Indiana Dunes

National Park Service
U.S. Department of the Interior

Indiana Dunes National Lakeshore

Mount Baldy

Mount Baldy is a 140-foot sand dune at the southern tip of Lake Michigan, lying within the eastern end of Indiana Dunes National Lakeshore (Argyilan and Morris, 2014). During the last 175 years, anthropogenic, or human caused influences have greatly impacted sand movement at Mount Baldy, causing the dune to move inland at an unnatural and alarmingly fast rate.

The Sand Supply

Mount Baldy began forming some 4000 years ago and is continually changing as a result of natural factors. Lake Michigan levels, precipitation, air and surface water temperature, frequency and intensity of storms, and duration of nearshore shelf ice all influence sand movement at Mount Baldy (Kilibarda and Shillinglaw, 2014). Natural shoreline processes along Lake Michigan's coast have provided a steady supply of sand from the east and deposited it onto the beach at the foot of Mount Baldy for thousands of years. Additional sand was also carried downstream by Trail Creek, which empties into Lake Michigan just east of the dune. This steady supply of sand provided much of the building material for the giant sand dune we know today.

Human Influences

The natural processes that helped form Mount Baldy have since been interrupted by anthropogenic (or human caused) changes. Beginning in 1836, piers, breakwaters, and other shoreline structures were constructed at the Michigan City Harbor, just east of Mount Baldy (Kilibarda and Shillinglaw, 2014). These structures interrupted the natural east-to-west transport of sand. Sediments moving from the east toward Mount Baldy, now become trapped by these man-made structures before ever reaching the beach at the foot of the giant dune. Development along Trail Creek also interrupted the flow of sand. These structures almost completely block the sediment supply to Mount Baldy and started a cycle of sediment starvation and coastal erosion (Argyilan and Morris, 2014).

At the same time, Mount Baldy became an increasingly popular destination area for public recreation. Beachgoers, hang gliders, and dune climbers traipsed across the dune, inadvertently trampling and killing the plants that grew there. Little vegetation remained to anchor the sand in place. High winds blowing from the north/northwest now erode sand from the lakeward side of the dune, up and over the dune, depositing it on the leeward side.

The cumulative result of these anthropogenic changes is a sand dune that is migrating to the south/southeast at a much faster than normal pace. A study of aerial photographs revealed that from 1938 to 2008 Mount Baldy advanced 135 meters (443 feet) toward the south, at an average rate of 1.9 meters (6.23 feet)/year (Kilibarda and Shillinglaw, 2014).

Restoring Mount Baldy

Staff and volunteers plant marram grass to stabilize the sand.

The Army Corps of Engineers periodically transports additional sand to the beach just east of Mount Baldy (but west of the Michigan City Harbor). Managers at Indiana Dunes National Lakeshore support this activity. "Beach nourishment" partially offsets the deficit of sand created by the harbor structures and eventually works its way to the foot of Mount Baldy, temporarily providing a source of sand for the dune and helping to minimize erosion.

Beach nourishment has helped, but not enough. In 2011 the National Park Service at the Indiana Dunes National Lakeshore declared Mount Baldy an "impaired" landform and managers are actively working to restore the dune and slow its landward migration. Beach nourishment will continue. Trails have been strategically rerouted and even closed.

Visitor access has been restricted in areas to prevent the dune and dune vegetation from being trampled. Signs have been installed to educate people and remind them to stay on the designated trail. Park staff and volunteers have spent countless hours planting marram grass to help hold the sand in place. Interpretive rangers have been stationed on site to talk with the public about the situation. In 2014, rows of discarded Christmas trees, logs, snow fencing, and cut shrubs and branches were strategically installed to slow the wind in order to prevent it from carrying sand long distances across the dune. These wind blocks will also protect newly planted marram grass while it develops its extensive root systems. All these efforts have helped, but how much? How can we measure their effectiveness?

Monitoring the Changes

Monitoring initiatives are currently in place on Mount Baldy: the Northwest Indiana Restoration Monitoring Inventory has established vegetation plots to track changes in plant densities and species composition, and photographic monitoring stations have been established by park managers to visually record changes to the dune.

A research project recently established additional strategies and methods for monitoring dune morphology and wind flow to assess both short and long-term restoration success on coastal dunes (Argyilan and Morris, 2014). The project utilized LiDAR (Light Detection and Ranging), a remote sensing method used to examine the surface of the Earth, coupled with traditional ground surveying methods to develop digital terrain models. Direct comparison of the 2010, 2012, and 2013 models identifies and quantifies areas of erosion and deposition across the dune form. (See figure # 1.) As time goes on, managers will continue to monitor Mount Baldy's dune morphology to assess the effectiveness of current restoration practices and plan the most effective restoration strategies for the future.

During the summer of 2013, the Mount Baldy area was closed due to hazardous conditions. It will remain closed indefinitely, pending further investigation. Interestingly, since Mount Baldy has been closed, native plants have become established on their own in several locations on the dune face. http://www.nps.gov/indu/parkmgmt/mount-baldy-dune-investigation.htm

Citations

Argyilan, E.P., Morris, C.C., 2014. Developing methods for monitoring short-term changes in the morphology and migration of Mount Baldy, Indiana Dunes National Lakeshore. Master Agreement #H6000082000, Task Agreement #P12AC10447. Indiana University Northwest, College of Arts and Sciences, Gary.

Kilibarda, Z., Shillinglaw, C., 2014. A 70 year history of coastal dune migration and beach erosion along the southern shore of Lake Michigan. Aeolian Research; Article in press.

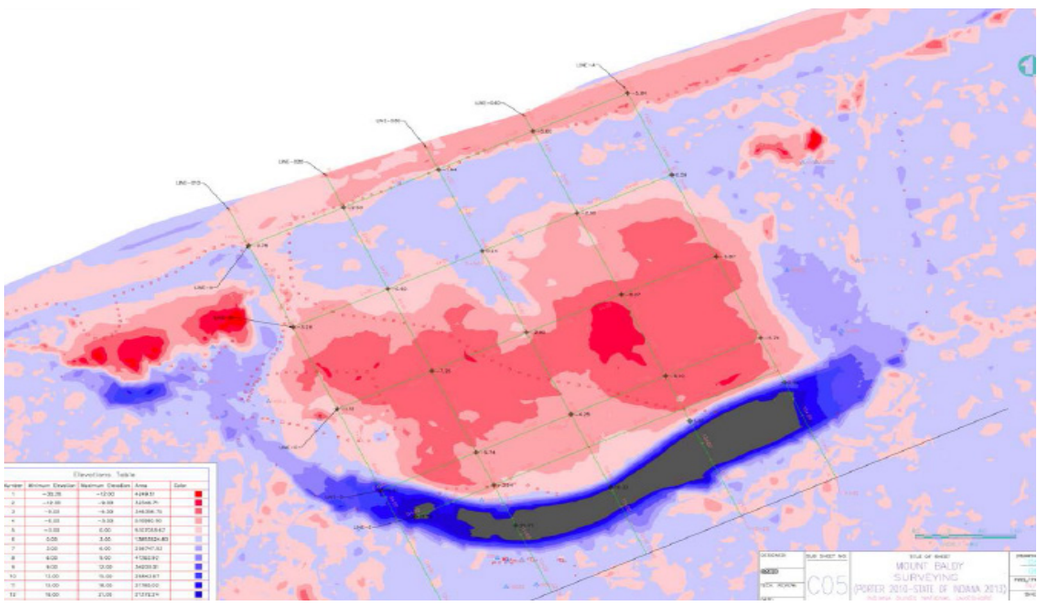

Figure 1. Areas of erosion (red) and deposition (blue) on Mount Baldy based on the comparison of 2010 and 1013 digital terrain models generated in AutoCAD Civil 3D (Argyilan and Morris, 2014)