# Buoy is that water green! Exploration One

Name _____

Class Period _____

1. Open the map using this URL: esriurl.com/enviroGeoinquiry7

   - Spend a few minutes exploring the map and become familiar with its functions.
   - Let's think about this question as we explore this map together: What types of land cover are distributed across our country and around our Great Lakes?

2. In the upper left corner of the map, the "Details" button will show types of land cover.

   - What types of land cover do you notice covering the United States? _____

     _____

     _____

   - What types of land cover do you notice around the Great Lakes? _____

     _____

     _____

3. With the Details pane visible, click the button, "Contents" to show the contents of the map. The "Contents" button is the middle icon under the "Details" button.

   - Click the checkbox to the left of the layer named "World Hydro Reference Overlay".
   - Zoom in and out to analyze the rivers in the United States and Canada. The zoom tool is inside the map in the upper left corner.
   - What are the names of a few of the major rivers in the United States? _____

     _____

   - Zoom in on the United States just enough so you can see dotted brown lines on the map. What do you think the brown dotted lines represent? _____

     _____

   - Which major river in the United States seems to have the largest amount of land in its watershed boundary? _____
   - Trace the Mississippi River and identify the body of water it ultimately drains into. What is the name of this body of water? _____
   - Think about the term "runoff"and the runoff that occurs from the land in the watershed to the river and to a larger body of water. What types of material could be part of the runoff that ultimately ends up in a larger body of water? _____

     _____

- Look back at the major rivers you identified on the map. What type of land cover do these rivers seem to flow through? If you need to look at the land covers again, click on the third button to access the "Legend". _____

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4. You may already know that fertilizer application is a common practice in yards, golf courses, and large-scale agricultural farms. The excess nutrients from fertilizer application can runoff into the local watershed. Make sure you have the "Contents" pane of the map open and turn on the layer named "GLDAS Runoff".

   - What do you think the darker blue colors represent? If you are unsure, take a look at the "Legend" of the map again. _____

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   - Do you notice any patterns related to high levels of runoff? You may need to use a very close zoom to notice something significant. _____

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   - Why do you think there are higher levels of runoff in urban areas?_____

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5. Turn on the layer named "Chlorophyll-a Concentration". Make sure you are zoomed out enough to see the entire country. Chlorophyll a is a green pigment found in plants and algae that is essential for photosynthesis.

   - Where do you notice increased concentrations of chlorophyll-a? _____

   _____

   _____

   _____

   - What do you think are some possible causes of elevated chlorophyll levels?_____

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6. As runoff containing high levels of nutrients from fertilizer enter the rivers and dump into larger bodies of water, chlorophyll-a levels increase. This could be an indication of an algal bloom (even a harmful algal bloom). As the high number of algae begin to die, the decomposers that break them down use up the available oxygen in the water. This creates hypoxia or "dead zones" in the water.

   - Create a diagram below that starts with nutrient runoff from an agricultural watershed that ultimately creates a dead zone in a larger body of water.

   - Turn on the layer named "Gulf of Mexico DO".
   - Notice the dead zone near the coast of Louisiana. The lowest levels of dissolved oxygen are indicated in yellow. This can be verified by checking the "Legend". Measure the low DO levels near the coast of Louisiana. Here are a few tips to make using the measuring tool easier.
     - Click the measure button at the top of the map.
     - Click the button named "Distance".
     - Set the unit of measurement to square miles.
     - Position the area of interest on the map so that it is not obscured by the Measure window.
     - On the map, click once to start the measurement, click again to change direction, and double-click to stop measuring.
     - What is the approximate surface area of the dead zone, indicated by the yellow color, near the coast of Louisiana? _____
     - What relationship(s) do you notice between chlorophyll concentrations and dissolved oxygen? _____

       _____

- How do you think low dissolved oxygen levels might impact local marine life? ____

_____

_____

7. Let's pull everything we have discovered together.

- Define hypoxia._____

_____

- Generate a possible list of solutions to lower hypoxic conditions in marine systems.

_____

_____

- Recall our original driving question of the lesson, "How do our local land use practices impact life in the Great Lakes?" If you were tasked with explaining this phenomenon to a group of citizens in your community what would you say to them?_____

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