Winter Severity Indices
2008–2009

By Christopher N. Jacques

Abstract

This report details the Winter Severity Index (WSI) monitoring for the northern forest region of Wisconsin during the winter 2008-2009. Region-wide, this winter was rated as moderate. Average WSI was 60.5 and matched the 30-year average ($\bar{x}$ = 60.9). Moderate to very severe conditions were reported at 24 of 31 stations throughout northern Wisconsin with the most severe readings recorded at two stations from Iron County. Despite widespread moderately severe winter severity values, region-wide weather impacts on the 2009 fawn cohort are expected to be relatively minor.

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 was using 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 entails 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 0°F or below as a measure of winter air-chill, and the number of days with 18 or more 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.
US 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.

Beginning in the winter of 1986-87, weather data were collected at 35 DNR stations across the North (Figure 1*).* Since 1999-2000, four stations were discontinued (Iron River, Cumberland, Medford, and Pound) and one new station was added (New Wood). Daily snow depths and minimum temperatures were recorded at these stations from 1 December through 30 April on a standardized form, and this information was sent to the Northern Wildlife Research Group at the end of each month. Survey instructions request that the presence of crusts be recorded. To date, information on crusts has not been incorporated into the index, but this information may affect our interpretation of the index.

WSI values for the Northern Forest from 1960-61 through 2007-08 are shown in Figure 2. Winters are considered “mild” if the calculated WSI is less than 50, “moderate” if it is between 50 and 80, “severe” if it is 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).

Results

The region-wide winter of 2008-2009 rated as moderate. The average WSI across 31 stations with complete reporting was 60.5 (SE = 3.3) compared with a 30-yr average of 60.9 (SE = 4.7). Fifty-two (87%) of the generated WSI “points” were “temperature” points and most of these were accumulated

during December and January (Fig. 3). Eight (13%) of the WSI points were “snow” points accumulated mostly during January and February (Fig. 3). Low temperatures occurred early and continued throughout the winter, however, December and January were the coldest months (Table 1).

Among 31 individual stations with complete records, 22 reported WSIs reflective of moderate conditions (50<WSI<80), 1 reported moderately severe conditions (80<WSI<100), and 1 reported very severe conditions (WSI>100; Table 1). The area experiencing WSI $\geq$ 80 encompassed a relatively small region of north central and southeastern Iron County. Moderate readings were recorded throughout Douglas, Bayfield, Burnett, Washburn, Barron, Rusk, Vilas, Oneida, Forest, Langlade, Florence, and northern Marinette counties. Elsewhere, mostly mild conditions prevailed. This was the second consecutive moderate winter in northern Wisconsin after a succession of three mild winters during 2004-2007.

Discussion

Region-wide the winter of 2008-09 was not severe enough to cause excessive winter mortality or depressed fawn production during spring 2009. Despite widespread moderate winter severity values throughout most of northern Wisconsin, significant snow accumulation was minimal throughout the winter and gone by April when deer are particularly vulnerable to winter effects. A notable exception included Iron County, where severe and very severe winter conditions prevailed through early April 2009. Reports of distressed and dead deer (particularly fawns) were occasionally reported in this area, and suggested that local deer populations may have been vulnerable to winter weather effects. Despite localized winter effects, a relatively robust fawn age class is expected throughout most of northern Wisconsin during spring 2009. Recruitment predictions and antlerless harvest predictions for Fall 2009 were adjusted based on historic herd responses following comparable winter conditions. Due to a decreased proportion of yearling deer of both sexes in the 2008 harvest (Wisconsin Department of Natural Resources 2008), subsequent declines in yearling recruitment in areas locally impacted by winter effects are possible and warrant continued monitoring.

Acknowledgments

This survey depends on the timely recording and reporting of temperature and snow depth by a DNR field staff and volunteers. Sincere thanks go to all that participate. A special thanks goes to Keith McCaffery for providing helpful comments on an earlier draft of this report.

Literature Cited

Kohn, B. 1975. Deer survey improvement. Wis. Dep. Nat. Resour. Final Rep. Job 210.4, P-R Proj. W-141-R-10.

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. J. Wildl. Manage. 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.

Wisconsin Department of Natural Resources 2008. Deer ages and condition in 2007. Bureau of Integrated Science Services, Madison, WI.

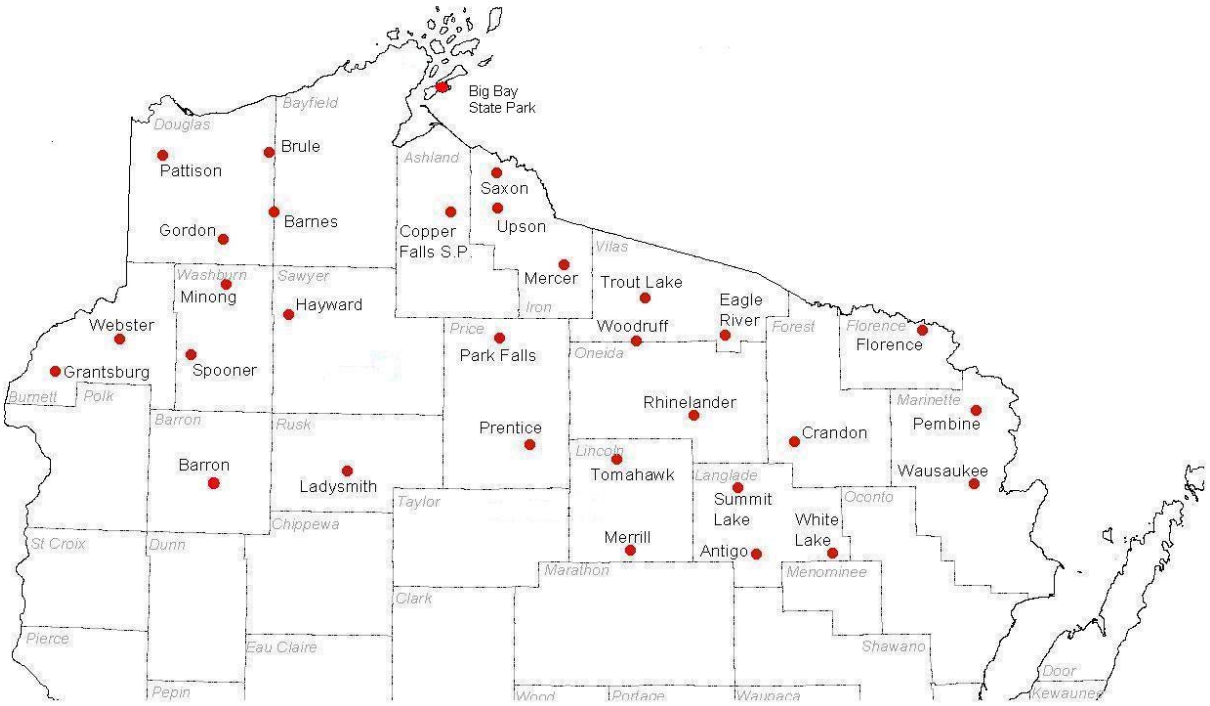

Figure 1. *Location of winter severity index recording stations, 2008–2009.*

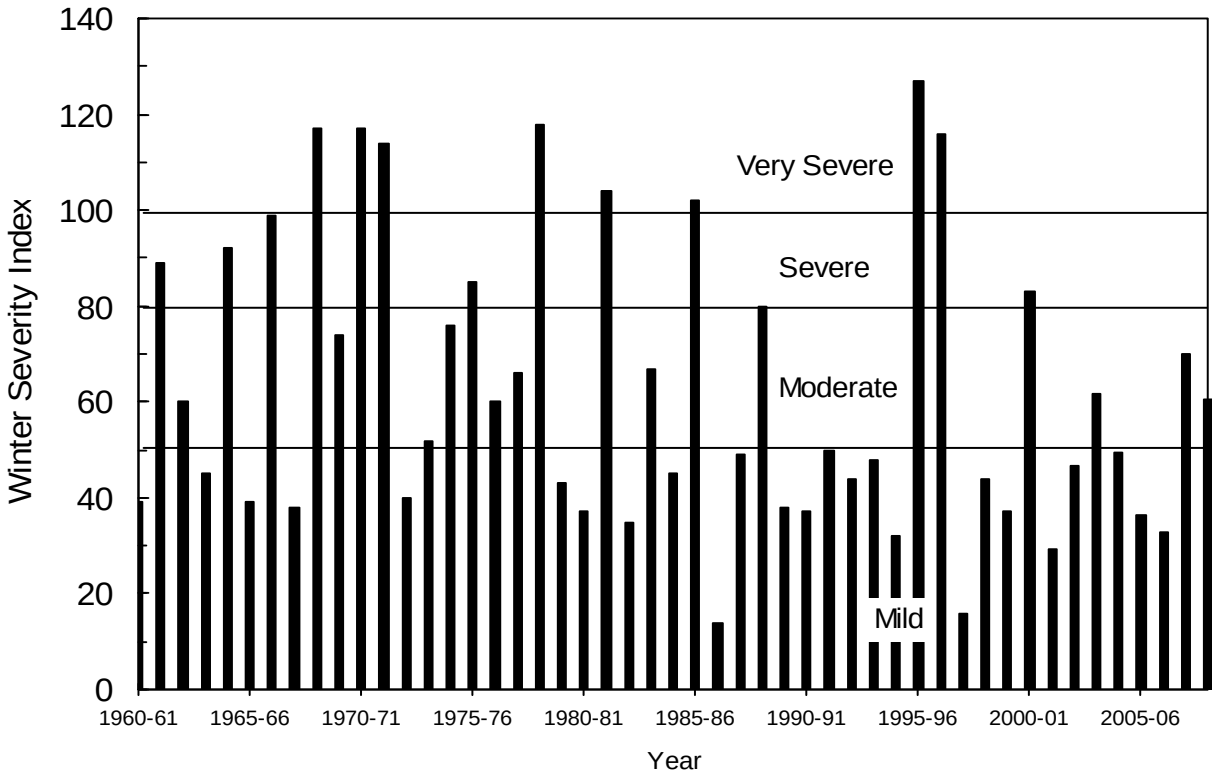

Figure 2. *Winter Severity Indices 1960-1961 to 2008-2009*.

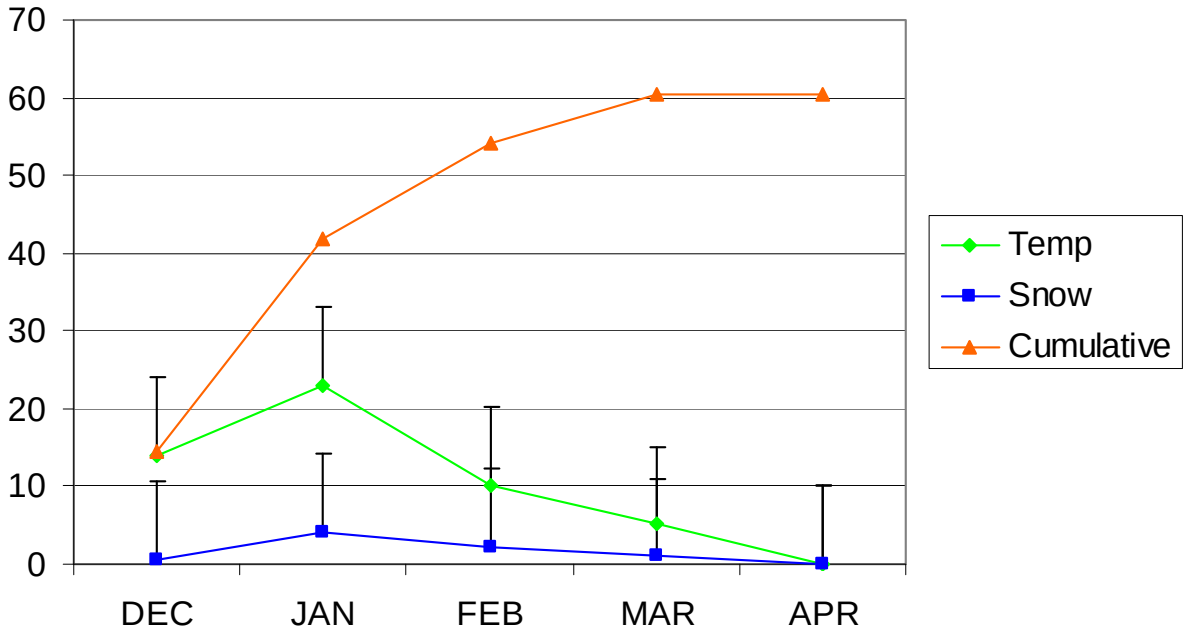

Figure 3. *WSI trend during 2007-2008. Error bars represent ± 1 SD.*

Table 1. *WSI data reported for 2008-2009. TEMP = number of days with temperatures ≤ 0° F, SNOW = number of days with snow depths ≥ 18 inches.*

STATION	DECEMBER		JANUARY		FEBRUARY		MARCH		APRIL		TOTAL	
	TEMP	SNOW	TEMP	SNOW	TEMP	SNOW	TEMP	SNOW	TEMP	SNOW	TEMP	SNOW
Antigo	13	0	25	0	12	7	4	2	0	0	54	9
Barnes	14	0	23	0	10	0	6	0	0	0	53	0
Barron	18	0	29	0	11	0	3	0	0	0	61	0
Big Bay SP	3	0	12	8	4	2	4	3	0	0	23	13
Brule	18	0	24	0	14	0	7	0	0	0	63	0
Copper Falls SP	17	0	23	0	7	1	6	0	0	0	53	1
Crandon	14	0	25	0	9	0	6	0	0	0	54	0
Eagle River	12	0	21	0	9	0	5	0	0	0	47	0
Florence East	9	0	22	11	7	8	3	3	0	0	41	22
Gordon	16	0	29	0	13	0	6	0	0	0	64	0
Grantsburg	14	0	27	0	13	0	6	0	0	0	60	0
Hayward	13	0	25	0	10	0	6	0	0	0	54	0
Ladysmith	18	0	29	0	16	0	5	0	0	0	68	0
Mercer	16	4	20	24	9	12	6	4	0	0	51	44
Merrill	14	0	25	15	11	2	5	5	0	0	55	22
Minong	17	0	27	1	11	0	6	0	0	0	61	1
Park Falls	19	2	25	2	14	0	7	0	0	0	65	4
Pattison	18	0	25	0	10	0	7	0	0	0	60	0
Pembine	12	0	22	0	11	0	6	0	0	0	51	0
Prentice	13	0	20	0	9	0	5	0	0	0	47	0
Rhinelander	12	0	22	1	9	0	6	0	0	0	49	1
Saxon	9	0	13	8	11	0	4	0	0	0	37	8
Spooner	11	0	22	0	6	0	3	0	0	0	42	0
Summit Lake	16	0	25	13	12	2	4	1	0	0	57	16
Tomahawk	10	0	23	0	7	0	5	0	0	0	45	0
Trout Lake	12	0	22	8	11	4	4	0	0	0	49	12
Upson	19	12	23	30	10	27	5	10	0	0	57	79
Wausaukee	10	0	20	0	8	0	5	0	0	0	43	0
Webster	14	0	24	0	10	0	6	0	0	0	54	0
White Lake	17	0	23	4	12	3	4	4	0	0	56	11
Woodruff	14	0	21	3	10	4	5	0	0	0	50	7
Averages	13.9	0.6	23.1	4.1	10.2	2.3	5.2	1.0	0.0	0.0	52.4	8.1
SD	3.6	2.3	3.8	7.5	2.5	5.4	1.2	2.2	0.0	0.0	9.2	16.4