

# Natural Hazards Assessment

Dodge County, MN

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



# Natural Hazards Assessment for Dodge County, MN

Prepared by NOAA / National Weather Service – La Crosse  
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# Natural Hazards Assessment

## Dodge County, MN

Prepared by National Weather Service – La Crosse

### Overview

Dodge County is in the Upper Mississippi River Valley of the Midwest with rolling hills and relatively flat farm land.

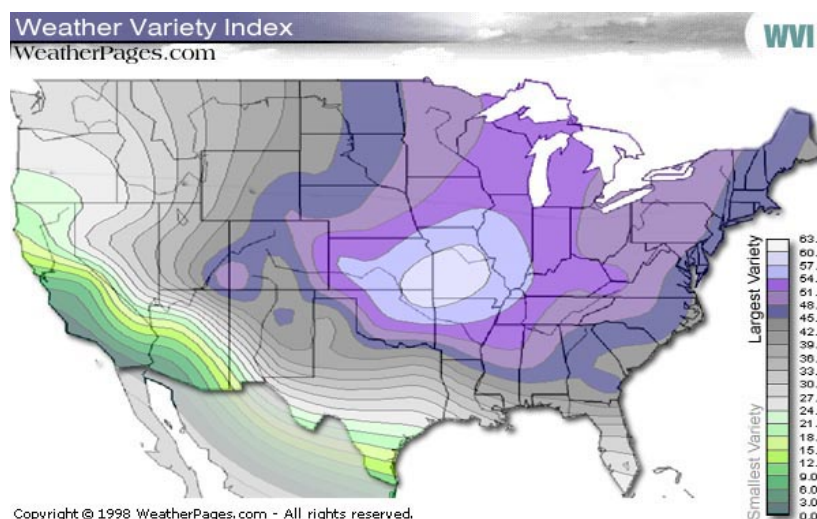
The area experiences a temperate climate with both warm and cold season extremes.

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 4-5 times per season. Occasional arctic outbreaks bring extreme cold and dangerous wind chills.

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. Heat and high humidity is occasionally observed in June, July, or August.

The autumn season usually has the quietest weather. Dense fog occurs several times during mainly the fall or winter months. High wind events can also occur from time to time, 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 3<sup>rd</sup> highest in variability out of 277 cities.



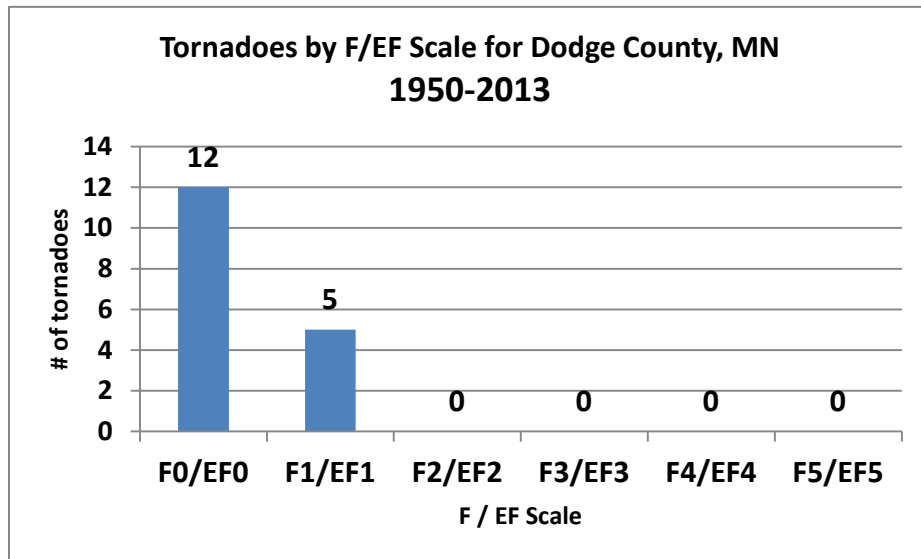
Since 1998, Dodge County has been included in a FEMA Federal Disaster Declaration 5 times:

- 2000 – Severe storms / flooding
- 2001 – Flooding
- 2004 – Severe storms / flooding
- 2007 – Severe storms / flooding
- 2010 – Severe storms / flooding

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## Tornadoes

Even though Minnesota averages about 24 tornadoes per year, Dodge County has only had 17 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. Tornadoes are less common east of the county.



### Most recent tornadoes:

- Jun 5, 2013 (EF0)
- Aug.13, 2010 (EF1)
- June 17, 2010 (EF1)
- June 17, 2010 (EF0)
- Aug.9, 1999 (F0)
- July 20, 1997 (F0)
- July 2, 1992 (F0)
- May 17, 1982 (F0)
- June 5, 1980 (F0)
- Oct.9, 1973 (F0)
- May 31, 1969 (F0)
- May 15, 1968 (F1)
- May 15, 1968 (F1)

In 1883, two large tornadoes hit parts of Dodge County. One hit on July 21<sup>st</sup> passing near the towns of Dodge Center, Byron, and Kasson, MN. Four people were killed and at least 20 homes were destroyed by this F4. A month later (August 21), a large, killer tornado (F5) hit Dodge and Olmsted Counties. This was the same, infamous tornado that hit Rochester, MN but killed five people in Dodge County and damaged at least 10 farms. More recently, another large tornado (F4) moved out of the Austin area towards Oslo, MN on June 13, 1930 hitting 6 farms and destroying the town hall there.

### Strongest tornadoes: (1850-2013)

- Aug.21, 1883 (F5) – 200 inj, 37 dead
- July 21, 1883 (F4) – 30 inj, 4 dead
- June 13, 1930 (F4) – 0 inj, 0 dead
- June 13, 1925 (F3) – 3 inj, 0 dead
- Aug.26, 1880 (F2) – 2 inj, 0 dead

### Dodge County Tornado Facts:

- One F5 tornado in history
- Last significant tornado - 1930
- 8 deaths and 227 injuries since 1850
- Tornadoes have occurred May – October
- Most have occurred in May and July (5)

Tornado Watches		Tornado Warnings	
Year		Year	
2013	1	2013	0
2012	2	2012	0
2011	1	2011	0
2010	5	2010	5
2009	3	2009	2
2008	6	2008	0
2007	5	2007	0
2006	5	2006	1
2005	7	2005	0
2004	11	2004	1
2003	5	2003	1

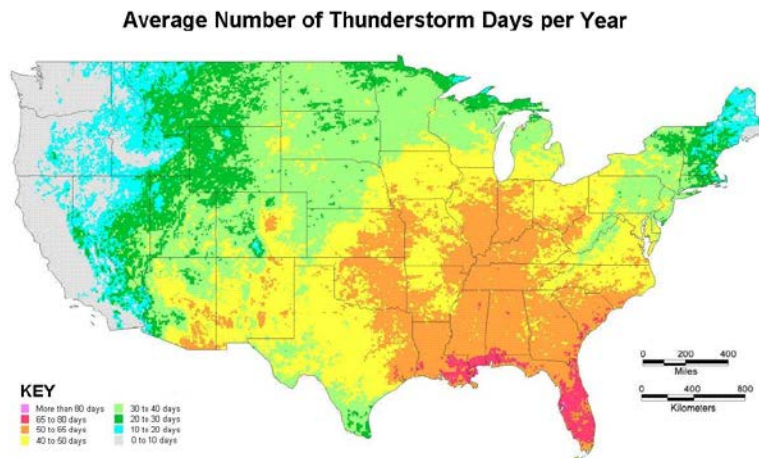
Enhanced Fujita (EF*) Scale	
EF0	65-85 mph
EF1	86-110 mph
EF2	111-135 mph
EF3	136-165 mph
EF4	166-200 mph
EF5	>200 mph

\* Started February 1, 2007

## Severe Thunderstorms / Lightning

Dodge 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 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. Power was also out in many communities. In May 1996, thunderstorm wind gusts to 85 mph created damage in Hayfield and West Concord. In June 2010 a gust of 74 mph hit the Dodge Center area. There have been 51 damaging wind reports since 1982.



Large hail can also occur in a severe thunderstorm. May and June are the peak months 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 August 1989 and June 2009, hail the size of tennis balls fell in the county. Golf ball size hail or larger has fallen 10 times since 1988 and there have been 78 large hail ( $\geq 3/4$ ") reports in the county 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 28<sup>th</sup> in lightning related fatalities with 64 deaths reported between 1959 and 2013. There has been at least 1 lightning fatality in Minnesota in 2007, 2009, 2012, and 2013.

(Photos below: Thunderstorm wind damage in June 1998)



Severe Thunderstorm Watches		Severe Thunderstorm Warnings	
Year		Year	
2013	3	2013	1
2012	9	2012	9
2011	8	2011	9
2010	12	2010	10
2009	6	2009	3
2008	11	2008	7
2007	17	2007	9
2006	10	2006	8
2005	16	2005	5
2004	13	2004	7

## Flooding and Hydrologic Concerns

On occasion intense, heavy rain producing thunderstorms or consecutive thunderstorms (“training”) can bring excessive rainfall leading to flash flooding in Dodge County. Given the relatively flat terrain, most of the time problems develop when ponding of water occurs, but erosion can occur.

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 deaths in Minnesota.

In August 2007, a major flash flood event hit the region with widespread 12 to 17 inches of rain over a 24-hour period. Some highways were closed and numerous homes and business were damaged. Homes had water in their basements around Dodge Center and Kasson, along with major damage to nearby railroad beds.



While there are numerous watersheds and creeks, the main river basins that can impact Dodge County include the South and North Branches of the Middle Fork of the Zumbro River. The headwaters of the Root and Cedar Rivers also begin in southern Dodge County. Flooding can occur from spring snowmelt and area rain, although many of the worst floods have occurred from heavy rain scenarios.

Flash Flood Warnings	
Year	
2013	2
2012	0
2011	2
2010	2
2009	0
2008	0
2007	2
2006	1
2005	0
2004	4
2003	0
2002	1

In mid-September 2004, rainfall amounts near twelve inches left much of the county flooded. Flash flooding was the initial problem, but as all the rain drained into river basins, many roads were closed and there was widespread damage. There have been floods in Dodge County in 1998, 2000, 2001, and 2006 as well.



(Dodge County flooding images courtesy of [www.weatherpaparazzi.com](http://www.weatherpaparazzi.com) and Ray Shubert)



## Winter Storms and Extreme Cold

Hazardous winter weather can bring a variety of conditions to Dodge County. Since 1982, an average of 4 winter storms impact the area each season. The relatively flat terrain does lead to blizzard or near-blizzard conditions more frequently than counties to the east, with about 7 blizzards documented since 1961. Heavy snow, sleet, and periods of blowing/drifted snow all occur.

The 30-year average seasonal snowfall at nearby Rochester is 52.5 inches with a record of 84.7 inches set during the 1996-1997 winter. 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.

During late February and early March 2007, a major winter storm impacted Dodge County. After a significant storm had hit the region about a week earlier, 11.5" of snow fell at Claremont and 11" fell at Mantorville, MN. Strong northwest winds caused considerable blowing and drifting snow, which resulted in the closure of several roads.

Top 5 Seasonal Snowfalls in Rochester	
Years	Snowfall
1996-97	85.1"
1950-51	77.5"
2012-13	74.0"
1961-62	73.7"
1951-52	73.6"

In late January 2008, a sharp cold front plunged temperatures about 40 degrees in a matter of hours. Blizzard conditions developed very rapidly as northwest winds increased as high as 50 mph.

March can often be a snowy month. Even though snowfall may be less frequent, heavy wet snow can form from large spring storms. In March 2005, a large winter storm dropped 19" of snow in the Kasson area, with 16" at West Concord, Dodge Center, and Mantorville. Many new one-day snowfall records were set in the region.

Ice storms (1/4" of ice or more) can occur but are relatively rare with only 7 occurrences since 1993.

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 33 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 -30°F most days.

Since 1993 there have been 7 fatalities in Minnesota due to extreme cold.



In 1996, Rochester went 5 consecutive days with temperatures below zero degrees (F) following a blizzard about a week earlier. Low temperatures of -27°F, -35°F, and -30°F were set on three straight mornings.

Coldest Lows at Rochester, MN	
Low	Date
-42°F	1/7/1887
-40°F	1/30/1951
-39°F	1/13/1912
-39°F	1/12/1912
-39°F	12/17/1909

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. Wind chills of -35°F to -45°F were recorded as recent as January 2009.

## 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 around 80°F and record highs above 100°F most days.

In Dodge 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 southeast Minnesota hit 90°F or higher on 14 consecutive days, including 12 days at or above 100°F and an all-time record of high of 108°F at Rochester, MN. In more recent years, heat waves occurred in July 1995 (99°F) and again in July and August of 2001 when a fatality occurred in Rochester.

Warmest Highs at Rochester, MN	
High	Date
108°F	7/14/1936
107°F	7/13/1936
107°F	7/12/1936
106°F	5/31/1934
105°F	7/10/1936

In July 2011, the heat index hit 105 or higher for 4 straight days (July 17-20) including 108, 118 (record), 112, and 105 at Rochester with dew points up to 83. At Dodge Center the heat index hit 105 on July 18<sup>th</sup> and 108 on July 19, 2011.



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.

Droughts have occurred in Minnesota numerous times over the past 20 years, including 2012 when the USDA declared a drought disaster for much of the region.

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 or cropland field fires in Dodge 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 southeast Minnesota. Data is valid for Rochester, MN based on normals from a 30-year period (1981-2010).

Month	Normal Maximum Temperature	Normal Minimum Temperature	Average Temperature	Precipitation	Snowfall
JAN	22.8	6.8	14.8	0.86"	12.1"
FEB	27.2	11.5	19.3	0.84"	8.7"
MAR	39.6	23.4	31.5	1.88"	8.9"
APR	56.1	35.4	45.7	3.23"	3.4"
MAY	67.9	46.5	57.2	3.63"	0.0"
JUN	77.2	56.3	66.7	4.67"	0.0"
JUL	80.6	60.4	70.5	4.54"	0.0"
AUG	78.1	58.3	68.2	4.52"	0.0"
SEP	70.5	49.5	60.0	3.45"	0.0"
OCT	57.5	37.5	47.5	2.23"	0.8"
NOV	40.8	25.1	32.9	1.91"	6.1"
DEC	26.2	11.3	18.8	1.22"	12.5"
Year	53.7	35.2	44.4	32.99"	52.5"

NOTE: Climate data is not available for any site within Dodge County. Rochester, MN information was used as a replacement.

### Miscellaneous facts:

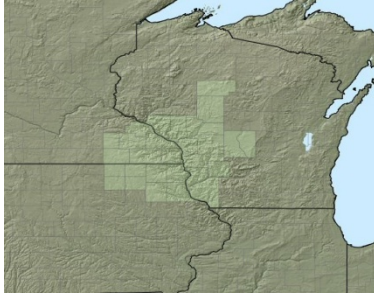
- Warmest year on record – 2012 (50.3°F)
- Warmest month on record – July 1936 (77.7°F)
- Warmest day on record – July 14, 1936 (108°F)
- Greatest number of days with 90°F or warmer – 1934 (38 times)
  
- Coldest year on record – 1917 (40.6°F)
- Coldest month on record – January 1912 (-3.8°F)
- Coldest day on record – January 7, 1887 (-42°F)
- Greatest number of days at 0°F or colder – 1978 (63 times)
  
- Wettest year on record – 1990 (43.94")
- Wettest month on record – August 2007 (14.07")
- Wettest day on record – July 11, 1981 (7.47")
- Driest year on record – 1910 (11.86")
- Driest month on record – December 1943 (Trace)
  
- Highest seasonal snowfall on record – 1996/97 (85.1")
- Highest monthly snowfall on record – December 2010 (41.3")
- Highest one-day snowfall on record – March 18, 2005 (19.8")
- Least seasonal snowfall on record – 1967/68 (9.1")



## NOAA/National Weather Service Support and Weather Monitoring



NOAA's National Weather Service (NWS) forecast office at La Crosse, WI serves Dodge 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](http://www.weather.gov/lacrosse)

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

NOAA Weather Radio coverage in Dodge County includes WXX41 (Rochester) on 162.475 MHz.

Storm spotter groups are active and consist mainly of volunteer fire departments. There is also some involvement by law enforcement, amateur radio operators, and the general public. Spotter training is held sporadically with an average attendance in the past 5 years of 79.

There are a variety of weather monitoring sources in Dodge County, including:

### Automated weather station(s):

- Dodge Center (KTOB)

### River Gauge(s):

- S.Branch Middle Fork Zumbro River @ Wasioja
- Middle Fork Zumbro River @ Berne
- N.Branch Middle Fork Zumbro River @ Roscoe

### Cooperative Observers

- Dodge Center

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	<a href="http://www.weather.gov/lacrosse">www.weather.gov/lacrosse</a>
NWS La Crosse Tornado Database	<a href="http://www.weather.gov/lacrosse/?n=tornadomain">www.weather.gov/lacrosse/?n=tornadomain</a>
NWS La Crosse River Monitoring	<a href="http://www.crh.noaa.gov/ahps2/index.php?wfo=arx">http://www.crh.noaa.gov/ahps2/index.php?wfo=arx</a>
NWS La Crosse Climate	<a href="http://www.weather.gov/climate/index.php?wfo=arx">www.weather.gov/climate/index.php?wfo=arx</a>
NWS La Crosse Drought information	<a href="http://www.weather.gov/lacrosse/?n=drought">www.weather.gov/lacrosse/?n=drought</a>
NWS La Crosse Storm Summaries	<a href="http://www.weather.gov/lacrosse/?n=events">www.weather.gov/lacrosse/?n=events</a>
NWS La Crosse NOAA Weather Radio page	<a href="http://www.weather.gov/lacrosse/?n=nwr">www.weather.gov/lacrosse/?n=nwr</a>
NWS La Crosse Severe Weather Climatology	<a href="http://www.weather.gov/lacrosse/svr_climate.php">www.weather.gov/lacrosse/svr_climate.php</a>
NWS Storm Prediction Center	<a href="http://www.spc.noaa.gov/">http://www.spc.noaa.gov/</a>
SPC Online Severe Weather Climatology	<a href="http://www.spc.nssl.noaa.gov/climo/online/grids/">http://www.spc.nssl.noaa.gov/climo/online/grids/</a> <a href="http://www.spc.noaa.gov/climo/online/rda/ARX.html">http://www.spc.noaa.gov/climo/online/rda/ARX.html</a>

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