



Plants and the Environment – A Delicate Balance

Middle School Food and Agricultural Literacy Curriculum

Precepts

- A. Action
- A5. Communicate effectively with others.

National Standards

- NRS.02.06.09.a. Describe climatic factors that influence natural resources.
- NRS.02.01.01.a. Identify hazards associated with the outdoor environment.
- CS.01.01.01.a. Work productively with a group or independently.
- NL-ENG.K-12.4 – Communication Skills
- NS.5-8.3 – Life Science

Student Learning Objectives

- As a result of this **unit** the students will...
- Identify environmental impacts related to plant production.
- As a result of this **lesson** the students will ...
- Discuss common environmental applications and impacts of plant production.

Content Outline

Objective 1. Discuss common environmental applications and impacts of plant production.

- I. **Plants are essential for life on earth.** All living organisms rely on plant matter directly or indirectly for energy (food). For hundreds of years, humans have been planting and harvesting thousands of acres of plants to meet our needs for food and shelter. However, crop production often leads to negative effects as well.

Positive impact of plants on the environment

Primary Producers:

Plants are called **primary producers** because they are the only living organisms that are capable of producing their own energy from the sun rather than from other animals or plants.

Time

Instruction time for this lesson: 45 minutes.

Resources

National FFA Organization. (2009). LifeKnowledge Online. Retrieved July 9, 2009, from <http://agedlearning.org> — National FFA Organization. (2003). LifeKnowledge Precepts and Signs of Success.

Tools, Equipment, and Supplies

Overhead projector/transparencies
Rulers
Tennis ball
Masking tape
Small building blocks (marbles, pennies, or rocks may be substituted)
MS.PS.4.1.AS.A – print one copy on colorful paper
MS.PS.4.1.AS.B – one per student
MS.PS.4.1.AS.C – one per student
MS.PS.4.1.TM.A make available on public surface
MS.PS.4.1.ASSESS.A – one per student

Key Terms

The following terms are presented in this lesson and appear in **bold italics**:

Pesticide

Erosion

Greenhouse Gases

Primary Producers

Fertilizer

All other living things on earth rely on plants either directly or indirectly for energy (food).

Erosion control:

Erosion is the loss of soil, sand, and rocks from the earth's surface due to wind and rain. Plants are often used to slow and reduce ***erosion*** because their roots help hold the soil in place rather than letting it stream or blow away. Also plants help absorb water deep into the ground to prevent fast-flowing streams that may create gullies. While man-made boundaries may be used to control ***erosion***, plants are often the most affordable, practical, and long-term solution.

Greenhouse gas storage:

Common ***greenhouse gases*** are carbon dioxide, methane, and nitrogen. These gases are released as fossil fuels are burned, through agricultural plant and animal production, and through natural earth processes.



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Greenhouse gases are the major cause of gradual global warming (a general increase in temperature of the earth's surface over time).

However, plants are the best tool for reducing the effects **greenhouse gases** have on the environment. Trees and plants store large amounts of these gases in their tissues keeping the gases from reaching the atmosphere. And during the process of photosynthesis, plants convert carbon dioxide into oxygen (what we breathe!).

Plants also have additional value. First, plants help reduce noise pollution. Often trees are planted between busy roadways and residential areas to reduce the noisiness. Trees are also used on highways to help shade the roadway to prevent sunlight from hitting drivers directly in the eye and causing wrecks.

Plants, such as herbs, have hundreds of medical uses as pharmaceutical drugs and therapy treatments. And the aesthetic value of plants (their beauty) not only helps to increase property value for homeowners, but also has been proven to positively impact people's mood and work efficiency; plants are even believed to hasten recovery time for hospital patients.

Negative impacts plant production may have on the environment

Erosion:

Just as plants are often used to stop **erosion** (the loss of topsoil and rocks due to wind and rain), crop production is often a leading cause of **erosion**. Because large areas of land are cleared for use as cropland to grow fruits, vegetables, and grains, a large portion of the surface of the soil is left vulnerable to **erosion**.

Conventional farming practices are often accused of being the largest cause of **erosion** problems in the United States because of the common practice of plowing up the soil and dead plants before planting new crops. Tilling the soil loosens the top layer making the soil more apt to run off in heavy rains.

Greenhouse gas emission:

When land is clear to make way for crops to be planted and harvested, the **greenhouse gases** that were once stored in the plants and the soil are released into the atmosphere.

When land is cleared, there are fewer trees to convert carbon dioxide into oxygen. And planting, harvesting, and transporting plant products for human and animal consumption requires the use of gas and diesel to power tractors, tractor trailers, and processing equipment. Burning these fossil fuels releases even more greenhouse gases into the environment.

Chemical contamination

Another common issue with plant production is the necessary use of **pesticides**, specifically insecticides, which are used to kill or repel damaging insects. Other contamination may be caused by **fertilizers**, which are nitrogen-based solutions that are used to increase healthy growth in plants. Overuse or misuse of chemical **fertilizers** and **pesticides** leads to chemical runoff into water sources which could affect entire ecosystems. Most insecticides used today are not pest-specific and will therefore potentially harm even harmless insects.

- C. Conclusion: Plants are the most valuable asset on the face of the earth. However, misuse and poor management of this resource for human gain can and will have detrimental effects on the environment and our ability to continue producing healthy and delicious fruits, vegetables, and grains.

Interest Approach

To prepare for this lesson, make class copies of **MS.PS.4.1.AS.B** and **MS.PS.4.1.AS.C** as well as **MS.PS.4.1.TM.A** prepared on a transparency. Then, print **MS.PS.4.1.AS.A** on bright colored paper and cut out each square. Place these squares in visible places around the room using paperclips or tape.

Good morning, everyone, and welcome to class. It is so great to have everyone here and so eager to learn. Today we will continue our discussion on plants by exploring the relationship between plants and the environment around them. But first, please get out a clean sheet of paper and copy this chart.

Display **MS.PS.4.1.TM.A** and allow students to copy. Instruct students to list as many positive and negative effects they know plants have on the environment. Then ask the students to list at least two things they need to find out during this lesson.



Lesson Number: MS.PS.4.1

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Summary of Content and Teaching Strategies

Objective 1. Discuss common environmental applications and impacts of plant production.

Begin this lesson by placing students in seven groups. This activity will work best if the students in each group can sit close to one another at a table or group of desks.

Now let's get ready to learn! Today we are going to try something new. Instead of me teaching you, you are going to teach each other! There are seven yellow (or other color available) cards placed around the room. When I say GO, one person from each group will travel around the room and grab a card. The first person who returns safely to their seat will earn their entire group a piece of candy. What are your questions? Remember, no running and do not hurt yourself or others. Ready, set, GO!

Monitor students as they move around the room collecting the cards. Ensure students do not run, push, or otherwise endanger themselves or others. Take note of the first group to complete the activity and reward that group with candy (or prize of your choice).

Very good! Everyone have a seat and be ready for more instructions. Congratulations to group number ____ for finishing this activity the safest and fastest. Now each group should have one card. These cards are labeled one through seven. Share these cards with your group members. Everyone should read the card and thoroughly understand what it says. Then it will be your turn to teach the rest of the class. You will have five minutes for everyone to read the card and prepare a plan for teaching the information to the class. Go ahead and get started.

Allow the students five minutes to prepare for this *Little Professor e-Moment®*. As the students read their cards or present the information, encourage maximum participation from all group members and ensure that the rest of the class takes notes on **MS.PS.4.1.AS.B**.

Now that everyone has the chart copied, when I say GO, begin in the first box by listing as many positive and negative effects you know plants have on the environment. You will only have one minute to complete this activity so work quickly.

Are there any questions before you begin?

Choose two students to call on to ask a review question.

What are you listing?

What I know about the positive and negative effects plants have on the environment.

How long do you have to complete this task?

One minute.

GO!

Allow the students one minute to complete this assignment. As the students work, monitor the class and ensure all students are on task and understand the assignment.

All right class, your time is up. Please place your pencils on your desk and focus your attention back to the front. Who will be first to share what they already know about plants and the environment with the class?

Allow a few students to share their thoughts. If they are correct let them know. If not, explain that they may learn something new today during the upcoming class activity.

In the second column, list at least two things you hope to learn from today's discussion. You will have one minute to record these thoughts. Ready, begin.

Allow the students one minute to complete this assignment. As the students work, monitor the class and ensure all students are on task and understand the assignment.

Very good! Everyone please put your pencils down. As we begin discussing both the positive and negative effects plants and plant production may have on the environment, keep these two thoughts in the back of your mind. At the end of class, if your questions have not been answered, we will take time to discuss them.



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Very good! Now we will go in order based on the number on each group's card. As your classmates present, record notes on your worksheet. Fill in the box on the left with all of the positive impacts plants have on the environment and the box on the right with all of the negative impacts plants have on the environment. Record definitions for numbers 2-5. While you present, keep in mind your classmates need to take notes, so speak clearly and slowly. Also, if your card has the definition for one of the terms, read this definition at least three times. If you have questions, feel free to raise your hand and ask your classmates who are presenting. I will sit quietly in the back of the room and enjoy your presentations.

Allow students to present in order 1-7. As they present, prompt students with questions or ask students to repeat important information so that the class can record the information on **MS.PS.4.1.TM.B**. This activity should take about 15 minutes.

Great! I learned so much from each group that presented. Isn't it amazing how plants can have so many positive impacts on the environment yet plant production can potentially harm the environment in so many different ways? Take a look at the balance beam on the front of your worksheet. This beam depicts the delicate balance between the benefits of plants and the harm of irresponsible farming.

Let's take a minute to ensure all of our worksheet is completed.

Allow students to share questions they may still have and repeat definitions for those that are missing.

Great! Now turn your worksheet over to the reverse side. When I say **BALANCE**, you and your group members will conduct the balancing lab. I will read the directions for you aloud: As you just learned--the balance between the negative impacts and positive impacts plants and plant production have on the environment is very delicate. In this activity, you will build a balance beam that represents an ecosystem that is impacted by plant production nearby.

Follow the directions below to discover just how difficult this balancing act may be. To begin, collect the necessary items: one tennis ball, one wood ruler, 12 inches of masking tape, and nine small blocks. Then, conduct the lab and complete the questions on the worksheet. You have 25 minutes to complete this assignment. **BALANCE**

Monitor students as they complete this activity. Encourage students to stay on task and actively participate. Manage behavior by moving closer to those individuals or groups that seem to struggle with staying on task. Warn students when ten, five, and two minutes remain.

If you can hear me, clap once.

Clap

If you can hear me, clap twice.

Clap, Clap

Everyone bring their work and conversations to a close and refocus your attention back to the front. Thank you for working so well together. I am glad everyone remembered that by taking turns, communicating clearly, and understanding differences among members of your group, everyone can work well together to accomplish a task.

Review/Summary

Let's take a minute to review this activity and everything we learned today by answering questions one through four together.

Name four examples of positive impacts plants have on the environment.

Erosion control, aesthetic value, minimized noise pollution, captures greenhouse gases, creates oxygen, and provides food and shelter for animals and humans

Name four examples of negative impacts plants or plant production may have on the environment.

Erosion; release of greenhouse gases; water contamination due to chemical fertilizers and pesticides; clear cutting land; and loss of wildlife habitat

What happened as you added more and more negative effects?

The balance beam became unbalanced and began to lean more toward the negative side. In other words, the negative effects outweighed the positive impacts plants have on the environment.

What can farmers do to diminish the negative effects of plant production?



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Take suggestions from the class. For more discussion on environmental stewardship, follow this lesson with MS.PS.4.3.

Great! Make sure both sides of your worksheet are complete and turn this sheet in.

We are out of time for today. But before you leave, turn back to the chart you drew at the beginning of class. In the third box, name at least one thing you learned in today's lesson. This will be your ticket-out-of-the-door. Thank you for your attention and have a great rest of the day!

Application

Extended classroom activity:

To extend further study of plant application and impacts on the environment, allow each student to choose and research a particular issue related to crop production. Topic ideas can range from erosion to global warming or even methane emissions from rice! Students will conduct extensive research using Internet, books, news, and other printed material and prepare a five-slide presentation for the rest of the class.

FFA activity:

Participate in a community service project that controls erosion, adds aesthetic value, creates oxygen, or provides food and shelter for animals or humans.

SAE activity:

This lesson can be used to introduce the many opportunities students have to pursue a Supervised Agricultural Experience Program in crop production. Students can develop a novel way to produce fruits, vegetables, and grains in an environmentally friendly way. Or students may wish to begin an organic farm operation which will demonstrate environmental stewardship as well as provide value-added products for increased profit.

Evaluation

MS.PS.4.1.ASSESS.A

Answers to Evaluation

1. C
2. B
3. D
4. A
5. E

1 Primary Producers- Plants are called primary producers because they are the only living organisms that are cable of producing their own energy from the sun rather than from other animals or plants. All other living things on earth rely on plants either directly or indirectly for energy (food).

2 Erosion Control- Erosion is the loss of soil, sand, and rocks from the earth's surface due to wind and rain. Plants are often used to slow and reduce erosion because their roots help hold the soil in place rather than letting it stream or blow away. Also, plants help absorb water deep into the ground to prevent fast flowing streams that may create gullies. While man-made boundaries may be used to control erosion, plants are often the most affordable, practical, and long-term solution.

3 Greenhouse gas storage Common greenhouse gases are carbon dioxide, methane, and nitrogen. These gases are released as fossil fuels are burned, through agricultural plant and animal production, and through natural earth processes. Greenhouse gases are the major cause of gradual global warming (a general increase in temperature of the earth's surface over time). However, plants are the best tool for reducing the effects greenhouse gases have on the environment. Trees and plants store large amounts of these gases in their tissues keeping the gases from reaching the atmosphere. And, during the process of photosynthesis, plants convert carbon dioxide into oxygen (what we breathe!).

4 Additional Value First, plants help reduce noise pollution. Often trees are planted between busy roadways and residential areas to reduce the noisiness. Trees are also used on highways to help shade the roadway to prevent sunlight from hitting drivers directly in the eye and causing wrecks. Plants, such as herbs, have hundreds of medical uses as pharmaceutical drugs and therapy treatments. And the aesthetic value of plants (their beauty) not only helps to increase property value for homeowners, but also has been proven to positively impact people's mood and work efficiency; plants are even believed to hasten recovery time for hospital patients.

5 Erosion Just as plants are often used to stop erosion (the loss of topsoil and rocks due to wind and rain), crop production is often a leading cause of erosion. Because large areas of land are cleared for use as cropland to grow fruits, vegetables, and grains, a large portion of the surface of the soil is left vulnerable to erosion. Conventional farming practices are often accused of being the largest cause of erosion problems in the United States because of the common practice of plowing up the soil and dead plants before planting new crops. Tilling the soil loosens the top layer making the soil more apt to run off in heavy rains.

6 Greenhouse Gas Emission When land is clear cut to make way for crops to be planted and harvested, the greenhouse gases that were once stored in the plants and the soil are released into the atmosphere. Also, when land is cleared, there are fewer trees to convert carbon dioxide into oxygen. And planting, harvesting, and transporting plant products for human and animal consumption require the use of gas and diesel to power tractors, tractor trailers, and processing equipment. Burning these fossil fuels releases even more greenhouses gases into the environment.

7 Chemical contamination Another common issue with plant production is the necessary use of pesticides, specifically insecticides, which are used to kill or repel damaging insects. Other contamination may be caused by fertilizers, which are nitrogen-based solutions that are used to increase healthy growth in plants. Overuse or misuse of chemical fertilizers and pesticides leads to chemical runoff into water sources which could affect entire ecosystems. Most insecticides used today are not pest-specific and will therefore potentially harm even harmless insects.



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Name: _____

Directions: In the boxes provided, list the positive and negative effects plants and plant production may have on the environment. When you are finished, please complete questions 1-3. Then, move on to the lab activity on the back of this paper.

Positive Impacts	Negative Impacts
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
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_____	_____
_____	_____



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1. Do plants have the ability to help change the negative impacts that plant production may have on the environment in some cases? Why or why not? If so, give an example.

2. Define erosion:

3. Define greenhouse gases and give three examples:

4. Define pesticides:

5. Define primary producers and give an example:



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Name: _____

As you just learned, the balance between the negative impacts and positive impacts plants and plant production have on the environment is very delicate. In this activity, you will build a balance beam that represents an ecosystem that is impacted by plant production nearby. Follow the directions below to discover just how difficult this balancing act may be.

Procedures

1. Obtain the following materials: ruler, tennis ball, 12 inches of masking tape, 9 small blocks
2. Build the balance beam by centering the ruler on top of the tennis ball.
3. Then secure the ruler and the ball to your table using your piece of masking tape.
4. See image below.
5. Now, using the small building blocks, imitate what happens when plant production impacts the environment. Let the right side of the beam represent positive impacts and the left represent negative impacts.

Tape wrapped around ball and ruler. Ruler centered on ball

6. **Begin by placing all four of the positive effects on the right side of the beam (this symbolizes an environment with plentiful plant populations without large scale plant production). Name four examples of positive impacts plants have on the environment:**

7. **One at a time, add the remaining blocks (negative effects) on the left side of the beam (this represents the impact agricultural production may have on environments). Name five examples of negative impacts plants have on the environment:**

8. **As you added more and more negative blocks, what happened to the scale?**

9. **What are some ways you think farmers and land owners can help to reduce the negative impact plant production may sometimes have on the environment?**



Name _____

Directions: Match the following key terms with the letter that corresponds with the correct definition.

1 _____ Fertilizer

a. Organisms that receive their energy from the sun in a process called photosynthesis.

2 _____ Pesticide

b. Synthetic chemicals or natural solutions used to deter pests such as: insects, rodents, and weeds.

3 _____ Greenhouse Gases

c. Nitrogen-based chemicals used to increase plant growth.

4 _____ Erosion

d. Gases such as nitrogen, carbon, and methane, which are released from burning fossil fuels, plant and animal production, and natural occurrences.

5 _____ Primary Producers

e. The loss of topsoil and rocks due to wind and rain.