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“HOW DO I.....?”

Lessons compiled by

The New Jersey Agricultural Society’s

LEARNING THROUGH GARDENING

Program

March 2022

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MAKING BIODEGRADABLE PLASTIC FROM CORN

A lesson from the New Jersey Agricultural Society Learning Through Gardening program

OVERVIEW & PURPOSE

So many things are made from corn, even plastic! Prove this to your students by showing them how to make plastic from cornstarch and corn oil. Discuss how this type of renewable resource benefits everyone.

GRADES: K-5

OBJECTIVES

The student will be able to:
•Describe an environmental reason for using corn as a source for the production of plastics
•Explain the difference between a nonrenewable resource (plastic from oil) and a renewable resource (plastic from corn)
•Make a sample of plastic from corn

MATERIALS NEEDED

(For 30 students)

- Microwave
- 2 cups of cornstarch
- ¼ cup corn oil
- 2 cups water
- 30 resealable baggies
- 1 box of food coloring
- Medicine droppers
- Measuring tablespoons

INTRODUCTION

Explain that plastics made from nonrenewable oil products last for thousands of years in our environment because they do not break down or decompose. Because they do not decompose, these plastics take up valuable space in our landfills. Our landfills

are filling up fast. To help alleviate this problem, researchers have invented a biodegradable plastic made with cornstarch. Plastics made with cornstarch will break down and not take up space in landfills. Plus, the added benefit is that biodegradable plastic is made with a renewable resource – corn.

Corn is produced every year, unlike oil. Oil is a nonrenewable resource because we only have a certain amount of it. Once we have used our oil reserves they will be gone. Corn can be grown every year and used to make more biodegradable plastic products. There are more than 3,500 different uses for corn products and more uses are being found every day. Many of the new products, like paint or fuel, are more environmentally friendly than petroleum (oil)-based products.

Explain that today the students will make a simple biodegradable plastic using nothing but corn products and water.

ACTIVITY

1. Making Biodegradable Plastic: Mix 2 tablespoons of cornstarch, 2 tablespoons of water, and 2 drops of corn oil in a resealable baggie. Add 2 drops of food coloring to the mixture. Seal the bag tightly and knead the contents until they are well mixed, and no cornstarch lumps are seen. Heat the baggies in a microwave for 20-30 seconds at a high setting.
2. NOTE: Do not microwave all the baggies at the same time; they will not become hot enough. Only microwave three or four baggies at a time. Allow baggies to cool.
3. Students can create shapes with the biodegradable plastic.

Class Discussion: Compare this biodegradable substance to other plastics. What could you make out of this plastic if you let it harden? Remember that it will dissolve eventually. (For example, golf tees, plastic plates, and cups, and packing peanuts are already being made from corn.)

EVALUATION:

Student explains why it is important to find other forms of material and fuel instead of depending on oil. Student will be able to explain the difference between a renewable and nonrenewable resource.

EXTENSION:

Pass out the Things Made from Corn sheet and discuss the products listed. What products are familiar to the students? What products are they surprised to see on the list? Send home the Corn Products Found in the Home sheet for homework and have students search their own cupboards for corn products.

Do the Pick a Peanut experiment. Drop a packing peanut made of Styrofoam and one made of biodegradable plastic into water and see what happens. Which packing peanut is better for the environment?

NEW JERSEY LEARNING STANDARDS

Science: K:ESS3.C 1:LS1.A 2:LS2.A 3:ESS2.D, LS1B 4:LS1.A 5:ESS1.C, ESS2.D
Social Studies: K-2: 6.1.2.EconEM.1, 2, 6.1.2.EconNE.1 3-5: 6.1.5.EconEM.1, 2

Things Made from Corn Products that use corn include:

Adhesives, Insecticides, Aluminum, Instant coffee & tea, Antibiotics, Insulation, Aspirin, Jams, jellies, & preserves, Baby food, Ketchup, Biodegradable plastic, Latex paint, Breakfast cereals, Licorice, Candy, Lipstick, Canned vegetables, Livestock feed, Carbonated beverages & soda, Maple syrup, Chalk, Margarine, Cheese spreads, Marshmallows, Chewing gum, Paper plates & cups, Chocolate products, Peanut butter, Coatings on wood, paper, & metal, Potato chips, Corn chips, Rubber, Corn meal, Rugs & carpets, Cosmetics, Salad dressings, Crayons, Shaving cream & lotions, Dessert powders, Shoe polish, Disposable diapers Soaps & cleaners, Dry cell batteries, Spark plugs, Dyes, Tacos & tortillas, Edible oil, Textiles, Ethanol, Wallpaper, Finished leather, Wheat bread, Flour & grits, Windshield wiper fluid, Frozen food, Yogurts, Fructose

Name_____

Corn Products Found in My Home

Search around your house for different corn products. Make a list of corn products that you find. Some key words to look for on labels are: cornstarch, corn syrup, dextrose, high fructose corn syrup, and corn oil.

Pick A Peanut Experiment

Packing Peanuts can be made from Styrofoam, a non-biodegradable material made from petroleum. (Gasoline is made from petroleum). Packing peanuts can also be made from corn, which will decompose naturally. Which packing peanut is better for the environment?

1. Examine both packing peanuts. How are they the same? How are they different?

2. What tests can we do to determine which is the one made from corn?

3. Predict what will happen when each packing peanut is stirred into water. Stir each packing peanut into water and record your observations below.

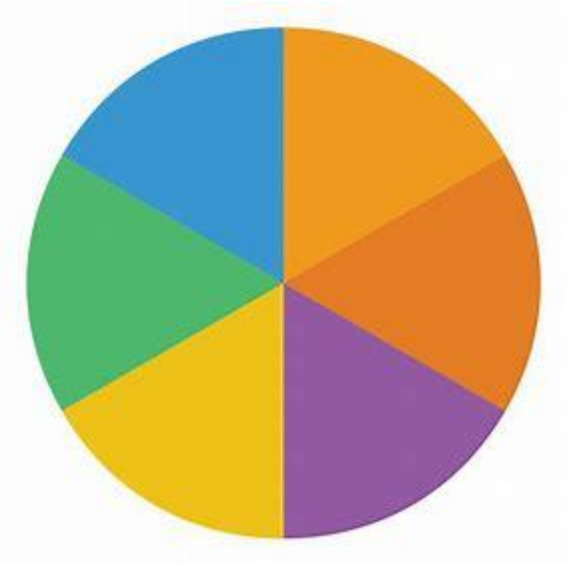
4. Which packing peanut is better for the environment? Why?

Classroom Management: Who Goes Where?

A lesson from the New Jersey Agricultural Society Learning Through Gardening program

Purpose: An easy to employ system to allow groups of students to rotate to various garden tasks.

Divide the class into small groups. Assign each group of students a different color. Create a pie chart reflecting the number of student groups. You could do this with paper or digitally. If you had six groups, you would need six colors, like this:



This could easily be made using construction paper and a plate. Attach the plate to a piece of oak tag using a brad, so the plate can be turned. On the oak tag, garden tasks can be listed, and the plate can be turned so that students can easily determine their daily garden job!

Possible jobs: Weeding, watering, pruning, trellising, pest management, disease control, planting seeds, harvesting, transplanting, seed collection, etc.

Collecting Seeds

How many seeds can you find at home? Be a seed collector and find out! Remember, you can find seeds inside the fruit of a plant.

Start with some of the most popular fruits: apples and oranges. Then consider some items that we call vegetables, but in fact contain seeds, and are therefore fruits: tomato, bell pepper, and cucumber.

Before your family cuts open a fruit or vegetable, estimate how many seeds are inside and write it down. Then cut open the fruit or vegetable, scoop out the seeds, and count them. If there are many seeds, try skip counting by twos or fives. Dry the seeds on a paper towel and save them. An empty egg carton makes a handy box to save seeds.

Make a chart of your estimates and the actual number of seeds you found. Are you surprised at the number of seeds you find in one fruit?

Take a walk outside. Can you find any seeds? What do you think they are? Take them home and add them to your collection.

Growing Plants and Seeds in the Classroom

Light sources:

Plants should have proper light for approximately 8 to 10 hours each day. Overhead class with fluorescent lights provides enough light for starting seeds and growing small seedlings. However, they do not provide enough light for the rapidly growing phases of plant life. The following list mentions ways you can make sure your plants receive enough light:

- A source of incandescent or fluorescent light that is no higher than two feet above the growing plan. Desk lamps are simple grow lights purchased from a garden center that work well.
- Sunlight from **sunny** windows will provide enough light for bean plants. However, corn and wheat plants require more light. If necessary, students can take their plants outside in the morning and then return them to the classroom in the afternoon. When the students are transporting them, make sure they are careful not to touch or break the plants and the plants are protected from hot winds and other students.

Pots:

There are a variety of small planting pots that can be purchased at garden centers or from scientific supply companies. However, it is not necessary to use true planting pots. Remember, plants require drainage, so holes should be put in the bottom or lower sides of any pot you use. Pots should be placed on pans, aluminum pie plates, or other waterproof trays so the overflow water will not spill onto unprotected areas. You separate drainage pans for potted water. All pots should be washed thoroughly, with clean water, before each planting.

Suggestions for inexpensive pots?

- Well rinsed school milk cartons with two holes poked through the bottom with a nail.
- 5-ounce wax lined paper cups with two holes poked in the bottom with a nail.
- Donated cups from fast food restaurants with holes poked through the bottom.
- Clear plastic cups. You can make holes in the bottom of these cups by heating a nail over an open gas flame and then placing the nail through the bottom of each cup.

Soils:

There are many types of soils and available soil amendments at garden centers .Using soil gathered from local surroundings will be suitable for some experiments. However, more reliable laboratory results will occur if soil is purchased. Some garden centers will donate broken bags of soil to schools for student use.

- Standard potting mix or soil. This is what should be used unless otherwise indicated. It contains the nutrients required for successful plant growth. Generic brands of potting soil will work fine. Potting soil should not be reused unless it has a chance to dry out and has old roots, seeds and plants removed. The molds and other organisms in unused potting soils can often harm seeds and young seedlings. Used potting soil can be spread into school gardens, landscaped areas or put into compost piles.

- Vermiculite- This is expanded mica, grayish in color, and is used to sprout seeds that will later be transplanted. It can be found at garden centers. Vermiculite is gentle on foot systems but does not contain a lot of nutrients.

Plants and seeds

- Bean pea corn seeds.

To ensure successful plant growth, try to use garden seeds that are produced for the current planting season. If you are using older seeds, the likelihood of non-germination with your students and have them plant more than the suggested number of seeds in each pot. Sometimes the seeds are covered with a fungicide. If this is the case, make sure your students wash their hands after touching the seeds. Dried grocery store beans can be used for seed dissections, but are not recommended for plant growth experiments.

- Wheat seeds.

Wheat seeds are sometimes called wheat berries or grains of wheat, and they can be purchased in the grain section of health food stores or health food sections of some grocery stores. They are very inexpensive and generally grow quite well. Plant the seeds yourself before doing experiment with your students. If you are not certain of their viability. Wheat seeds can also be purchased from livestock feed and grain stores.

Appropriate amounts of water

Overwatering tends to be a major problem with students. There are many ways to prevent your students from overwatering and underwatering their plants. Generally, you want the soil to be moist, not wet after watering. You then let the soil dry out before the next watering. Excessive drainage from the pot or standing water are good indications of overwatering.

Suggestions?

- Show your students examples of soil that is just right too wet into dry.
- Monitor your students the first few times they water their plants. Discuss with each student what an appropriate amount of water would be.
- You spray bottles or eye droppers for watering.
- place a specific amount of water in a plastic cup for each group and explained that no more water than the specified amount should be necessary

HOW TO GROW CORN FROM A COB

Each kernel on a corn cob is a seed. You can grow corn just from placing a dried corn cob in water.

Here's how to do it: Make sure you use a dried corn cob. You can use a cob from ornamental corn if you want. Place the cob in a container filled with one inch of water. Wait a few days, and the corn seeds on the cob will start to sprout. It's a great activity for fall!

You will have to change the water the cob sits in often or else it will get smelly.

When the sprouts are a few inches high, you can try to keep your corn growing by planting the entire cob in a container of soil.

HOW TO MAKE A CLASSROOM WORM BIN

A lesson from the New Jersey Agricultural Society Learning Through Gardening program

OVERVIEW & PURPOSE

Discover why earthworms are considered a gardener's best friend. The worm bin or wormery built in this activity allows students to observe the worms as they convert plant material into rich compost.

GRADES: PreK-5

OBJECTIVES

The student will be able to:
• explain that plants move toward the light, and why
• explain how they can prove plants move toward the light
• record the day-to-day results of an experiment

MATERIALS NEEDED

Large plastic bin

- Soil from your garden or outside the school
- Red worms (red wigglers)
- Newspaper
- Black plastic sheet or plastic, cloth or wood lid for bin
- Clean kitchen fruit and vegetable scraps, coffee grinds, tea leaves, eggshells

NOTE: Don't go out and dig for nightcrawlers that live in the soil to populate your worm bin. Night crawlers need to tunnel through dirt to eat and survive, and they can't live on vegetable waste. Instead, you need red worms, Eisenia foetida (also known as red wigglers), which live in rich organic material like manure and compost (not soil) and are adapted to crowding and warmer temperatures.

VOCABULARY

Vermiculture: the raising of worms to make compost.
Vermicompost: the mixture of decomposing vegetable or food waste, decomposing leaves, and pure vermicast, (worm poop), also known as worm castings.

Worm tea: is made by leaching vermicompost in water (just like a tea bag). The resulting liquid after it has steeped for several hours is a tea-colored liquid that can be used to fertilize plants.

INTRODUCTION

Begin the discussion by asking students how they know something is alive. Encourage answers such as grow, breathe, reproduce, move, eat or require nourishment. Next ask how we know that plants are alive.

Ask the students what plants need to live. Ask if plants move. Ask if they have ever seen a plant move. Ask why they think a plant would move. Discuss their answers.

Next, tell students that they are going to do an experiment to prove that plants will move toward the light. Ask students if they know what a maze is and if they have ever seen one, (Answers may include a corn maze, a hedge maze, or a puzzle maze drawn on paper.) Now tell students they are going to create a maze that a plant will have to solve to reach the light.

ACTIVITY

Tell students you are going to make a worm bin so that you can harvest the worm casting for compost for your garden. Explain that the red worms you will use in the bin are somewhat different from worms you find in the garden. They don't live in soil. They live naturally in manure piles and compost. They live and feed near the surface and do not create tunnels.

Making the Worm Bin:

- Find or buy a plastic bin or dishpan. An approximate size is 16" x 24" x 8" or 10 gallons, but bigger or smaller bins will work as well. Make sure the bin is clean by rinsing it with tap water to remove any residues which may be harmful to the worms.
- Drill about twenty evenly spaced ¼-inch holes in the bottom of each bin. These holes will provide drainage.
- Drill ventilation holes about 1 – 1 ½ inches apart on each side of the bin. Prepare the bedding. Instead of soil, your red worms will live in moist newspaper bedding. Like soil, newspaper strips provide air, water, and food for the worms.
- Tear newspaper into 1/2" to 1" strips, enough to fill your bin three-quarters of the way to the top. Avoid using colored print, which may be toxic to the worms.
- Place newspaper strips into a large plastic garbage bag or container.
- Add water until bedding feels like a damp sponge, moist but not dripping. Add dry strips if it gets too wet. Add the strips to the bin, making sure bedding is fluffy (not packed down) to provide air for the worms. The bin should be three-quarters full of wet newspaper strips.
- Sprinkle two to four cups of garden soil in bin, which introduces beneficial microorganisms. Gritty soil particles also aid the worms' digestive process. Use natural soil, not potting soil.
- Add the worms. Your worms will mostly feed and live in the topmost layer of the bin, so it is the surface area that matters when figuring how many worms to use.

About one pound of worms can live in one square foot of composting surface. So if you have X pounds of worms, you need at least X square feet of surface at the top of the container.

- Feed your worms fruit and vegetable scraps, such as peels, rinds, and cores. Egg shells, coffee grinds, and used tea leaves are good, too. Limit the amount of citrus fruits that you place in the bin so that it does not become too acidic. NO MEATS, BONES, OILS, OR DAIRY PRODUCTS.
- Cut or break food scraps into small pieces – the smaller, the better. Measure the amount of food. Feed the worms approximately three times their weight each week. Monitor the bin every week to see if the worms are eating the food and adjust feeding levels accordingly. (If you start with one pound of worms, add three pounds of food per week.)
- Bury food scraps in the bin. Lift bedding, add food scraps, then cover food with bedding. Place a full sheet of dry newspaper on top. This will help maintain the moisture balance, keep any possible odors in the bin, and help prevent fruit flies from making a home in the bin. Replace this sheet frequently if fruit flies are present, or if bin gets too wet.
- Cover the bin with a lid made of plastic, black plastic sheeting, plywood, or cloth, but leave the lid ajar so the bin receives some air. Place the bin away from windows and heaters. Worms prefer temperatures of 55 to 70 degrees Fahrenheit.
- FEED, WATER and FLUFF! To keep worms happy, feed them about once a week. If the bedding dries up, spray it with water. If bedding gets too wet, add dry newspaper strips. Fluff up bedding once a week so the worms get enough air.

Harvesting your compost:

After three to six months, you should have a fair amount of worm compost stored up in your bin. Now it's time to harvest. Keep in mind that you might not be able to save every worm when harvesting the compost. That's okay; by and large, your worms have multiplied, and there should be plenty to continue composting. Put on rubber or plastic gloves and move any large uncomposted vegetable matter to one side. Then gently scoop a section of worms and compost mixture onto a brightly lit piece of newspaper or plastic wrap. Scrape off the compost in layers. Wait awhile giving the worms time to burrow into the center of the mound. Eventually you will end up with a pile of compost next to a pile of worms.

After harvesting, you should replace the bedding and then return the worms to the bin and add your compost to your garden. If you prefer a hands-off technique, simply push the contents of the bin all to one side and add fresh food, water, dirt, and bedding to the empty space. The worms will slowly migrate over on their own. This requires much more patience. It could take up to a few months for the worms to fully migrate to the scraps side of the compost bin.

Student Observations:

Have the students draw the contents of the bin. Label this drawing as “start.” Ask students to hypothesize about what will happen in the next weeks to the worms, the

bedding, and to the food. Have students check the bin regularly, draw and write what they see, and date their observations. Ask the students: Have any of the fruits and vegetable scraps disappeared? How about the bedding? What does it smell like? How many worms are there now? What do they look like?

EVALUATION:

Students' drawn and written observations of the changes in the worm bins.

EXTENSION:

Read: Diary of a Worm, by Doreen Cronin OR An Earthworm's Life, by John Himmelman.

NEW JERSEY LEARNING STANDARDS

Science: PreK:5.1.1-5, 5.3.1,3 K:LS1.1, ESS2.E 1:LS1.A,B 2:LS4.1 3:LS1.B 4:LS1.A 5:LS2.A

HOW TO MEASURE RAIN

A lesson from the New Jersey Agricultural Society Learning Through Gardening program

OBJECTIVES

The student will be able to:
• Explain that plants need water to grow and that in nature, this water comes from rain.
• Explain how to measure how much water falls on their garden or neighborhood

MATERIALS NEEDED

- 2-liter plastic bottles with tops cut off, one for each group
- Rulers
- Permanent markers
- Duct tape

PREPARATION

Cut the tops off two-liter soda bottles about one-third of the way down from the top. Turn these tops upsides down so they look like funnels. Insert these “funnels” inside the cut bottles to catch the rain. So that the funnels do not slip down into the bottles, tape the tops securely in two places with duct tape. Before this lesson, the teacher, or the teacher and students, should dig small holes somewhere in the garden away from foot traffic that are big enough to bury just the bottoms of the rain gauges. (See detailed rain gauge-making instructions below.)

ACTIVITY

Ask students what three things plants need to grow. Ask how our garden would get water if we didn't water it with a hose or watering cans. Ask what would happen to the plants if there wasn't enough rain.

Share these rainfall fun facts:

• The average yearly rainfall in New Jersey is 40 to 45 inches.
• It usually rains on about 100 days in New Jersey.
• It rains more than an inch on only about 10 of those days, most of those in the summer.

• In New Jersey, Superstorm Sandy in 2012 brought as much as 8 inches of rain to the southernmost shore towns, while some areas in the northern part of the state got less than two inches.

• Hawaii is the rainiest state with about 64 inches of average rainfall each year.

• Nevada is the driest state with only an average 9 ½ inches of rain each year.

Tell students that today we are going to make a tool called a rain gauge that will let us measure the amount of rain that falls on our garden.

In small groups of three or four, students measure inches and mark them on the side of the bottles. This is easier for younger students if the ruler is taped to the side of the bottle with the 0 end of the ruler flush against the bottom of the bottle. Students use permanent markers to mark measurements one inch apart on the side of the bottle, marking 0 at the bottom of the bottle. Students should mark up to at least three inches. Then add numbers to the marks. (Older students can add measurements of one-half inches.)

Place bottles in the holes in the garden and tamp soil down around them so the wind does not blow them over. Students check each week to see how much rain has fallen and record their observations.

EVALUATION:

The student will be able to describe the three things plants need to grow and how to make a tool to measure the amount of rain.

EXTENSION:

Older students can graph the amount of rain that falls over several weeks. Older students can compare the actual amount of rain in a week to the amount of rain forecasted.

NEW JERSEY LEARNING STANDARDS

PreK:5.1.1-5, 5.3.4, 5.4.3 K:ESS2.D 1:LS1.A 2:LS2.A 3:ESS2.D 4:ESS2.A 5:LS2.B

HOW TO PLANT SEEDS FOR A COOL SEASON CROP

A lesson from the New Jersey Agricultural Society Learning Through Gardening program

OVERVIEW & PURPOSE

It's easy for your students to grow vegetables that can be planted and harvested during the school year. There are plenty of vegetables that prefer to grow in the cooler weather: lettuce, carrots, kale, and peas, just to name a few. This lesson teaches which vegetables grow in the cooler seasons and how to plant them.

GRADES: PreK-5

OBJECTIVES

The student will be able to:
• Identify what a seed needs to grow
• Correctly plant a seed
• Explain how to plant seeds indoors
• Identify vegetable seeds that can be planted outside in the spring and fall in New Jersey

MATERIALS NEEDED

- Various cool-season vegetable seeds such as lettuce, spinach, scallions, peas, kale, Swiss chard, and radishes. (See the entire list in the chart below.)
- Potting soil
- Small (4- or 5-inch) plant pots. If you don't have plant pots, use recycled containers such as milk cartons, yogurt containers, or egg cartons. Make sure to poke holes in the bottom of these types of containers for drainage.
- Small pitcher, spray bottle, or watering can for watering
- Large spoons or small pot to scoop out soil

NOTE: In New Jersey for a spring crop, cool-season vegetables should be started indoors in late February or early March and planted outside in early April.

ACTIVITY

Tell students: a seed is like an instant plant – you just have to add three things. What are they? (Water, soil, and sun for warmth) Tell students that today we are going to plant seeds for a salad garden. Because it is still too cold outside, we are going to first plant the seeds inside, and then transplant the seedlings outside when it is warmer. Because we want to harvest all the vegetables in our garden by June before we leave on summer vacation, we can only plant what we call cool-season crops – vegetables that can be planted in the early spring when the weather is still chilly. These vegetables include lettuce, spinach, radishes, onions, kale, Swiss chard, and peas.

Ask students why we cannot plant vegetables such as tomatoes, corn, or cucumbers. (They are summer vegetables that require warmer weather and cannot be planted in New Jersey until mid-May.) Fill the pots with soil about 3/4 of the way to the top. Explain that most of the seeds are very small and need to feel the sun in order to germinate, therefore students must not bury their seeds way down in their pots. The tiny lettuce seeds need to be covered with only about ¼ of an inch of soil, the slightly larger radish and spinach seeds with just ½ of an inch of soil, and the large pea seeds with only 1 inch. Show students the directions on the back of a seed packet that explain how to plant the seeds.

NOTE: Lettuce, radish, and spinach seeds are very small, so do not expect students to plant them one by one. Put a few seeds in the student's non-writing hand and tell him /her to take a pinch of seeds and sprinkle them on top of the soil.

Then the student should sprinkle soil on top of the seeds. If there are too many plants for one container, you can always thin them out later. Set the pots on trays on a windowsill or under a light. (The trays will trap excess water that drains from the pots.)

Ask the students what is the number-one way to kill plants indoors? (Over-water them.) To check if their plants need water, students should stick their fingers about one inch into the soil. If the soil is dry, it is time to water. If the soil is damp, don't water them yet.

At the beginning of April, it is time for the vegetable seedlings to be planted outside. Before you do this, it is best to get your small plants used to colder weather by setting them outside for a few hours at a time. This is called hardening off your plants. Take the trays outside to a sunny spot where they won't be disturbed in the morning, then bring them inside at the end of the school day. Put a couple of students in charge of reminding everyone to bring the plants inside at the end of the day. Repeat this process for three or four days. Now you can transplant the seedlings into your garden.

NOTE: You can also plant the same cool-season seeds directly outdoors at the beginning of September for a cool-season crop in the fall.

New Jersey Cool-season Vegetables

- Beets
- Bok choy
- Broccoli

- Cabbage
- Carrots
- Cauliflower
- Collards
- Kohlrabi
- Lettuces
- Onions
- Parsnips
- Peas
- Radishes
- Spinach
- Swiss chard
- Turnips

EVALUATION:

Correctly planted seeds. Older students write an informative paragraph on how to plant seeds and which vegetables to plant in the spring in New Jersey.

NEW JERSEY LEARNING STANDARDS

Science: PreK: 5.1.1-5, 5.3.1-4, 5.4.2 K:LS1.C, ESS3.A 1:LS1.A 2:LS2.A 3:LS1.B 4:LS1.A 5:LS1.C English Language Arts: 2:W.2.2,4,8 3:W.3.2.A-D; W.3.4,8 4:W.4.2.A-E; W.4.4,8 5: W.5.2.A-E; W.5.4,8

Kitchen Scrap Gardening

Overview:

With little effort and a pinch of creativity you can devise some very imaginative indoor gardens from your kitchen leftovers! Kitchen scrap gardening is when you grow plants from items you'd normally throw in your compost bucket. Kids love this idea, and it's a great way to reinforce the sustainable living concepts of recycling and reusing. Plus, it's a kick to grow new plants from old plant parts.
Grades K-5

Materials:

• Vegetable and fruit scraps (oranges, lemons, limes, sweet potatoes, avocados, carrots, beets, onions, and ginger work well)
• Growing containers
• Potting soil
• Water Approximate

ACTIVITY:

1. Scout your kitchen and refrigerator for potential vegetable and fruit candidates. Some of the best are oranges, lemons, limes, sweet potatoes, avocados, carrots, beets, onions, and ginger. Believe it or not, you can use all of these and many other vegetables and fruits to propagate new plants.
2. Plant scraps in potting soil or immerse in water. The best method for encouraging new growth will depend on the plant and plant part represented.

Here are specific instructions for some easy to plant scraps:

Starting Little Seeds Citrus fruits are plentiful in winter, and the seeds in oranges, lemons, grapefruit, and limes are easy to grow into new houseplants. Fill a 4-inch-diameter pot with moistened potting soil. Remove whole seeds from the fruit and plant three to four of them one inch deep in the pot. The seeds should sprout in two to four weeks, and you'll have a mini citrus orchard. Keep the seedlings well-watered for about six weeks and then transplant individual trees into bigger pots. It will be quite a while before you see citrus flowers (let alone fruit - these trees won't bear for many years, and most eating-quality fruits are borne on grafted, not seed-grown trees.) But you can enjoy the leaves. The leaves smell like whatever type of citrus you're growing, so be sure your children do some "rub and sniff" tests.

Starting Big Seeds If the small seeds are a hit, try growing big seeds of tropical fruits such as mango and avocado. Let an avocado pit dry out for a day or two, then plant it in a 6-inch-diameter plastic pot filled with moistened potting soil. Leave the tip of the pit exposed to air.

Another fun - and easy - way to sprout an avocado is to suspend the pit over a glass of water. Poke three toothpicks around the middle of a pit and rest the toothpicks on the rim of the glass. Add water until it just touches the bottom of the pit. Kids can watch the roots and sprout emerge. Cool! It can take a month or two for roots to appear. If using the water sprouting method, replant the pit in potting soil once roots and a sprout emerge. Mangoes are a little more difficult. Soak the hard seed for a week in warm water, replacing the water every day. Then plant it in potting soil like an avocado and settle down for a wait; it can take up to four months for a sprout to emerge. |

New Plants from Tubers Sweet potatoes and ginger -tuberous roots and rhizomes, respectively - are plant parts that that are easy to grow into new plants. Prop a sweet potato over a water-filled glass by poking three toothpicks in a circle into the middle of the tuber and resting the toothpicks on the rim of the glass so that the narrower, pointed half of the tuber is submerged in the water. Place the glass in a sunny window. Soon roots will begin to sprout from the portion in the water, and usually within a few weeks, stems and leaves will begin to grow from the top of the tuber. To keep your sweet potato as a houseplant, carefully transplant it into a container of potting soil once a good root system has developed. Ginger is particularly fun to grow because both the cut ends and the glossy new leaves (when crushed) emit a strong gingery aroma. Suspend a chunk of ginger with toothpicks over a glass of water or place it in a container of moistened potting soil. If using the water method, transfer the new plant to a container of potting soil once roots appear.

Off With Their (Carrot) Heads! You can force many root crops (beets, parsnips, and carrots, for instance) to sprout new top growth by beheading them. Kids love the chopping part. Slice off the head end along with one to two inches of the root and place it in a saucer filled with pebbles for support and water. In a week or so new greens should appear from the top. Then snug the root into a container filled with potting soil. This beheading technique also works well with pineapples. Cut off the top inch of the fruit and scoop out most of the yellow flesh inside the crown, leaving the core. Let the top dry for a day or two, then place it in a tray filled with pebbles for support and water. Roots will appear and new shoots will sprout from the top in about two weeks, and soon you'll have a fantastic tropical plant. To continue growing the new pineapple, transplant it into a pot, covering the crown and roots with soil.

Spicy Greens For a kitchen scrap plant that's both pungent and edible, try garlic or onions. Plant old cloves of garlic or bulbs of onions just below the surface in containers filled with moistened potting soil. Within a few weeks you'll see sprouts. Unlike the other kitchen scrap plants described above, you can eat these greens in salads and stir-fries.

3. Place in a sunny window and watch your gardens grow!

From Kidsgardening.org

MEASURING WIND SPEED

A lesson from the New Jersey Agricultural Society Learning Through Gardening program

OVERVIEW & PURPOSE

How does wind impact your garden? You can see how fast the wind is blowing in your garden by making an anemometer. An anemometer measures wind speed in miles per hour. Your homemade version will help you compare wind speeds, but not give you an actual measurement.

GRADES: 3-5

OBJECTIVES

The student will be able to:
• explain that plants move toward the light, and why
• explain how they can prove plants move toward the light
• record the day-to-day results of an experiment

MATERIALS NEEDED

- Scissors 4 small paper cups
- Dark colored marker
- 2 strips of stiff, corrugated cardboard – the same length
- Ruler
- Stapler
- Push pin
- Sharpened pencil with eraser on the end
- Modeling clay
- Watch that shows seconds

BACKGROUND

Winds speeds are measured in miles per hour. Depending on the speed of the wind, different weather phenomena are created. The following chart illustrates the various speeds and the condition.

ACTIVITY

1.Cut off the rolled edges of the paper cups to make then lighter.
2. Color the outside of one cup with the marker.
3. Cross the cardboard strips so they make a plus (+) sign. Staple them together.
4. Take the ruler and pencil and draw lines from the outside corners where the cardboard strips come together to the opposite corners. Where the pencil lines cross will be the exact middle.
5. Staple the cups to the ends of the cardboard strips making sure the cups all face the same direction.
6. Push the pin through the center of the cardboard (where the pencil lines cross) and attach the cardboard cross with the cups on it to the eraser point of the pencil. Blow on the cups to make sure the cardboard spins freely on the pin.
7. Place the modeling clay on a surface outside, such as the sidewalk, a porch railing, wooden fence rail, or a rock. Stick the sharpened end of the pencil into the clay so the anemometer stands straight.
8. Students can approximate the speed of the wind by counting how many revolutions take place in one minute. They can calculate this by counting how many times the colored cup goes around from its starting point. By doing this you will be measuring wind speed in revolutions, not miles per hour like an actual anemometer. Ten revolutions in one minute is equal to one mile per hour of wind speed.
9. Students should take their anemometers outside and measure the wind speed at various locations on the school grounds. You can compare wind speeds on different days, in different months, before or after a storm, etc. They should notice trends in areas that are blocked by trees or buildings, open fields, etc. Discuss how the wind speed may affect your garden. If you scatter dandelion seeds on a windy day compared to a calm day, what happens? How about the effect of the wind on small, fragile plants? Have your students record their observations in their garden journals.

EVALUATION:

Observation of students using an anemometer.
Recordings in science journals.

EXTENSION:

Have students investigate the way wind affects a farm or garden. For example, farmers look for dry, slightly breezy days to dry hay that has been harvested. Some seeds are spread by wind, including those of weeds. Some plants - grasses such as corn and wheat - are pollinated by the wind. Farmers cannot spray on windy days. Students could also report how wind can be both helpful and detrimental.

NEW JERSEY LEARNING STANDARDS

Science: 3:LS2.C, 3:LS4.C 4:ESS2.E 5:ESS2.A,C, 5:ESS3.C

The Beaufort Scale

Beaufort*	Avg Miles per Hour	Knots	Surroundings
0 calm		0-1	Smoke rises vertically and the sea is mirror smooth
1 light air	1.2 - 3.0	1 - 3	Smoke moves slightly with breeze and shows direction of wind
2 light breeze	3.7 - 7.5	4 - 6	You can feel the breeze on your face and hear the leaves start to rustle
3 gentle breeze	8.0 - 12.5	7 - 10	Smoke will move horizontally and small branches start to sway. Wind extends a light flag
4 moderate	13.0 - 18.6	11 - 16	Loose dust or sand on the ground will move and larger branches will sway, loose paper blows
5 fresh breeze	19.3 - 25.0	17 - 21	Surface waves form of water and small trees sway
6 strong breeze	25.5 - 31.0	22 - 27	Trees begin to bend with the force of the wind and causes whistling in telephone wires. Some spray on the sea surface
7 moderate gale	32.0 - 38.0	28 - 33	Large trees sway. Moderate sea spray
8 fresh gale	39.0 - 46.0	34 - 40	Twigs break from trees, and long streaks of foam appear on the ocean
9 strong gale	47.0 - 55.0	41 - 47	Branches break from trees
10 whole gale	56.0 - 64.0	48 - 55	Trees are uprooted and the sea takes on a white appearance
11 storm	65.0 - 74.0	56 - 63	Widespread damage
12 hurricane	75+	64 +	Structural damage on land, and storm waves at sea

NO POTTING SOIL? NO PROBLEM!

Potting soil is great for planting seeds—the soil is full of nutrients that plants need to grow. But if you don't have any potting soil at home, you can still experiment with plantings seeds.

All you need is some soil from your backyard and some coffee grounds. Coffee grounds contain the three main nutrients plants need to grow: nitrogen, potassium, and phosphorus.

Dig some soil from your backyard—the soil we used is thick clay—and add about a teaspoon of coffee grounds to every cup of soil. Mix the soil and coffee grounds well. Then plant your seeds.

NO-COST SCHOOL GARDEN DRIP IRRIGATION SYSTEM

A lesson from the New Jersey Agricultural Society Learning Through Gardening program

OVERVIEW & PURPOSE

Vacations and weekends when nobody is around to water can be tough on the school garden. It's discouraging for teachers and students to return from a much-needed break only to discover that the garden plants are dry and suffering. The solution is simple – collect some empty gallon milk jugs or other large plastic containers. Poke some holes in the bottom, fill the jugs with water, and place them strategically around your plants. Ta da! A drip irrigation system that doesn't cost a cent.

GRADES: K-5

OBJECTIVES

The student will be able to:
• create a no-cost irrigation system for the school garden
• experiment with the number and size of holes made in the milk jugs and the way the jugs are spaced in the garden to determine the optimum watering system for their plants.

MATERIALS NEEDED

- A collection of empty gallon milk jugs or other plastic juice containers (2-liter soda bottles can be used as well)
- Large pins, small nails, or pointed scissors to cut holes
- Older students can make the holes in the jugs with adult supervision. Younger students can discuss the project while the teacher makes the holes.

ACTIVITY

Rinse the containers out thoroughly with soap and water. Don't discard the caps. You will need them later. Cut a few pin size holes or slits into the bottom of each jug, or one hole with a small nail. Start with one container, as you may have to experiment with making the holes until you get the right "drip." Test the drip over your sink. Fill your milk jug with water, put the cap on, and watch to see that the water drips slowly, but does not pour out. If it does, the holes may be too big.

Take the jugs out to the garden. Have your students survey the garden area to decide the best placement of the jugs. You want to choose places where the water will reach the root zones of several plants. Space the jugs around the plants. To prevent them from blowing away when the water level gets low, tell your students to bury the bottom of the jugs oneinch deep in the soil. Or you can fill the bottoms of the jugs with about three inches of gravel or small rocks. Fill each jug with water — the opening should be a perfect fit for a hose.

Have your students monitor the drip system for a few days to see how long the jugs take to empty, and to make sure that your plants are not too wet or too dry. Make modifications to the jug placement or to the drainage holes if needed. Refill the jugs when needed. NOTE: If rain is forecast, have your students remove the caps of each container, so the rain will refill them!

EVALUATION:

Students take notes of their initial observations of the new irrigation system and brainstorm ways to make changes if needed. Students write sentences or paragraphs on how they built the irrigation system, their observations of the garden, any corrections they made, and the system's effect on the garden.

EXTENSION:

Students can create alternative irrigation systems for the garden.

NEW JERSEY LEARNING STANDARDS

Science: K:ESS3.C 1:LS1.A 2:LS2.A 3:ESS2.D 4:ESS2.A 5:LS1.C English Language Arts: K:W.K.2,3 1:W.1.2,7 2:W.2.2,4,8 3:W.3.2.A-D, W.3.4,8 4:W.4.2.A-E, W.4.4,8 5: W.5.2.A-E; W.5.4,

SODA BOTTLE HYDROPONICS

A lesson from the New Jersey Agricultural Society Learning Through Gardening program

OVERVIEW & PURPOSE

In this lesson, students will explore how to grow plants without soil and why people would want to grow plants this way. Students will see exactly how hydroponics works by making a hydroponics system with a soda bottle.

GRADES: PreK-5 (Teachers may want to demonstrate the construction of the soda bottle hydroponics system for younger children.)

OBJECTIVES

The students will be able to:

- Explain what hydroponics is.
- Describe different types of hydroponics.
- Describe the advantages of hydroponics
- Explain how their own hydroponics soda bottle works.

MATERIALS NEEDED

- 1-liter or 2-liter clear soda bottles for each group of three or four students
- Cotton towel or old T-shirt cut into strips that are 1 inch wide and 10 inches long, one for each group (You can also use cotton string.)
- Jumbo cotton balls, 10-15 for each group
- Lettuce seeds
- Miracle Grow powder fertilizer
- Epsom salts
- Eggshell Lemon or lemon juice
- Hydroponics - Growing Plants Without Soil, Facts for Kids sheet for each student
- Optional: PowerPoint from NJ Agricultural Society: https://youtu.be/9bWA4hcufZw

PREPARATION

You must cut the tops off the soda bottles about 4 inches down from the top or at the “shoulders" of the bottle. To do this, use a knife to slit an opening and then use scissors to cut all the way around the bottle. Teachers of older students may want to just make the slit with a knife on all the bottles and then let the students finish the cutting. Teachers of younger students should cut the bottles themselves.

INTRODUCTION

Begin the discussion by asking students how they know something is alive. Encourage answers such as grow, breathe, reproduce, move, eat or require nourishment. Next ask how we know that plants are alive.

Ask the students what plants need to live. Ask if plants move. Ask if they have ever seen a plant move. Ask why they think a plant would move. Discuss their answers.

Next, tell students that they are going to do an experiment to prove that plants will move toward the light. Ask students if they know what a maze is and if they have ever seen one. (Answers may include a corn maze, a hedge maze, or a puzzle maze drawn on paper.) Now tell students they are going to create a maze that a plant will have to solve in order to reach the light.

ACTIVITY

Read the Hydroponics – Growing Plants Without Soil, Facts for Kids sheet. Share PowerPoint. Discuss with students and answer any questions. Explain that you are going to make your own classroom hydroponics system using soda bottles.

Making the Soda Bottle Hydroponics System:

- Cut the top off the soda bottle about four inches from the top. (See Preparation notes above.)
- Turn the top over and insert it into the bottom of the bottle like a funnel.
- Tape the edges of the top and bottom of the bottle together with waterproof tape. (Duck/duct tape works well.)
- Fill the bottle halfway with water.
- Thread a strip of cotton towel or T-shirt through the hole to the bottom of the bottle, so that the bottom of the strip is submerged in water and the top end drapes over the funnel.
- Shred the cotton balls by pulling them apart. Hold the end of the cotton strip up and layer the shredded cotton balls around the inside the top of the bottle. The end of the cotton strip should lay on top of the cotton balls.
- Use a watering can or spray bottle to soak the cotton and the top of the cotton strip with water. Spread lettuce seeds lightly all over the cotton. Set the soda bottles in a sunny spot. Now observe the growth of the plants. Students can record daily in their science journals what they observe.

It should take 10-14 days for the lettuce to grow little leaves. The seeds do not need nutrients to germinate, as all the nutrition a plant needs to sprout is stored in the

seed. When the leaves appear, photosynthesis will begin and it is time to add nutrients to the water.

To make the nutrient solution:
You will need a 2-liter bottle with a cap. (You can use a 1-liter bottle – just cut the recipe in half)

- Fill the bottle with water.
- Add 1/4 teaspoon of Miracle Grow or other plant food.
- Add 1/8 teaspoon of plain Epsom salts.
- Add 5 drops of eggshell extract (see recipe below)

Shake well.

To make the eggshell extract (calcium solution):

- Crack an egg and remove the yolk and white. Leave the membrane intact, and let it dry.
- Crush the dried eggshell as finely as you can, membrane and all. Then dissolve it in lemon juice using these measurements:
- 1/2 teaspoon of dried powdered eggshell and the juice of half a lemon (about 1 1/2 tablespoons)

Let the solution sit overnight in a covered glass or jar to dissolve. It's okay if it's a bit gritty or if some of the shell doesn't dissolve. Add nutrient solution to the water so that the bottle is again one-half full. When the water level starts to drop, add more nutrient solution to sustain this level. Ask the students to continue to observe the growth of the lettuce. When it is grown, students can harvest the lettuce and eat it.

EVALUATION:

Ask the students to write a paragraph about hydroponics: how it works and why it is used. Younger students can discuss what they observed and what they know about hydroponics.

EXTENSION:

Ask students to research places where hydroponics is used such as:

- Science stations in Antarctica – research has been done there for NASA.
- Former industrial buildings are being used in cities for aeroponics.
- Check out Aerofarms, an aeroponics company with a large facility in Newark, N.J.
- Many of the tomatoes and sweet peppers grown in New Jersey are started hydroponically.

NEW JERSEY LEARNING STANDARDS

Science: PreK: 5.1.1-4 K:LS1.C, ESS3.C 1:LS1.A 2:LS2.A 3:LS1.B, LS4.B 4:LS1.A 5:LS1.C, ESS3.C English Language Arts: 3:W.3.2.A-D, W.3.4,8 4:W.4.2.A-E, W.4.4,8 5: W.5.2.A-E; W.5.4,8

Growing Plants Without Soil Facts for Kids

Hydroponics is a way to grow plants without soil. In hydroponics, the nutrients or important materials plants need to grow are put into water and then taken up to the plant through its roots.

Outside, in nature, a plant’s roots do two things: they take up water and nutrients from the soil, and they help fix the plant to the ground so it isn’t blown away by wind. Mineral nutrients needed by plants are often naturally present in the soil, but farmers also add them with fertilizers.

Indoors, farmers do not need to worry about the wind, so the roots' only job is to deliver nutrients to the plant. This can be done by putting nutrients and the plant’s roots into water.

There are several different ways to build a hydroponics system. Sometimes, the plants are hung in nets or other structures with their roots dangling into the water below. In some systems, the plant's roots grow in materials other than soil. This material supports them and leaves lots of space around them. One example of these support materials is vermiculite, which is a mineral that looks like a stone but is very light and can absorb water easily. The outer husks of coconuts are also used, as well as a material called rock wool, a light substance that is made by blowing air through very hot rocks. Aeroponics is another form of hydroponics. In aeroponics systems, the roots do not sit in water. The plants hang in the air, and water containing nutrients is sprayed on the roots. A larger variety of plants can be grown with aeroponics, as some

plants do not like to have their roots sitting continuously in water. NASA is interested in aeroponics to grow plants in space because managing a spray is easier than handling liquids in zero gravity.

Aquaponics is another type of hydroponics. In this system, the roots of plants float in a fish tank. The fish help the plants by providing all the nutrients they need in the form of fish poop. Bacteria in the water break down the fish poop into nutrients that the plant roots can absorb. The plants help the fish by removing the fish poop from the water and keeping the water clean. If the water becomes too dirty, the fish will die.

There are many advantages to growing plants hydroponically: No soil is used. Plants are off the ground and inside, so there are no weeds and fewer insect pests and diseases. Hydroponic gardens actually use less water, even though the plant always sits in water. Less water is needed than for crops in the ground, and the plants are never over-watered or under-watered. Water in hydroponics systems is always recirculating.

Hydroponics is a perfect way to grow plants for areas without good soil, such as deserts or very cold climates. All the stations in Antarctica have hydroponics systems to provide fresh vegetables for the scientists who work there.

VERMICOMPOSTING AT HOME OR AT SCHOOL

Make your own Bin!

A lesson from the New Jersey Agricultural Society Learning Through Gardening program

MATERIALS NEEDED

- Two large plastic storage containers, with tight-fitting lids (both the same size)
- A drill and a ⅛ inch size bit
- Dry decomposable materials, like leaves, thin twigs, etc.
- Wet decomposable materials, like food scraps
- A container of earthworms (optional yet recommended. Learn more below!)
- A helpful reference is Worms Eat my Garbage by Mary Appelhof

ACTIVITY

Making a compost bin for around $50 is simple. Once you've gathered your supplies, it's just seven easy steps to begin DIY composting.

1. **Get your plastic bins.** Head over to your local department store or home improvement center and buy two large plastic storage containers, at least 24 inches tall or higher. You can likely find these for only a few bucks, especially if they're on sale. Make sure the containers come with tight-sealing lids, as keeping your bin closed will allow the compost to retain moisture and protect it against the outdoor elements.
2. **Power up your drill.** Drill ⅛-inch sized holes every three inches along all four sides of the plastic containers. On *one* of the containers only, drill holes on the bottom of the container too. Then, drill three rows of holes across the lid of *one* of the containers, leaving the other untouched. Empty any plastic residue from the inside of the storage containers.
3. **Place one bin inside of the other.** Place the container with the base holes inside of the other. The bin should lock into the lip of the other, suspending it slightly higher. This creates a gap inside, so any excess moisture will be able to drip into the second bin, helping to ensure your compost doesn't oversaturate or leak stinky juice all over! The holes allow for airflow and oxygen to break down the matter.

4. **Choose a convenient home for your compost bin.** Before you start filling the compost, find a good spot for it to “live.” It can be placed outside of your back door to make adding to it easy or place it in a sheltered area, out of sight. Ensure it’s undercover to stay sheltered from the rain or excessive sun, which can cause your compost to overheat, “baking” and creating a smell. Fortunately, using two containers helps to contain any decomposition odor.
5. **Add your starter dry materials.** When composting, it’s best to layer dry materials with wet incrementally. Start your first layer with dry materials — like leaves, broken down sticks, grass clippings, and dirt. If you add a newspaper, ensure it’s damp to promote decomposition. These organic matters will create a stable base and stop the wet fruits and veggie excretions from dripping greatly into the bottom of the bin.
6. **Release the worms!** While your compost can break down materials without worms, these little guys will expedite the process. The worms feed on the scraps — called “vermicomposting”— and the organic matter gets recycled back into the compost. *
7. **Add your kitchen scraps.** Before adding your kitchen compostables — like vegetable pieces, fruit skins, etc. — be sure you chop them up very finely. This will help them to break down faster and are easier for worms to consume.

*The number of worms you’ll need will vary depending on the size of your bin, but you can generally start with a 250 count. You can order red wriggler worms on-line.

Websites About Teaching in the Garden

From the New Jersey Agricultural Society Learning Through Gardening program

The National Agriculture in the classroom website contains lists of lesson plans by agricultural subject for grades K-12 in its Curriculum Matrix.
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KidsGARDENING This site provides advice on getting started, educational support, materials for sale, and fundraising ideas.

Edible Schoolyard includes agricultural lesson plans subject and by grade level.

My American Farm Interactive, online agricultural-related games for all elementary ages that educate as they entertain. Also free, downloadable lessons and agricultural activities.

Raritan Headwaters is a New Jersey environmental organization whose educational resources include wonderful indoor and outdoor activities for children about environmental science, conservation, and New Jersey's plants and animals