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Socioscientific Issues Unit Plan: 3rd Grade Life Science

June 6, 2023

Topic: Life Science and Measurement

Targeted Grade Level: 3rd grade

Time Needed: 5 months from start to finish

-Introducing phenomenon/stream data and planning for solution (3-30 minute lessons)

-Sowing seeds-30 minutes in late winter-January

-Collecting data bi-weekly (4 classes-February and March -30 minutes each)

-Researching plants, collecting data, discussions (2 classes-40 minutes each)

-Reporting data into graph and sharing (2 classes-30 minute)

-Developing a model (1 class-30 minutes)

Not included in this lesson plan:

Prepping rain garden beds, planting pollinator plants, developing a brochure of PSA, and reevaluating the stream to see if our plan is helping.

Subject Integration: Science, Math, Literacy, Technology

Teacher Background Information: In New Jersey local pollinators are on the decline and more specifically the Monarch Butterfly who just entered in on the endangered species list the summer of 2022. Students in 3rd grade learn that reproduction is essential for a species to continue and how different plants and animals have unique life cycles. Students will be sowing pollinator plant seeds in late winter in the classroom watching the plant life cycle and taking note of its characteristics. Different native seeds will be given: common milkweed, cardinal flower, beebalm, and swamp milkweed, and Hollowstem Joe-Pye Weed. This unit will be building off what they learned last year in 2nd grade which was the importance of pollinators and different types of pollinator plants. As the plants grow indoors the DCIs (Disciplinary Core Ideas) from K-2 will be reinforced: plant parts and what plants need to grow. Students will also gather evidence and research each type of plant to determine which plant it is by its inherited traits based on the adult ones that were previously planted in our other pollinator garden. They will also have to research in order to prepare for planting it in the spring.

During the growth time, students will learn about various native pollinators and how their plants help support them. Throughout the activity students will be collecting data on the plants growth by measuring the growth bi-weekly and then monthly once they are planted (3rd grade math standard). Students will measure plants to the nearest quarter inch. They will report the data in line plot

format combining their data with others in their class and grade for each plant species. After comparing, students will discuss trends in growth of the different species and other findings from the data. Students will use Google Sheets to develop a clear graph to add to their report about the importance of pollinator plants and the correlation between the growth rate to why we need more pollinator plants. Students will then develop a plan to plant their pollinator plants in the rain/pollinator garden considering its needs. The need for a rain garden has become evident from a recent stream assessment completed by our Watershed Ambassador for our stream behind our school. The stream data revealed high levels of pollution tolerant macroinvertebrates. This stream feeds Rosedale Lake which has had high amounts of algal blooms. This proposed garden plan should be placed in an area where rainwater enters our stream which then feeds Rosedale Lake. Students will be developing the plan to help solve this problem along with collecting the data to support their research on the importance of certain pollinator plants. They will be using their data and knowledge to build awareness in our community about the problem and possible solutions with their brochures on their particular plant species. Everything the students are doing has a real purpose and ties in with their curriculum standards in a very real way.

The integration is logical because it is starting with the basis of science and their grade level DCIs and then bridging organically to collecting growth measurement data to the nearest quarter inch and reporting it into a line plot graph to make sense of the data for their understanding of plant traits. Using Google Sheets to develop the graph will incorporate tech standards as well as 21st century skills. Not included in this lesson plan is adding the component of creating a brochure to teach the public about their specific pollinator plant and how it helps the environment will add the last level of communicating ideas. Our human impacts have affected the growth of Monarch butterflies' host plant, milkweed, with pollution, fertilizers, and pesticides. The deforestation rate in New Jersey has also affected it. The Monarch Butterflies are not able to survive well in our current environment. If we want to bring back pollinators and create a healthier environment we need to reduce the amount of pollution we produce and procure land for the native plants so native species can flourish.

Additional Resources:

Rosedale Park Algae Blooms: https://mercerme.com/floating-wetlands-launched-at-rosedale-park/

Monarch Butterflies Endandered Species:
https://www.nj.com/news/2022/07/beloved-monarch-butterflies-that-spend-part-of-the-year-in-nj-now-listed-as-endangered.html

New Jersey Climate Change Standards/Integration into the NGSS:

Core Ideas: Populations live in a variety of habitats and change in those habitats affects the organisms living there.

When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.

Performance Expectation-3-LS4-4: Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

NGSS Standards:

Performance Expectation- 3-LS1-1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. [Clarification Statement: Changes organisms go through during their life form a pattern.] [Assessment Boundary: Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.]

LS1.B: Growth and Development of Organisms: Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.

Performance Expectation- 3-LS2-1. Construct an argument that some animals form groups that help members survive.

LS2.D: Social Interactions and Group Behavior: Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size (Note: Moved from K–2).

Performance Expectation- 3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. [Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.]

LS3.A: Inheritance of Traits: Many characteristics of organisms are inherited from their parents.

LS3.B: Variation of Traits: Different organisms vary in how they look and function because they have different inherited information.

Performance Expectation-3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.

[Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a pet dog that is given too much food and little exercise may become overweight.]

LS3.A: Inheritance of Traits: Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment.

LS3.B: Variation of Traits: The environment also affects the traits that an organism develops.

New Jersey Student Learning Standards-Math

3.MD.B.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.

3.NF.3d Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.

Computer Science and Design Thinking Standards (New Jersey)
8.1.5.A.4 Graph data using a spreadsheet, analyze and produce a report that explains the analysis of the data.

8.2.5.C.4 Collaborate and brainstorm with peers to solve a problem evaluating all solutions to provide the best results with supporting sketches or models

New Jersey Student Learning Standards (ELA)

RI.3.1. Ask and answer questions, and make relevant connections to demonstrate understanding of a text, referring explicitly

to the text as the basis for the answers

Essential Questions:

What impact do humans have on plants and animals?

What causes lakes to grow algae blooms?

What is causing the Monarch Butterfly population to decline?

Why is it difficult for Monarchs to survive?

Why are native pollinator plants unique?

How can line plots be used to analyze plant growth?

How are plant and animal life cycles connected?

Why can some animals and plants survive while others cannot?

Measurable Student Learning Objectives:

Students will be able to identify how their local environment has changed which has caused a change in the plants and animals that live there.

Students will be able to analyze data in order to determine the stream's health.

Students will research solutions to help reduce the impact of pollution getting into our stream.

Students will be able to explain the monarch butterflies life cycle with connection to their migration cycle.

Students will develop an argument for the decline of the Monarch butterflies in New Jersey using evidence of deforestation in Mexico and decrease of host plants.

Students will be able to identify the life cycle of the 5 different pollinator plants and explain how they are able to reproduce.

Students will demonstrate how to use a ruler in order to measure plants to the nearest quarter inch and compile the data into a line plot graph to show growth rate of different plants and identify them according to various traits.

Students will be able to research and gather information on various pollinators and attributes of different plants in order to construct an information paper/brochure about their pollinator plant (choose one that they grew).

Students will be able to use Google Sheets to develop a graph to add to their informational report about their plant.

Engaging Context/Phenomena: Our Stream behind our school is showing signs of pollution (62 out of the 70 macroinvertebrates collected last year from the stream were pollution tolerant macros). Rosedale Lake has had an increase of algal blooms caused by excess amounts of fertilizers, pesticides and other pollution. Pollinators are on the decline in New Jersey and the Monarch Butterfly has just entered on the endangered species list summer of 2022. To help with both problems students will design and create a pollinator garden which will also act as a rain garden. The seeds will be mixed up and students will have to use data they collect on the plant growth to determine which plant is what species.

Data Integration: Students will be collecting data on various pollinator plant growth (observations and measurement) in order to analyze the data to identify the pollinator plant species. They will also be using that data in their brochure about their plant species to talk about growth rate and appearance.

Students will look at data on the decline of pollinators through articles about the decline of popular NJ fruits and vegetable crops not producing as much (https://www.rutgers.edu/news/decline-bees-other-pollinators-threatens-us-crop-yields), Monarch Butterflies (https://www.nj.com/news/2022/07/beloved-monarch-butterflies-that-spend-part-of-the-year-in-nj-now-listed-as-endangered.html), Rosedale Park (https://mercerme.com/floating-wetlands-launched-at-rosedale-park/) and climate changes (https://climate.nasa.gov/climate_resources/41/video-sting-of-climate-change/) . The data will be used to provide further information about the decline, what we can do to help and why it is so important to do so.

Differentiation of Instruction: These lessons will be student-driven and will be able to be differentiated by providing different modalities to learn information and output the information: readings/text (different levels), recording of readings, voice to text usage, allowing for online formats for videos presentation of information, scaffolding for collecting data (rulers with clearer markings, graphic organizer for collecting data, step-by-step guidance to create data graphs using Google Sheets)

Possible Misconceptions:

All macroinvertebrates mean a stream is unhealthy.

Pollution tolerant vs pollution intolerant...Which do we want to see more of?

Monarch butterflies will adapt to the new environment.

All plants grow at the same rate and need the same amount of light, water, and space.

Every plant species looks exactly alike.

Using a ruler you start at the end of it.

Line plot graphs tell you how many plants.

5E Model	5E Objectives
Engage	**Procedure:** 1.Teacher introduces the problem/anchor phenomenon: The 5th grade completed a stream assessment last year (May 2021) and collected 70 macroinvertebrates. Macroinvertebrates are small organisms that do not have a backbone that can be seen without the use of a microscope. Macroinvertebrates can tell us a lot about a stream's health. The findings reveal interesting information about our stream. 62 of the 70 collected were pollution tolerant/pollution sensitive. 2. Group students and provide macroinvertebrate data. 3. Students look at the data and make true statements based on what they notice. Students will complete a T chart to help interpret the data: What do I see? What does it mean? 4. Class discussion of data. What did they discover through looking at the data? 5. Next, students write down researchable/testable questions they have? Possible questions: What does it mean to be pollution sensitive/tolerant/intolerant? What happened to the pollution intolerant macroinvertebrates? How did the stream become polluted? How can we make the stream healthier? **Modifications:** Teacher will lean into student discussions to help facilitate conversation. Asking probing questions: what does _____ mean? How do you know _____? **Standards Addressed:**

	3-LS2C.1: When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. (secondary to 3-LS4-4)
	Formative/Summative Assessments: Students will be formatively assessed on their questions they are going to investigate making anecdotal notes on the types of questions. Is the question researchable or testable? Does it make sense with the phenomenon? (evaluating the practice of asking questions and defining problems: Identify scientific (testable) and non-scientific (non-testable) questions).
	Resources: Macro Data, WIS/WIM chart, chromebooks, journal
Explore	**Procedure:**
	1. Students will use their researchable/testable questions to begin collecting information about the problem. Students will use their chromebooks to begin researching ideas:jerseyyards.org, https://www.nyc.gov/site/dep/water/rain-gardens.page
	2. While students are researching, the teacher is leaning in and talking with students about what they are researching. Guiding students to start to think about solutions that are manageable and can help solve another problem.
	3. Class discussion of findings to questions...pause on the stream problem. Explain to students that sometimes when we solve one problem we can create another but on the flip side we can also be more forward thinkers and solve two problems with one solution.
	4. Introduce the second problem/phenomena with our local ecosystem: Native pollinators are on the decline. Read pollinator article: https://nj1015.com/decline-of-bees-threatens-crop-yields-across-nj-and-the-u-s/, http://www.conservewildlifenj.org/protecting/projects/pollinators/, https://earthobservatory.nasa.gov/images/8506/deforestation-in-monarch-butterfly-reserve

Introduce that research being done at NASA with climate change and honeybees:
https://climate.nasa.gov/climate_resources/41/video-sting-of-climate-change/

5. Class discussion: How are these two problems connected (stream health and decline of pollinators)?What are others doing to solve the problem? Last year we developed a pollinator garden. What was the purpose of that? Brainstorm solutions...leading students to thinking more about rain/pollinator garden solutions.

Day 2 of Explore:

1. Explain how we are going to use seeds from pollinator plants that will act as a rain garden later. When seeds were collected they got mixed up. Seeds were collected from: beebalm, hollow stem joe-pye weed, cardinal flower, common milkweed and swamp milkweed.

2. Students will be given 10-20 seeds, observe them and will sort them by traits. Students will need to be placed in 5 groups. Each cluster will have 10-12 **like** seeds to investigate and determine the species.

3. Students will plan out an investigation to determine which plant is what species (ex:sowing the seeds, making observations, comparing the plant growth to adults). In order to plant it in our pollinator/rain garden we need to know about its growing needs.

4. Students can start researching traits of each of the 5 plant species on Jerseyyards.org to gain background knowledge of its appearance, growth rate, and the types of native pollinators it attracts.

Day 3 of Explore:

1. Students will begin collecting quantitative data along with their qualitative observational data about their plant growth by measuring it to the nearest quarter inch and recording the data. Students will measure the plants bi-weekly. All plants should be receiving what it needs for growth water and light. For now students can report the data: date and height of plants. It would be helpful

to label plants a,b,c,d for measurement purposes. Students may need to be shown how to use a ruler to measure accurately.

2. Students will use the data from observations (adult plants), measurement data, and plant research information to start to try to identify the plant species. Students should continue to research to learn more about the native plant.

3. Facilitate group discussions: What are your findings? What is your data telling you? What observations have you made? How do you know that your plant species is _____? What evidence do you have to support that?

Modifications: partner students accordingly, reading support, scaffolding questions to help lead a better discussion and better planning of investigation. Provide rulers with the markings for quarter of an inch clearly marked. Provide a graphic organizer for collecting data.

Standards Addressed:

NGSS:

3-LS1B.1: Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (3-LS1-1)

3-LS3A.1: Many characteristics of organisms are inherited from their parents.

(3-LS3-1) ELA:

RI.3.1. Ask and answer questions, and make relevant connections to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers

8.2.5.C.4 Collaborate and brainstorm with peers to solve a problem evaluating all solutions to provide the best results with supporting sketches or models

Math:

Explain	3.MD.B.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters. **Formative/Summative Assessments:** Students will be evaluated on class participation, peer interaction, and collaboration. Students will also be evaluated on the practice: Planning and conducting an investigation- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. Collect anecdotal notes on students' development as they work through the process. **Resources:** chromebooks, websites listed in procedure shared with students, journals to collect data and take notes, seeds from: beebalm, hollow stem joe-pye weed, cardinal flower, common milkweed and swamp milkweed, soil, cups, grow lamps, magnifying glasses, rulers, water **Procedure:** 1. Facilitate group discussions/presentation: What are your findings? What is your data telling you? What observations have you made? How do you know that your plant species is _____? What evidence do you have to support that? What pollinators are attracted to your plant? 2. Other groups are actively listening and asking questions to help learn more about the other plant species to help with planning where to plant their species. The plants in the garden will work together just as we are working together. Some plants will provide shade for other plants as they grow. 3. Allow time for group collaboration after discussion and presentation of information to discuss what their plants needs are and planting goals. **Modifications:** Provide students with a list of questions (noted about) they need to be able to answer from the data they collected. Use WIS/WIM

Elaborate	**Standards Addressed:** NGSS: 3-LS1B.1: Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (3-LS1-1) 3-LS3A.1: Many characteristics of organisms are inherited from their parents. (3-LS3-1) ELA: RI.3.1. Ask and answer questions, and make relevant connections to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers **Formative/Summative Assessments:** Journal review (rubric) of student data: note taking, measurement data, observation data **Resources:** Journals and data **Procedure:** 1. Students in the group will create 3 line plot graphs of measurement data to the nearest quarter on 3 separate dates of data collection (beginning growth, middle growth, and current growth). 2. Students will use google sheets to create the graphs (measurement along the Y axis and amount/number of plants that were that height along the X axis). How to create charts on google sheets: https://youtu.be/UOoH0Lb4dc4 3. Students will then complete a WIS/WIM looking at all three data points. 4. Share findings with the class about data and how it correlates with your plant species.

Evaluate	**Modifications:** teacher support, step-by-step directions **Standards Addressed:** Math: 3.MD.B.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters. 8.1.5.A.4 Graph data using a spreadsheet, analyze and produce a report that explains the analysis of the data. **Formative/Summative Assessments:** graphing data on google sheets and WIS/WIM sheet **Resources:** chromebooks and data **Procedure:** 1. Assessment: Students will develop a model of their plant species and where it should be planted based on its growing needs. -The model should include how their plants will help solve both the pollinator problem and the stream problem. -The model should include arrows to show relationships and cause and effect. -Include any other important information you learned about your plant species into your model. For example its traits and special qualities like what type of pollinators it attracts, growth rate, and other needs **Modifications:** Check off list of what model needs to include, allowing partners to complete the model together, model can be 3-D, 2-D or done electronically on jamboard or another platform

	Formative/Summative Assessments: Modeling rubric which can be converted into I can do statements for modifications.
	Resources: chromebooks, journals, poster paper, markers, crayons, rubric and directions

More Teacher Background:

-Have DCIs, practices, and cross cutting concepts that will be used in this unit posted in the room in student friendly language

-Information on Macroinvertebrates from Watershed and article from MercerMe about Algae Blooms and solution
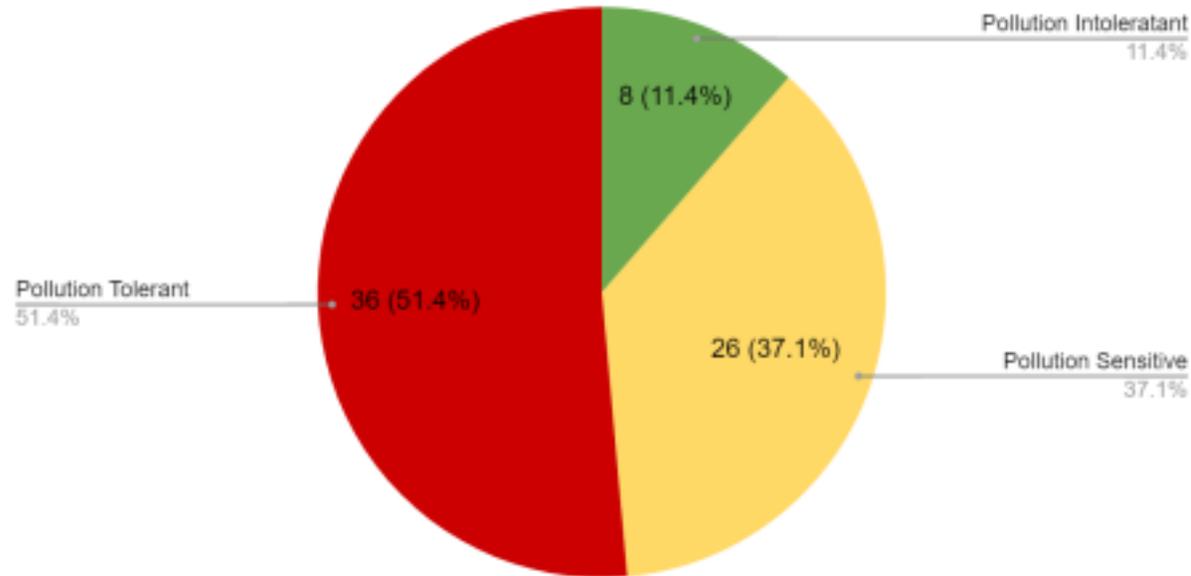
-Knowledge of plant growth of 5 species listed

-Familiarize yourself with websites and resources

-How a rain garden works (see link in the procedure for resources for students to use)

-How to create a google sheets data chart (see link in the procedure)

-How pollution gets into our waterways (see enviro-scape youtube video listed in procedure)

Macroinvertebrates from Stream Assessment

Pollution Intoleratant
11.4%

8 (11.4%)

Pollution Tolerant
51.4%

36 (51.4%)

26 (37.1%)

Pollution Sensitive
37.1%

Pollution Tolerant Macros found:	Pollution Sensitive Macros Found:	Pollution Sensitive Macros Found:
Mayflies Stoneflies Gilled Snails	Alderflies Damselflies Dragonflies Crane Flies Sow Bugs	Alderflies Damselflies Dragonflies Crane Flies Sow Bugs

WIS/WIM Organizer

Directions: Look at the data. Make statements about what you see and then answer the question of what it means.

(Ex: I see a red pie piece. That means 36 of the macros were pollution tolerant)

What I see?	What it means?

Student Journal Rubric:

	Scientific Process Uses Science Knowledge to understand phenomenon	Group Participation	Organization/ Understanding
Meeting Expectations (3)	Student uses DCIs and evidence of questions, data to accurately predict results. Data and observations are clearly communicated throughout the investigation or activity. Labels are used accurately	Student worked cooperatively with partners and group communicating ideas respectfully.	Journal is organized, quite accurate and demonstrates concept understanding.
Approaching Expectations (2)	Student uses DCIs or predictions and results from investigation. Student may use the data inaccurately or lack evidence. Students communicate information.	Student participated with some reminders and needed to be refocused.	Scientific principles not well understood. May contain errors in thinking.
Not Meeting Expectations (1)	DCIs are not used and or some are missing. Written work may contain missing information or misconceptions. Scientific evidence is poorly laid out.	Student was troublesome in class and with partners and groups. Unfocused and uncooperative.	Content lacks detail and shows little understanding.

Develop a model of your plant species and where it should be planted based on its growing needs. -The model should

include how your plants will help solve both the pollinator problem and the stream problem. -The model should include

arrows to show relationships and cause and effect.

-Include any other important information you learned about your plant species into your model. For example its traits and special qualities like what type of pollinators it attracts, growth rate, and other needs

-Everything in your model should have a purpose.

	Not Meeting Expectations (1)	Approaching Expectations (2)	Meeting Expectations (3)
Developing and Using Models: Develop a diagram or simple physical prototype to convey a proposed object, tool, or process Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system. Develop and/or use models to describe and/or predict phenomena.	Student develops a model with limited data provided and does not explain the cause and effect relationships.	Student develops a model that has data on one to two parts: growth, pollinators and traits. The model has arrows but there may be incorrect relationships between elements highlighted. Most parts in the model have a purpose.	Student develops a model that has data on two to three parts growth, pollinators and traits. The model has arrows that show the relationship between various elements (rain water to roots and pollinators to flowers). Everything in the model has a purpose.

Plant Growth Data for _____

(date)

Plant Name (a,b,c,d..) Measurement to nearest quarter inch

Resources

Climate Change Standards by Grade Band. (n.d.). https://www.nj.gov/education/standards/climate/learning/gradeband/

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Pollinator Conservation - Conservation Projects - Protecting Wildlife - Conserve Wildlife Foundation of New Jersey. (n.d.).

http://www.conservewildlifenj.org/protecting/projects/pollinators/

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Rutgers University. (2020). Decline of Bees, Other Pollinators Threatens U.S. Crop Yields. *Rutgers University*.

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https://climate.nasa.gov/climate_resources/41/video-sting-of-climate-change/

Rain Gardens - DEP. (n.d.). https://www.nyc.gov/site/dep/water/rain-gardens.page