

Title of Lesson:

Race to the drains: How your school returns rainwater to the soil.

Discipline focus:

Environmental science, Biology, Chemistry, Physics.

Grade/ Age level:

9-12

Project 2061 Benchmarks NAS Science Standards or NCTM Standards supported by this activity:**Purpose:**

This activity will illustrate the impact that abiotic features, including those that are man-made (such as parking lots, roofs, retention ponds, etc.) have on rainwater infiltration to the soil, and on water quality within the school's watershed.

Context:

Urban growth is responsible for changes in the natural rates of water infiltration, and affects biotic components of the environment. Different features have been proposed in new construction projects to mitigate these effects, such as building detention ponds, rain gardens, buffer strips, managed wetlands and enhancing stream and creek embankments. How does this happen in the students' communities? What role does their school play in those changes? This activity will contribute to the students' understanding of the processes that drive these changes in the ecosystem.

Planning ahead**Supplies:**

30ft measuring tape or poly-cord marked every 3 feet
Grid paper
Pencils
Rulers
PCs with web browser and internet connectivity

Preparation:

Students will team up in groups no larger than 4. Students will go out and list all present features in the school property related to rainwater management, as well as general features of buildings, green areas and other structures, such as walkways and parking lots. If particular features, such as rain gardens are present, these should be measured along their perimeter.

Websites:

www.lakeerie.utoledo.edu will contain a specific webpage for this activity, where students will navigate to a satellite image of their school or selected study area. The embedded grid overlaying the map is preset to 10x10 meter polygons. A scoring area will

allow the students to assess the total impact of their school's rainwater management features.

Motivation:

Formulate ideas and develop hypotheses on how the school's rainwater management features affect water infiltration to the soil. Present the concept of Geographic Information Technologies (GIS) as a means for collecting and analyzing data. Compare quality and limitations of physical and GIS-based data collection and analysis. Discuss how current rainwater management features could be enhanced or improved.

Lesson:

1. Students will form teams (up to 4 students per team).
2. students will split areas of the school's grounds and list that area on their grid sheet.
3. students will count and list the number of features according to their general types: building roof gutters and drains; green area sumps and drains; channels, ditches and storm drains; storm sewers and combined sewer registers; retention ponds, wetlands and rain gardens.
4. Students will also list the type and material used in constructing walkways and parking areas. They will be classed in three main classes: impermeable surfaces (asphalt, concrete, brick, etc.); permeable surfaces (permeable pavement, cobblestone, paving tiles); and bare surfaces (sand, mulch, gravel, sod, etc.)
5. Students will measure the perimeter of rain management features, such as rain gardens, ponds and wetlands. Students should also sketch the general shape of the feature on their grid paper.
6. If a stream, creek or channel is found within school's grounds, the students assigned to that area should measure the distance from the bank of the creek or channel to the nearest building or structure.
7. students will return to their classroom and navigate to www.lakeerie.utoledo.edu, then they will select the link "race to the drains"
8. The webpage "race to the drains" will present an embedded google maps TM window, which includes a grid overlay. Each polygon in the grid measures 10x10 meters.
9. Students will count the grids that cover buildings, green areas, walkways, parking lots and rainwater management features. Each category should be input into the fields provided by the webpage.
10. students should also click on the pertinent value modifier checkboxes present in the webpage: permeable walkways present ; rain garden present; pond present; wetland present; stream present.
11. students will now retrieve their school area's score for all features, and combine their values with the rest of the teams. A total value should be determined. This is the schools "race to the drains" water management value. A higher value represents an improved capacity of rainwater infiltration to the soil.
12. Students can now submit and compare their school's "race to the drains" score to that of other participating schools.

Assessment:

1. Verify accuracy of grid and category counts for each team.
2. Discussion on relevance of rainwater infiltration to soil.
3. Grid sheet/ questionnaire.
4. Total school score and comparison to other participating schools.

Extensions:

1. Discuss how the area occupied by the school would look like 200 years ago.
2. Focus on role of impermeable surfaces on rainwater infiltration to the soil.
3. Formulate strategies to mitigate impacts on the environment and the extent of mitigation that could be expected.