Lake Erie case study

How do phosphorus and nitrogen get into Lake Erie?

Background

One way phosphorus and nitrogen get into the Lake Erie is from water runoff. Rainwater falling on farm fields, parking lots, roads and backyards flows into creeks, streams and rivers. The rainwater carries soil, fertilizers and other pollutants that have washed from the land. You have probably seen how much more water creeks carry just after a storm and how muddy the water looks. Eventually, all this water runs into the lakes, bringing nutrients and other chemicals with it. The water in Old Woman Creek runs through the estuary and into Lake Erie.

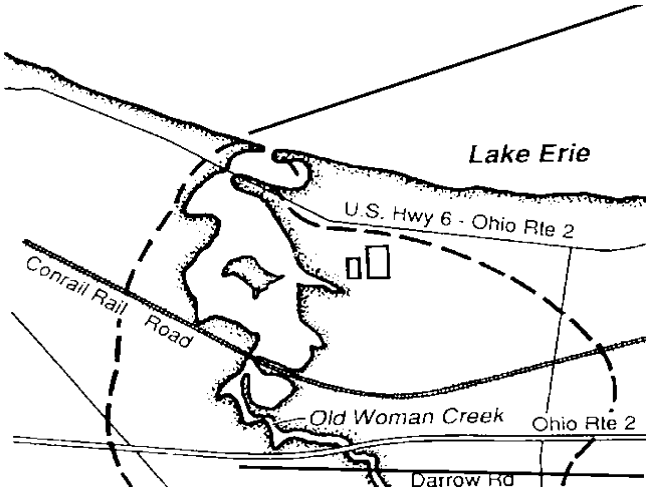
In this activity, you will analyze maps and data to learn how estuaries (wetlands) affect nutrient levels as water enters a lake. You will also make predictions about how the effects of climate change might affect an estuary's ability to improve water quality.

Analyzing Maps

1. Go to Google Maps to view Old Woman Creek, near Lake Erie. Using the map below and google maps, make observations about potential issues that could impact water quality.

- Look at the land surrounding the creek. All the land within the dotted line on Figure 1 is the watershed of Old Woman Creek. Water from this land runs off into Old Woman Creek, then through Old Woman Creek Estuary (https://oceanservice.noaa.gov/facts/estuary.html), before reaching Lake Erie. (This wetland/estuary is NOT filled with brackish water, but is a place where rainwater from runoff, drains into the lake. The lake is a freshwater body of water.)
- A watershed includes all of the land drained by a creek, stream or river. From the satellite image, are there any roads or farms in the Old Woman Creek watershed? How might these affect the water entering the creek?

Figure 1. The Old Woman Creek Estuary and Water Test Stations



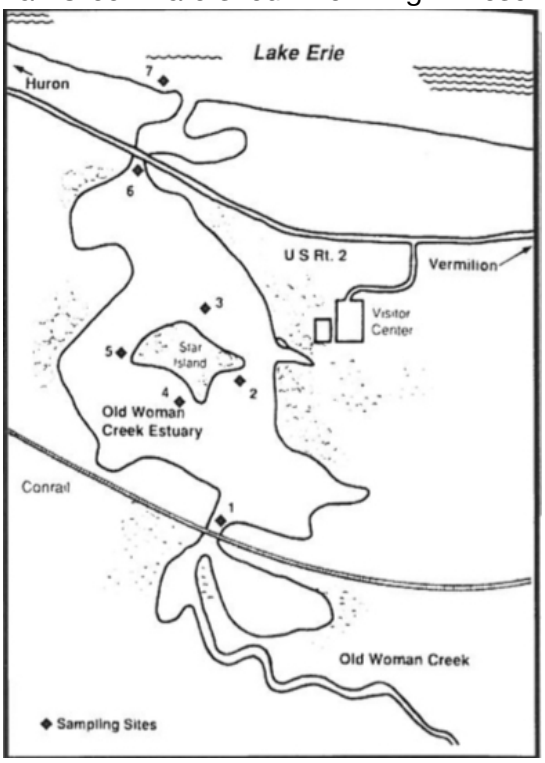


Figure 2. These charts show changes in nitrate (nitrogen) and phosphate (phosphorus) concentration in water at sites along Old Woman Creek following a storm. (Notice N and P units are not the same!)

Station	Nitrogen levels (ppm) days after storm										
	1	2	3	4	5	6	7	8	9	10	11
1	283	82	70	94	60	32	40	49	40	35	30
2	104	97	79	79	50	35	21	12	10	7	3
3	9	41	67	66	32	19	15	10	9	8	7
4	9	7	35	28	29	11	11	10	7	5	3
5	8	11	10	22	20	16	12	10	6	3	29
6	9	5	10	26	19	11	10	10	8	6	5
7	5	2	4	6	5	3	3	3	2	2	2

Station	Phosphorus levels (ppb) days after storm										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1	6.5	6.9	9.7	12.4	10.5	9.5	7.8	6.5	6.6	6.5	6.6
2	1.5	3.3	6.1	8.7	9	10.1	9	8	7.7	6.5	5.9
3	0.4	1.9	2.8	7.6	5.4	9.9	8	6.8	5.8	4.1	2.3
4	0.2	0.3	2.4	3.3	5.1	8.8	8.7	8.4	6.5	4.8	2.2
5	0.2	0.8	0.6	2.6	4.9	9.7	7.8	6.9	6	4.1	2.3
6	0.5	0.5	2	3.4	3.4	3.4	3.3	3.3	3	2.7	1.7
7	0.9	1	1.1	1.4	1.6	1.7	2	2.1	1.7	1.5	1.2

Map & Data Obtained From: **©Ohio Sea Grant, The Ohio State University**

Analyzing Data

Study the data in **Figure 2** and the station sampling areas on the map. Look for trends in the data as it relates to the role of the estuary and water flow.

1. Create two or three graphs that may provide patterns in the data collected from the google sheet. Make a copy of the sheet before beginning your analysis and eliminating data you might not use. https://docs.google.com/spreadsheets/d/1_yfbBUJjbz0kByLM-1ugbYxAjsrHmLSeCw99u4XMBeU/edit#gid=0

   The goal is not for you to graph all the data available in the spreadsheet, but rather select information that you feel may be relevant when looking for trends. (Be sure to think about both phosphorus and nitrogen.)

2. Copy your graphs to a document and write a brief paragraph summary of what you found in your analysis to this point.

3. Load the document to a shared post as instructed by your teacher. Next, we will look at classmates' graphs, look for additional patterns and figure out ways to reduce the impact of harmful algae blooms.

Watersheds, wetlands and water quality

Share your Findings

1. Research the following aspects of wetlands and review the nitrogen and phosphorus cycles
    a. Role of wetlands with nutrient and sediment filtration
    b. Nitrogen vs phosphorus uptake by wetlands
    c. Wetland destruction and restoration in Ohio (urban and rural areas)
    d. Similar studies
2. Based on the research shared, answer the essential question posed on day one backed with data analysis as support. Address nitrogen and phosphorus findings.