



**Grade:** 9 to 12

**Length:** variable

**Subjects:** life science, math

**Topics:** seed dispersal

## Objectives

Exercises in this lesson help students achieve the following objectives:

- Understand how wind disperses weed seeds
- Design weed seeds for dispersal by the wind
- Quantify seed dispersal by the wind through experimentation
- Summarize and analyze data in graphical form

## Introduction

Weeds have developed excellent adaptations to aid in dispersal of their seeds. A weed's ability to readily disperse its seeds contributes to the weed problem. Wind plays an important role in the dispersal of many of the most problematic weed seeds. Students will design weed seeds and test the seeds to determine how long they remain aloft and how far they travel by wind.

For best results, conduct the *Activity* in late summer or early fall when most weeds have gone to seed. Before teaching this lesson, read the entire lesson and make sure all materials are available.

## Background

Plants are unable to thrive when they live too close to other plants. Plants compete for nutrients in the soil, sunlight, and other resources. Plants must disperse to share resources, otherwise they risk extinction by crowding out each other. **Competi-**

**tion** among plants of the same species is even more pronounced because these plants compete within their own niche.

Weeds have developed excellent seed **dispersal** techniques. Some weeds, such as burdock and hound's tongue, produce burs with hooks that attach to fur and clothing. Animals or humans then disperse the seeds. Leafy spurge produces capsules with a spring-like mechanism that launches its seeds up to ten feet from the parent plant.

Tansy, purple loosestrife, and other weeds disperse their seeds through water. Some seeds, like those of the Brazilian pepper tree in Florida, pass through the digestive system of birds and mammals unharmed. These seeds are dispersed when the animal eats the weed and moves on before defecating.

Wind disperses the seeds from many weeds. Some plants, such as dandelions, western salsify, and Canada thistle, have developed seeds with a parachute, which enables the seeds to disperse over great distances. Some invasive tree species have developed seeds with wings, similar to those found on a maple tree. These seeds disperse relatively short distances from the parent tree. A removable sheath encloses tumbling mustard seeds. The parent plant dries, breaks off, and tumbles across the ground as it's pushed by wind. As the plant moves along, the sheath falls off, and the seeds inside disperse over miles of land.

Two important factors determine how effectively wind disperses weed seeds: time aloft and distance traveled. Shape, mass or density, and wind speed determine the distance a seed can be dispersed.

## Preparation

### Materials

- copies of the *Amazing Travelers* worksheet
- Have available one copy for each student.


- collection of assorted weed and plant seeds

**1** Give each student a copy of the *Amazing Travelers* worksheet, which lists weeds that have unusual dispersal adaptations. Discuss information about weed seeds. (See *Background* earlier in this lesson.)

**2** See the charts below for samples of weed seeds to have available so students can view seed adaptations.

Have available a seed from this plant:	To show this adaptation:
bitter nightshade	red berries that attract birds
mesquite	seed pods that attract animals
curly dock or purple loosestrife	floating characteristics of seeds
houndstongue or burdock	hitch-hiking capabilities of seeds

Have available a seed from this plant:	To show these adaptations for dispersal by wind:
salsify, dandelion, milkweed	parachute
tumbling mustard	removable sheath and stem that breaks off and tumbles
green ash, maple, box elder	wings
cattails	tufted seeds

 If actual weed-seed samples are unavailable, use photos from reference books, or use your favorite search engine to search for images on the Internet.

**3** Explain that students will design a seed and test the seed to determine the amount of time it remains aloft and how far it travels by wind.

## Activity

### Materials

- copies of the *Wind Dispersal* worksheet – Have available one copy for each student.
- one copy of the *Seed Test Results* chart
- measuring tape

- portable fan
- stopwatch
- wind meter
- sunflower seeds – Have available at least one seed for each student.
- pipe cleaners, tissue paper, and other materials to construct a seed
- graph paper

**1** After students have viewed the weed seed samples, give each student a copy of the *Wind Dispersal* worksheet and explain the exercise to students. To motivate students, tell them that whomever builds the best seed will receive extra credit or have no homework for one night.

**2** Distribute materials and ask students to design one seed for dispersal by the wind. Students will use the sunflower seed as the basis for their creation.

**3** Set up the window fan and prepare the measuring tape. Use a wind meter to check the approximate speed of the wind.

**4** Have students drop their seed in front of the window fan three times; measure and record the distance the seed travels each time. Calculate the average distance traveled.

**5** Record the results on the *Seed Test Results* chart.

**6** Have students drop the same seed from a height of two meters, three times. Using a stopwatch, determine the time aloft. Record the time aloft each time. Calculate the average time aloft.

**7** Record the results on the *Seed Test Results* chart.

**8** After students have tested all of their seeds and recorded results on the classroom chart, ask students to graph the results. Determine if there is a correlation between time aloft and distance traveled.

## Conclusion and Evaluation

- Conclude the lesson by having students answer the questions under Evaluating a Seed on the *Wind Dispersal* worksheet.
- Evaluate students based on the seed they created and their answers to the questions on the worksheet.

## Independent Practice and Related Activities

- Set up a similar activity using water as the dispersing agent. When students design their seed, have them take into account what will happen to the seed when it becomes waterlogged.

## Resources

National Botanical Association. <http://www.Mcintosh.botany.org/bsa/misc/Mcintosh>

## Vocabulary

competition, dispersal

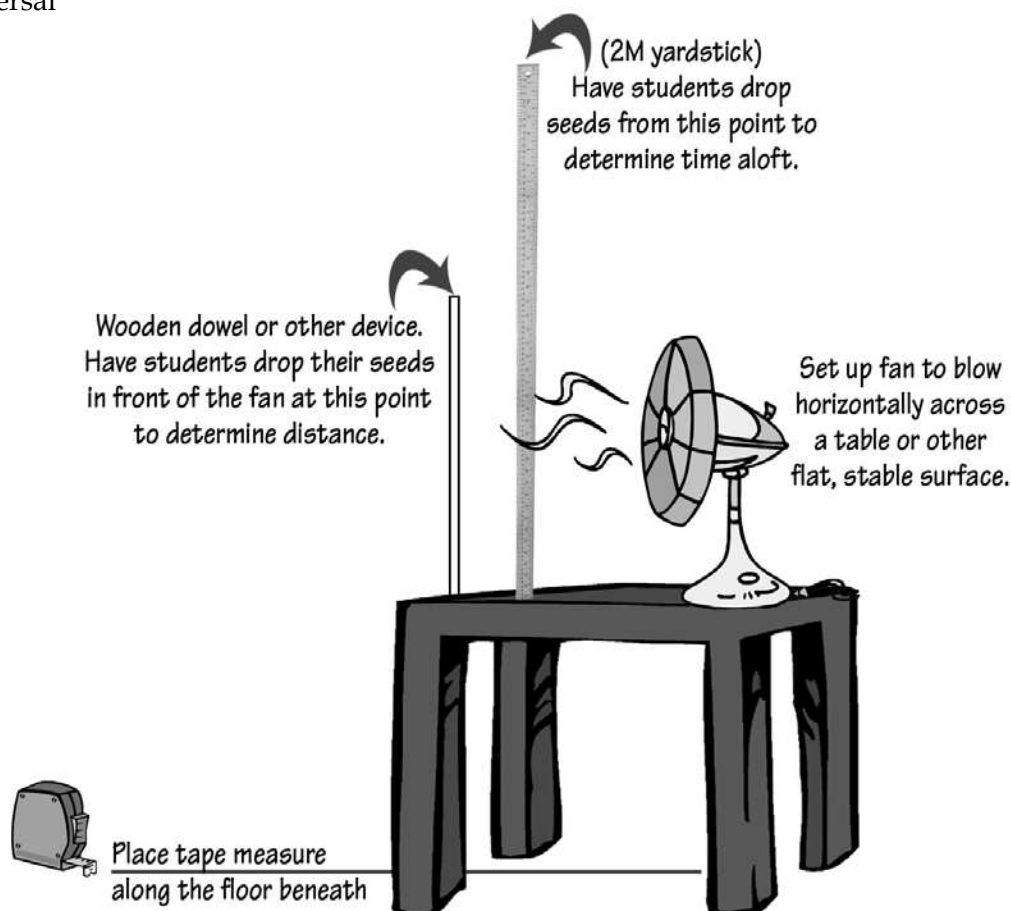
## National Science Education Standards

As a result of activities in grades 9 to 12, students should develop abilities in and an understanding of the following areas:

**Science as Inquiry – Content Standard A:** scientific inquiry

**Life Science – Content Standard C:** biological evolution, interdependence of organisms, behavior of organisms

This lesson adapted from *Sailing Seeds: An Experiment in Wind Dispersal*, by the National Botanical Association. Original lesson developed and edited by Amy Russell and Steven Rice, Department of Biological Sciences, Union College, Schenectady, NY.



# Weed Warrior Worksheet

## Amazing Travelers

Weeds have developed amazing adaptations to help disperse their seeds. The following examples explain some of the more unusual adaptations.

### Colorful berries

Many weeds, such as bitter nightshade, produce red berries. The red color of the berries is especially beneficial for seed dispersal, since red is a color that birds can see and are attracted to. These berries usually have a chemical that causes diarrhea in animals. After eating the seeds, the birds get a mild case of diarrhea, and they expel the seeds before their digestive juices damage them.

### Thin stem

The tumbling mustard plant develops a stem that is relatively thin at a point just above the ground. The stem is filled with fluid, which keeps the stem rigid while the plant is growing. At the end of the plant's life, the fluid dries, and the thin portion of the stem becomes very weak. When the fall winds blow, the stem breaks off just above the ground and the plant tumbles across the landscape.

### Seed sheath

The seeds of the tumbling mustard are contained within a sheath that protects the seeds during development. When the seeds are fully developed, the protective sheath becomes "spring loaded." As the dried plant tumbles across the landscape, it comes in contact with the ground. When the sheath

touches the ground, it shoots away from the plant and frees the seeds to scatter.

### Hitchhiker seeds

Hound's tongue and burdock are two examples of plants that disperse their seeds by hitching rides on unsuspecting carriers. The seeds are surrounded by hair-like bristles that become entangled in the fur or clothing of the carrier. One theory proposes that the idea behind the development of velcro came from investigating the seeds of hound's tongue.

### Exploding seed capsules

Wood sorrel and leafy spurge have both developed dispersal techniques that involve exploding seed capsules. When fully ripe, the seed capsules of these two plants explode. The explosion ejects the seeds up to 15 feet from the parent plant. In terms of plant dynamics, 15 feet is a significant distance.



## Weedy Definitions

**competition** – the struggle between organisms of the same or different species for limited resources such as food or light

**dispersal** – the natural distribution of plant seeds over a wide area by various methods



# Weed Warrior Worksheet

## Wind Dispersal Page 1 of 2

### Creating and Testing A Seed

Your job is to design a seed that can be dispersed very effectively by wind.

#### Materials

- two sunflower seeds
- 1 pipe cleaner
- tissue paper, clear tape
- stopwatch
- large fan

**1** After examining the samples of weed seeds that your teacher has provided, decide what size and shape to make the seed to achieve maximum time aloft and maximum distance traveled.

**2** After deciding on an efficient design, build a seed using the materials provided.

**3** Drop the seed in front of a large window fan and measure the distance it travels. Repeat three times, record the results below, and calculate the average. Record the average on the *Seed Test Results* chart.

Distance seed traveled:      Trial 1      \_\_\_\_\_  
   Trial 2      \_\_\_\_\_  
   Trial 3      \_\_\_\_\_

Average distance traveled:      \_\_\_\_\_

**4** Drop the seed from a height of two meters and record the time aloft. Repeat three times, record the results below, and calculate the average. Record the average on the *Seed Test Results* chart.

Time aloft:      Trial 1      \_\_\_\_\_  
                                 Trial 2      \_\_\_\_\_  
                                 Trial 3      \_\_\_\_\_

Average time aloft:      \_\_\_\_\_



## Wind Dispersal Page 2 of 2

## Evaluating a Seed

- 1 Explain how you designed your seed and why you chose this design.
- 2 Describe the design of the seed(s) that traveled the farthest and stayed aloft the longest. Was it built stronger and lighter? How much paper or tape did this design have?
- 3 Did it matter how the student dropped the seed in front of the fan?
- 4 What are the advantages and disadvantages of wind dispersal?
- 5 Is wind dispersal more likely to occur in dry or fleshy seeds?

## Seed Test Results

### Distance Traveled

Student	Avg. Dist.	Student	Avg. Dist.

### Time Aloft

Student	Avg. Time	Student	Avg. Time

