

Title: Strategies for Dealing with Problems Caused by Over Fertilization

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Abstract:

After having learned about the 4 major cycles (water, C, N, P) students will consider how fertilization affects the cycles. They will then visit UF's SEEP (Stormwater Ecological Enhancement Project) and learn how the design helps reestablish the ecological function (service) of water filtration. Students will then have to explain how the SEEP works and its effect on the cycling of water, N and P; identify other ways of dealing with over fertilization; come up with a plan for mitigating/avoiding the problems associated with over fertilization.

Subject, Grade, Level:

Environmental Science, Honors (grades 11 and 12)

Learning objectives:

- Apply knowledge related to nutrient and water cycling by describing the effects of fertilization on the environment.
- Study the structure and function of the SEEP
- Describe the structure and function of the SEEP and explain its environmental effects.
- Identify and evaluate the merit of 3 alternative ways of dealing with fertilizer runoff.
- The following standards relate to this lesson:
 - SC.912.L.17.10: Diagram and explain the biogeochemical cycles of an ecosystem, including water, carbon, and nitrogen cycle.
 - SC.912.L.17.7: Characterize the biotic and abiotic components that define freshwater systems, marine systems and terrestrial systems.
 - SC.912.L.17.8: Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species.
 - SS.912.G.5.4: Analyze case studies of how humans impact the diversity and productivity of ecosystems.
 - SC.912.L.17.11: Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests.

- SC.912.L.17.12: Discuss the political, social, and environmental consequences of sustainable use of land.
- SC.912.L.17.14: Assess the need for adequate waste management strategies.
- SC.912.L.17.16: Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion,
- and surface and groundwater pollution.
- SC.912.L.17.20: Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.
- SC.912.L.17.8: Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species.
- SS.912.G.5.2: Analyze case studies of how changes in the physical environment of a place can increase or diminish its capacity to support human activity.
- SS.912.G.3.5: Use geographic terms and tools to explain how hydrology influences the physical character of a place.
- SC.912.L.17.13: Discuss the need for adequate monitoring of environmental parameters when making policy decisions.
- SC.912.L.17.18: Describe how human population size and resource use relate to environmental quality.
- SC.912.N.4.2: Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human,
- economic, and environmental.
- SC.912.L.17.18: Describe how human population size and resource use relate to environmental quality.
- HE.912.C.1.3: Evaluate how environment and personal health are interrelated.
- SS.912.G.5.2: Analyze case studies of how changes in the physical environment of a place can increase or diminish its capacity to support human activity.

Timeframe:

- 250 minutes (we see students every other day for 100 minutes):
 - 50 minutes to draw cycles of water, N, and P considering the application of fertilizer
 - 100 minutes to visit and learn about the SEEP
 - 50 minutes to explain the effect of the SEEP on the cycles of water, N, and P considering the application of fertilizer

- 50 minutes to Identify and evaluate the merit of 3 alternative ways of dealing with fertilizer runoff.

List of materials:

- Paper and pencils to draw the cycles and explain the system
- Field trip permission forms (completed)
- Bus for the field trip
- Clipboards for note-taking on the field trip
- Fertiliser in its original bag or fertilizer labels.

Procedure and general instructions (for instructor). REQUIRED.

1. Required prior knowledge: Students should be able to draw and explain the water, N, and P cycles.
2. Watch the [TreeTender Video](#) (15 minutes) and identify 4 ecology services. [water filtration, medicinal compounds, maintain biodiversity, protect coastlines, supports fish industry, food]
3. Fertilization:
 - a. Students identify what is in fertilizers using fertilizer or fertilizer labels.
 - b. Discuss in groups why fertilizer is used and how it is applied and in what quantities. Summarize as a class.
 - c. Groups draw the water cycle and track the movement of fertilizer solubilized in the water and share out.
 - d. Groups predict what the outcomes would be from the changes effected from applying fertilizers.
4. SEEP Field Trip:
 - a. SEEP leader will display different columns of water and students will try to guess the source of the water.
 - b. Students will be grouped and lead to different parts of the SEEP to investigate its functions.
5. Understanding the SEEP
 - a. Students will describe the function of the SEEP (Stormwater Ecological Enhancement Project) and draw the water/N/P cycles showing what the effect of the SEEP is.
 - b. Students will identify other ways of dealing with excess fertilizers, first as an individual brainstorm, then in groups, and then as a whole class. [legislation, education, tax/cost system, cultural shift, etc.]

- c. Groups will consider the advantages and disadvantages of each strategy and come up with a plan to be applied to PKY and share.
6. Summative Assessment: Each student will write and submit a plan for the reduction of fertilizer pollution that includes a justification of their plan.

Reference:

- Tree Tender (2017) Retrieved July 18,2018 from : <https://www.treetender.org/>