This is Wisconsin Water News, a production of the University of Wisconsin Sea Grant Program. I'm your host, Marie Zhuikov. Today's episode is:

Gaining a big picture of bluff erosion and sand movement along Lake Michigan

High water levels in Lake Michigan since 2013 have caused erosion rates that are faster than usual, especially in 2020, when lake levels set records. This has created an urgent need to know more about erosion processes along and in the lake.

Lucas Zoet with the University of Wisconsin-Madison Department of Geoscience and his research team are looking at bluff erosion and sediment movement at two Wisconsin sites along Lake Michigan. They're doing the project in a holistic way to better understand erosion rates and where the eroding sediment goes. This information will help guide shore protection and bluff stabilization processes and preserve beaches for recreation.

The two study sites are located just south of Port Washington and at Point Beach State Forest, which is farther north, near Two Rivers. The researchers chose those sites because they offer good representations of different erosion processes. The Port Washington site sits on a bluff, the Point Beach State Forest site is composed of sand dunes.

Zoet explains why they chose these sites.

"They're good representations of these processes. And those processes can be applied all over the place in Wisconsin. And so, lots of the bluffs we have are generally similar characteristics. They're composed of a mix of glacial tills and various lake deposits that are interbedded. So just understanding these processes at like a base level, they should be generally applicable to more or less everywhere."

Zoet said the project's holistic approach is unique.

"The real strength of this project is that it doesn't break the whole system up into little chunks, like we study this part and then we don't know how it works because it's in isolation from this other part. We're trying to look at the whole continuous system, from what's happening onshore, to what's happening on the beach, to what's happening in the nearshore and over multiple years so we can sort of get a representative timescale of how things are happening. Not just in a week or a month, but over seasons, which we know is such a big player in the Great Lakes region."

Compared to the well-studied processes that happen on marine coastlines, winter is the season that makes erosion issues in the Great Lakes distinctive. Zoet said that cold weather impacts erosion differently.

"We have the bluffs freeze solid, the shore ice forms – all of these different components that drastically alter the sediment transport that you don't see if you're looking at beaches in North Carolina or Oregon."

To study the onshore section, Zoet, J. Elmo Rawling with the Wisconsin Geological and Natural History Survey and Ph.D. student Chelsea Volpano, use drones and trail cams to gather data. To study the beach, Volpano conducts wading surveys. For these, Zoet said she carries a staff with a GPS unit on it to measure lakebed elevation.

"She walks out into the water up to about her waist, about a meter deep, and just does that over and over. So, with that, she can connect the onshore component to the offshore component for this

continuous map that's called topo-bathy. So, topography for the onshore and bathymetry for the lakeshore component."

This type of field work is uncommon.

"She might be one of the only people to do these wading surveys in near-freezing waters, like repeatedly throughout the years."

To study the nearshore area, the team uses a medium-sized remote-controlled boat that contains an instrument that measures the elevation of the lakebed for a full 3D map of the system. By repeating these measurements over time, the team can assess how the lakebed is changing and where the sediment is going.

One aspect of communicating the project involves Great Lakes Quests. These are story maps compiled by Justin Hougham, University of Wisconsin-Madison, and Sea Grant. The Port Washington site is already part of the Quest database, but the Point Beach State Forest isn't, and will be added.

Zoet said the project will also be communicated through public workshops for educators and property owners along Lake Michigan who are concerned about coastal erosion.

"We'llgo out there and do a walk of the terrain with them and we'll probably bring a couple of the instruments we use because they're sort of interesting. Like one is a drone, like I was saying, that sort of takes photographs. The other a medium-sized remote-controlled boat."

The first workshop is planned for September 2024.

Zoet has a long-standing working relationship with the College of Menominee Nation in Wisconsin. He's currently helping design the college's new geoscience program. Faculty members at the college plan to recommend students who could help work on the story maps and computer mapping for the project.

Summing up this multifaceted endeavor, Zoet said,

"In the end, I think we'll learn a lot about the processes, but we'll also learn a lot about like how to better advise coastal managers, county managers and parks managers."

That's it for this episode of Wisconsin Water News, just one of the ways that Wisconsin Sea Grant promotes the sustainable use of Great Lakes resources through research, education and outreach. Listen and subscribe to us through I-Tunes and Google Play or at seagrant.wisc.edu. Thank you to Luke Zoot for the interview, and thank you for listening.