COaStS

CITIZENS OBSERVING AND SURVEYING THE SHORELINE

A GUIDE FOR VOLUNTEERS

Updated June 2017

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WELCOME TO COaStS!

WHY THIS PROJECT?

Along Illinois' Lake Michigan coast, there is significant variability in how the shoreline changes daily, monthly, and annually. Under high lake level conditions, some locations experience dramatic bluff and sand erosion, which leads to a loss of critical habitat and threatens key infrastructure. Other coastal areas are burdened by excessive sand deposition, which increases the need for dredging to keep harbors open. Until recently, our understanding of the coast has been limited to short-term studies and analyses of historical aerial photographs. Without a long-term beach and nearshore monitoring program it is extremely challenging to decipher the rates and magnitude of coastal change. Furthermore, a lack of wind, wave, current, and water level observations across the region have made it difficult to understand the physical forces shaping our ever changing coast.

The Illinois Department of Natural Resources (IDNR) Coastal Management Program has identified this limited understanding of coastal geologic and physical processes as a significant data gap for the state of Illinois. To meet this need, a new *Lake Michigan Coastal Geology Research Group* has formed at the Illinois State Geological Survey (ISGS). Under the direction of Dr. Ethan J. Theuerkauf this research team is beginning to observe and measure shoreline change by establishing a research and long-term monitoring program along the coast. The data and information gathered as part of this program will aid municipal and state land managers in understanding how beaches and dunes move and change over time. This information will aid our understanding of long-term shoreline change and will help both land managers and the public prepare for, and adapt to the impacts of a changing coastline.

The Citizens Observing and Surveying the Shoreline (COaStS) project will support the larger Illinois-Lake Michigan coastal monitoring program by providing valuable, site-specific data about beach topography change and coastal currents. Additional project information can be found here: https://publish.illinois.edu/lakemichigancoasts.

COaStS is a project of the following partners:

ILLINOIS STATE GEOLOGICAL SURVEY
PRAIRIE RESEARCH INSTITUTE

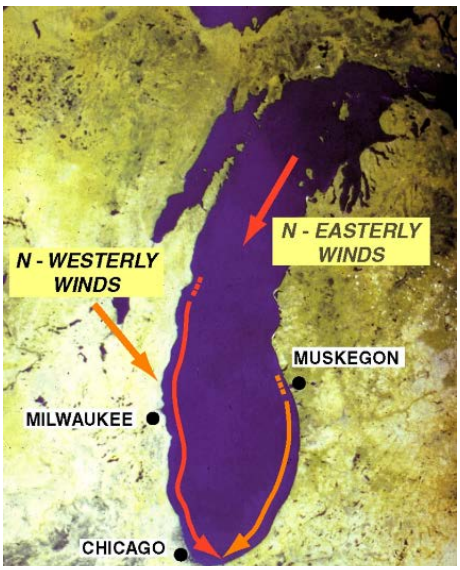
ILLINOIS DEPARTMENT OF NATURAL RESOURCES

COASTAL Management Program
IL Dept of Natural Resources

BACKGROUND INFORMATION

ABOUT ILLINOIS' LAKE MICHIGAN COAST

The Illinois coast of Lake Michigan is a dynamic geologic setting. Natural coastal processes like wave action, ice damage, and changing lake levels contribute to seasonal and yearly erosion and accretion patterns along the shore. The dominant sediment movement along Illinois' northern coast is from North to South due to the prevailing winds and currents. This natural process is referred to as littoral drift, and has occurred along the shores of Lake Michigan for thousands of years. Littoral drift is essential to shoreline stability since it replenishes the sand and sediment supplies to maintain beaches and dunes. In a natural setting, coastal erosion, the landward movement of the shoreline caused by the loss of sand or other geologic materials is the predominant process along northern Illinois' beaches and bluffs.



Natural southward littoral drift patterns in Lake Michigan

The Illinois coast has the highest degree of engineering and human modification in the Great Lakes. The introduction of man-made marine infrastructure (e.g. harbors, breakwaters, piers, revetments, jetties and private shoreline protection structures) interrupts natural littoral drift, permanently altering the drift of sand. Changes to the natural erosion and deposition patterns have created economic, recreational, and environmental challenges for Illinois' northern coastal communities. Current patterns of sand deposition and erosion are impacting the planned uses of public beaches and harbors, and destroying the structure and function of critical habitats.

Our coast is the most densely populated coastal area in the entire Great Lakes region. Despite this, the area is home to rich natural resources and abundant plant and animal diversity, such as that found in the Chiwaukee Prairie Illinois Beach Lake Plain between Waukegan, IL and Kenosha, WI. In addition to high quality environments, the coast provides important ecosystem services to humans, including the protection of Lake Michigan water quality; exhibits of natural communities for education and scientific research; and significant tourism opportunities for local communities. Recreation also plays a vital role along Illinois' northern coast, with a public beaches and marina, small-boat harbors and several boat-launch and ramp facilities.

KEY TERMS & DEFINITIONS

Longshore Currents	• Nearshore currents that run parallel to the shoreline
Littoral Drift	• Natural geologic process of sediment movement along the shore by waves and currents • Littoral drift is essential to shoreline stability as it naturally replenishes sediment to beaches and dunes
Erosion	• Coastal erosion is the removal of beach, dune, and nearshore sediment (i.e. sand, gravel, or clay) by the processes of waves and currents • Although erosion was the natural and predominant trend along the Illinois coast for the last 1,000 years, introduction of shore structures meant to slow erosion have interrupted the natural southward net transport of littoral sand and have accelerated coastal erosion
Accretion	• The accumulation of sediment on beaches, dunes, and in the nearshore • The seasonal cycle of a natural and healthy beach goes through a period of erosion during winter storms and a period of accretion during summer calm weather • If a coastline is not in a healthy state, then erosion can be more severe during winter storms and accretion may not fully restore the volume of material eroded, which will lead to permanent beach loss
Coastal Infrastructure	• Examples include harbors, breakwaters, piers, revetments, and jetties
Lakebed Downcutting	• Underwater erosion of the cohesive layers of glacial till or clay that underlie the sand beds of Lake Michigan • Initiated when sand deposits are not present on the lake bed because of storms or human disturbances, such as updrift shore protection structures • Non-reversible because the loss of cohesive material cannot be replaced • Long-term impact is the lowering and steepening of the lake bottom profile, which results in deeper water occurring closer to shore. This allows larger waves to impact the shore and, in turn, increases the potential for erosion along the beaches and bluff toes.

MONITORING LOCATIONS

For summer 2017, COaStS data collection is limited to the Waukegan Municipal Beach. This Google Earth map shows the parts of the beach that you will survey as a volunteer.

VOLUNTEER GUIDELINES

MONITORING SURVEY PROTOCOL

The COaStS program provides an excellent opportunity to get involved in a scientific study of geologic change at Illinois' beaches. As COaStS volunteers, you will collect site-specific data about beach topography and elevation change, and coastal currents. This information will be analyzed by the Lake Michigan Coastal Geology Research Group at the Illinois State Geological Survey to answer the following research questions:

- What are the rates and magnitudes of shoreline change?
- What were the physical environmental processes (e.g. lake level, winds, and waves) that resulted in beach change?

PREPARING FOR YOUR SURVEY

1. Confirm your survey date, time, and location with your site coordinator.
2. Gather your equipment.
3. If needed, coordinate with your volunteer team to ensure you have at least 2 people to conduct the survey. It is not possible to survey with less than 2 people. **It is best to have 3 people.**
4. Check the weather to confirm it is safe to be on the beach.

EQUIPMENT INVENTORY

Your site coordinator will have a survey kit of supplies. Each kit should include the following:

- ☐ Site maps with profile start points
- ☐ Field Data Sheets
- ☐ Notebook
- ☐ Clipboard
- ☐ Pencils (at least 2)
- ☐ Sharpies (at least 2)
- ☐ Flagging stakes (set of 20)
- ☐ Emery pole set (connected with a 10-foot rope)
- ☐ Compass
- ☐ 2 yardsticks
- ☐ Measuring tape
- ☐ Level

Optional supplies:

- ☐ Garbage bag to collect beach trash
- ☐ Cell phone for emergencies
- ☐ First Aid kit
- ☐ Water & snacks

Remember to always prepare for and dress appropriately for fieldwork. Each survey lasts approximately 2-4 hours depending on the number of profiles you are measuring. It is wise to dress in layers, bring plenty of water and snacks, and have an emergency contact number on hand. Volunteers should never attempt to survey a beach that is not public, or for which they do not have explicit written permission to be at. If for any reason you do not feel safe being on the beach, you should not proceed to collect data. Please notify your site coordinator if you are unable to collect data, and the reason so that the coordinator can make alternative arrangements.

CONDUCTING YOUR PROFILE SURVEY

COaStS survey data is collected using the Emery Rod survey method. This method works best with a group of three people – two to move the rods and take measurements, and one person to record the information on a data sheet and take pictures.

Steps for data collection:

1. Double check that you have all the required supplies. Nothing is worse than getting to the beach and realizing you have forgotten critical equipment!
2. Begin by filling out the top of your data sheet with the date, approximate start time, weather, team member names, site location, and profile e.g. Waukegan Municipal Beach.
3. Take note of any anomalous conditions such as presence of beach groomer tracks, ponding of water on the beach, etc. Also, note weather conditions such as winds, recent storms, etc.
4. Photograph the site before you begin your survey. Take one photo at the starting point of your profile looking lakeward. Take a second photo of the profile from a side-angle.
5. Start your survey by locating the "known reference point" for the profile that you will be surveying. Each profile has a different reference point, which is highlighted on the map included in your supply kit. For example, the left image in figure 1 shows a metal plate on a light post. The top of this metal plate is the "known reference point for "Profile #1 at Waukegan Municipal Beach.

Figure 1. Finding your known reference point & profile start point

6. Place one of your yardsticks on the "known reference point" parallel to the ground. At the end of the parallel yardstick, place your second yardstick perpendicular, making a "T". The point of intersection is the "profile start point". See middle panel of Figure 1. Flag this location.
7. Place the level on the yardstick parallel to the ground to make sure you are taking an accurate measurement. Take a measurement from the beach surface to the intersection with the parallel yardstick (Right panel on Figure 1). Note this measurement on your data sheet in inches. This measurement will be used to determine the elevation of the "profile start point".

8. Use your compass to determine the direction of the profile. Bearings of each profile are noted on the map included in your survey kit.
9. Another team member should place flags in a straight line from the profiles start point about every 20-30 feet until you reach the water's edge. The person with the compass needs to help line up the flagger using the compass bearing. This will ensure consistency in measuring the same profile over time.

Figure 2. Aligning your profile

10. Hold the first rod (Rod A) vertical on the ground directly next to the flag.
11. With the second rod (Rod B) in hand, walk towards the lake until the rope is taught.
12. The person with Rod A should help their partner line up with the flags that mark the beginning and end of the profile.
13. Make sure that Rod B is level in the horizontal direction by placing a level on the side.

Figure 3. Finding the horizon

14. Hold both rods steady. The person with Rod A (furthest from the lake) will look through the peephole and line up the horizon line with Rod B. Note the point where the view of the horizon intersects with Rod B.

Record this number on your datasheet in the line for the first segment of the profile. This number, measured in inches, identifies the elevation change above or below the reference mark. The person with Rod B (closest to the lake) should use a level to ensure an accurate measurement of the horizon.

Date and Time:				
Team members:				
	Waukegan Profile #1	Waukegan Profile #2	Waukegan Profile #3	Waukegan Profile #4
Photo Collected				
Compass Bearing	90 ° E	120° SE	150° SE	90° E
Vertical measurement from "known reference point" to beach surface at "permanent profile starting point"				
Segment #	Change in Elevation (inches)- Up (+) or Down (-)	Change in Elevation (inches)- Up (+) or Down (-)	Change in Elevation (inches)- Up (+) or Down (-)	Change in Elevation (inches)- Up (+) or Down (-)
Segment 1				
Segment 2				
Segment 3				
Segment 4				
Segment 5				
Segment 6				
Segment 7				
Segment 8				
Segment 9				
Segment 10				
Segment 11				
Segment 12				
Segment 13				
Segment 14				
Segment 15				
Segment 16				
Segment 17				
Segment 18				
Segment 19				
Segment 20				
Segment 21				
Segment 22				
Segment 23				
Segment 24				
Segment 25				
Notes:				

Figure 4. Example data sheet for Waukegan Municipal Beach

15. If the horizon is higher or lower than the markings on the pole, use the inch side of your yardstick to add length. Be sure to add 24 to whatever number you read off the yardstick. For example, if the horizon intersects with the yardstick at 5 inches, then the overall elevation change is 29 inches.
16. If the horizon is above the reference mark, (the top half of the stick) then this section has dropped elevation and the measurement should be recorded as negative. If the horizon is below the reference mark (the bottom half of the stick), then this section has gained elevation and the measurement should be recorded as positive.

Figure 5. Measuring your final segment

17. After you have measured your first segment, move Rod A into the exact spot where Rod B was, and walk Rod B towards the lake until the rope is taught. Repeat steps 9-13, always checking your compass bearing to ensure you are headed in the same direction.
18. Continue measuring your profile in 10 ft. segments until you reach the water's edge, but DO NOT go into the water! It is okay if the last segment of the beach profile is not ten feet. When you reach the water's edge, simply pull the rope taught, and measure the length of the segment to the nearest foot (the rope is marked in 1 foot sections). Note the length of the rope (in feet) under the last elevation measure for that profile.
19. Once you have finished measuring the final segment of Profile 1, ensure that all data has been recorded. Move on to the next profile at your site. Repeat the survey method, starting at step 4, until you have measured all the profiles at your site.

Volunteers are to follow the monitoring protocol at all times. This promotes safety and ensures data is standardized for quality-control purposes.

SUBMITTING YOUR DATA

Datasheets will be collected by your site coordinator at the end of each survey. Before submitting your datasheet to the coordinator, you should:

- ☐ Review data sheet for legibility
- ☐ Ensure all measurements have been recorded, with a + or – to indicate elevation change.
- ☐ Check that all fields have been filled in-PLEASE DON'T FORGET THE DATE & TIME!
- ☐ Include anecdotal information (e.g. tracks from beach groomer present).

If you cannot reach your site coordinator immediately after the survey, please scan and email your datasheet to the project manager, Catherine Buchalski at Catherine.Buchalski@illinois.gov.

CONTACT INFORMATION

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Additional information about this project is available here:
https://publish.illinois.edu/lakemichigancoasts