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FRED KONRATH: Remembering former Bears' coach **PAGE 10A**

July sunshine brings November evaporation

BY DEBRA NEUTKENS
EDITOR

WHITE BEAR LAKE — Lake water is vanishing into thin air.

Even in November when it's least expected, a couple inches of water is evaporating off White Bear Lake.

That's the surprising summation thus far of evaporation studies underway by University of Minnesota scientists, including Paul Bolstad, a White Bear Lake resident and professor of environmental science.

Bolstad volunteered to collect the data when three climate stations were installed in 2014 to help sort out reasons for fluctuating lake levels. He provided an update on the research Nov. 15 to the White Bear Lake Conservation District.

"We know that sunlight drives evaporation, as does wind, temperature and humidity," Bolstad said. "The warmer the temperature, the more active the evaporation."

The equipment is almost magical, he told the board. "It can measure wind speed and humidity 60 times per second. At the end of the day, we can count how many molecules of water went up and how many came down. Every half hour we get an estimate of how much water enters or leaves the lake."

In 2014, there were big jumps in evaporation rate over short time periods, Bolstad said. The peak is in July. The lake lost 4 inches of water off the surface in July and 2 to 3 inches in October and November. "It's much higher than most people would expect," he noted. The same thing happened in 2015.

"Again, evaporation ramps up to the highest rate in July and stays on through fall. It doesn't matter that it's a lot cooler in October," Bolstad pointed out.

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EVAPORATION: Lake storing more heat, meaning longer ice out than past years

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The reason is heat storage in the lake.

As the sun gets lower, the lake is still warm, Bolstad explained. Stored energy seeks to exit the water, so basically, as long as there isn't ice on the lake, it will maintain high evaporation rates.

"I bet we're losing as much water this month as we did in August or September," he said. "Rainfall or water draining from the watershed may still cause a net gain, or break even, but it's an interesting finding."

The length of time it takes for the lake to heat up and cool off is taking longer now than it used to, Bolstad added. "The lake is storing more heat than in the past. If it's storing heat at deeper levels, we will have longer ice-out periods as time goes on."

In 2014, researchers measured 21 inches of evaporation and in 2015, 25 inches. The rates are perfectly related to the number of ice-free days, Bolstad noted.

Calling the information "useful," data will be shared with the U.S. Geological Survey and compiled to develop models for predicting evaporation, the scientist continued. They are also looking at historic data, some provided by a weather satellite that has been circling over White Bear Lake every two weeks since 1984, to study the effect of water temperatures on ice-in dates. "We can look at trends for these variables to guess what might happen in the future," Bolstad said.

"It's clear temperature in the region is rising. We can't dump all this carbon dioxide into the atmosphere and not have an impact," he maintained. "Along with changing climate, the main thing here is changing temperature. Increased temperatures mean more heat storage in the lake, and that means it takes longer to freeze. The extension at the end of the season extends evaporation."

He told the board it would be valuable to have not just ice-out records, but ice-in. "I recommend getting those dates, too. Ice-in is more sensitive to change than ice-out."

The research is winding down. The group has been unable to secure funding to keep it going, so this is likely the last year of the study. He thanked the board for its support in getting the monitoring equipment and offered to keep one station going if a secure location can be found. The Department of Natural Resources owns the other two climate stations.

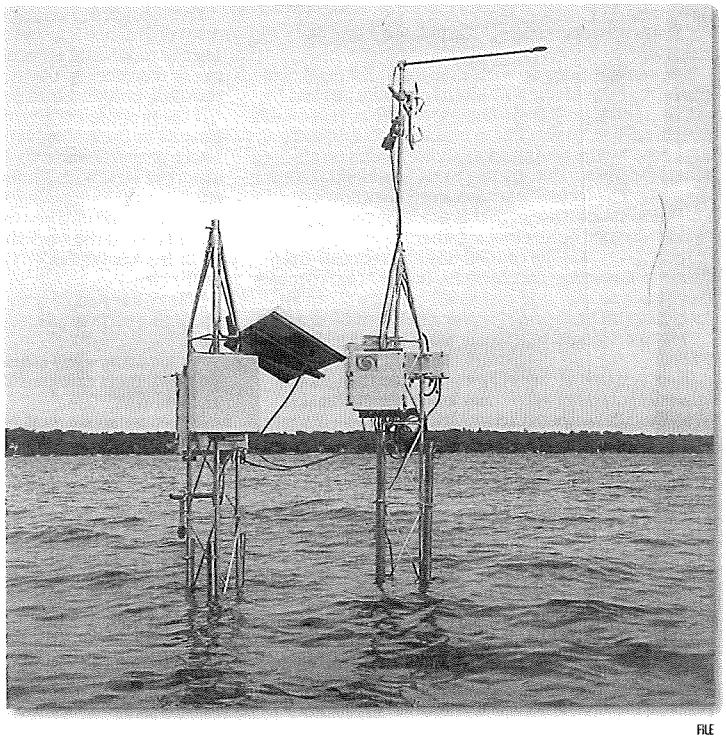
Noting that some northern lakes are averaging a month longer for the ice-free period, Bolstad believes that could mean an extra 3 to 4 inches of evaporation. "Over 10 years, that's 30 inches," he said. "It could be part of the reason the lake is down and an unintended consequence of climate change."

BY THE NUMBERS: LAKE EVAPORATION RATE

2014	
21	inches lost
219	days ice free
2015	
25	inches lost
258	days ice free

BY THE NUMBERS: LAKE STATS

922.56 feet	current elevation
11.5 inches	increase over last year
3 feet, 8 inches	increase over 2013 record low
49 degrees	current temperature
42 degrees	temperature this time last year



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Three of these climate stations were used to measure evaporation on White Bear Lake over the three-year study.