

Nitrogen Management

Grade: 8

GPS: S8P1. Students will examine the scientific view of the nature of matter.

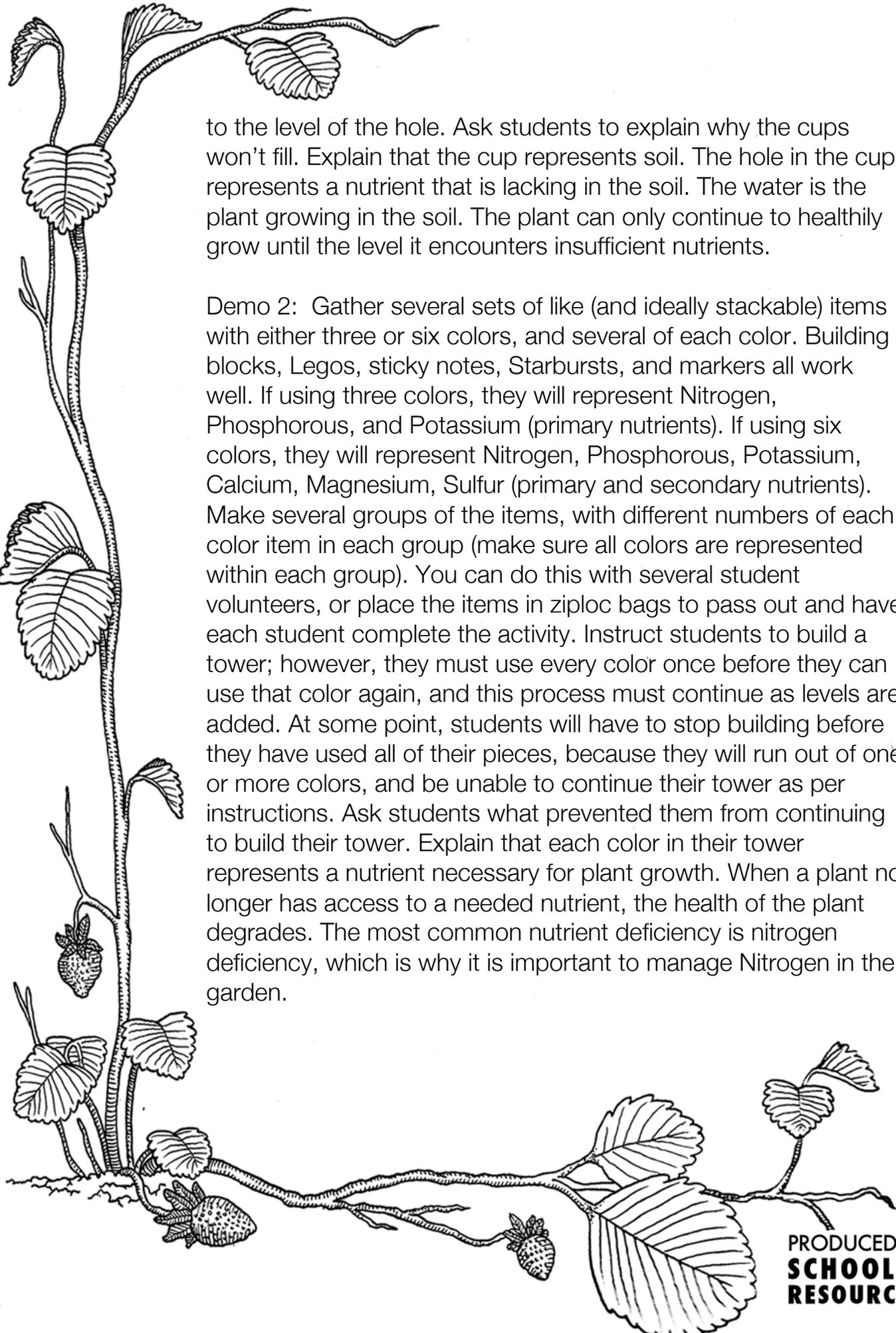
Essential Question: What are methods of managing nitrogen in the soil?

Teacher Note: In this lesson, students will research different methods used to manage Nitrogen in the soil. Students will create a nitrogen management plan for the school garden. This lesson may take 2-3 class days, depending on the length of your class periods.

Interest Approach

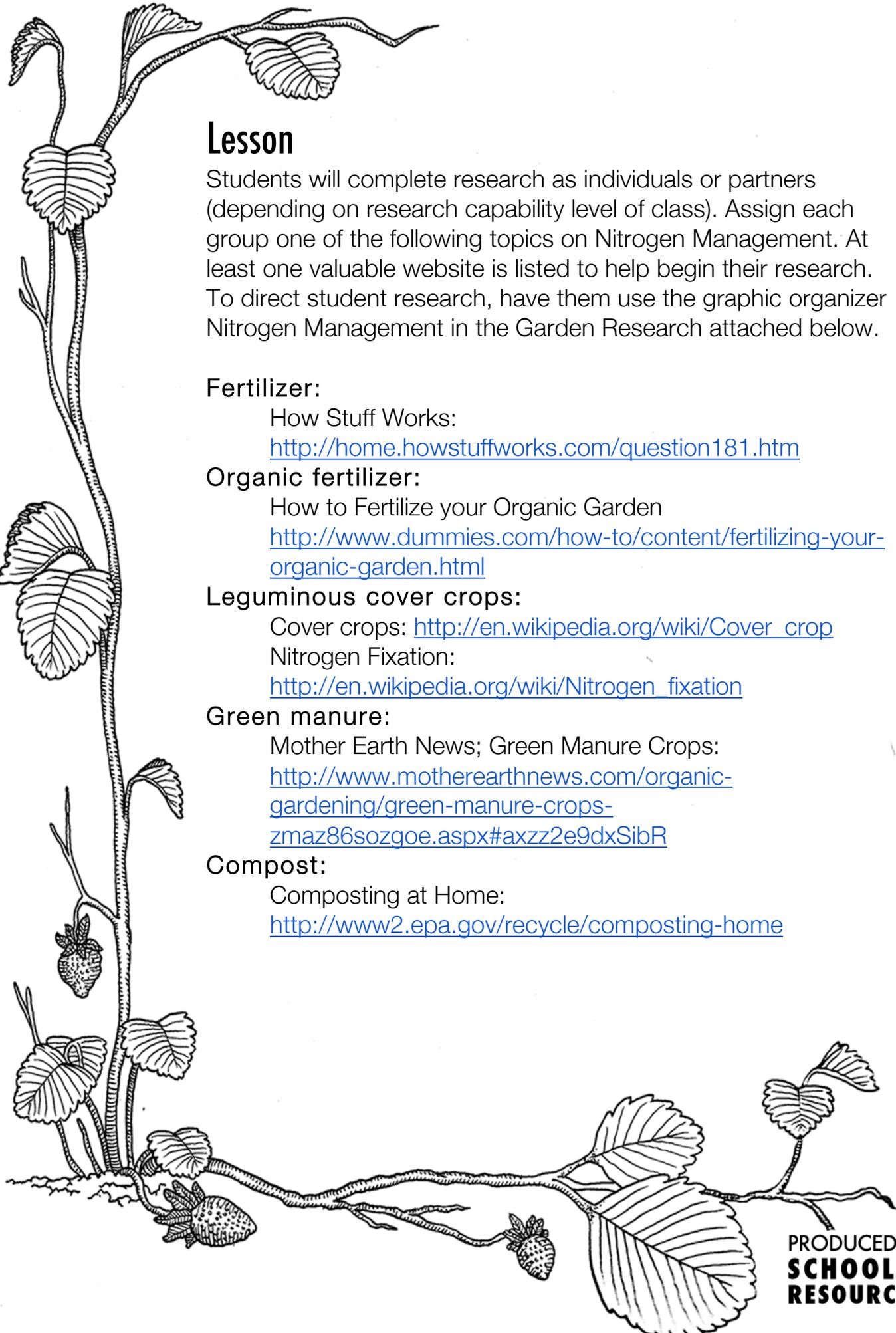
Liebig's Law of the Minimum: Liebig's Law of the minimum states that plant growth is not controlled by the total amount of resources available, but by the scarcest resource. This is relevant because nitrogen is most commonly the limiting plant nutrient. Use one of the following demonstrations to explain Liebig's Law to students.

Demo 1: Before class gather five or six plastic cups. Using a nail, punch one hole in each cup, and at a different level in each. Fill a pitcher with water. Make sure you have a Tupperware container, or even better a sink if your classroom has one to catch water overflow. At the beginning of class ask several students (as many as you have cups) to volunteer. Ask students to fill up the cups (over the sink). Naturally, each cup will only continuously stay filled



to the level of the hole. Ask students to explain why the cups won't fill. Explain that the cup represents soil. The hole in the cup represents a nutrient that is lacking in the soil. The water is the plant growing in the soil. The plant can only continue to healthily grow until the level it encounters insufficient nutrients.

Demo 2: Gather several sets of like (and ideally stackable) items with either three or six colors, and several of each color. Building blocks, Legos, sticky notes, Starbursts, and markers all work well. If using three colors, they will represent Nitrogen, Phosphorous, and Potassium (primary nutrients). If using six colors, they will represent Nitrogen, Phosphorous, Potassium, Calcium, Magnesium, Sulfur (primary and secondary nutrients). Make several groups of the items, with different numbers of each color item in each group (make sure all colors are represented within each group). You can do this with several student volunteers, or place the items in ziploc bags to pass out and have each student complete the activity. Instruct students to build a tower; however, they must use every color once before they can use that color again, and this process must continue as levels are added. At some point, students will have to stop building before they have used all of their pieces, because they will run out of one or more colors, and be unable to continue their tower as per instructions. Ask students what prevented them from continuing to build their tower. Explain that each color in their tower represents a nutrient necessary for plant growth. When a plant no longer has access to a needed nutrient, the health of the plant degrades. The most common nutrient deficiency is nitrogen deficiency, which is why it is important to manage Nitrogen in the garden.



Lesson

Students will complete research as individuals or partners (depending on research capability level of class). Assign each group one of the following topics on Nitrogen Management. At least one valuable website is listed to help begin their research. To direct student research, have them use the graphic organizer Nitrogen Management in the Garden Research attached below.

Fertilizer:

How Stuff Works:

<http://home.howstuffworks.com/question181.htm>

Organic fertilizer:

How to Fertilize your Organic Garden

<http://www.dummies.com/how-to/content/fertilizing-your-organic-garden.html>

Leguminous cover crops:

Cover crops: http://en.wikipedia.org/wiki/Cover_crop

Nitrogen Fixation:

http://en.wikipedia.org/wiki/Nitrogen_fixation

Green manure:

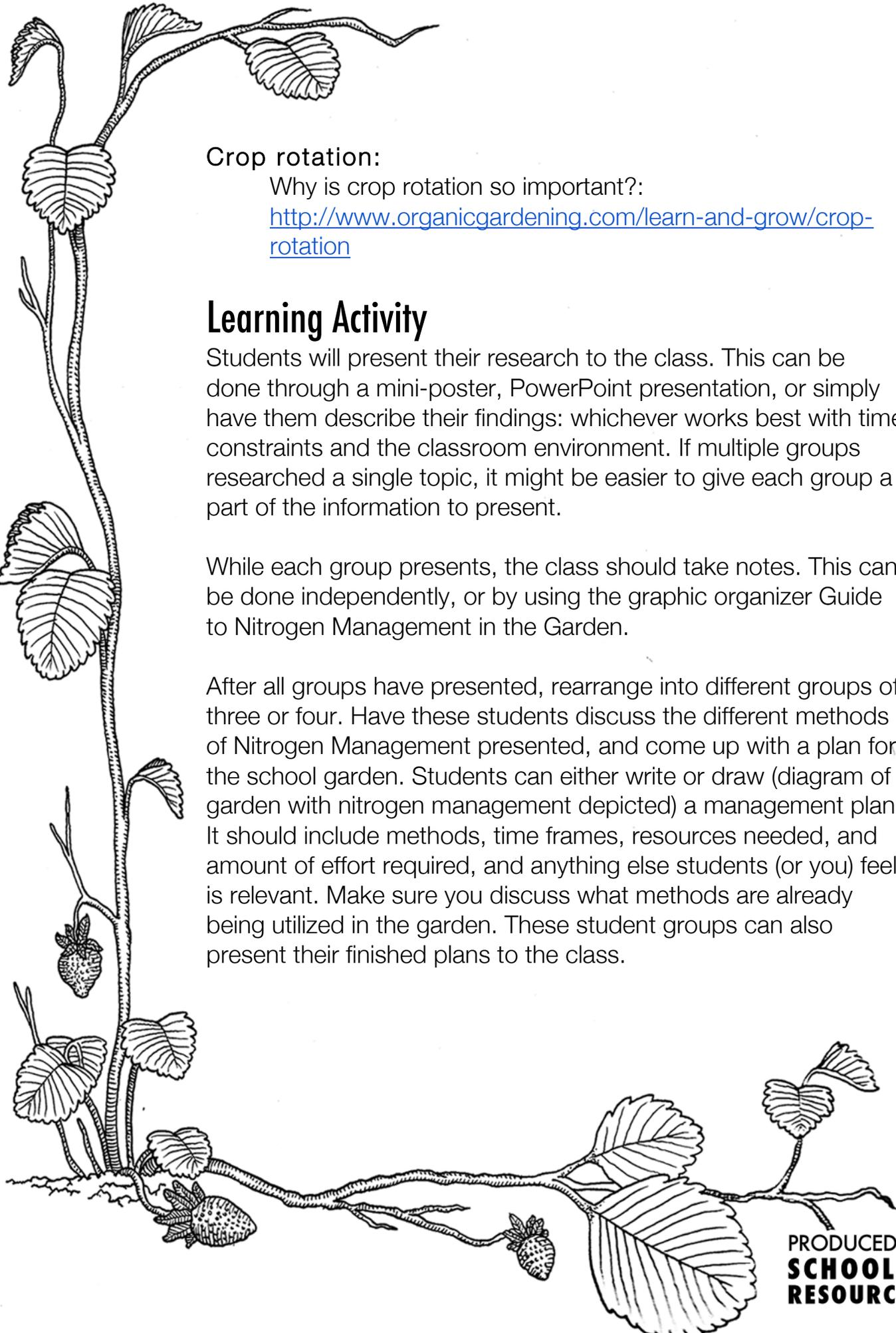
Mother Earth News; Green Manure Crops:

<http://www.motherearthnews.com/organic-gardening/green-manure-crops-zmaz86sozgoe.aspx#axzz2e9dxSibR>

Compost:

Composting at Home:

<http://www2.epa.gov/recycle/composting-home>



Crop rotation:

Why is crop rotation so important?:

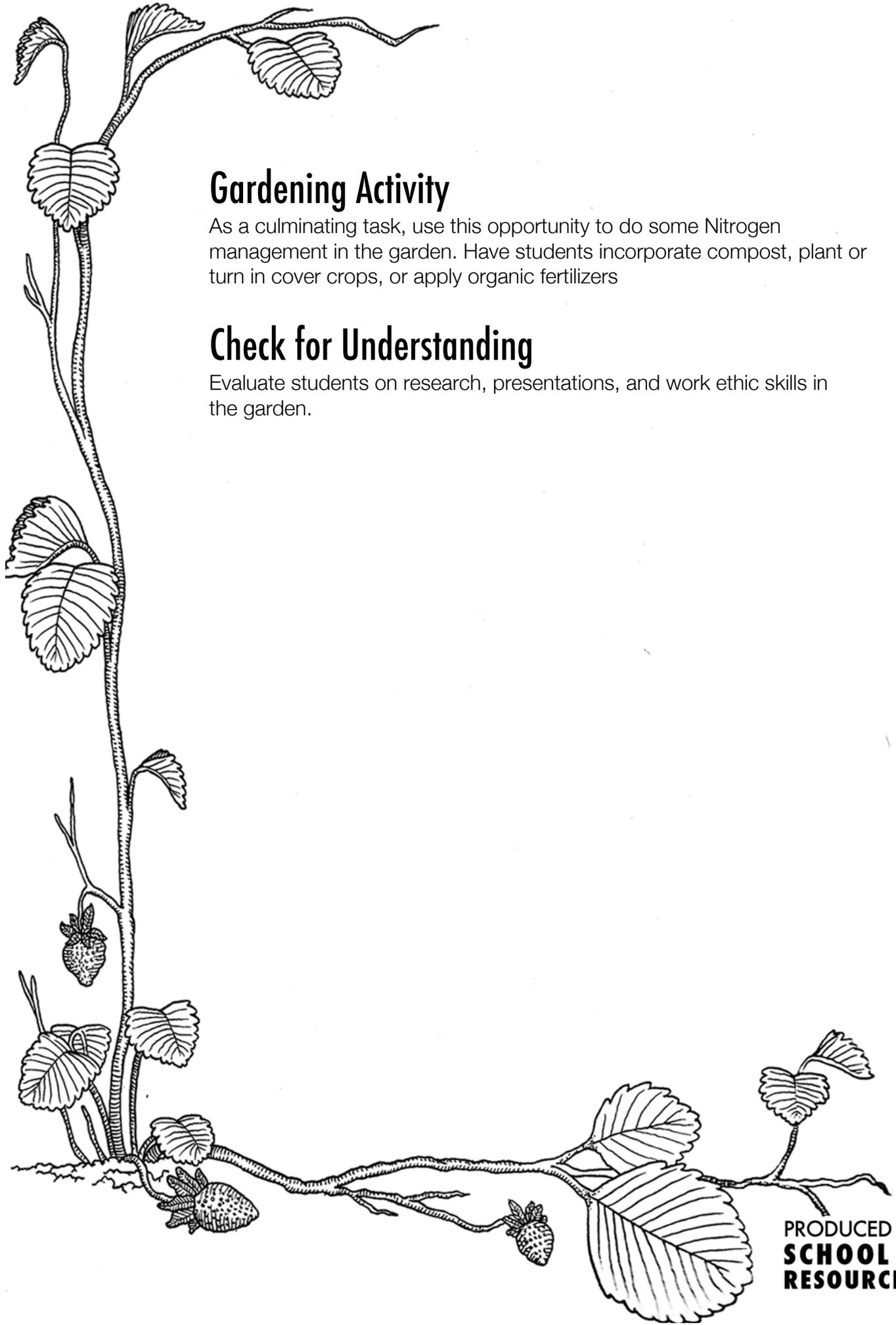
<http://www.organicgardening.com/learn-and-grow/crop-rotation>

Learning Activity

Students will present their research to the class. This can be done through a mini-poster, PowerPoint presentation, or simply have them describe their findings: whichever works best with time constraints and the classroom environment. If multiple groups researched a single topic, it might be easier to give each group a part of the information to present.

While each group presents, the class should take notes. This can be done independently, or by using the graphic organizer Guide to Nitrogen Management in the Garden.

After all groups have presented, rearrange into different groups of three or four. Have these students discuss the different methods of Nitrogen Management presented, and come up with a plan for the school garden. Students can either write or draw (diagram of garden with nitrogen management depicted) a management plan. It should include methods, time frames, resources needed, and amount of effort required, and anything else students (or you) feel is relevant. Make sure you discuss what methods are already being utilized in the garden. These student groups can also present their finished plans to the class.



Gardening Activity

As a culminating task, use this opportunity to do some Nitrogen management in the garden. Have students incorporate compost, plant or turn in cover crops, or apply organic fertilizers

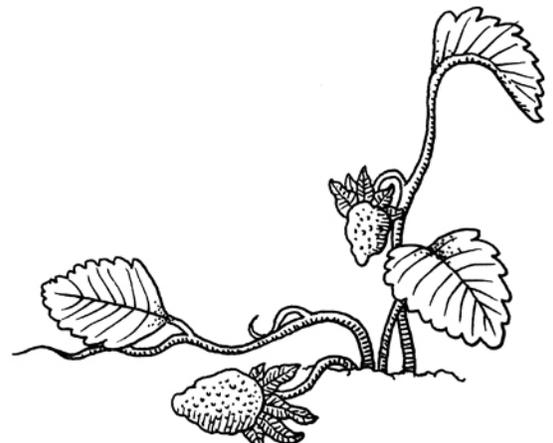
Check for Understanding

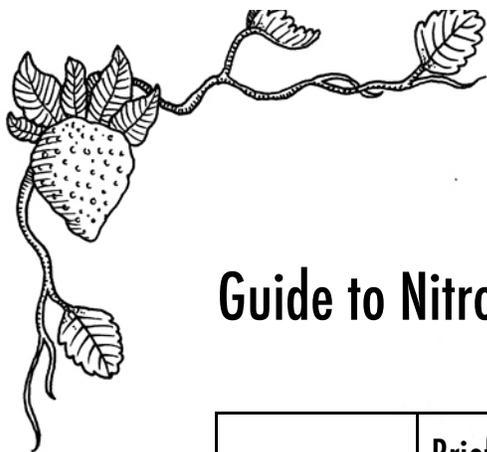
Evaluate students on research, presentations, and work ethic skills in the garden.



Nitrogen Management in the Garden Research

1. What Nitrogen management method are you researching?
2. Write a brief definition/description of that method.
3. How does this method conserve or promote Nitrogen in the soil?
4. What, if any, other benefits does this method include?
5. List pros and cons of using this method: examples may include convenience, sustainability, resources required, time requirements, etc. Make sure to explain each pro and con. For example, if convenience is listed as a pro, explain what that method is convenient.
6. Do you think this method could be put into action in the school garden? Describe a plan for implementing this method. How easy or difficult would it be? Is a similar method already being used?





Guide to Nitrogen Management in the Garden

	Brief description of method	Pros	Cons
Fertilizer			
Organic fertilizer			
Leguminous cover crops			
Green manure			
Compost			
Crop rotation			

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