

# Winter Severity Indices

## 2020-2021

By Joseph J. Dittrich

### **Abstract**

This report details the Winter Severity Index (WSI) monitoring for the Northern Forest region of Wisconsin during winter 2020-2021. Region-wide, the average WSI for this winter was 32, a rating of 'mild'.

### **Background and Methods** (Wisconsin Department of Natural Resources 2001)

Prior to 1975, Wisconsin did not have a formal procedure for measuring winter severity and predicting its impact on deer herds. Michigan had developed a severity index that used calorimeters to estimate a winter air-chill factor, and snow depth and sinking-depth measurements to estimate a snow-hazard factor (Verme 1968). The air-chill and snow-hazard factors were summed at the end of each week to derive a cumulative severity index. Ontario was using the Passmore-Hepburn Method, which also involved collecting relatively complex snow measurements (Passmore and Hepburn 1955).

Our winter severity index (WSI) was developed after testing several procedures for quantifying winter conditions (Kohn 1975). It used the number of days with a minimum temperature of  $\leq 0^{\circ}\text{F}$  as a measure of winter air-chill, and the number of days with  $\geq 18$  inches of snow on the ground to estimate the snow hazard. Days when both conditions occurred are scored as 2. These are added together from 1 December through 30 April to obtain the WSI.

United States Department of Commerce (USDC) weather data were initially used to measure winter severity because they were easily obtained, and initially allowed us to compare WSI for previous winters with historical deer data (i.e. results of dead deer surveys, Summer Deer Observations, and buck harvests). The WSI was calculated for each of 12 USDC stations and then averaged to obtain the Northern Forest WSI for each winter back to 1960-61.

Beginning in the winter of 1986-87, weather data were collected at DNR stations across the northern portion of the state. These stations recorded daily snow depths and minimum temperatures from December 1st through April 30th and sent their data to the Northern Wildlife Research Group at the end of each month. Starting in the winter of 2014-2015, we began creating monthly WSI maps to better show the spatial variation in WSI. WSI maps are created in ArcMap using the kriging spatial interpolation tool. Maps are augmented with data from the National Oceanic and Atmospheric Administration's Climate Data Online Tool.

Winters are considered "mild" if the calculated WSI is less than 50, "moderate" if between 50 and 80, "severe" if between 80 and 100, and "very severe" if the WSI exceeds 100. These designations are based on observed associations between WSI and winter mortality, fawn production, and buck harvest during the following year (Wisconsin Department of Natural Resources 2001:5.11). Severe to very severe winter conditions were commonly reported across the northern forest region from the early 1960s through the late 1980s, whereas moderate and mild winter conditions have prevailed across the region since the early 1990s (Fig. 2).

## **Results**

Across the Northern Forest, the winter of 2020-2021 rated as 'mild'. The average (mean) WSI across 34 stations with complete reporting was 32 (SD = 8) compared with a 61-yr mean of 61 and median of 49. Approximately 85% of the WSI points were "temperature" points and 15% were "snow" points. Most of the temperature points were accumulated from January - March and most snow points were accumulated in February (Fig. 3). Of the 34 stations, 32 reported 'mild' conditions, 2 reported 'moderate' conditions, and none reported 'severe' or 'very severe' conditions (Table 1). The most severe winter conditions occurred in north central and north eastern Wisconsin (Figure 1).

## **Discussion**

The winter of 2020–2021 was the 7<sup>th</sup> mildest winter, on average, since record keeping began in 1960-61. Given the 'mild' WSI index, expect above average overwinter survival and recruitment.

## **Acknowledgments**

This survey depends on the timely recording and reporting of temperature and snow depth by DNR field staff and volunteers. Sincere thanks go to all that participate.

## **Literature Cited**

Kohn, B. 1975. Winter severity measurements. Wis. Dep. Nat. Resour. Final Rep. Job 210.4, P-R Proj. W-141-R-10. 11pp.

Passmore, R.C. and R.L. Hepburn. 1955. A method for appraisal of winter range of deer. Ontario Dep. Lands and Forests. Res. Rep. 29. Maple, Ontario.

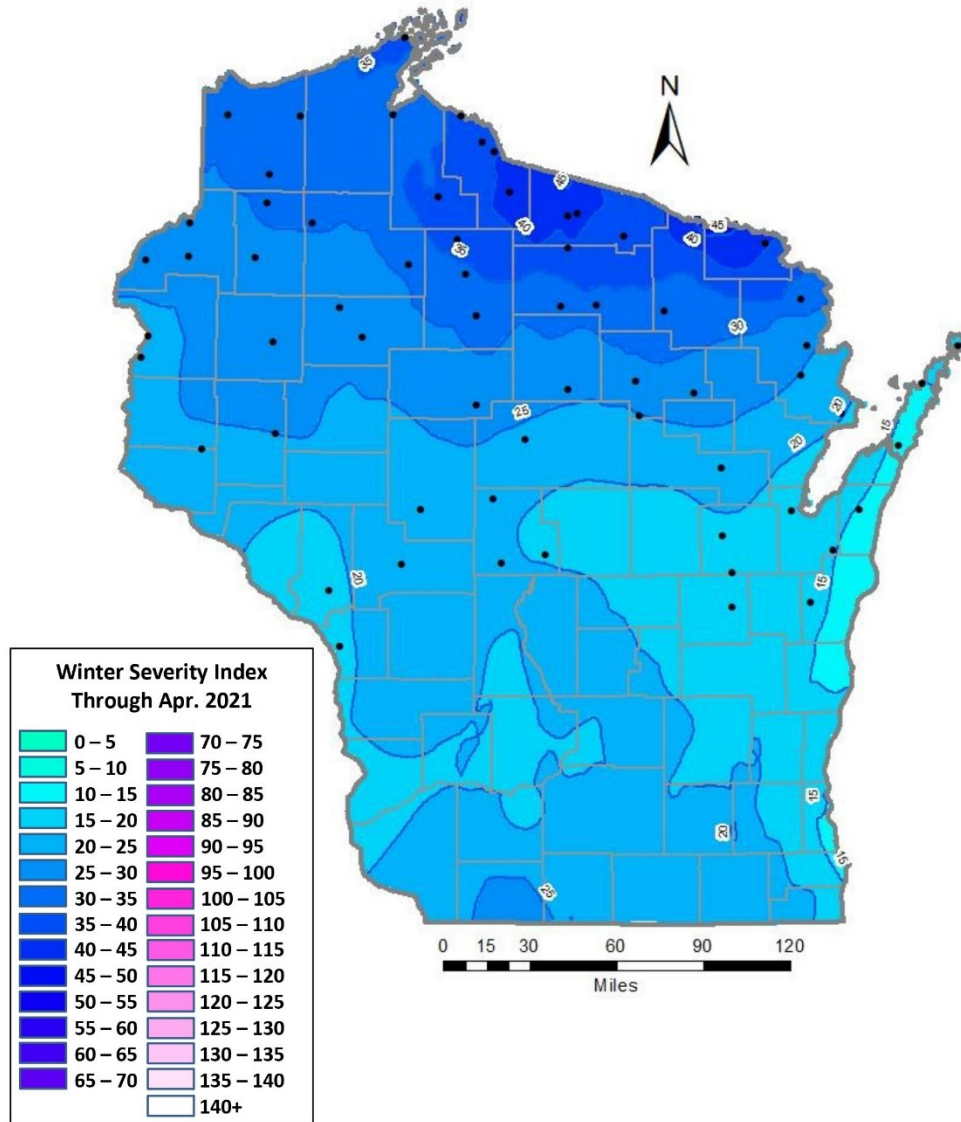
Verme, L.J. 1968. An index of winter weather severity for northern deer. *Journal of Wildlife Management* 32:566–574.

Wisconsin Department of Natural Resources 2001. *Management Workbook for White-tailed Deer, Second Edition*. Bureaus of Wildlife Management and Integrated Science Services, Madison, WI, USA.

Wisconsin Department of Natural Resources 2008. *Deer ages and condition in 2008*. Bureau of Science Services, Madison, WI, USA.

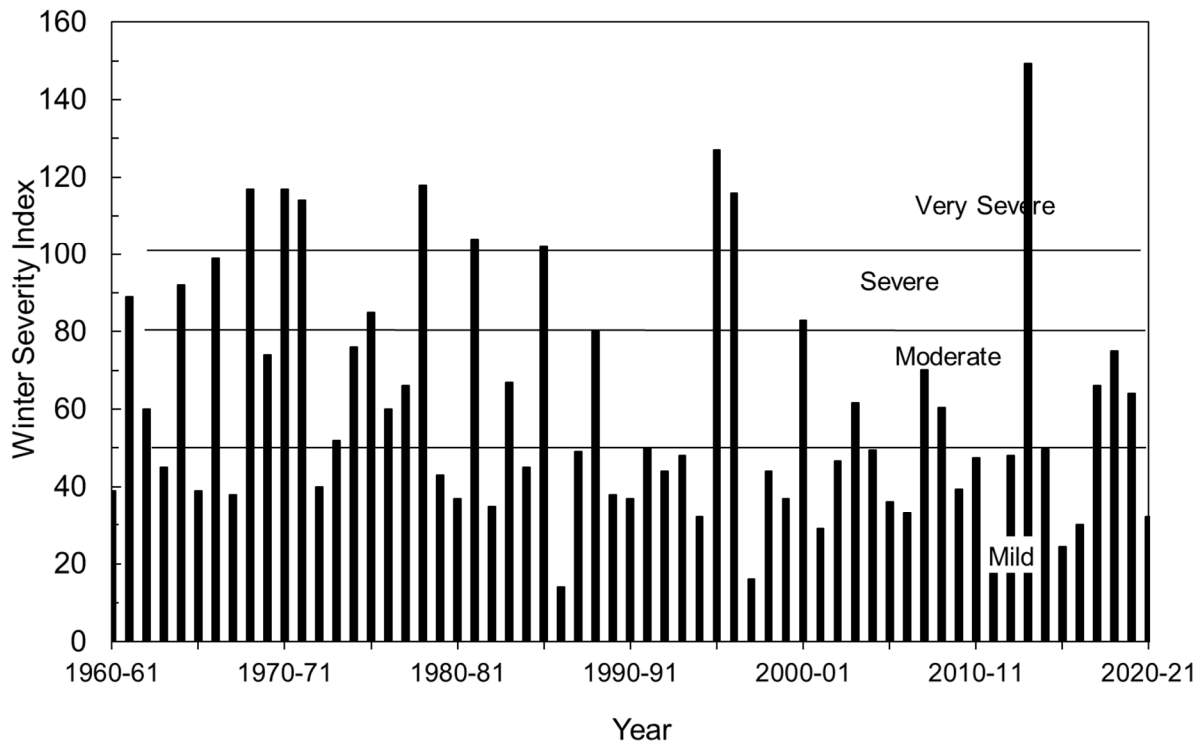
Wisconsin Department of Natural Resources 2009. *Deer ages and condition in 2009*. Bureau of Science Services, Madison, WI, USA.

# Winter Severity Index – Apr 2021

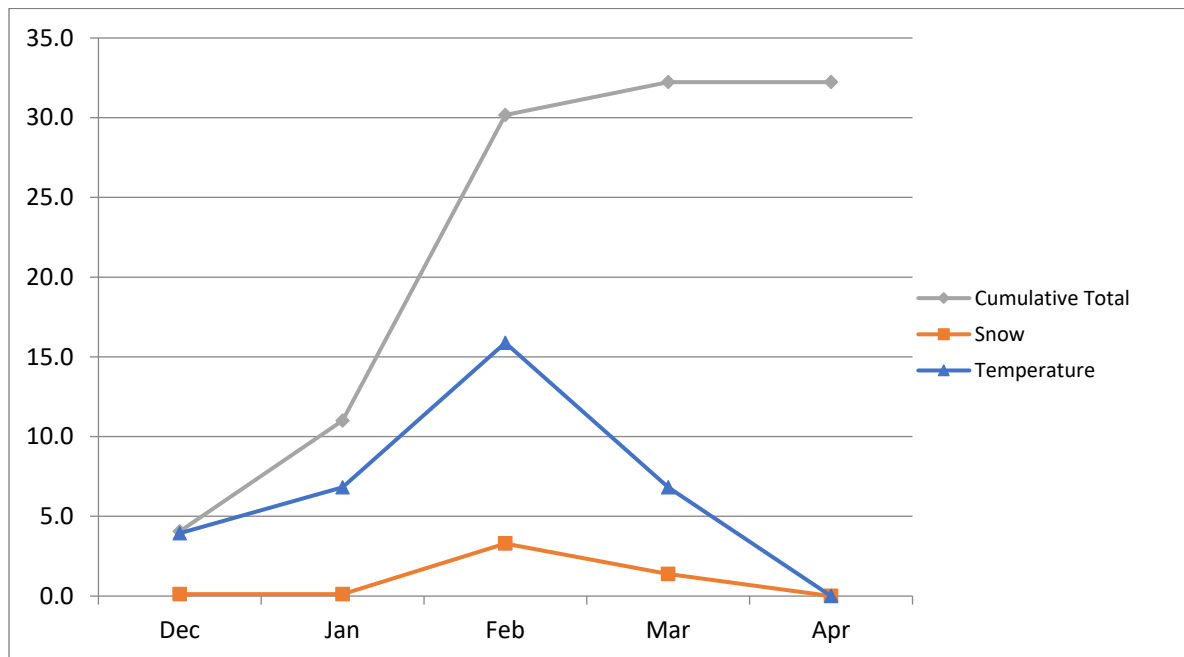


This map depicts the Winter Severity Index (WSI) across northern Wisconsin. WSI is calculated by adding the number of days with a snow depth of at least 18 inches to the number of days when the minimum temperatures were 0°F or below. WSI points accumulate through the winter. WSI of 49 or less is considered mild, 50 to 79 is moderate, 80 to 99 is severe, and 100 or greater is very severe. Most WSI readings are taken by WDNR biologists across northern Wisconsin, but some readings are from National Weather Service stations. The WDNR stations used are displayed on the map. A statistical procedure is used to estimate the WSI in areas between stations. Questions can be directed to [DanielJ.Storm@wisconsin.gov](mailto:DanielJ.Storm@wisconsin.gov).

**Figure 1.** Map of WSI, 2020–2021.



**Figure 2.** Winter Severity Indices 1960–1961 to 2020–2021.



**Figure 3.** Monthly values of 'snow' and 'temperature' points and cumulative WSI during 2020–2021.

**Table 1.** WSI data reported for 2020–2021. TEMP = number of days with temperatures  $\leq 0^{\circ}$  F, SNOW = number of days with snow depths  $\geq 18$  inches. **\*\*Note that this table includes some WSI stations outside of the Northern Forest Region, and not discussed in the report.**

STATION	DECEMBER		JANUARY		FEBRUARY		MARCH		APRIL		TOTAL		WSI
	TEMP	SNOW	TEMP	SNOW	TEMP	SNOW	TEMP	SNOW	TEMP	SNOW	TEMP	SNOW	
Antigo	2	0	5	0	16	0	0	0	0	0	23	0	23
Appleton	1	0	2	0	15	0	0	0	0	0	18	0	18
Ashland	4	1	9	1	15	4	1	0	0	0	29	6	35
Barron	5	0	7	0	15	0	0	0	0	0	27	0	27
Black River Falls	4	0	4	0	15	0	0	0	0	0	23	0	23
Blue Hills East	5	0	7	0	15	1	0	0	0	0	27	1	28
Brule	6	0	9	0	15	1	1	0	0	0	31	1	32
Casco	0	0	1	0	13	0	0	0	0	0	14	0	14
Collins	0	0	2	0	13	0	0	0	0	0	15	0	15
Cornucopia	5	1	9	1	15	3	2	1	0	0	31	6	37
Crandon	3	0	8	0	18	4	1	0	0	0	30	4	34
Crex Meadows	5	0	6	0	15	0	0	0	0	0	26	0	26
Crivitz	3	0	5	0	16	0	1	0	0	0	25	0	25
Denmark	0	0	2	0	13	0	0	0	0	0	15	0	15
Eagle River	3	0	8	0	17	15	2	2	0	0	30	17	47
Edgar	2	0	5	0	16	0	0	0	0	0	23	0	23
Elk Mound	4	0	5	0	16	0	0	0	0	0	25	0	25
Ephraim	1	0	1	0	12	0	0	0	0	0	14	0	14
Ettrick	1	0	3	0	15	0	0	0	0	0	19	0	19
Flambeau River	4	0	8	0	15	2	0	1	0	0	27	3	30
Florence	3	0	7	0	20	8	2	0	0	0	32	8	40
Gile	3	0	5	0	15	24	1	8	0	0	24	32	56
Glidden	4	1	8	1	15	3	1	3	0	0	28	8	36
Gordon	6	0	8	0	15	0	1	0	0	0	30	0	30
Green Bay	1	0	2	0	15	0	0	0	0	0	18	0	18
Hayward	6	0	8	0	15	1	0	0	0	0	29	1	30
La Crosse	1	0	3	0	15	0	0	0	0	0	19	0	19
Ladysmith	4	0	7	0	15	0	0	0	0	0	26	0	26
Marshfield	1	0	4	0	16	0	0	0	0	0	21	0	21
Medford	5	0	6	0	16	1	0	0	0	0	27	1	28
Mercer	4	0	7	0	15	8	1	7	0	0	27	15	42

STATION	DECEMBER		JANUARY		FEBRUARY		MARCH		APRIL		TOTAL		WSI
	TEMP	SNOW	TEMP	SNOW	TEMP	SNOW	TEMP	SNOW	TEMP	SNOW	TEMP	SNOW	
Merrill	3	0	6	0	17	0	0	0	0	0	26	0	26
Minong	6	0	8	0	15	1	1	1	0	0	30	2	32
Neillsville	3	0	4	0	15	0	0	0	0	0	22	0	22
Osceola	4	0	4	0	16	0	0	0	0	0	24	0	24
Oshkosh	0	0	2	0	14	0	0	0	0	0	16	0	16
Park Falls	4	1	8	1	15	4	1	2	0	0	28	8	36
Pattison	6	0	9	0	15	0	1	0	0	0	31	0	31
Pembine	3	0	5	0	18	1	1	0	0	0	27	1	28
Pence	2	1	5	1	15	5	1	5	0	0	23	12	35
Peshtigo	2	0	3	0	15	0	0	0	0	0	20	0	20
Phillips	4	0	8	0	16	1	1	1	0	0	29	2	31
Prentice	4	0	7	0	16	5	0	2	0	0	27	7	34
Red Cliff	4	1	8	1	15	3	2	1	0	0	29	6	35
Rhineland	4	0	8	0	17	0	1	0	0	0	30	0	30
Sandhill	2	0	3	0	16	0	0	0	0	0	21	0	21
Saxon	3	1	6	1	15	5	1	4	0	0	25	11	36
Shawano	2	0	4	0	16	0	0	0	0	0	22	0	22
Shiocton	2	0	3	0	15	0	0	0	0	0	20	0	20
Siren	5	0	6	0	16	1	0	0	0	0	27	1	28
Spooner	6	0	7	0	15	0	0	0	0	0	28	0	28
Spring Valley	3	0	4	0	16	0	0	0	0	0	23	0	23
St. Croix Falls	4	0	4	0	16	0	0	0	0	0	24	0	24
Sturgeon Bay	1	0	1	0	12	0	0	0	0	0	14	0	14
Summit Lake	3	0	6	0	17	2	1	0	0	0	27	2	29
Tomahawk	3	0	8	0	17	0	1	1	0	0	29	1	30
Trout Lake	3	0	8	0	16	17	1	9	0	0	28	26	54
Washington Island	0	0	1	0	11	4	0	0	0	0	12	4	16
Wausaukee	3	0	5	0	16	0	1	0	0	0	25	0	25
Webster	5	0	7	0	15	0	0	0	0	0	27	0	27
White Lake	3	0	6	0	16	1	1	0	0	0	26	1	27
Wisconsin Rapids	1	0	3	0	16	0	0	0	0	0	20	0	20
Woodruff	3	0	8	0	17	3	1	4	0	0	29	7	36