Lesson Number: MS.NR.3.4

Understanding Point vs. Nonpoint Source Water Pollution

Middle School Food and Agricultural Literacy Curriculum

Precepts

J. Mental Growth

J3. Practice sound decision-making

National Standards

NRS.01.01.01.b. Differentiate between renewable and non-renewable natural resources.

NRS.02.06.08.a. Describe sources of pollution and delineate between point and nonpoint source pollution.

ESS.04.01.01.a. Identify types of pollution and distinguish between point source and nonpoint source pollution.

NL-ENG.K-12.3– Evaluation Strategies

NS.5-8.6 – Science in Personal and Social Perspectives

NSS-GK-12.5 – Environment and Society

Student Learning Objectives

As a result of this **unit** the students will…

Explain the role of clean water in sustaining life.

As a result of this **lesson** the students will …

Cite three examples and sources of water pollution (point and nonpoint)

Time

Instruction time for this lesson: 45 minutes.

Resources

Pollution Source: Point and Nonpoint. (2007). Retrieved August 21, 2009, from Water Encyclopedia Web Site: http://www.waterencyclopedia.com/Po-Re/Pollution-Sources-Point-and-Nonpoint.html —National FFA Organization. (2009). LifeKnowledge Online. Retrieved September 1, 2009 from http://agedlearning.org

Tools, Equipment, and Supplies

Six clear cups/glasses
Water
Oil
Soil
Bleach
Miracle Grow liquid fertilizer
Dish soap
Overhead/LCD projector or writing surface
Writing utensil
Note card – one per student
MS.NR.3.4.TM.A – one per teacher
MS.NR.3.4.TM.B – one per teacher
MS.NR.3.4.TM.C – overhead or one per group of four students
MS.NR.3.4.TM.D – overhead or one per group of four students
MS.NR.3.4.ASSESS.A– one per student

Key Terms

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

Point source

Nonpoint source

Content Outline

Objective 1. Cite three examples and sources of water pollution (***point*** and ***nonpoint***)

I. Review water pollution

A. The addition of harmful chemicals or substances to water

***II. Point* vs. *nonpoint* water pollution**

A. ***Point source*** water pollution occurs when the contaminant comes from an obvious source.

1. ***Point source*** contaminants come from industrial, commercial, and residential. Often there are waste products that are a byproduct of daily operations.
2. Examples of ***point*** pollution include: tanker oil spill in water, animal waste treatment lagoon spills, or wastewater treatment facilities.

B. ***Nonpoint source*** water pollution occurs when the contaminant comes from a source that is not easily identifiable or from a number of sources.

1. ***Nonpoint*** pollution often originates as precipitation and collects contaminants as it travels across the ground until it becomes polluted.
2. ***Nonpoint*** is found over a large area, and it is hard to pinpoint the exact origination of the contamination.
3. Examples of ***nonpoint*** pollution include: agricultural or urban runoff (fertilizers), runoff from parking lots (grease, gasoline), salt contamination from road de-icing.

Interest Approach

Before students arrive, obtain six clear glasses, water, soil, bleach, dish soap, liquid fertilizer, and oil. In cup A, mix together water and soil. In cup B, mix together water and bleach. In cup C. mix together water and oil. In cup D, mix together water and dish soap. In cup E, mix together water and liquid fertilizer. And finally, in cup F, fill with water. Set up the glasses in the front of the room for students to easily observe. Students will have to complete the Interest Approach in six groups – if it is easier to divide the class as they arrive then set this up appropriately. As students arrive, acknowledge them for being on time and prepared for class.

What have we learned before about water as a resource? Why do we sometimes call water a non-renewable resource?

Allow students to discuss the previous lesson, MS.NR.3.3, which discusses how water can be a non-renewable resource.

Refer to this lesson if it was not taught and introduce students to the idea that water can be considered non-renewable.

Great job! If water becomes polluted, or if there is an addition of harmful chemicals or substances to the water, then it often becomes unusable for the task we might have. Take a look at these six glasses of water.

Point to the cups a-f displayed at the front of the room.

Summary of Content and Teaching Strategies

Objective 1. Cite three examples and sources of water pollution (***point*** and ***nonpoint***)

I. Review water pollution

A. The addition of harmful chemicals or substances to water

Five of these six cups have been contaminated with common water pollutants. When I say GO, you will have one minute to determine what your contaminant is and its source. What is meant by the word "source"?

Allow students to answer where the contaminant comes from.

Great. How long do you have to complete this activity?

Allow students to answer one minute.

Oh, complete this activity within your groups. What questions are there?

Answer any questions. Pass out one cup to each of the six groups.

GO.

Answer any questions that might arise during this activity. Obtain a copy of **MS.NR.3.4.TM.A** to record the results from their discussion on either an overhead or a writing surface. To save time, **MS.NR.3.4.TM.A** can be made into a large poster prior to class. It is very important to NOT reveal the last two columns of the chart. This would show the students what the actual contaminant of the water is, which will be saved for later on in the lesson. When one minute is complete, regain the attention of the classroom. Instruct students to make a copy of the chart from **MS.NR.3.4.TM.A** in their notes and fill in as items are discussed.

Great job. Let's discuss your results.

As you call on each group to record their results, recollect the cups and display them in the front of the room again for further discussion.

What is the conclusion of the group that had cup a?

Allow students to share their results. Record the results in **MS.NR.3.4.TM.A** again, refraining from showing the last two columns of the chart.

Thank you. What is the conclusion of the group that had cup b?

Again, allow students to share then record the results in **MS.NR.3.4.TM.A.**

Great. What is the conclusion of the group that had cup c?

Repeat the sharing and recording.

Thank you. What is the conclusion of the group that had cup d?

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Repeat the sharing and recording.

Great. What is the conclusion of the group that had cup e?

Repeat the sharing and recording.

Thank you. And finally, what is the conclusion of the group that had cup f?

Fill in the final blanks for cup f.

Great job, everyone! It looks like there were some great discussions. Would you like to know what actually is contaminating this water? Well, we'll just have to wait! Understanding what is contaminating this water gives us the potential of ensuring that our sources of water remain clean and healthy for us and other living things to consume. Let's think like super sleuths and investigate a little deeper into sources of water pollution and see if we can decode what we've seen in these cups today.

Content outline can be found on **MS.NR.3.4.TM.B**. If you would like this to aid in instruction, have an overhead or writing surface available to display information. Information can be written on a large poster board or piece of paper prior to class for easy access and instruction. If technology, similar to an LCD or a SMART board, is available, prepare the following information in presentation software prior to class meeting. This will be lengthy, so ensure enough time is allotted to transfer material. Make sure all students have appropriate writing utensils and paper to collect information discussed during the lesson. **MS.NR.3.4.TM.C-D** will also be needed during this lesson to help illustrate both point and nonpoint pollution. Make sure all students have appropriate writing utensils and paper to collect information discussed during the lesson on water pollution.

Water pollution can come in many different forms and methods. Many times water becomes polluted from an obvious source. In the news we have heard about oil tankers in the ocean spilling oil or of chemical plants with hazardous waste runoff that ends up in our waterways.

Display **MS.NR.3.4.TM.B**.

These types of pollution, sources that can be easily pinpointed, are called ***point source*** water pollution. Direct and allow students time to write down the definition and examples of ***point source*** water pollution.

II. *Point* vs. *Nonpoint* water pollution

A. ***Point source*** water pollution occurs when the contaminant comes from an obvious source.

1. ***Point source*** contaminants come from industrial, commercial, and residential. Often there are waste products that are a byproduct of daily operations.
2. Examples of ***point*** pollution include: tanker oil spill in water, animal waster treatment lagoons, or wastewater treatment facilities

Point source water pollution is often the factor of industrial plants and commercial facilities that manufacture waste products that do not get taken care of properly. These waste products can easily be pointed back to the facility that produced them, therefore can be considered ***point source*** pollution.

Display **MS.NR.3.4.TM.C**.

Look at these pictures. Will someone share the source of the pollution in Picture A?

Allow students to discuss.

Great job.

Repeat this for Pictures B-D.

We were able to easily pick the source of pollution for Pictures A through D. What does that tell us about the source of the pollutants in these pictures?

Allow students to make reference that this means they can be considered "***point source***" pollution sources.

Great job. All of these pictures show ***point source*** pollution because the pollutant is coming from an obvious source. But what if we don't know where the pollutant is coming from? What do you think we would call a pollutant that comes from a source that is not easily identifiable or possibly a number of sources?

Allow students to brainstorm what this might be called. They may come up with a couple of other guesses, but students should narrow down to the right word.

That's right! Pollutants that come from a source that is not easily identifiable or from multiple sources is called a ***nonpoint source*** pollutant.

Understanding Point vs. Nonpoint Source Water Pollution

Nonpoint source water pollution often originates as a type of precipitation, like rain or snow, and collects pollutants on the ground as it makes its way to our local waterways. It's often hard to tell exactly where the contaminant is coming from, but its affects on our water can be very hazardous.

Direct and allow students time to write down the definition of the ***nonpoint source*** water pollution. Display **MS.NR.3.4.TM.D**.

Let's look at some more pictures: This time the source of pollution is unknown and is more difficult to pinpoint. Who will describe what they see in this picture?

Select a student to describe what they see in the picture.

Where is the pollutant coming from in this picture?

This should be difficult for the students to pick out. They may also list multiple sources.

As you can see, it often is hard to tell exactly where a pollutant is coming from in ***nonpoint*** pollution. Other examples of situations that may cause ***nonpoint*** pollution could be agricultural or urban runoff from fertilizers or extra sediment into our waterways or even salt runoff from roads that are being de-iced.

Direct and allow students time to write down these examples of nonpoint pollution.

B. ***Nonpoint source*** water pollution occurs when the contaminant comes from a source that is not easily identifiable or from a number of sources.

   1. ***Nonpoint*** pollution often originates as precipitation and collects contaminants as it travels across the ground until it becomes polluted
   2. ***Nonpoint*** is found over a large area is hard to pinpoint the exact origination of the contamination
   3. Examples of ***nonpoint*** pollution include: agricultural or urban runoff (fertilizers or sediment), runoff from parking lots (grease, gasoline), salt contamination from road de-icing.

OK. Let's look back at our six cups of water and see if we can be a little more specific about what is the contaminant.

Display **MS.NR.3.4.TM.A** from earlier. Instruct students to add the last two columns of the chart, "Actual Contaminant" and "Point or Nonpoint." As each cup is discussed, remind students to complete the chart.

Looking at our chart, will a representative from Cup A please tell us again what you thought your contaminant was and its source?

Allow student to read the chart.

The actual contaminant of Cup A is soil or sediment. From what we have just discussed, is this ***point*** or ***nonpoint source*** pollution?

Allow students to answer. Reveal the last two columns for Cup A only on **MS.NR.3.4.TM.A.**

Great job! Soil or sediment found in water is considered a ***nonpoint source*** water pollutant because we cannot pinpoint its exact origination.

Let's look at Cup B. Will a representative from this group please read to the class what you thought the contaminant was and its source?

Allow student to read the chart.

The actual contaminant in Cup B is bleach. Bleach is a common household chemical used for cleaning and disinfecting. Would bleach be considered a ***point*** or a ***nonpoint source*** pollutant?

Allow students to answer and then reveal the last two columns for Cup B on **MS.NR.3.4.TM.A**.

Great job! If bleach was used in several households, it would be hard to determine its exact origination, making it a ***nonpoint source*** pollutant.

On to Cup C. Will a representative from this group please read to the class what you thought the contaminant was and its source?

Allow student to read the chart.

The actual contaminant in Cup C is oil. Oil has several different uses and purposes. It can be found throughout the world. This is a tricky one, but would oil be considered a ***point*** or a ***nonpoint source*** pollutant? You may want to define the situation you would find it in to explain your selection.

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Allow students to answer and then reveal the last two columns for Cup C on **MS.NR.3.4.TM.A**.

Great answers. If oil is spilled from a larger tanker in the ocean, we could consider that a ***point source*** water pollutant because we can define the source of the contamination. If oil is running off a parking lot into a storm drain, the source is coming from various cars and other vehicles. A direct source cannot be pinpointed, therefore in this situation it is a nonpoint pollutant. Great job!

Next: Cup D. Will a representative from this group please read to the class what you thought the contaminant was and its source?

Allow student to read the chart.

The actual contaminant in Cup D is dish soap. Dish soap is used in households to clean and wash dishes and other items like cars. Would dish soap be considered a ***point*** or a ***nonpoint source*** pollutant?

Allow students to answer and then reveal the last two columns for Cup D on **MS.NR.3.4.TM.A**.

When dish soap is used it is combined with water and washed down storm drains. We cannot pinpoint one exact source of dish soap because many households use it for a variety of tasks. Therefore, dish soap is considered to be a ***nonpoint source*** pollutant.

Two more to go! Will a representative from Cup E's group please read to the class what you thought the contaminant was and its source?

Allow student to read the chart.

The actual contaminant in Cup E was liquid fertilizer. Liquid fertilizer is often used by homeowners to improve their landscape, but it can also be used by large commercial facilities to fertilize large quantities of plants. Would liquid fertilizer be considered a ***point*** or a ***nonpoint source*** pollutant?

Allow students to answer and then reveal the last two columns for Cup E on **MS.NR.3.4.TM.A**.

Often homeowners do not read labels correctly when using fertilizers. Many people believe that the more fertilizer you put on plants, the bigger and faster they will grow.

Each plant has a specific amount of nutrients it can take in, and once it can take no more, the extra fertilizer runs off and pollutes the waterways. Could this be considered ***point*** or ***nonpoint source*** pollution?

Allow students to answer and then reveal the last two columns for Cup F on **MS.NR.3.4.TM.A**.

Since many people do this, we cannot pinpoint one exact source of the contaminant; therefore liquid fertilizer can be considered a ***nonpoint source*** pollutant.

The last cup, Cup F, was a little different. Will someone from this group please read to the class what you thought the contaminant was and its source?

Allow student to read the chart.

The water in Cup F was water that was actually not contaminated. If you compare Cup F to Cups A through E, you can see what the water originally looked like. Some contaminants actually changed the appearance of the water, where others changed the way the water smelled, but not the way it looked. Contamination can come in many different forms and from many different sources. It is important to understand how the activities you participate in on a daily basis, like washing your car or fertilizing your yard, can have an effect on our water systems. We must practice sound decision-making to ensure that we work toward preventing ***point*** and ***nonpoint source*** water pollution.

Review/Summary

Utilize the *Show What You Know e-Moment®*.

Pass out a 3x5 note card to each student. Instruct students to place their name and any other class identifier deemed necessary on the card.

OK – it's time to Show What You Know! On the one side of the note card illustrate the definition of ***point source*** water pollution**.** Remember, ***point source*** water pollution can be defined as a contaminant that comes from an obvious source, like an oil spill from an oil tanker. If you had to explain what ***point source*** water pollution was to a person who had never heard of it before, how would you illustrate it? Take two minutes to complete this task. Show what you know!

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As students work on this, circulate around the room and check for understanding. Answer any questions that students might have, but do not lead them in their illustrations. Through this exercise, you should have a clearer picture if any re-teaching will need to take place. When two minutes end, regain the class's attention.

Great job! Now flip the card over. Illustrate the definition of ***nonpoint source*** water pollution**.** Remember, ***nonpoint source*** water pollution can be defined as a contaminant that comes from a source that is not easily identifiable or from multiple sources. If you had to explain what ***nonpoint source*** water pollution was to a person who had never heard of it before, how would you illustrate it? You have two minutes to complete this task.

Again, circulate throughout the room to check for understanding. Answer any questions, but refrain from guiding answers. At the end of two minutes, regain the class's attention.

It is important to be able to locate and identify point and ***nonpoint source***s of pollution. Like we discovered today, pollution can come from a variety of different places and can have different effects on our water sources. If we can identify the source, we have a better opportunity of stopping the pollution and keeping our water safe and clean for our daily use. When we meet again we will continue our investigations on the importance of clean water. Upon arriving to class next time, make sure to have all that stored information present because we will use it again!

On the way out of class today please make sure you hand in your note card. It is your exit ticket out! Great job!

Application

Extended classroom activity:

Allow students to brainstorm ways to prevent water pollution.

FFA activity:

Have members create a public service announcement encouraging students to be aware of water pollution and ways to prevent it.

SAE activity:

Allow students to research examples of point and ***nonpoint source*** pollution, determining which one has a greater impact on local waterways.

Evaluation

MS.NR.3.4.ASSESS.A

Answers to Evaluation

1. Water Pollution
2. Point
3. Answers will vary. Answers could include: oil tanker spill, chemical factory waste
4. Nonpoint
5. Answers will vary. Answers could include: parking lot runoff, agriculture or urban runoff

What's that Contaminant?

	Speculated Contaminant	Speculated Contaminant Source	Actual Contaminant	Point or Non-Point?
Cup A			Soil/Sediment	Nonpoint
Cup B			Bleach	Nonpoint
Cup C			Oil	Point AND Nonpoint
Cup D			Dish Soap	Nonpoint
Cup E			Liquid Fertilizer	Nonpoint
Cup F			None	N/A

Point Source vs. Nonpoint Source Water Pollution

Objective 1. Cite three examples and sources of water pollution (***point*** and ***nonpoint***)

I. Review water pollution

A. The addition of harmful chemicals or substances to water

II. Point vs. Nonpoint water pollution

A. Point source water pollution occurs when the contaminant comes from an obvious source.

1. Point source contaminants come from industrial, commercial, and residential. Often there are waste products that are a byproduct of daily operations.
2. Examples of point pollution include: tanker oil spill in water, animal waste treatment lagoon spills, or wastewater treatment facilities

A. Nonpoint source water pollution occurs when the contaminant comes from a source that is not easily identifiable or from a number of sources.

1. Nonpoint pollution often originates as precipitation and collects contaminants as it travels across the ground until it becomes polluted
2. Nonpoint found over a large area is hard to pinpoint the exact origination of the contamination
3. Examples of nonpoint pollution include: agricultural or urban runoff (fertilizers), runoff from parking lots (grease, gasoline), salt contamination from road de-icing.

Examples of Water Pollution

Picture A

Picture B

Picture C

Picture D

Nonpoint Water Pollution

Point vs. Nonpoint Source Water Pollution

Name _____

Section 1: Short Answer

Directions: Answer the following questions correctly.

1. **The addition of harmful chemicals or substances to water is called _____.**

2. **_____source water pollution occurs when the contaminant comes from an obvious source.**

3. **Give three examples of a point source water pollutant.**

4. **_____ source water pollution occurs when the contaminant comes from a source that is not easily identifiable or from a number of sources.**

5. **Give three examples of a nonpoint source water pollutant.**

_____

_____

_____