

THE MULCH MYSTERY



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-



Rural Science Education Program
A partnership between Oregon State University
and rural K-12 schools



OSU
Oregon State
UNIVERSITY
Extension Service

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Rural Science Education Program

The Rural Science Education Program is a partnership between Oregon State University and rural K–12 schools for enrichment of the science curriculum with hands-on science activities. The curricula include simple, innovative inquiry- and site-based experiments that encourage critical thinking in K–12 students about the impacts of agriculture on the environment and the implications of advanced scientific research on human lives.

For more information

For more information about the Rural Science Education Program or to order copies of *The Mulch Mystery*, contact Sujaya Rao by phone (541-737-9038), e-mail (sujaya@oregonstate.edu), or fax (541-737-5725).

Also available: *Insects: Taking a Deeper Look at the World of Bugs*, EM 8896-E, three lesson plans for grades 3 through 8; and *Salmon in the Classroom*, EM 8910-E, four lesson plans.

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Lesson Plan

Wild Cards

THE MULCH MYSTERY



DESCRIPTION

This unit describes a fourth- or fifth-grade class experiment that is conducted both in the classroom and at a field site, either at the school or in the community. The field site should be a place where invasive, non-native plants are growing, and where a native plant area could be established. A site with low-growing, herbaceous, non-native plants, such as lawn grass, works well.

The mystery in this project is to find the best method for getting rid of the invasive plants so the school, community, or class can plant native plants and encourage native wildlife. This experiment involves testing different mulch treatments, collecting data to identify the most successful treatment, and using that treatment to get rid of invasive plants at the entire field site. At the end of the experiment, the class will develop a poster, which can be presented at a science fair, to the school, or to the community.



STUDENT OUTCOMES/OBJECTIVES

Students will be able to:

- Make detailed observations about invasive and native plant species.
- Establish reasonable policies that they will be expected to follow while working at their field site.
- Identify, in small groups, two treatments that have been used previously to control invasive plants at the field site (if applicable).
- Participate in a class brainstorm of possible methods to get rid of the invasive plants at the field site.
- As a group, choose two feasible methods to try.
- Define the terms **treatment**, **plot**, and **control**.
- Work cooperatively in groups in the field to set up their treatments.
- Assign and record a rating for each treatment based on the scale described on the Data Sheet.
- Predict which treatment will work best to get rid of the invasive plants.
- Work cooperatively in groups to create signs to label their treatments in the field.
- Define vocabulary terms without looking at the definitions (plot, treatment, control, native plant, invasive plant).
- Create title cards to use on a poster describing their project.
- Use their data to describe the solution to the Mulch Mystery.
- Work cooperatively in groups to remove the treatments that did not work well and apply the “winning” treatment.
- List at least one reason why their treatment did or did not work.



OREGON STANDARDS

Level: Fifth grade

Subject: Science

Strand: Scientific Inquiry

- Make observations. Ask questions or form hypotheses based on those observations, which can be explored through scientific investigations.
- Design a simple scientific investigation to answer questions or test hypotheses.
- Collect, organize, and summarize data from investigations.
- Summarize, analyze, and interpret data from investigations.



TIME ESTIMATE

This project requires eight 60-minute class periods. During the treatment phase, each class period should be a week apart to allow enough time for the treatments to affect the plants.



MATERIALS

See individual lessons for detailed material lists.

- A field site where non-native or invasive plants are growing (Ideally, the site can be used to plant native plants in the future.)
- Invasive plant specimens from the field site
- Pictures of native plants or potted specimens
- Poster board
- Loupe lenses or other magnifying lenses
- 3-ring binder
- Camera (optional)
- Clipboards
- Prizes for Wild Cards (stickers, pencils, bookmarks, etc.) We were able to get many free items from the Siuslaw National Forest Headquarters.
- 3 x 5 cards
- Materials to establish treatments (see Creating Our Experiment)
- Shovels
- Buckets
- Wooden stakes
- Flagging tape
- One adult volunteer/aide (Days 4–8)
- Construction paper
- Colored pencils, markers, crayons
- Rulers
- Pencils
- Trifold display board



WORKSHEETS

- Scavenger Hunt
- My Mulch Plot Plan
- Describing Our Experiment
- Data Sheet



LESSON PLANS

- Plant Detectives, Part I
- Plant Detectives, Part II
- Designing Our Experiment
- Creating Our Experiment
- The Mystery Unfolds, Part I
- The Mystery Unfolds, Part II
- The Mystery Unfolds, Part III
- The Mulch Mystery — Solved!



VOCABULARY

- Treatment
- Plot
- Control
- Native plant
- Invasive plant



BACKGROUND KNOWLEDGE

Students should have some knowledge about the difference between a native and an invasive plant. They should be familiar with their school’s “outside area” or the project field site. Students should have at least some experience asking scientific questions, making and recording observations, and writing procedures.



EXTENSIONS/RESOURCES

The 4-H Wildlife Stewards Summit can provide an opportunity for the class to present its poster to the community and other schools. A Science Fair is another option. If such an activity is not planned, the school principal, librarian, or other school personnel could visit the classroom for a presentation. Alternatively, if the field site is not on the school property, students could present their project to members of the community or at a town meeting.



Plant Detectives, Part I

Lesson Plan

Scavenger Hunt Worksheet

**Scavenger Hunt Worksheet
(Teacher Key)**

LESSON PLAN

PLANT DETECTIVES, PART I



Note: Italicized words are potential script for the teacher.

Objectives

- Students will be able to make detailed observations about an invasive plant.
- Students will be able to define reasonable policies that they will be expected to follow while working at their field site.

Materials

- Invasive plants specific to your field site (e.g., lawn grass, English ivy, or another low-growing invasive plant), which you will try to eradicate—one for each student (Each plant should be connected at the base and include some roots.)
- A piece of poster board for listing Field Policies to be followed when working in an outdoor classroom
- Loupe lenses or other magnifying lenses—at least one for each pair of students; preferably one for each student
- Scavenger Hunt worksheets—one for each student
- Crayons, markers, or colored pencils
- One 3-ring binder to organize all class work from the project

Introduction (10 minutes)

Ask students, “What is a native plant?” Use their answers to discuss the differences between native and invasive plants. Include why it is important to encourage native plants and discourage invasive plants.

Explain that during “The Mulch Mystery” the students will solve a problem, or mystery, at the school (or at a local field site) where invasive plants need to be eradicated so that native plants can become established. The mystery is: What is the best way to get rid of the invasive plants so that native plants can survive at this site?

Tell students that the first part to solving a mystery is to make observations. This is like being a detective! By the end of this unit, the class will solve the mystery by finding the best solution for eradicating invasive plants at the school or local site.





Student directions/Demonstrations of techniques (10 minutes)

Pass out loupe lenses and one invasive plant to each student. Explain that this is one of the invasive plants growing at the field site (if applicable). Ask students to describe this invasive plant; discuss descriptions together as a class.

Draw a picture of the plant on the board, based on the students' descriptions. Use the drawing to guide them toward observing and describing all of the details of the plant (e.g., the way the leaves grow off the main stem, the color changes along the stem, the roots).

Activity procedures (20 minutes)

Hand out the Scavenger Hunt worksheets and have students draw their invasive plant in the space provided. This work should be done individually. Explain that the worksheets will be used when students go on a scavenger hunt to explore the field site. *A detective must use good observation skills to look at the problem. This is the best way to think about a solution! Today we learned how to closely observe the invasive plants and draw a detailed picture; in the next lesson we will observe the field site.*

Closing activity/Assessment (15 minutes)

As a class, go over the rest of the worksheet so students know what they will be expected to do during the next class period. There is a space for drawing a native plant; ask students what they will look for in order to make a detailed drawing. (Refer to the details used to draw today's invasive plant.)

During the next class period, we will be working outside, in the field, so we need to agree on some class policies for working in the field. As a class, brainstorm acceptable behavior when working in the outdoor classroom. List these policies on the poster board. Students will take this board to the field site when they work outside.

Cleanup (5 minutes)

Collect plants and put them in a compost pile. (If the plants are flowering or have formed seeds, do not compost them.) Collect supplies and worksheets. Worksheets can be kept in a class binder. Look over the worksheets to identify any problems that might need to be addressed before students draw a picture of a native plant.



My name: _____



STUDENT WORKSHEET SCAVENGER HUNT

1. Can you find both **invasive** and **native** plants at the field site? Draw each type of plant in the boxes below.

Invasive plant

Native plant

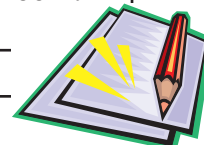
2. Can you find two ways the school or community has tried to get rid of the invasive plants before? List two ways below.

a. _____

b. _____

3. After getting a “teacher check,” try pulling up an invasive plant by hand. How easy is it to pull up this plant by hand? Report your findings below.

When you get to this point, work on the back of the worksheet INSIDE the classroom.





4. Why do we want to get rid of invasive plants at our field site?

5. What are some other ways we might try to get rid of the invasive plants? List as many as you can think of below. (Hint: think about materials we could put on top of the invasive plants to try to kill them.)



My name: _____ (Teacher Key)



STUDENT WORKSHEET SCAVENGER HUNT

1. Can you find both **invasive** and **native** plants at the field site? Draw each type of plant in the boxes below.

Invasive plant

Note to teacher: *Students will complete only this box during this lesson. Collect the worksheets and pass back for the next lesson.*

Native plant

2. Can you find two ways the school or community has tried to get rid of the invasive plants before? List two ways below.

a. _____

b. _____

3. After getting a “teacher check,” try pulling up an invasive plant by hand. How easy is it to pull up this plant by hand? Report your findings below.

When you get to this point, work on the back of the worksheet INSIDE the classroom.





4. Why do we want to get rid of invasive plants at our field site?

5. What are some other ways we might try to get rid of the invasive plants? List as many as you can think of below. (Hint: think about materials we could put on top of the invasive plants to try to kill them.)





Plant Detectives, Part II

Lesson Plan

Scavenger Hunt Worksheet

(Teacher Key)

Wild Cards

LESSON PLAN

PLANT DETECTIVES, PART II



Note: If the field site is not nearby, this lesson will need to be done in two class periods.

Objectives

- Students will be able to make detailed observations about a native plant.
- Students will be able to identify, in small groups, two treatments that have been attempted previously at the field site in order to control invasive plants (if applicable).

Materials

- Scavenger Hunt worksheets (from Day 1)
- Clipboards (or something hard that students can take outside to write on)—one for each student
- Pictures of native plants growing at the field site or pictures of native plants that could be planted at the site (If no natives are growing at the site, it would be ideal to bring in some potted native plants for students to draw.)
- Loupe lenses or other magnifying lenses—at least one for each pair of students; preferably one for each student
- Crayons, markers, or colored pencils
- Wild Cards (printed and cut)
- Field Policies
- Camera (optional)
- Small plastic bags

Introduction (10 minutes)

Pass back the Scavenger Hunt worksheets from Day 1. Review the drawings and the questions for the scavenger hunt. Explain that students will work outside in small groups to answer the scavenger hunt questions.

Review the Field Policies (recorded on Day 1) and explain that students can earn Wild Cards for following the policies in the field. Each Wild Card can be turned in for prizes (e.g., stickers, pencils, bookmarks). An alternative is to give students the opportunity to donate their Wild Cards to a class bag to earn an Ice Cream Lab (making ice cream in sealable plastic bags). Students may donate some Wild Cards and keep some, too; this seems to be a popular option.



Student directions/Demonstrations of techniques (5 minutes)

Show students the pictures or examples of native plants that are growing at the site or could be planted at the site. If students are already familiar with the site (e.g., a site on the school grounds), ask them where they can find native plants on the site.

Have one or two students describe some key features to include in their drawings based on their invasive plant drawings from Day 1 (e.g., how the leaves grow off the stem, color changes along the stem, flowers, width of leaves, etc.).



Activity procedures (30 minutes)

Place students in groups of four. The number of groups will determine how many treatments you will have for the experiment on Days 4–7.

Hand out clipboards and crayons, markers, or colored pencils. Explain that groups will work together. As students demonstrate the agreed-upon field policies, they can earn Wild Cards.

As a class, go out to the field site. Students will work on the Scavenger Hunt worksheet (native plant drawing and questions 2 and 3) in the field. Take pictures, if possible.

Closing activity/Assessment (10 minutes)

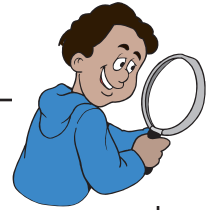
Review the worksheets as a class and share answers.

Cleanup (5 minutes)

Collect worksheets, supplies, and clipboards. Place worksheets in the binder. If there is time, collect Wild Cards that students wish to donate to an Ice Cream Lab. Or, pass out small plastic bags that students can use to leave Wild Cards in their desk overnight. (Wild Cards can be collected at the beginning or end of each class.) Students who wish to redeem their Wild Cards for individual prizes are responsible for keeping their Wild Cards until the end of the unit.



My name: (Teacher Key)



STUDENT WORKSHEET SCAVENGER HUNT

1. Can you find both **invasive** and **native** plants at the field site? Draw each type of plant in the boxes below.

Invasive plant

This box was completed during the previous lesson.

Native plant

2. Can you find two ways the school or community has tried to get rid of the invasive plants before? List two ways below. *If your school or the site has not attempted to eliminate the invasive plants, this question can be changed to “Can you find any critters that might benefit from restoring native plants in this area (e.g., insects, worms, birds, etc., or even signs of these, such as nests or burrows)?*

a. _____
b. _____

3. After getting a “teacher check,” try pulling up an invasive plant by hand. How easy is it to pull up this plant by hand? Report your findings below.

Although some invasives are easy to pull up, ask students if they would like to do this over the entire field site?! Is that practical?

When you get to this point, work on the back of the worksheet INSIDE the classroom.

Students will work on the questions on the back during the next lesson. Collect the worksheets and pass back for the next lesson.





4. Why do we want to get rid of invasive plants at our field site?

This question will be answered during the next session.

5. What are some other ways we might try to get rid of the invasive plants? List as many as you can think of below. (Hint: think about materials we could put on top of the invasive plants to try to kill them.)

This question will be answered during the next session.



 <p>Wild card!</p> <p>Earned for outstanding behavior in the outdoor classroom</p> 	 <p>Wild card!</p> <p>Earned for outstanding behavior in the outdoor classroom</p> 
 <p>Wild card!</p> <p>Earned for outstanding behavior in the outdoor classroom</p> 	 <p>Wild card!</p> <p>Earned for outstanding behavior in the outdoor classroom</p> 
 <p>Wild card!</p> <p>Earned for outstanding behavior in the outdoor classroom</p> 	 <p>Wild card!</p> <p>Earned for outstanding behavior in the outdoor classroom</p> 



Designing Our Experiment

Lesson Plan
Scavenger Hunt Worksheet
(Teacher Key)

LESSON PLAN

DESIGNING OUR EXPERIMENT



Objectives

- Students will brainstorm methods to get rid of the invasive plants at the field site.
- Students will choose two feasible methods, as a group, that they would like to try in their experiment.

Note: Italicized words are potential script for the teacher.

Materials

- Scavenger Hunt worksheets from Day 2
- A large area (chalkboard, whiteboard, or large pieces of butcher paper) where you can list the ideas discussed during the brainstorm
- One 3 x 5 card per group.

Introduction for students (10 minutes)

Begin by quickly collecting any Wild Cards that students wish to donate for an Ice Cream Lab (if not collected the previous day).

Explain that the students will design a class experiment to test different mulch methods that could be used to get rid of the invasive plants at the site. The mystery will be solved when they decide, based on the experiment, which method works best.

Introduce the vocabulary term **treatment**. A treatment is something that you are changing in your experiment. It is also called a **variable**. Write the definition of treatment on the board.

Student directions/Demonstrations of techniques (5 minutes)

Explain that the class will brainstorm possible treatments (different methods) to try at the field site. The treatments are things they could do to the invasive plants to try to get rid of them. The treatments are something they will change (in this case, add) in the experiment. (Review what it means to brainstorm. *We will write down any and all ideas. At the end of the brainstorm, we will decide which ones are more feasible than others, so try to focus on ideas that we could actually attempt!*)



Activity procedures (30 minutes)



Pass out the Scavenger Hunt worksheets. Students will answer questions #4 and #5. The final question should spark some ideas to begin the brainstorm. Spend at least 20 minutes brainstorming. The process may start out slowly, but once the students get rolling, they can brainstorm for a while.

After writing down all ideas, go through the list as a class and discuss whether or not each idea would be possible in the experiment. (For example, pesticides are not feasible because we are trying to create a native habitat that will encourage wildlife and because one needs a special license to apply some pesticides. Fire is not feasible because the area is so close to the school. A tractor will not work because it's too big for the area, and we don't have one, etc. Treatments that might work include tarps, wood chips, garbage bags, etc.)

Closing activity/Assessments (10 minutes)

Have students get into their groups, if they have not already done so. Pass out a 3 x 5 card to each group; ask students to write their names (or group name, if they have one) on the card. As a group, have students choose their top two choices for possible treatments and write them on the card. If there are few possible treatments on the brainstorm list, you might wish to have each group write its top three choices to avoid duplicates. Emphasize cooperation...what will cooperation look like and sound like?

Cleanup (5 minutes)

Collect the worksheets and 3 x 5 cards. Put the worksheets in the class binder. Explain that each group will try a different treatment, so you will choose the treatments based on the top two (or three) choices from each group.

Collect donated Wild Cards or have students leave them in their desks overnight.

After class, use the 3 x 5 cards to assign treatments to the groups. Try to give each group one of their top choices.



My name: (Teacher Key)



STUDENT WORKSHEET SCAVENGER HUNT

1. Can you find both **invasive** and **native** plants at the field site? Draw each type of plant in the boxes below.

Invasive plant

This box was completed during the first lesson.

Native plant

2. Can you find two ways the school or community has tried to get rid of the invasive plants before? List two ways below. *This question was answered during the previous session.*

a. _____

b. _____

3. After getting a “teacher check,” try pulling up an invasive plant by hand. How easy is it to pull up this plant by hand? Report your findings below.

This question was answered during the previous session.

When you get to this point, work on the back of the worksheet INSIDE the classroom.

TURN THE PAGE





4. Why do we want to get rid of invasive plants at our field site?

So that native plants can be planted and won't be outcompeted by the invasives. This will provide better native wildlife habitat.

5. What are some other ways we might try to get rid of the invasive plants? List as many as you can think of below. (Hint: think about materials we could put on top of the invasive plants to try to kill them.)

– fabric

– aluminum foil

– newspaper

– wood

– black plastic

– rocks

– chemicals

– etc.





Creating Our Experiment

Lesson Plan

My Mulch Plot Plan Worksheet

**My Mulch Plot Plan Worksheet
(Teacher Key)**

Wild Cards

LESSON PLAN

CREATING OUR EXPERIMENT



Objectives

- Students will be able to define the terms **treatment**, **plot**, and **control**.
- Students will work cooperatively in groups in the field to set up their treatments.

Preparation (before class)

- Assign treatments to each group based on their 3 x 5 card choices from the previous class period.
- Mark plots with flagging or stakes.
- Recruit at least one parent volunteer or other aide to help. One adult needs to be in the classroom, while another goes outside with student groups. A call for parent volunteers could include asking them to bring supplies such as shovels, buckets, or gloves.
- If the site is not at the school, you may need to establish an outdoor working space where students will work on their worksheets while others are setting up treatments.

Materials

- Flagging or stakes
- Materials for each group's treatment (e.g., aluminum foil, black plastic garbage bags, tarp, newspaper, soil)
- Supplies for holding down the treatments (stakes, metal U-pins, etc.)
- Shovels
- Buckets
- Wild Cards (printed and cut)
- My Mulch Plot Plan worksheet—one for each student
- Field Policies
- Camera (optional)



Introduction for students (5 minutes)

Describe the field design to the class by drawing the plots on the board.

Introduce the vocabulary terms: **plot** and **control**.

- **Plot:** The space where you will test your treatment (Review the term **treatment**.)
- **Control:** A plot where you are not changing anything in your experiment. A control plot gives you something to compare the rest of your treatment plots to. The importance of the control plot will become more apparent as students collect data.



Student directions/Demonstrations of techniques (5 minutes)

Have students get into their groups. Pass out the My Mulch Plot Plan worksheets. Explain that groups will work on these worksheets in the classroom while one group at a time goes into the field to set up its treatment. Alternatively, the class could set up treatments together if you have enough aides and supplies.

Announce treatments assigned to each group, and show the class the materials you have brought (stakes, metal U-pins, shovels, buckets, etc.).

Explain that the first group setting up its treatment will need to answer the first two questions and get a teacher check before they go outside. Review the Field Policies.

Activity procedures (35 minutes)

Circulate around the room and help groups as they work on describing their Mulch Plot Plans and defining the vocabulary terms. Another adult should be outside helping groups set up their treatments. This field aide should hand out Wild Cards when appropriate. Take pictures if possible.

Closing activity/Assessments (10 minutes)

Review answers to worksheets and have groups that went outside share how the process went.

Cleanup (5 minutes)

Wash hands, if necessary. Collect worksheets and place in the class binder.

Collect donated Wild Cards or have students leave them in their desks overnight.



My name: _____ Today's date: _____

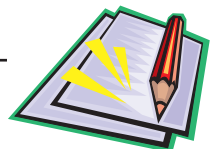
Names of other group members:

STUDENT WORKSHEET MY MULCH PLOT PLAN



1. Our plot will have _____
for the mulch treatment.

2. Write a plan for how you will set up your plot. Include the amount of the treatment you
will apply and how you will keep it in place.



Vocabulary review

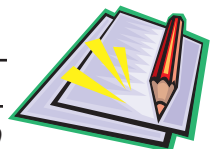


3. What is a **plot**?

4. What is a **treatment**?

5. What is a **control**?

6. The control plot will have _____ as its treatment. Why?



My name: _____ (Teacher Key) Today's date: _____

Names of other group members:

STUDENT WORKSHEET MY MULCH PLOT PLAN



1. Our plot will have _____ *List your treatment here.* _____
for the mulch treatment.
2. Write a plan for how you will set up your plot. Include the amount of the treatment you will apply and how you will keep it in place.

Write this as a procedure with steps that anyone could follow to set up the treatment. Students should see the available supplies before writing their plan and should mention those supplies in their plan.



Vocabulary review



3. What is a **plot**?

A plot is the space where you will test your treatment in the experiment.

4. What is a **treatment**?

A treatment is something that you are changing in the experiment. A treatment is also called a variable.

5. What is a **control**?

A control is a plot where you are not changing anything in the experiment. The control plot will be compared to your treatment plots.

6. The control plot will have _____ *nothing done to it* _____ as its treatment. Why?

The control plot has nothing done to it to provide an area of comparison when we look at the results of our treatments. If we are not sure if a plant in our treatment plot looks a little yellow, we can compare it to the plants in our control plot.



 <p>Wild card!</p> <p>Earned for outstanding behavior in the outdoor classroom</p> 	 <p>Wild card!</p> <p>Earned for outstanding behavior in the outdoor classroom</p> 
 <p>Wild card!</p> <p>Earned for outstanding behavior in the outdoor classroom</p> 	 <p>Wild card!</p> <p>Earned for outstanding behavior in the outdoor classroom</p> 
 <p>Wild card!</p> <p>Earned for outstanding behavior in the outdoor classroom</p> 	 <p>Wild card!</p> <p>Earned for outstanding behavior in the outdoor classroom</p> 



The Mystery Unfolds, Part I

Lesson Plan

**Describing Our Experiment
Worksheet**

**Describing Our Experiment
Worksheet (Teacher Key)**

Data Sheet

Data Sheet (Teacher Key)

Wild Cards

LESSON PLAN

THE MYSTERY UNFOLDS, PART I



Note: If the site is not at the school, students will need to collect data together during a visit to the site.

Objectives

- Students will be able to assign and record a rating for each treatment based on the scale described on their Data Sheet.
- Students will be able to make a prediction about which treatment they think will work best to get rid of the invasive plants.
- Students will work cooperatively in groups to create signs to label their treatments in the field.

Materials

- Clipboards—enough for each member of one group
- Describing Our Experiment worksheet—one for each student
- Data Sheet worksheet—one for each student
- A parent volunteer or other aide
- Construction paper
- Colored pencils
- Field Policies
- Wild Cards (printed and cut)
- Camera (optional)

Introduction for students (5 minutes)

Begin by quickly collecting any Wild Cards that students wish to donate for an Ice Cream Lab (if not collected the previous day). Have students get into their groups.

Explain that today students will collect the first data from their experiment. Pass out the Data Sheet worksheets. Review the field design and fill in the names of the treatments.

Pass out the Describing our Experiment worksheets. Go over questions. Some are review questions.



Student directions/Demonstrations of techniques (5 minutes)



Explain that one group at a time will go outside to rate the treatments, while everyone else works on:

- (1) coloring example blocks to describe each rating on their Data Sheet
- (2) answering the questions on the Describing Our Experiment worksheet
- (3) making signs for their treatments

When rating treatments outside, explain that groups will need to look in the center of the plots. Why would we not want to rate the edges?

Explain that the first group to go outside must first make its prediction on the Describing Our Experiment worksheet (question #2).

Activity procedures (35 minutes)

One group at a time will go with the other adult to the field site and rate *every* treatment. The field aide will pass out Wild Cards when appropriate.

Meanwhile, circulate the room and help groups as they work on their worksheets. (There will be additional time to work on the worksheets during the next lesson.)

After about 15 minutes, pass out the construction paper so groups can work on making a sign for their treatment. The finished sign should list their treatment, e.g., “Treatment: Aluminum foil.” Discuss how you can work with one or two other people to make a sign together. For groups that finish early, have one group work on a sign that says “Control Plot.” Other possible signs include “The Mulch Mystery” and the class or teacher’s name and grade. Take pictures if possible.

Closing activity/Assessments (10 minutes)

Share class ratings. Also share answers to “Describing Our Experiment.”

Cleanup (5 minutes)

Collect all worksheets and place in the binder. Collect signs.

Collect donated Wild Cards or have students leave them in their desks overnight.



My name: _____



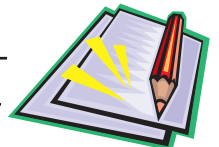
STUDENT WORKSHEET DESCRIBING OUR EXPERIMENT

1. What question are we asking in this experiment? (What are we trying to find out?)

2. What is your prediction in this experiment? (Which treatment do you think will work best?)

3. Draw a picture of *your group's* plot below.

4. What is *your group's* treatment?



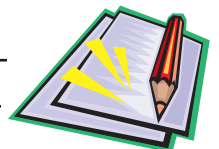


5. What other treatments are being tested by the class?

6. What is your **control**?

7. What is an **invasive plant**?

8. Why are we doing this experiment?



My name: (Teacher Key)



STUDENT WORKSHEET DESCRIBING OUR EXPERIMENT

1. What question are we asking in this experiment? (What are we trying to find out?)

What is the best way to get rid of invasive plants at our field site?

2. What is your prediction in this experiment? (Which treatment do you think will work best?)

I predict that the _____ treatment will work best to get rid of the invasive plants because it will block the sunlight from the plants.

3. Draw a picture of *your group's* plot below.

4. What is *your group's* treatment?

List your group's treatment.





5. What other treatments are being tested by the class?

List all other treatments being used.

6. What is your **control**?

*It is the plot that has **NOTHING** done to it.*

7. What is an **invasive plant**?

An invasive plant is a plant that did not originally grow in this area and grows so quickly that it outcompetes other plants.

8. Why are we doing this experiment?

To solve our mystery and provide our school or community with a good way to get rid of the invasive plants in our field site, so that we can successfully grow native plants for native wildlife to enjoy!



My name: _____ Today's date: _____



STUDENT WORKSHEET DATA SHEET

Below is a picture of the area where the class plots are set up. Label each treatment, and record the rating for each plot.

Treatment:
Rating:

Record any other observations here:

Treatment:	Treatment:	Treatment:	Treatment:	Treatment:
Rating:	Rating:	Rating:	Rating:	Rating:

Plant growth rating

- 0 = ALL plants are completely dead and **brown**.
- 1 = ALL plants are **yellow**.
- 2 = There are MORE **yellow** plants than **green** plants.
- 3 = There is an EQUAL number of **yellow** and **green** plants.
- 4 = There are MORE **green** plants than **yellow** plants.
- 5 = ALL plants are **green**.

0	1	2	3	4	5
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My name: _____ (Teacher Key) Today's date: _____



STUDENT WORKSHEET DATA SHEET

Below is a picture of the area where the class plots are set up. *You may need to change the drawing based on the design of your plots.*

Label each treatment, and record the rating for each plot.

Treatment:
Rating:

Record any other observations here. *Examples:*

Weather (was it hot or cold, rainy or dry?)

Is the treatment wet or dry?

Did any of the treatments blow away?

Treatment:	Treatment:	Treatment:	Treatment:	Treatment:
Rating:	Rating:	Rating:	Rating:	Rating:

Plant growth rating

Students should color the boxes below with brown, yellow, and green pencils to illustrate each rating.

0 = ALL plants are completely dead and **brown**.

1 = ALL plants are **yellow**.

2 = There are MORE **yellow** plants than **green** plants.

3 = There is an EQUAL number of **yellow** and **green** plants.

4 = There are MORE **green** plants than **yellow** plants.

5 = ALL plants are **green**.

0	1	2	3	4	5
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 Wild card! Earned for outstanding behavior in the outdoor classroom 	 Wild card! Earned for outstanding behavior in the outdoor classroom 
 Wild card! Earned for outstanding behavior in the outdoor classroom 	 Wild card! Earned for outstanding behavior in the outdoor classroom 
 Wild card! Earned for outstanding behavior in the outdoor classroom 	 Wild card! Earned for outstanding behavior in the outdoor classroom 



The Mystery Unfolds, Part II

Lesson Plan

Data Sheet

Data Sheet (Teacher Key)

Wild Cards

LESSON PLAN

THE MYSTERY UNFOLDS, PART II



Note: If the site is not at the school, students will need to collect data together during a visit to the site.

Objectives

- Students will be able to assign and record a rating for each treatment based on the scale described on their Data Sheet.
- Students will be able to define the vocabulary terms without looking at the definitions (**plot, treatment, control, native plant**).

Preparation (before class)

- Laminate the students' signs and attach them to wooden stakes, such as paint sticks from a local paint store.

Materials

- Prizes for the group quiz. These can be the same prizes as those used for earning Wild Cards, or Wild Cards can be prizes for the quiz.
- Any past worksheets that have not yet been completed
- Clipboards—enough for all members of one group
- New Data Sheet worksheets—one for each student
- Colored pencils
- A parent volunteer or other aide
- Laminated, staked signs ready for groups to take outside
- Field Policies
- Wild Cards (printed and cut)
- Camera (optional)

Introduction for students (5 minutes)

Begin by quickly collecting any Wild Cards that students wish to donate for an Ice Cream Lab (if not collected the previous day). Have students get into their groups.

Explain that students will be collecting more data and pass out new Data Sheets. Pass out any previous worksheets that are incomplete. (There will likely be lots of these!)



Student directions/Demonstrations of techniques (5 minutes)

Groups will take turns going outside as the rest of the groups work on unfinished worksheets. When groups are outside, they will color the rating boxes on their new Data Sheets. Review the rating scale on the Data Sheets.



Activity procedures (30 minutes)

One group at a time will go with the other adult to the field site and rate *every* treatment. They will also place their laminated sign in front of their plot. The field aide will pass out Wild Cards when appropriate. Take pictures if possible.

Meanwhile, circulate the room and help groups as they finish their worksheets. Students that finish early can be paired with those who are struggling and can help them finish their worksheets.

After all groups have completed their ratings (this will go more quickly than the first time), reconvene as a class in the classroom. Collect all worksheets.

Closing activity/Assessment (15 minutes)

Explain that there will be a group quiz. Each group will work together to answer questions, and they can earn prizes (or Wild Cards) for correct answers. Have each group take out one sheet of notebook paper and designate a recorder.

Explain that the question will be given to the entire class and each group will have 2 minutes to quietly talk about the answer and write it down.

After 2 minutes, each group will give its answers. If correct, the group will get a small prize (e.g., a sticker or Wild Card). Questions to ask: What is a treatment? Control? Plot? Native plant? Why are we doing this experiment? What is the mystery we are trying to solve?

Cleanup (5 minutes)

Throw away any prize wrappers. Place all worksheets in the binder.

Collect donated Wild Cards or have students leave them in their desks overnight.



My name: _____ Today's date: _____



STUDENT WORKSHEET DATA SHEET

Below is a picture of the area where the class plots are set up. Label each treatment, and record the rating for each plot.

Treatment:
Rating:

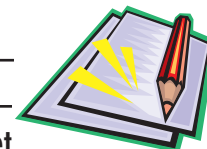
Record any other observations here:

Treatment:	Treatment:	Treatment:	Treatment:	Treatment:
Rating:	Rating:	Rating:	Rating:	Rating:

Plant growth rating

- 0 = ALL plants are completely dead and **brown**.
- 1 = ALL plants are **yellow**.
- 2 = There are MORE **yellow** plants than **green** plants.
- 3 = There is an EQUAL number of **yellow** and **green** plants.
- 4 = There are MORE **green** plants than **yellow** plants.
- 5 = ALL plants are **green**.

0	1	2	3	4	5
---	---	---	---	---	---



My name: _____ (Teacher Key) Today's date: _____



STUDENT WORKSHEET DATA SHEET

Below is a picture of the area where the class plots are set up. *You may need to change the drawing based on the design of your plots.*

Label each treatment, and record the rating for each plot.

Treatment:
Rating:

Record any other observations here. *Examples:*

Weather (was it hot or cold, rainy or dry?)

Is the treatment wet or dry?

Did any of the treatments blow away?

Treatment:	Treatment:	Treatment:	Treatment:	Treatment:
Rating:	Rating:	Rating:	Rating:	Rating:

Plant growth rating

Students should color the boxes below with brown, yellow, and green pencils to illustrate each rating.

0 = ALL plants are completely dead and **brown**.

1 = ALL plants are **yellow**.

2 = There are MORE **yellow** plants than **green** plants.

3 = There is an EQUAL amount of **yellow** and **green** plants.

4 = There are MORE **green** plants than **yellow** plants.

5 = ALL plants are **green**.

0

1

2

3

4

5



 Wild card! Earned for outstanding behavior in the outdoor classroom 	 Wild card! Earned for outstanding behavior in the outdoor classroom 
 Wild card! Earned for outstanding behavior in the outdoor classroom 	 Wild card! Earned for outstanding behavior in the outdoor classroom 
 Wild card! Earned for outstanding behavior in the outdoor classroom 	 Wild card! Earned for outstanding behavior in the outdoor classroom 



The Mystery Unfolds, Part III

Lesson Plan

Data Sheet

Data Sheet (Teacher Key)

Wild Cards

LESSON PLAN

THE MYSTERY UNFOLDS, PART III



Note: If the site is not at the school, students will need to collect data together during a visit to the site.

Objectives

- Students will be able to assign and record a rating for each treatment based on the scale described on their Data Sheet.
- Students will create title cards to use on a poster describing their class project.
- Students will be able to use their class data to describe the solution to the Mulch Mystery.

Materials

- Clipboards—enough for all members of one group
- New Data Sheet worksheets—one for each student
- A parent volunteer or other aide
- Construction paper cut into rectangles
- Markers or colored pencils
- Rulers
- Pencils
- One trifold cardboard display board for the class poster
- Field Policies
- Wild Cards (printed and cut)
- Camera (optional)

Introduction for students (5 minutes)

Begin by quickly collecting any Wild Cards that students wish to donate for an Ice Cream Lab (if not collected the previous day). Have students get into their groups.

Explain that students will collect a third set of data, and pass out new Data Sheets.

Explain that the class will create a poster to share their experiment; show the class the display board.

Student directions/Demonstrations of techniques (5 minutes)

When groups are not outside collecting data, they will make title cards for the poster on pieces of construction paper. These will be glued to the poster with examples of their work illustrating each of the topics.



Activity procedures (30 minutes)



Pass out construction paper rectangles. Assign words to each group. Words to use on the poster title cards are: “Question,” “Our Plan,” “Prediction,” “Title,” “The Mulch Mystery,” “Data,” “Conclusion,” and “What We Recommend.” Although everyone in a group will have the same words, each student should work on a title card individually. The best cards will be chosen for the poster, so emphasize neat work using a ruler and starting in pencil.

One group at a time will go with the other adult to the field site and rate every treatment. The field aide will pass out Wild Cards when appropriate. Take pictures if possible.

Circulate the room and help groups as they work on their title cards. After all groups have completed their ratings, reconvene as a class in the classroom.

Closing activity/Assessment (15 minutes)

As a class, discuss which treatment received the lowest rating (meaning it did the best job getting rid of the invasive plants). Have students take out a piece of notebook paper and work individually to write a recommendation to the school or community (depending on where the field site is located). Students should include what they recommend for getting rid of the invasive plants and how the recommendation can be implemented. Remind the class to write neatly and in complete sentences. Choose a good answer from this exercise to use under the “What We Recommend” section of the poster.

Cleanup (5 minutes)

Collect all title cards. Put away markers, rulers, and other supplies. Collect data sheets and put in the binder.

Collect donated Wild Cards or have students leave them in their desks overnight.



My name: _____ Today's date: _____



STUDENT WORKSHEET DATA SHEET

Below is a picture of the area where the class plots are set up. Label each treatment, and record the rating for each plot.

Treatment:
Rating:

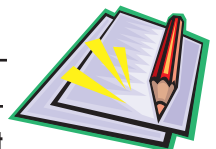
Record any other observations here:

Treatment:	Treatment:	Treatment:	Treatment:	Treatment:
Rating:	Rating:	Rating:	Rating:	Rating:

Plant growth rating

- 0 = ALL plants are completely dead and **brown**.
- 1 = ALL plants are **yellow**.
- 2 = There are MORE **yellow** plants than **green** plants.
- 3 = There is an EQUAL number of **yellow** and **green** plants.
- 4 = There are MORE **green** plants than **yellow** plants.
- 5 = ALL plants are **green**.

0	1	2	3	4	5
---	---	---	---	---	---



My name: _____ (Teacher Key) Today's date: _____



STUDENT WORKSHEET DATA SHEET

Below is a picture of the area where the class plots are set up. *You may need to change the drawing based on the design of your plots.*

Label each treatment, and record the rating for each plot.

Treatment:
Rating:

Record any other observations here. *Examples:*

Weather (was it hot or cold, rainy or dry?)

Is the treatment wet or dry?

Did any of the treatments blow away?

Treatment:	Treatment:	Treatment:	Treatment:	Treatment:
Rating:	Rating:	Rating:	Rating:	Rating:

Plant growth rating

Students should color the boxes below with brown, yellow, and green pencils to illustrate each rating.

0 = ALL plants are completely dead and **brown**.

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3 = There is an EQUAL number of **yellow** and **green** plants.

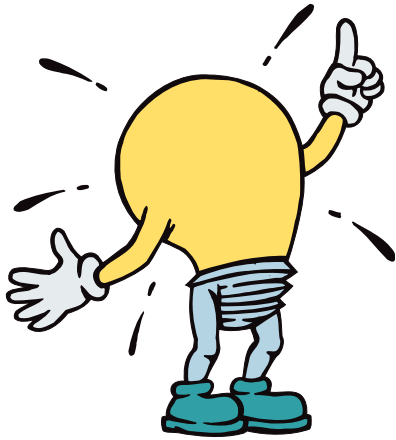
4 = There are MORE **green** plants than **yellow** plants.

5 = ALL plants are **green**.

0	1	2	3	4	5
---	---	---	---	---	---



 <p>Wild card!</p> <p>Earned for outstanding behavior in the outdoor classroom</p> 	 <p>Wild card!</p> <p>Earned for outstanding behavior in the outdoor classroom</p> 
 <p>Wild card!</p> <p>Earned for outstanding behavior in the outdoor classroom</p> 	 <p>Wild card!</p> <p>Earned for outstanding behavior in the outdoor classroom</p> 
 <p>Wild card!</p> <p>Earned for outstanding behavior in the outdoor classroom</p> 	 <p>Wild card!</p> <p>Earned for outstanding behavior in the outdoor classroom</p> 



The Mystery—Solved!

Lesson Plan
Wild Cards

LESSON PLAN

THE MYSTERY—SOLVED!



Note: If the class wishes to keep its treatments visible for a school presentation or to show parents, students can work on their poster without removing the treatments. The section of this lesson that involves removing the ineffective treatments and applying the “winning” treatment can be saved for a later date.

Note: Italicized words are potential script for the teacher.

Objectives

- Students will work cooperatively in groups at the field site to remove the ineffective treatments and apply the winning treatment.
- Students will be able to list at least one reason why their treatment did or did not work well.

Preparation (before class)

- Choose title cards and work from previous worksheets to create the poster. You may want to plan the layout ahead of time, and you may wish to type out answers from worksheets to make the poster look consistent. Alternatively, you could spend an extra class period with your students working on the poster.
- Print photos of the plots (if applicable).

Materials

- Trifold display board
- Title cards for the poster
- Other work to use on the poster
- Photos of the plots (if applicable)
- Prizes for Wild Card holders
- A supply of the “winning” treatment to cover all plots (For example, if the winning treatment is newspaper, you could send notices home with the students to bring in newspaper.)
- A parent volunteer or other aide
- Wild Cards (printed and cut)
- Field Policies

Introduction for students (5 minutes)

Begin by quickly passing out prizes for those who turn in their Wild Cards, or place Wild Cards in a bag if they are donated for an Ice Cream Lab. (If there is a shortage of time, you can collect Wild Cards and record the number



of Wild Cards for each student; hand out prizes at a later date.) Instructions for an Ice Cream Lab are available at <http://www.teachnet.com/lesson/science/icecream051999.html>



Have students get into their groups. Explain that they will finish their project by making a class poster and removing the treatments that did not work. *The goal of this project was to determine the best solution to the mystery to help get rid of the invasive plants...so now we want to apply our best treatment to the entire field plot area.*

Student directions/Demonstrations of techniques (10 minutes)

Groups will take turns going outside to remove their treatment and apply the winning treatment to their plot. The group with the most successful treatment won't remove it. Instead they can apply their treatment to the control plot.

When not working outside, explain that students will be:

- (1) answering the following questions on a piece of paper as a group (write the questions on the board):
 - Why do you think your treatment did or did not work well?
 - If you were to use your treatment again, how would you change your plan? (Would you apply thicker layers? Would you use different tools?)
- (2) gluing items to the poster (for example, title cards, selected work, pictures, examples of treatments, and any other items that are appropriate; students can cut out pieces of their treatments to create a small-scale illustration of the field plots)

Activity procedures (30 minutes)

One group at a time will go with the other adult to the field site to remove their treatment and apply the winning treatment to their plot. The field aide will pass out Wild Cards when appropriate.

Circulate the room and help groups as they answer the questions and work on the poster. You may wish to call individual groups to come up to the poster to work on one section at a time. Add group responses to today's questions to the poster.

Closing activity/Assessment (10 minutes)

Share the poster together as a class! Discuss options for sharing the poster with others in the school or community and/or giving a tour of the field site.

Cleanup (5 minutes)

Clean up any supplies.



 Wild card! Earned for outstanding behavior in the outdoor classroom 	 Wild card! Earned for outstanding behavior in the outdoor classroom 
 Wild card! Earned for outstanding behavior in the outdoor classroom 	 Wild card! Earned for outstanding behavior in the outdoor classroom 
 Wild card! Earned for outstanding behavior in the outdoor classroom 	 Wild card! Earned for outstanding behavior in the outdoor classroom 

