



View of interdunal wetland in 2019 (left) and 2022 (right) after water levels in nearby Lake Michigan dropped.

Ecohydrology of a Lake Michigan interdunal wetland

by Suzanne DeVries-Zimmerman

NESTLED within the Great Lakes coastal dunes lie interdunal wetlands or slacks, imperiled ecosystems with high biodiversity. The Hope College Coastal Group has been conducting an ecohydrological study in one such interdunal wetland in the Saugatuck Harbor Natural Area (SHNA) south of the Kalamazoo River mouth near Saugatuck, Michigan since 2016. Our work includes annual vegetation quadrat sampling, remote sensing flights with an unoccupied aerial vehicle (drone), and sampling of groundwater and surface water within and around the wetlands. Wetlands were absent from this area prior to 2014 due to the low Lake Michigan-Huron lake levels. The area was generally dry with dominant upland/dune vegetation except for several ponds along the northernmost wetland edge. However, rising lake levels, beginning in 2014, wetted the area, allowing wetland vegetation to germinate from the seedbank.

Our initial work focused on how water levels within the wetland influenced the diversity, density, and distribution of vegetation. As the wetland has a subtle microtopography, we established over 40 vegetation quadrats that are surveyed annually. We noted that vegetation was zoned according to water depth, and that the highest diversity was found along the damp edges of the wetland. Additionally, in 2016 and 2017, damp ground to shallow water (about 16 centimeters deep) supported dense stands of *Cladium mariscoides* with accompanying *Spiraea tomentosa*, especially in the central portion of the wetlands. *Carex* and *Juncus* species dominated the deeper ponds along the northern edge. As lake levels continued to rise between 2018 and 2020, water in the central ponds deepened to more than 70 centimeters, significantly decreasing the overall vegetation density and creating large areas of open water. The areal extent of the wetlands increased, however, as rising water submerged new areas, allowing wetland vegetation to germinate from the seedbank there.

Water levels decreased significantly, about 0.5 meter, from 2020 to 2021. Hence, we hypothesized that vegetation density would increase again in response. However, we failed to fully account for the activities of muskrats (*Ondatra zibethicus*) on the vegetation stands. In winter 2019–2020, muskrats migrated from a nearby water body to our study area, burrowing under the banks, eating selected vegetation types during summer 2020, creating lodges of vegetation in fall 2020, and most significant of all, foraging for seeds, rhizomes, and roots in the sediments under the ice in winter 2020–2021. Consequently, when water levels dropped, there was little to no vegetation in the central portion of the wetland in summer 2021. In 2022, water levels further dropped about 0.2 meter. The wetlands' edges and areas marginally impacted by the muskrats have dense stands of *Cladium mariscoides* as anticipated. However, little to no growth of vegetation has been noted in the central portion of the wetlands thus far. It remains open water and mud flats with muskrat channels still visible in the sediments. Hence, we are now documenting how vegetation re-establishes following a major disturbance, in this case, a muskrat "eat-out," in addition to monitoring vegetation changes in response to changing water levels.



Same wetland in 2022 with mud flat resulting from low water levels and the arrival of muskrats.

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