

## K6 Lesson Plan

### Science

**Standard:** 8.2.3, 8.2.3.f, 8.2.3.g.

**Materials:** Pencils and paper charts, topic related educational material

**Objective:** Bioretention Garden

**Anticipatory:** Before heading outdoors, divide the class into groups of 4 to 5 students and give each group pencils and paper charts. During the outdoor trip, ask them to write down their favorite plants in the garden, and share it with peers. After they come back from the tour, ask them if those plants can survive without people taking care of them, and what do the plants need to grow. Ask them to discuss within the groups, and then report their thoughts. If someone mentions the sun or photosynthesis, lecture them about sunlight energy and let them know that sunlight plays an important role in living organisms via energy transfer. Ask students what they think about energy transfer, let them discuss within the groups and share their idea. Use the textbook or other educational materials to lecture about energy transfer and the multiple ways for energy to transfer such as sound and heat. Then ask them how energy from sunlight transfers to plants in the bioretention garden. Discuss within the group, and then share their thoughts. Tell them energy won't disappear, but it can change forms such as heat the sound.

**Procedure:** 1. Divide the class into several groups of 4 to 5 students. 2. Give each group paper charts and pencils. 3. Ask them to write down their favorite plant on the chart and bring it back to the classroom. 4. Ask the students how plants survive without people taking care of them, and discuss within the group, then report their answers. 6. Lecture about the solar energy and plant photosynthesis 7. Ask students to think about how energy transfers to what plants need to grow. 8. Discuss within the groups and report their answer. 9. Conclude that energy has many forms, and it can transfer states all the time, but it won't disappear.

**Summary:** Students will learn that energy has many forms, and the plants in bioretention gardens will help them to better understand solar energy transfer in plants.

## **SCIENCE NEBRASKA K7**

**Science Standard:** 8.4.2 & 8.4.2g

### **Earth and Space Science**

- Energy in Earth's Systems – Students will investigate and describe energy in Earth's systems. 8.4.2
- Earth's Processes: Describe the water cycle (evaporation, condensation, precipitation) 8.4.2.g

**Materials:** RAIN GARDEN HANDOUT  
(3-5) 1 GALLON BOTTLE OF WATER

**Objective:** Understanding the process of the water cycle.  
Understand how Rain Gardens can aid in the process of the water cycle.

### **Anticipatory:**

At the beginning of class, the teacher will provide students with a diagram of the water cycle and ask each student to review it and ask the question, "Is the water cycle important; Yes/No and why?" During this time all students should be actively engaged in the discussion. During this lesson, students will learn what the water cycle is and how it functions. They will also be introduced to what a Rain Garden is and how it relates to the water cycle. The class will then take a trip to the nearest Rain Garden.

### **Procedure: (S):**

The first half of the lesson will be in the classroom presenting and describing the water cycle and rain gardens. During the second half of the class, students will take part in a hands-on experience to demonstrate the water cycle by using a rain garden.

During this hands-on experiment, students and teachers would use one-gallon containers to replicate rainfall and the associated stormwater runoff from surfaces near the rain garden. On-site, the teacher will explain the different aspects of the water cycle in relation to the rain garden. This activity will allow students to see how the rain garden works.

Sample lessons were developed by students from the University of Nebraska–Lincoln and funded through an EPA Urban Waters Grant.

## **Example:**

**Precipitation** – During the activity, the water being poured on the ground can be considered precipitation (rain, snow, sleet, etc...), which then leads to stormwater runoff. Once this occurs, the teacher can explain that the water would then flow to and fill the rain garden, allowing for water to infiltrate into the ground for plant use, replenish groundwater, and allow for subsurface outflow to a nearby body of water. Observations and discussions can be made for the differences in runoff from different types of surfaces, such as soil, grass, and concrete. After the precipitation process is evaporation.

**Evaporation-** At this time, the teacher would then explain the process of evaporation and how it works. The teacher will explain that this process can easily occur due to the water retention within the rain garden. **\*\*Explain Evapotranspiration (ET) as well; Explain the sun's role & note differences in shady vs. sunny areas\*\*** After evaporation is condensation.

**Condensation** – At this time, the teacher will explain to the class the importance of condensation. **\*\*Discuss water vapor, humidity, clouds, dew\*\***

**Summary: (S):** Students will have an opportunity to ask questions about things of interest. After the hands-on activity, students will have a better understanding of the water cycle through the use of the rain garden. They will also have a basic understanding of how rain gardens work and how they help with stormwater management.

## **NEBRASKA K8**

**Science Standard:** 8.3.3 & 8.3.3

### **Life Science**

- Flow of Matter and Energy in Ecosystems – Students will describe populations and ecosystems. 8.3.3
- Impact on Ecosystems: Identify positive and negative effects of natural and human activity on an ecosystem 8.3.3.g

**Materials:** Bioswales and Filter Strips handout

**Objective:** Part 1 Classroom: Understand what an ecosystem is and human influences on them

Part 2 Observation: Walk to the nearest green infrastructure practice (bioswale) to understand the concept of ecosystems

### **Anticipatory:**

Does anyone know what this infrastructure (PICTURE) is called? Based on the student responses, the teacher may have to give the name of the structure. What do we know about green infrastructure (i.e., bioswales) and how do they work? The teacher should formulate questions which will help lead students to active discussion on green infrastructure practices (bioswales). Student responses, once accepted, will be recorded on the board. Based on the student responses, the teacher will fill in the gaps and add important information needed to meet the objective. During this lesson, we are going to be learning what an ecosystem is and how natural and human activity can affect the ecosystem. We will be learning about what the green infrastructure practice used in part 2 (i.e., bioswale) was created for and the positive impact it has on our environment and the ecosystem. We will begin with defining the green infrastructure practice (i.e., bioswale) and follow up with a visit to an actual site where one is located.

### **Procedure: (S):**

Today, the class will be lectured based on group discussions. During the lecture, the teacher will define what an ecosystem is and its importance. After this, the class will be divided into groups of 3 to actively discuss what the students believe to be the positive and negative effects of natural and human activities on the ecosystem. Responses should include three positive and three negative effects. Students will have 5 minutes to discuss. Allow groups to record answers on the board. From the student's responses, the teacher will then add information as needed.

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The teacher will then introduce what green infrastructure is (i.e., bioswale) and how it can aid in helping the reduction of negative effects on the ecosystem introduced by the students.

On-site, the teacher will give a diagram and explain the process of how the green infrastructure practice (i.e., bioswale) is used.

### **Example:**

#### **What is an Ecosystem?**

<http://www.sewanhaka.k12.ny.us/cms/lib3/NY01001491/Centricity/Domain/2210/8R%20Review-%20Ecology.pdf>

1. **ECOSYSTEM** – all the living & nonliving things in an environment
  - a. BIOTIC FACTORS – living things
  - b. ABIOTIC FACTORS – nonliving things
  - c. Example: POND ECOSYSTEM
    - Biotic: fish, frogs, ameba, paramecium, bacteria, plants
    - Abiotic: water, rocks, dirt, sunlight, temperature
  
2. **COMMUNITY** – all of the different LIVING things in an ecosystem
  - a. Example: POND ECOSYSTEM
    - Community = fish, frogs, ameba, paramecium, bacteria, plants

***The link above goes into great detail breaking down how the eco-systems work***

#### **What is a bioswale?**

“A bioswale is a long, often linear depression in the ground that allows water to move from one location to another. It has gentle side slopes where plants can be grown to slow water enough to filter pollutants and foster infiltration while moving that water to a different location. A bioswale is sloped rather than level, and unlike a rain garden, it is designed to collect and move runoff to a particular location rather than temporarily hold water for infiltration into the soil.

Bioswales use deep-rooted native and adapted plants that enhance infiltration and slow water flow. They have less slope than traditional swales to slow water flow and increase infiltration, and regular mowing of swales to maximize water flow has been reduced or eliminated” (Rodie, Hartsis & Szatko, 2010).

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## **How do Bioswales relate to the ecosystem?**

Bioswales can create a community of living organisms within the ecosystem as well as manage the rate at which water enters existing habitats (ecosystems). Bioswales may also have filter strips which can help in eliminating trash and impurities from entering the ecosystem. Like mentioned above these swales include numerous plants which can lead to a new area for habitat by insects, frogs, birds, etc.

Bioswales can help with managing the human and natural effects on the ecosystem. Natural effects would include rainfall and melted snow both generating water runoff. Human elements that effect the eco-system includes the design of cities and their expansion with an increase of impermeable. This results in an increase of stormwater runoff which can then lead to pollutants being washed away into rivers, streams, lake along with contamination to the water table.

**Summary: (S):** During class, active discussions about the ecosystem and its relations to bioswales can impact the environment will be discussed.