

Natural Hazards Assessment

Richland County, WI

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



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Last Update: October 2016

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Natural Hazards Assessment

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Prepared by National Weather Service – La Crosse

Overview

Richland County is in the Upper Mississippi River Valley of the Midwest with relatively hilly terrain and bluffs. It is bordered by the Wisconsin River to the south.

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

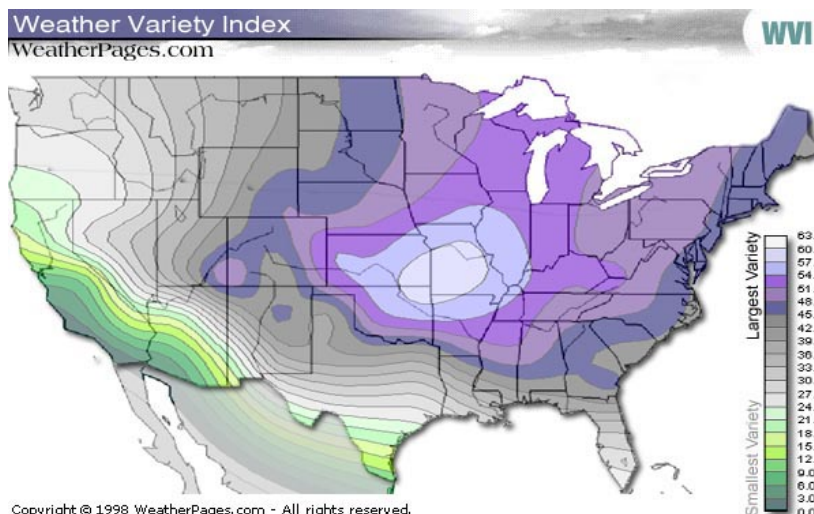
Winter months can bring occasional heavy snows, intermittent freezing precipitation or ice, and prolonged periods of cloudiness. While true blizzards are rare, winter storms impact the area on average about 3 to 4 times per season. Occasional arctic outbreaks bring extreme cold and dangerous wind chills.

Temperatures between river valleys and surrounding ridges can vary 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.

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 and Madison, WI ranked 8th highest in variability out of 277 cities.



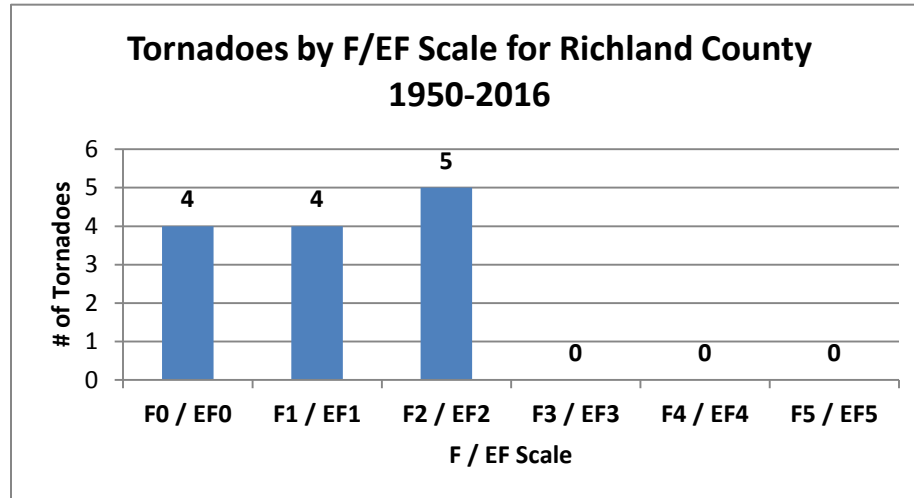
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Since 1998, Richland County has been included in a FEMA Federal Disaster Declaration 7 times:

- 1998 – Severe storms
- 2000 – Severe storms / flooding
- 2004 – Severe storms / flooding
- 2007 – Severe storms / flooding
- 2008 – Severe storms / flooding
- 2013 – Severe storms / flooding
- 2016 – Severe storms / flooding

Tornadoes

Even though Wisconsin averages about 23 tornadoes per year, Richland County has only 13 tornadoes since 1950, averaging about one tornado every 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:

- July 13, 2015 (EF0)
- June 22, 2015 (EF0)
- May 24, 2006 (F0)
- Aug.18, 2005 (F2)
- Aug.18, 2005 (F0)
- May 8, 1988 (F2)
- June 26, 1973 (F1)
- Aug.11, 1972 (F1)
- June 13, 1972 (F1)
- Aug.1, 1967 (F1)
- Sept.3, 1964 (F2)

In May 1918, a large killer tornado formed in northeast Iowa and tracked across southwest Wisconsin, hitting Lone Rock, WI and killing four there. Much of the town was destroyed before the storm collapsed near Baraboo. More recently, a significant tornado moved through northern sections of Richland County for 20 miles on August 18, 2005 (one of 27 in Wisconsin that day). The community of Viola, WI was hit directly causing major damage through the town and injuring 3. The storm tracked east but the tornado lifted just west of Hub City. Hundreds of trees were damaged along with numerous structures along the path.

Strongest tornadoes: (1850-2016)

- May 21, 1918 (F4) – 100 inj, 4 dead
- Aug.18, 2005 (F2) – 3 inj, 0 dead
- Sept.3, 1964 (F2) – 4 inj, 0 dead
- May 8, 1964 (F2) – 2 inj, 0 dead
- May 8, 1988 (F2) – 0 inj, 0 dead

Richland County Tornado Facts:

- No F5 or EF5 tornadoes
- Only one F4 tornado - 1918
- 4 deaths and 111 injuries since 1850
- Tornadoes have occurred May – October
- Most have occurred in August (6)

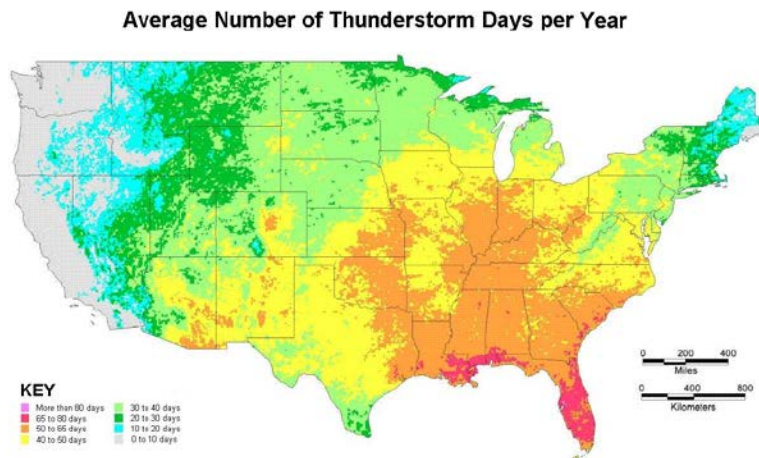
Tornado Watches		Tornado Warnings	
Year		Year	
2016	0	2016	0
2015	1	2015	0
2014	1	2014	0
2013	3	2013	2
2012	0	2012	0
2011	4	2011	0
2010	6	2010	0
2009	3	2009	4
2008	7	2008	3
2007	6	2007	1

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

Severe Thunderstorms / Lightning

Richland County averages 38 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, several large squall lines moved through the region with wind gusts in excess of 85 knocking down hundreds of trees and damaging buildings. Power was also out in many communities. There have been 49 damaging wind reports since 2000 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. On May 12, 2000 hail the size of baseballs fell in the Hub City and Viola areas. Large hail also hit Richland Center in June 1974. There have been 50 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 in 2007, 2008, 2011, and 2016 but no fatalities or injuries reported in Richland County from lightning since 1982.



Severe Thunderstorm Watches		Severe Thunderstorm Warnings	
Year		Year	
2016	8	2016	5
2015	5	2015	2
2014	11	2014	8
2013	7	2013	11
2012	5	2012	4
2011	10	2011	5
2010	12	2010	9
2009	4	2009	2
2008	12	2008	8
2007	13	2007	7
2006	27	2006	12

Flooding and Hydrologic Concerns

Richland County has an extensive flood history. On occasion intense, heavy rain producing thunderstorms or consecutive thunderstorms (“training”) can bring excessive rainfall leading to flash flooding. The hilly terrain promotes rapid run-off and enhances the threat. Mud and landslides can occur in extreme cases.

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. Since 1982, there have been 11 deaths from flooding in Wisconsin.

In August 2007, seven to thirteen inches of rain fell in one evening across the county leading to widespread flash flooding and property damage. A 51-year old was swept off a bridge on Highway 60 and drowned. Numerous roads were damaged and closed, people were evacuated, hundreds of homes had flooded basements, and landslides were common. The county was declared a federal disaster area with an estimated 10 million dollars in damage.



In June 2008, more heavy rain fell leading to widespread flash flooding and eventually river flooding in the area. Numerous rainfall records were set and river levels on the Kickapoo River reached all-time record high crest values, impacting communities like Viola, WI hard.

There are numerous watersheds and drainage basins in the county. Main rivers include the Wisconsin and Pine, but there is also Mill Creek, Knapp Creek, and Willow Creek, among others. Flooding along the Wisconsin River can occur from spring snowmelt but also from warm season heavy rain patterns. Many of the other drainage areas can experience local ice jam issues with snowmelt, but more commonly can become dangerous from heavy rain spawned flash flooding.

There is no official river gauging in Richland County, but there is an extensive flood control project in place on the Pine River, especially through the Richland Center area.



Flash Flood Warnings	
Year	
2016	7
2015	0
2014	3
2013	6
2012	0
2011	0
2010	3
2009	2
2008	4
2007	2
2006	0

Kickapoo River @ Viola Top 5 Crests (FS: 14 feet)	
Date	Crest
6/9/2008	21.25'
7/1/1978	21.00'
9/22/2016	19.32'
8/20/2007	18.20'
8/14/2010	17.25'

Winter Storms and Extreme Cold

Hazardous winter weather can bring a variety of conditions to Richland County. Since 1982, an average of 4 winter storms impact the area each season. The terrain in the county does limit the number of true blizzards (only 4 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 Richland Center, WI is 43.3 inches. There are occasions where milder daytime temperatures in valleys produce rain when a wintry mix or snow is falling on ridges. Blowing snow is more common on ridge tops as well. The all-time record one-day snowfall in Richland Center was 15.0 inches set on March 28, 1931. 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 Richland County. Heavy snow, including lightning, brought over a foot of snow (12.8") over a two day period. Winds also increased and created major blowing and drifting. Some sleet and freezing rain fell during the middle of the storm, followed by another round of heavy snow and blizzard conditions.

December 2008 was also a very snowy month with over 30" of snow falling (30.8") making it the 2nd snowiest December on record. On December 8-9, 2009, 11" of snow fell in Richland Center as a blizzard moved through the area.

March can often be a snowy month. Even though snowfall may be less frequent, heavy wet snow can form from large spring storms. In 1959, a total of 31.9" of snow fell in March alone.

Ice storms (1/4" of ice or more) can occur but are relatively rare with only 7 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 21 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 -20°F most days. The all-time record low at Richland Center, WI is -46°F set on January 30, 1951.

In 1996, the Richland Center area went 9 consecutive days with low temperatures at or below -12°F following a blizzard about a week earlier. Low temperatures of -35°F, -35°F, -32°F, -38°F, -38°F, and -33°F were set in a row from late January into early February.

Since 1982 there have been 38 fatalities in Wisconsin from cold weather and 54 direct injuries. 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. On January 30, 2008 a wind chill of -38°F was observed in Richland Center.

Top 5 Seasonal Snowfalls in Richland Center	
Years	Snowfall
2007-08	74.5"
1950-51	73.3"
1958-59	72.1"
1928-29	71.1"
1970-71	69.3"

Coldest Lows at Richland Center, WI	
Low	Date
-46°F	1/30/1951
-40°F	2/2/1951
-40°F	2/20/1929
-39°F	1/15/1963
-38°F	2/4/1996

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 Richland Center, WI is 110°F set in July 1936.

Since 1982, there have been 125 fatalities directly related to heat waves and another 95 indirectly, in Wisconsin. In Richland County, there have been 16 heat waves since 1982 and a heat related death in July 2012.

One of the longest heat waves on record occurred in July 1936 when the Richland Center area hit 90°F or higher for 14 consecutive days, including 11 days at or above 100°F and an all-time record of high of 110°F as noted right.

In more recent years, heat waves have hit in 1995, 1999, 2001, 2011, 2012, and 2013.

Warmest Highs at Richland Center, WI	
High	Date
110°F	7/14/1936
109°F	7/13/1936
108°F	7/12/1936
105°F	7/11/1936
104°F	7/29/1941



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. A Secretarial Drought Designation was given for the southern half of Wisconsin in 2012 from severe drought.

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 Richland 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 Richland County area. Data is valid for Richland Center, WI based on normals from a 30-year period (1981-2010).

Month	Normal Maximum Temperature	Normal Minimum Temperature	Average Temperature	Precipitation	Snowfall
JAN	28.2	7.3	17.7	1.12"	10.5"
FEB	32.9	11.6	22.3	1.03"	8.5"
MAR	44.3	22.6	33.5	1.86"	5.3"
APR	58.3	33.9	46.1	3.90"	1.4"
MAY	69.8	44.1	57.0	4.10"	0.0"
JUN	79.2	54.0	66.6	5.01"	0.0"
JUL	83.2	58.4	70.8	4.78"	0.0"
AUG	81.1	56.9	69.0	4.88"	0.0"
SEP	73.0	47.7	60.4	3.70"	0.0"
OCT	60.8	35.7	48.3	2.47"	0.1"
NOV	45.3	25.0	35.1	2.40"	3.8"
DEC	31.5	12.2	21.8	1.35"	10.7"
Year	57.1	34.0	45.6	37.41"	43.3"

Miscellaneous facts:

- Warmest year on record – 1931 (51.4°F)
- Warmest month on record – July 2012 (78.3°F)
- Warmest day on record – July 14, 1936 (110°F)
- Greatest number of days with 90°F or warmer – 1921 (51 times)

- Coldest year on record – 1996 (42.4°F)
- Coldest month on record – January 1977 (2.5°F)
- Coldest day on record – January 30, 1951 (-46°F)
- Greatest number of days at 0°F or colder – 2008 (54 times)

- Wettest year on record – 2007 (52.68")
- Wettest month on record – August 2007 (20.81")
- Wettest day on record – October 22, 1943 (5.90")
- Driest year on record – 1958 (17.49")
- Driest month on record – March 1996 (0.00")

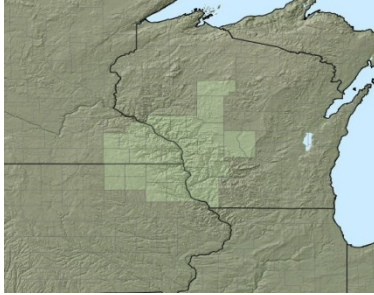
- Highest seasonal snowfall on record – 2007/08 (74.5")
- Highest monthly snowfall on record – December 2008 (39.6")
- Highest one-day snowfall on record – March 28, 1931 (15.0")
- Least seasonal snowfall on record – 1924/25 (8.1")



NOAA/National Weather Service Support and Weather Monitoring



NOAA's National Weather Service (NWS) forecast office at La Crosse, WI serves Richland 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 and amateur radio.

NOAA Weather Radio coverage in Richland County includes WWG89 (Richland Center) on 162.475 MHz.

Storm spotter groups consist of fire department personnel, amateur radio operators, and the general public, with some involvement from law enforcement. Spotter training is held every other year with an average attendance in the past 5 years of 53.

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

Automated weather station(s):

- Lone Rock, WI (KLNR)
- Nearby stations at Boscobel, WI (KOV5)

River Gauge(s):

- None, but nearby gauges at Muscoda (Wisconsin River) and Viola (Kickapoo River)

Cooperative Observers

- Richland 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	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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Last Updated:

October 2016