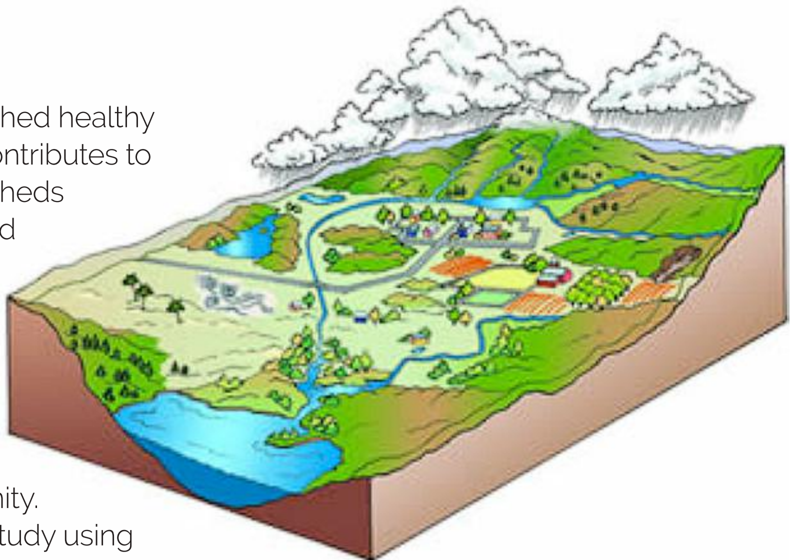
Grades: **Adaptable**

WYLAND FOUNDATION®

by Jill Rivero, MA • Wyland Foundation Educator

Waterway Report Card
"What is a *Healthy* Watershed?"



OBJECTIVE:

Students will learn about what makes a watershed healthy or unhealthy. Students will learn about what contributes to the health of species living in or around watersheds and what they can do to help keep a watershed cleaner and healthier, from the tiniest of species to the largest.

PURPOSE:

To educate students on population ecology by sampling the number of arachnids living in and around a waterway within their community. Students will conduct a population sampling study using the "sample method" across a mega-transect, to help illustrate the far-reaching effects of how the food chain in an ecosystem relies on its smallest parts. In sum, students will learn that healthy waterways make healthy watersheds. Students will also learn what makes a watershed and its waterways unhealthy.

Major Watersheds of the United States

VOCABULARY:

Waterway, Watershed, Ecosystem, Rachel Carson, "Silent Spring", Pesticides, Bio-accumulation, DDT, Population Ecology, Sample Method, Mega-transect

TIME NEEDED:

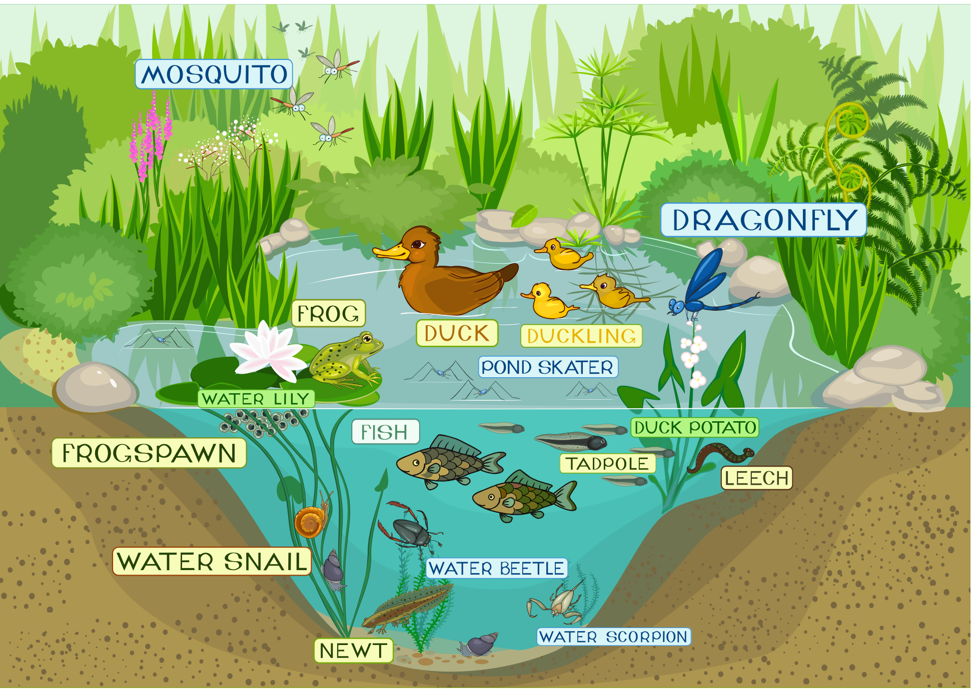
2 hour and 30 minutes

(1 hour Class Prep, Background Research and Video Viewing; 1 and 1/2-hour Lab Activity)

WYLAND FOUNDATION®

CLASS PREP AND BACKGROUND RESEARCH:

1. Ask students students to write down on a piece of paper or a sticky note what they think the word "ecosystem" means. Then ask them to turn the paper over and ask them to write down silently what they think "ecology" means. Then have students pair up with another student and pair-share with each other what they wrote down.



2. Next, in a class setting or in small groups, have students volunteer to share what they learned from each other or if there are any questions about what ecology or ecosystem might mean. Go over the closest answers with the class as examples. Discuss next what "water ecosystem" might mean? Does your particular region where you live have any water ecosystems? Where are they located? If there are none, why? Where could one possibly be if it rained a lot for a week straight?

3. Then, solicit from students what they think a "population" is? Have students ever hear of counting a population of a species before? What about the study of number of a population or the health of a population to see if an ecosystem is healthy? What experiences have students had with studying animals or insects? Have students discuss their answer first with a classmate, limiting the discussion to one minute per student, and switching to allow the other a chance to speak as well for one minute.

4. Finally, have students watch the videos below, about the famous scientist, Rachel Carson, and her book, "Silent Spring", and discuss together as a class afterwards what they learned about pesticides, like "DDT", and the management of healthy water ecosystems, in particular. Show students the questions below for them to try and answer as they watch the videos. Then allow students to discuss their answers afterwards in small groups, and then together as a whole class.

- Who is Rachel Carson? What important discovery did she make?
- What is a pesticide?
- What is DDT?
- What is Bio-accumulation?
- Should pesticides be sprayed on plants to kill insects?
- How do pesticides impact the health of a water ecosystem?

WYLAND FOUNDATION®

CLASS VIDEOS:

https://www.youtube.com/watch?v=uhiCORNRgzA
"An Introduction to Rachel Carson's Silent Spring - A Macat Geography Analysis" (3:24 min)

https://www.youtube.com/watch?v=Ipbc-6IvMQI
"Pesticides - DDT - Rachel Carson - Silent Spring" (10:58 min)

https://www.youtube.com/watch?v=QOrVotzBNto
"What Is a Watershed?" (1:17 min)

https://www.youtube.com/watch?v=2pwW2rlGla8
"Watersheds!" (5:21 min)

https://www.youtube.com/watch?v=dUlAANVBYHM
"USDA Watershed Learning Animation - For ASI Communications by VFX Direct" (3:10 min)

https://www.youtube.com/watch?v=wZGzqDfolks
"Ecosystems on the Edge: Stream Health" (8:03 min)

5. Read the Introduction section below together as a class. Ask students what does it mean to count the number of insects in or near a waterway and how would that help with management of a healthy river? What are methods in your region for keeping your rivers or waterways clean? Finally, why would a waterway, like a river, need managing? Why is it good for humans to have healthy rivers, waterways and watersheds?

6. Finally, have students look up pictures on their IPADS or on a computer of well-known waterways, rivers, or of watersheds that have been affected by pollution, such as pesticides or other chemicals, and print pictures of them. Hang them in a central area of the classroom along with their location and local name.

INTRODUCTION:

The health of a watershed depends on the health of every waterway leading into it. A watershed can be considered healthy if species identification and diversity are abundant within the waterways that make up, or lead to, a watershed. Lack of diversity and of the number of organisms that make up the basis of a food chain can have far-reaching effects within an ecosystem of a watershed and its waterways. If a species cannot survive due to toxic chemicals or pesticides coming from farms or factories that have gotten into the water, then the food chain can be disrupted, leading to an imbalance in nature. If the basis of a food chain, such as insects, are destroyed, then creatures that feed on these insects can go hungry, become sick, or even die. Even worse, if the insects survive and carry the poisonous chemicals within their bodies, then the creatures that in turn feed on them can also become carriers of those toxic chemicals for creatures higher up on the food chain that in turn feed on them. This effect is called bio-accumulation, and can have devastating consequences for an ecosystem. When a food chain becomes unbalanced or the creatures within the food web of a water ecosystem become sick with toxins, then a rupture in the balance of that ecosystem has occurred, and it can take years to re-establish the health of the waterways ultimately feeding into a larger watershed.

WYLAND FOUNDATION®

NAME: ______________________ DATE: ____________ PERIOD: __________

"Watershed Management: Spooky Spider Seeking Using the Sample Method"

LAB ACTIVITY

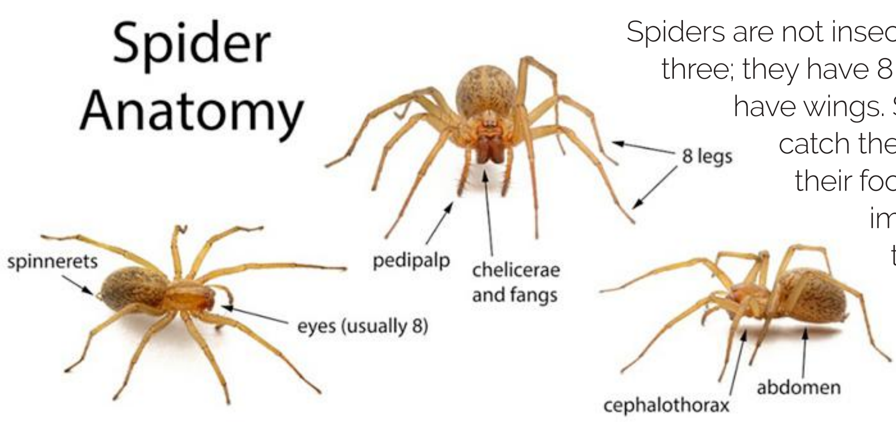
Conducting a Mega-Transect of a Waterway

PROBLEM:
Proving or disproving a spooky theory: Are Spiders always within 8 feet of us, even near water?

PURPOSE:
To conduct a spider population count next to a waterway, using metric mega-transects and population sampling techniques to see if the waterway is healthy. (The presence of spiders indicates a healthy ecosystem.)

INTRODUCTION:

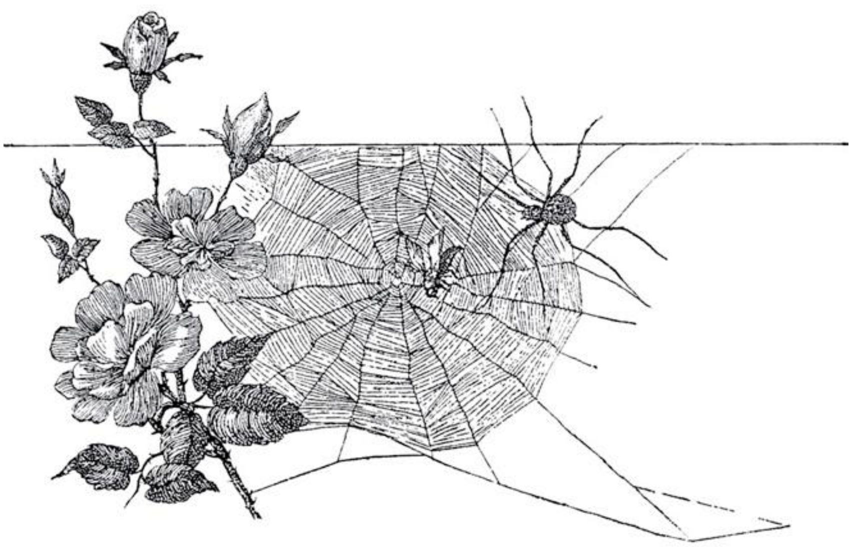
Spiders are one of the most successful predators on earth. Spiders originated on this planet more than 350 million years ago and today, there are over 38,000 species of spiders. Aside from the poles, spiders have been found on almost every portion of our globe. It is said that at any moment in time, there is a spider within 8 feet of you!



Spiders are not insects. They have two body parts rather than three; they have 8 legs rather than 6; and spiders never have wings. Spiders use many different methods to catch their prey, and amazingly, cannot chew their food. They must first catch their victims and immobilize them, stab them with venom to stop them from moving and wait while the animal's insides digest into soup, so that the spider can drink its nutrition, rather than eat them. A spider's 8 eyes are incredibly inefficient at seeing clearly, so spiders must rely on their other senses to respond to touch, vibrations and sounds. They are covered in hairs that help them sense movement, and contain organs on their feet that can smell and taste just through stepping on its own web. Their exoskeleton protects them from most harm, and spiders shed their old skin as they grow during a very stressful process called molting.

The most successful hunting tactic a spider possesses is its ability to spin silk threads, which can be strong, yet flexible and sticky. These threads shoot from an area on the abdomen called a spinneret, and can be woven into webs, or used to wrap egg sacs or draglines that the spider can use to walk along as it moves. The silk is stronger than steel, and can stretch to twice its own length. And it is recyclable, as the spider will eat it owns silk when it is finished with it. Other spiders have great hunting tactics without using silk webs, such as spitting venom, jumping (the jumping spider can jump 20 times their length) or fishing (fishing spiders can run on water to catch prey), or possess special fangs that bite down like a snake's (tarantulas).

The truth is, spiders are necessary for an ecosystem to be considered healthy. They eat insects and rarely bite humans. They are usually shy and only fight back when disturbed. Some female spiders will kill and eat the male after mating and can lay up to 2,000 eggs, which will then hatch and be carried away in a display known as "parachuting". Baby spiders become "aerial plankton" by throwing out a tiny amount of silk that is enough to lift them into the skies by wind drafts to be carried elsewhere, ensuring their survival, and increasing biodiversity in the environment.



HYPOTHESIS:

If we conduct a Mega-Transect on or near a waterway, then we predict that we will count ____________ of spiders in our sample plot.

MATERIALS:

Meter stick, Sample Plot, Calculator, Magnifying lens, Petri dish, Coverslip, Stereomicroscope (optional)

WYLAND FOUNDATION®

PROCEDURE:

1. Break class into 4-5 groups of 4 students each. Assign each group a number between 1-5.

2. Obtain a meter stick, petri dish, magnifying lens, and a calculator.

3. Determine a waterway near school (or the community that you live in) to be the boundary for your Mega-Transect (that will contain all of your sample plots).

4. Next, have your teacher determine the boundaries. Normally, a large enough area would be around 1,000 feet by 1,000 feet, including creek beds, and one side of the border should be the waterway itself. (If no river or creek is available, try a wetland area, estuary, or even a dry river bed.)

5. Assign each group a random spot within this boundary to conduct their spider seeking using the sample method.

6. Have students plot out a space 8 feet by 8 feet (convert to metric – one meter stick equals ______ feet; 8 feet = ________ meters?)

7. Students are to now search with the magnifying lens and count all spiders (no touching, please) found in the sampling area. Record on the Class Data Table below.

8. Repeat step #6 with each group in the class and record onto the Class Data Table below.

9. Find the average of the spider populations for the class and record below onto the Class Data Table.

10. <u>EXTRA:</u> Calculate the total spider population for the entire area of the waterway being mapped, by multiplying the average population size by the total area of the waterway (in sample plots). Have students measure the area of the waterway and break it up into 8 X 8-foot sample plots.

SPIDER POPULATION SAMPLING: CLASS DATA TABLE

	Sample 1 (group 1)	Sample 2 (group 2)	Sample 3 (group 3)	Sample 4 (group 4)	Sample 5 (group 5)	Spider Average	Total Population
Spider Population							

WYLAND FOUNDATION®

*EXTRA MATH IN SCIENCE:

CREATING A MEGATRANSECT USING POPULATION SAMPLING TECHNIQUES

DIRECTIONS:

Please draw the outline of your waterway below and label each plot (use a cover slip to represent a sample plot of 8X8 feet. Please include the dimensions in meters.

1,000 feet

sample
plot #

1,000 feet

WYLAND FOUNDATION®

PLEASE COMPLETE: ESTIMATED # of SPIDERS on WATERWAY

# of Sample Plots (within total area of waterway) X Spider Average = ______________________

QUESTIONS:

1. On the waterway, we surveyed, which group counted the most spiders? Where was their sample plot located? Why do you think they counted the most spiders?

2. On the waterway, we surveyed, which group counted the least spiders? Where was their sample plot located? Why do you think they counted the least spiders?

3. What was the waterway's average # of spiders per plot and how could you find the estimated total number of spiders on your waterway using this average and the Sample Method?

4. If we looked at another waterway closer to the ocean, do you think we would find the same average for spiders per sample plot? Why or why not?

5. If we looked at another waterway closer to the desert, do you think we would find the same average for spiders per sample plot? Why or why not?

6. If we looked at another waterway in the mountains, do you think we would find the same average for spiders per sample plot? Why or why not?

7. If we looked at another waterway in a rainforest, do you think we would find the same average for spiders per sample plot? Why or why not?

8. If your group found an amazing spider, what was it and what is its scientific name (in Latin)? Please include a picture of it below: