

# Learn About ...

## *Madison Lakes and Climate Change*



The Earth's climate changes continuously and many of the changes are "recorded" in the millennial-long formation and evolution of its lakes, well before humans ever saw them. The historical timeline below shows that Native American cultures flourished in the area around the Madison lakes about thirty centuries ago. Indeed, their ancestors passed on the names they bear today to the European settlers who arrived on the scene barely two centuries ago. During those two centuries, climate change has been greatly accelerated by human activities that have increased heat-trapping atmospheric greenhouse gases, mainly as a result of burning fossil fuels to drive the Industrial Revolution in North America and Europe.

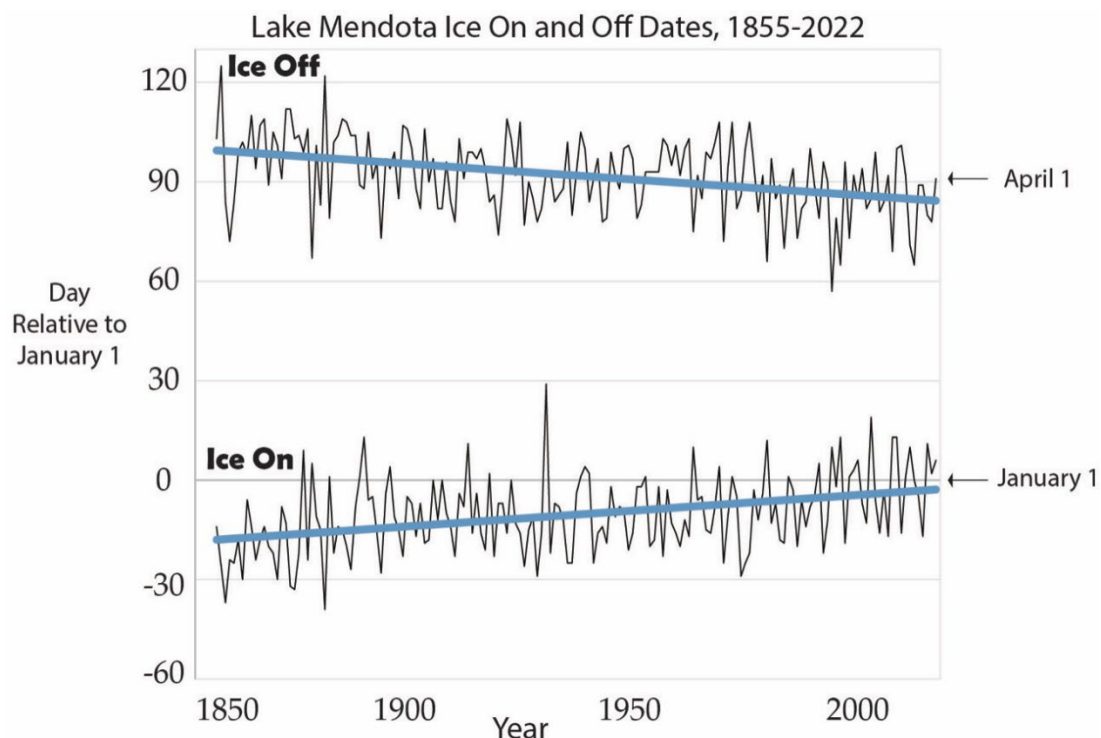
In the summer of 2018, the *Wisconsin State Journal* ran [a fascinating series of articles](#) on the history, impact, and health of our lakes.

### *A History of Madison's Lakes*

Year	Importance
15,000 B.C.	Madison area under 300 m of glacial ice
10,000 B.C.	Glacial ice gone from Madison; Lake Mendota twice present size
3,000 B.C.	American Indian population flourishing
1,000 B.C.	First signs of Indian mounds
1800	First European settler
1836	Madison becomes territorial capital
1848	Wisconsin becomes 30th state; Madison population 300
1849	First UW class for 17 students; Tenney Locks constructed
1855	Beginning of Lake Mendota and Lake Monona ice records

1877	First limnological studies (E.A. Birge)
1882	First noxious algae growth documented (Madison population 12,000)
1890	Carp introduced
1900	First limnology class taught at University by C. Juday
1920	Madison population 35,000
1928	Sewage diverted around Lake Monona
1940	Madison population 67,000
1958	Madison sewage diverted around Lakes Monona, Waubesa & Kegonsa
1960's	Eurasian water milfoil invades Madison Lakes
1963	Limnology Lab constructed with funds obtained by A.D. Hasler from the National Science Foundation
1971	Waunakee & DeForest sewage diverted around Lake Mendota
1985	Madison population 173,000
1987	Lake Mendota Biotic Manipulation Program begins
1994	Lake Mendota Priority Lake Project begins

This climate change is manifested in changes in the lakes and their surroundings and now humans are recording them. The average temperature of the Earth has increased by at least one degree Celsius (1.6 °F) during this period—it is harder to freeze water and easier to melt ice in a warmer world. The first freezing and first melting dates have been recorded for Lakes Mendota and Monona since 1852—the number of ice-covered days for Lake Mendota is shown in this figure. The ice season is about one month shorter now than it was in the mid-19th century.



A further consequence and evidence for global warming is shown in these hardiness zone maps that gardeners and farmers use to determine what plants and crops will thrive in their neck of the woods. The number associated with each zone is the lowest winter temperature (°F) observed in this area. As the globe warms, average winter temperatures get higher everywhere and we expect the warmer zones (higher lowest winter temperature) to move north. This is just what you see in these maps for Wisconsin. As we should anticipate, from the ice data above, the more recent map shows Madison and its lakes in a milder hardiness zone. For more background on human-caused global warming and climate change see *Learn Abouts* on [Carbon Dioxide](#), [Greenhouse Gases and Climate Change](#), [Limiting Climate Disruption](#), and [Methane](#) as well as the American Chemical Society's Climate Science Toolkit ([www.acs.org/climatescience](http://www.acs.org/climatescience)).

## PLANT HARDINESS ZONES

These maps display measurements taken to help farmers and gardeners with their planting. The differences between the two maps show that Wisconsin is getting warmer. This is a telltale of global warming and an indicator of how the climate is changing.

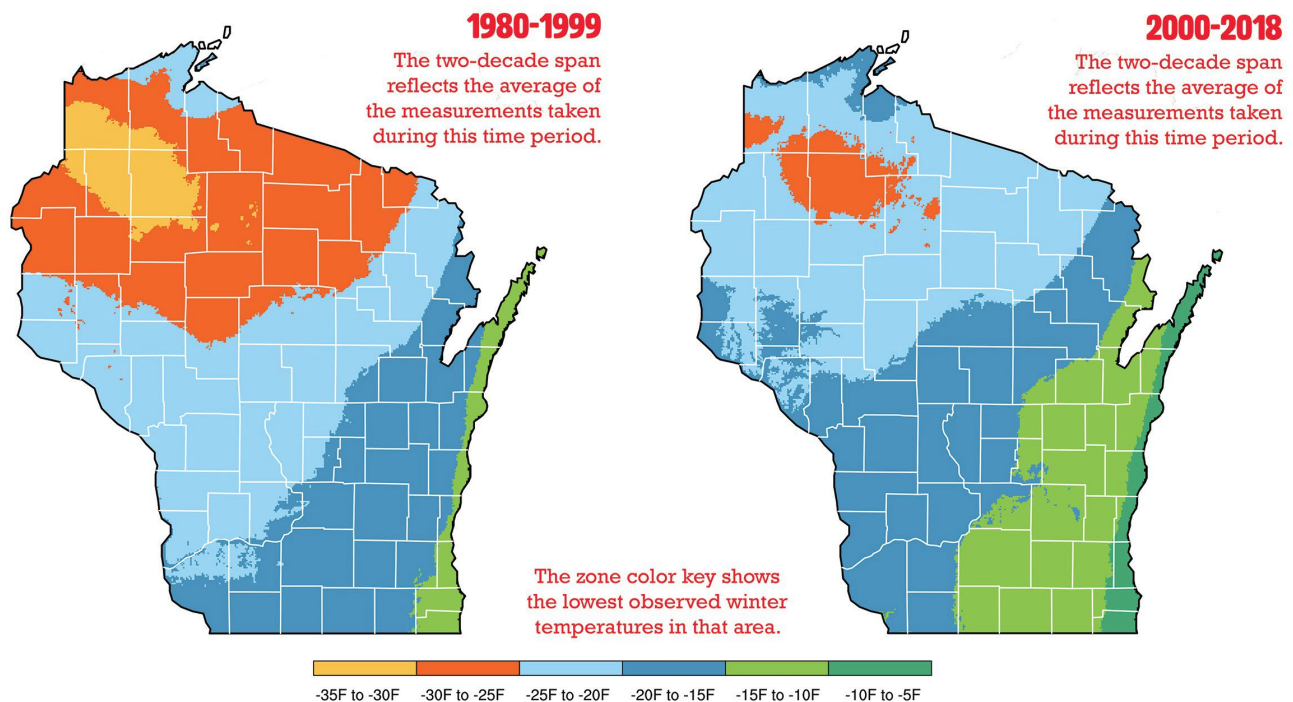


Illustration by Brandon Raygo, The Capital Times / Data Source: U.S. Dept. of Agriculture, PRISM Climate Group, Oregon State University

## Some Statistics about Madison's Lakes

### Sizes of the Lakes

		Mendota	Monona	Waubesa	Kegonsa	Wingra
<b>Area</b>	(km <sup>2</sup> )	39.8	13.3	8.4	13.0	1.3
	(acres)	9830	3290	2070	3210	320
<b>Shoreline Length</b>	(km)	35.2	21.2	15.1	15.4	5.9
	(miles)	21.9	13.2	9.4	9.6	3.7
<b>Volume</b>	(10 <sup>6</sup> m <sup>3</sup> )	505	110	40	67	6
	(10 <sup>9</sup> gallons)	130	29	11	18	1.6
<b>Maximum Depth</b>	(m)	25.3	22.6	11.6	9.8	4.3
	(ft.)	83	74	38	32	14
<b>Mean Depth</b>	(m)	12.7	8.3	4.7	5.1	2.7
	(ft)	42	27	15	17	9
<b>Direct Drainage Area</b>	(km <sup>2</sup> )	562	105	113	141	14
	(acres)	139000	25900	27900	34800	3460

### Water Temperatures for Lake Mendota

Surface Maximum:	34.3°C (94°F)
0 to 7 m (0 to 23 ft):	Average July-23.1°C (74°F)
0 to 7 m (0 to 23 ft):	Maximum July-28.4°C (83°F)
14 to 18 m (46 to 59 ft):	Average July-12.6°C (55°F)

### Thickest Annual Ice Cover for Lake Mendota

Average 49 cm (19 in)
Maximum 75 cm (30 in)
Minimum 30 cm (12 in)

### How does lake ice melt? UW-Madison Limnology Professor Hilary Dugan explains

#### Ice Cover

	Mendota	Monona	Wingra
<b>Median duration days/yr</b>	102	103	113
	Maximum	160	164
	Minimum	49	69
<b>Median Freeze Date</b>	20 Dec	15 Dec	29 Nov
	Latest	30 Jan 1932	30 Dec 2015
	Earliest	23 Nov 1880	2 Nov 1913
<b>Median Opening Date</b>	4 Apr	30 Mar	25 Mar
	Latest	4 May 1857	29 Apr 1881
	Earliest	27 Feb 1998	26 Feb 1998

## *Sources of More Information*

- [American Chemical Society's Climate Science Toolkit](#)
- Beckel, A. 1987. "Breaking New Waters: A Century of Limnology at the University of Wisconsin," *Transactions of the Wisconsin Academy of Sciences, Arts and Letters*; available from the Center for Limnology, UW-Madison.
- Brock, T.D. 1985. *A Eutrophic Lake, Lake Mendota, Wisconsin*, Springer-Verlag, New York.
- Frey, D.G. 1963. *Limnology in North America*, University of Wisconsin Press.
- *Madison Area Lakes Map, #84-1*, featuring Monona, Mendota, Wingra and showing depths and boat docks, available from Wisconsin Geological and Natural History Survey, 3817 Mineral Point Road, Madison, WI 53705; phone: 608-262-1705.
- [Madison Lakes Ice Summary](#), *Wisconsin State Climatology Office*

## *Further Reading*

[On Sacred Ground: The long and winding path to Picnic Point includes Madison's earliest inhabitants](#)  
By Erika Janik, *On Wisconsin*, Spring 2016

[The Model Lake: One of the world's most respected ecological thinkers sounds a warning for Lake Mendota](#) By Erik Ness, *Isthmus*, August 24, 2017

['Free-range scientist' Steve Carpenter remains inspired, inspiring — even in retirement](#)  
By Adam Hinterthuer, *UW News*, March 13, 2018

[The Yahara Lakes: Giants Among Us](#) A series by the *Wisconsin State Journal*, Summer 2018

[Climate Change Could Leave Thousands of Lakes Ice-Free](#)  
By Nadja Popovich, *The New York Times*, February 5, 2019

[Dane County lake levels report evaluates prevention, mitigation scenarios](#)  
By Abigail Becker, *The Cap Times*, February 5, 2019

[Reddit competes to visualize Madison's prized Lake Mendota ice data](#)  
By Eric Hamilton, *UW News*, February 12, 2019

[Easy on the salt, water quality experts tell UW-Madison](#)  
By Kimberly Wethal, *The Wisconsin State Journal*, January 31, 2023

[UW-Madison policy says road salt is toxic. So why did it dump so much?](#)  
By Kayla Huynh and Allison Garfield, *The Cap Times*, February 1, 2023