pose a threat for wildfires under extremely dry conditions but occur far less frequently.



In September 2012, a woman was killed when her crashed while driving through thick smoke from a wildfire in the Mather, WI area.

Local Climatology

Here are some basic climatology figures for the Monroe County area. Data is valid for Sparta, WI based on normals from a 30-year period (1981-2010).

Month	Normal Maximum Temperature	Normal Minimum Temperature	Average Temperature	Precipitation	Snowfall
JAN	25.8	6.1	15.9	0.61"	10.4"
FEB	31.6	11.1	21.3	0.80"	7.6"
MAR	43.2	22.7	32.9	1.57"	5.8"
APR	57.9	34.5	46.2	3.32"	1.9"
MAY	69.4	45.5	57.4	4.32"	0.0"
JUN	79.0	55.6	67.3	4.69"	0.0"
JUL	83.1	60.1	71.6	4.43"	0.0"
AUG	81.1	58.1	69.6	4.41"	0.0"
SEP	72.8	48.8	60.8	3.87"	0.0"
OCT	59.9	36.5	48.3	2.30"	0.2"
NOV	44.0	25.7	34.8	2.21"	3.4"
DEC	29.7	11.2	20.5	1.03"	9.7"
Year	56.3	34.9	45.6	32.86"	40.1"

Note: Climatological information for Sparta, WI is very sparse before 1936.

Miscellaneous facts:

- Warmest year(s) on record – 2012 (49.6°F)
- Warmest month on record – July 2012 (78.4°F)
- Warmest day on record – July 13, 1936 and July 12, 1936 (106°F)
- Greatest number of days with 90°F or warmer – 1936 (37 times)

- Coldest year on record – 1978 (41.6°F)
- Coldest month on record – January 1977 (-1.7°F)
- Coldest day on record – January 30, 1951 (-48°F)
- Greatest number of days at 0°F or colder – 1978 (64 times)

- Wettest year on record – 1965 (44.89")
- Wettest month on record – August 1980 (12.43")
- Wettest day on record – September 14, 1994 (5.42")
- Driest year on record – 1939 (15.97")
- Driest month on record – Numerous (0.00")

- Highest seasonal snowfall on record – 1996/97 (72.4")
- Highest monthly snowfall on record – March 1959 (31.6")
- Highest one-day snowfall on record – January 4, 1971 (18.0")
- Least seasonal snowfall on record – 1953/54 (13.6")

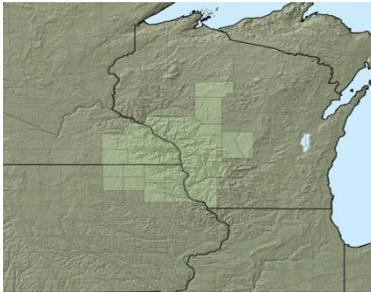


NOAA/National Weather Service Support and Weather Monitoring



NOAA's National Weather Service (NWS) forecast office at La Crosse, WI serves Monroe 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, VHF Radio, National Warning System (NAWAS), and amateur radio.

NOAA Weather Radio coverage in Monroe County includes:

- WXJ86 (La Crosse) on 162.550 MHz
- WNG564 (Black River Falls) on 162.500 MHz
- KE2XKP (Tomah/Ridgeville) on 162.525 MHz

Storm spotter groups consist of mainly amateur radio operators and the general public, with some involvement from law enforcement and fire departments, among others. Spotter training is held nearly every year with an average attendance in the past 5 years of 42.

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

Automated weather station(s):

- Sparta / Fort McCoy Airport (KCMY)
- Nearby observations from La Crosse (KLSE) and Volk Field (KVOK)

River Gauge(s):

- La Crosse River @ Fort McCoy
- Stillwell Creek @ Fort McCoy Yard Road
- Stillwell Creek @ Fort McCoy 16th Court

Cooperative Observers

- Cashton
- Sparta
- Tomah Ranger Station

In addition, numerous 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/arx/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/arx/drought
NWS La Crosse Storm Summaries	www.weather.gov/arx/events
NWS La Crosse NOAA Weather Radio page	www.weather.gov/arx/nwr
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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