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PRAIRIE ROOT KERPLUNK

BACKGROUND

Think back to the story of the three little pigs. Which house kept out the wolf but let in the pigs? Wood was stronger than straw, and brick was stronger than wood. Would a house using brick, straw and wood be most effective at letting certain things in and out?

Biodiversity is the variety of life in a landscape or ecosystem. In a diverse landscape, a variety of living things are working together – interacting effectively, like the brick, straw and wood. The complex root system under a prairie is a good example: roots of diverse prairie plants let certain things in and keep other things out of the soil, helping create a healthy landscape. These beneficial functions provided by prairie roots are examples of ecosystem services.

This activity explores two ecosystem services provided by prairie roots: invasive weed control (keeping weeds out) and nutrient reduction (keeping excess fertilizer in).

Invasive weeds – aggressive plants that out-compete desirable plants – are a concern to most landowners. The best way to keep these weeds out is to create a landscape that doesn’t let them in. Prairies keep invasive weeds out because their dense, thick tangled roots fill the soil, leaving little space for invading weeds to establish. And because prairie roots are perennial, they remain in the soil for years, controlling invasive weeds from season to season, year after year.

Another important ecosystem service provided by prairie roots is nutrient reduction. Farmers and other landowners sometimes apply more nutrients (fertilizer) than crops or lawns can use. This excess fertilizer moves through the soil, catching a ride in water that moves underground through spaces between soil particles. If nothing captures the excess nutrients, they wash out of the soil and into waterways, polluting streams and rivers.

Luckily, the roots of strategically placed prairie plants can capture these excess nutrients. Prairie buffer strips planted along waterways are an example of prairie plantings that capture nutrients.

This activity explores how the architecture and longevity of prairie roots aid in controlling invasive weeds and capturing excess nutrients.
**VOCABULARY**

**Biodiversity:** The variety of life in a particular landscape or ecosystem.

**Ecosystem services:** Beneficial functions provided by diverse organisms interacting with each other and the environment in which they live.

**Invasive weeds:** Aggressive, unwanted plants.

**Nutrient leaching:** Process of nutrients moving through the soil with percolating water.

**Buffer strip:** Relatively small areas or strips of land, maintained in perennial vegetation, designed to intercept runoff and pollutants. ([Buffer images.](#))

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**TEACHER PREPARATION**

- Collect enough jump ropes for each student.
- Collect 12 to 24 small, soft balls (nerf balls, etc.) to represent nutrient molecules.
- Decide if a formal assessment is needed. If so, printable templates are provided in the Appendix.
- Prepare to display root specimen, poster or image after the activity. ([Images available at tallgrassprairiecenter.org/curriculum_images.](#))

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**ACTIVITY**

**Part 1**

1. Introduce the topic of prairie roots using “Background” information as a starting point. Be sure to use and discuss the vocabulary words.

2. Ask questions like:
   - When thinking about the Three Little Pigs, why was the brick-wood-straw house a better choice than just the straw? How is this similar to biodiversity in nature?
   - Brick may be strong, but what does wood and straw help in a house? How is this similar to ecosystem services in nature?

3. Ask for three volunteers, and have them stand with you while you start the activity.

4. Set the scenario:
   - A farmer is planting a prairie buffer strip near a creek. She decides to plant three different kinds of prairie plants in the buffer strip. Let’s see what happens when weeds try to grow.

5. The remaining students will represent prairie roots in the buffer strip. Hand out jump ropes (one per pair of students) and have pairs stand across from each other in a line or circle with the rope stretched out between them. Have them hold the rope with only one hand.

6. Tell the three volunteers that they are invasive weeds. Have them try to “grow” in the soil between the roots. (It should be easy to break through.)
   - Why were the weeds able to come up so easily? What could the farmer do to keep the invasive weeds from growing?

7. New scenario:
   - The farmer has decided to increase the diversity in her buffer strip. As we have learned, variety is very important! In this new planting, there are many different kinds of prairie plants with different shapes, sizes and amounts of roots.

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8. Hand out another jump rope per student. Have them hold one end of this jump rope in their empty hand, leaving the other end of the rope "loose." (They now have one rope per hand.) Have students pick up any one loose end. (They now have two rope ends in one hand, and one in the other.) A net has been created with the jump ropes.

9. Ask the weeds to try to grow again. (They should have a harder time; the large net of tangled roots will suppress their growth.)
   - Why was it harder for the weeds to grow? (Diverse roots decrease space for weeds.)
   - What do we call it when a lot of different plants are living and working together in a landscape? (Biodiversity.)
   - What do we call it when a diverse group of plants provide beneficial functions in a landscape? (Ecosystem services.)

Part 2
1. Ask the “weed” volunteers to rejoin the group. Remove ropes to reset the activity.

2. Remember when we said the farmer planted the buffer strip next to a creek? Buffer strips are carefully placed to provide the most ecosystem services. The farmer chose this location because nutrients can move over or through the soil into the creek. Nutrients act as a kind of food for plants, which is great to make crops grow. But nutrients that leave the farmland pollute creeks and other water bodies. Let’s see how the buffer strip captures nutrients so less make it to the creek.

3. Place seine or other small mesh net on the floor and have students gather around the edge. Have them grip the edge with one hand and elevate. (Alternatively, continue to use the jump ropes, making sure there are enough ropes to keep nerf balls from falling through the “net.”)
   - What does the net represent? (Prairie roots in the buffer strip.)

4. Hand out nerf balls. (Note: While using one or more nerf balls per student would more accurately represent the large quantity of nutrient molecules present in many environments, limiting the number of balls keeps the activity under control, especially if it’s is being conducted inside.)
   Now we’re going to see how the tangled net of prairie roots helps capture nutrients and keeps them out of the creek. The nerf balls represent nutrient molecules. During a hard rain, the nutrients travel through the soil along with the water.

5. Have students use their free hand to toss nerf balls into the net.

6. Discussion (Students can place the net and balls on the ground and either sit or stand for discussion.)
   - Why do you think the roots did such a great job capturing the nutrients? (Diversity of roots and a lot of plants make a thick, tangled mat.)
   - Farmland has one type of plant growing in rows over a large landscape. What do you think the roots look like? What do you think would have happened if we threw nutrients into that root system? (Little intermingling of roots leave spaces for nutrients to leach through the soil.)
   - Corn and beans are annuals. They live one season – from spring to fall. What do you think happens to excess nutrients in crop fields during spring rains when the crops are young? (They travel through the soil with the water and can end up in waterways.)
   - How does a prairie buffer strip help? (Prairie plants are perennials. Their large, actively growing root systems are able to capture nutrients during spring rains (and throughout the season).

7. Show students a prairie root specimen or an image or poster of prairie roots. Discuss similarities and differences between the activity’s ropes and nets and the roots themselves.
ASSESSMENTS

Assessments for this activity are formative. Educators should ask students questions before, during and after the activity to check for understanding. Sample questions:

1. What are some ecosystem services prairie roots offer? (Invasive weed control, nutrient reduction.)
2. Which landscape has a higher level of biodiversity: a soybean field or a prairie planting? Why? (The prairie planting because it includes more than one plant species.)
3. What features of prairie roots help them suppress invasive weeds? Reduce nutrients? (The “mesh” of tangled roots under a diverse prairie leave little space for weeds and capture nutrients moving through the soil. The prairie roots remain in the soil from year to year; they do not die and decompose after harvest like annual corn and soybean roots.
4. Why are nutrients good for farmland and other landscapes? (Crops and other plants become taller, stronger and healthier.)
5. Why are too many nutrients not good for the landscape? (Excess nutrients leach through the soil and pollute water.)

EXTENSIONS

(Grades 7-8) Provide students with maps of local rural and urban areas. Students choose locations for prairie plantings/buffer strips, then present and defend their choices.

ADAPTATIONS

Students with limited mobility:
   a. Have students perform the activity sitting on the floor.

English Language Learners (ELL, ESL):
   a. If possible, request an aide to translate directions and questions.
   b. Use Google Translate to create a handout that includes background information, activity instructions and assessment.

Students from an urban area:
   a. Some students may not have a point of reference for farmland. If this is the case, show images of farmland.

RESOURCES

Prairie Roots Project: www.tallgrassprairiecenter.org/prairie-roots-project
Nutrient Reduction: www.nutrientstrategy.iastate.edu
STANDARDS

5–LS2–1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

3–5–ETS1–2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

SS.6–8.G.4 Understand how physical processes and human actions modify the environment and how the environment affects humans.

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