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NYSSLS 5-E Lesson

<table>
<tr><td>Grade/Grade Band: 8th Grade Living Environment</td><td>Topic: Carrying Capacity</td><td>Timeline:
Lesson #1 in a series of 3-5+ lessons</td></tr>
<tr><td colspan="3">Lesson Title: Carrying Capacity at Different Scales</td></tr>
<tr><td colspan="3">Brief Lesson Description: Students will explore their outdoor school campus to make observations regarding the Eastern Gray squirrel population at their school. They will then connect those observations to the online platform iNaturalist. They will engage with this platform to help record sightings of the squirrels, which in turn will help map populations and provide data to the larger scientific study they are a part of. Also, students will draw conclusions regarding the important biotic and abiotic factors that influence the survival, or lack thereof, for these populations.</td></tr>
<tr><td colspan="3">Performance Expectation(s):
HS-LS2-1. Use mathematical and/or computational representations to support explanations of biotic and abiotic factors that affect carrying capacity of ecosystems at different scales.
MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.</td></tr>
<tr><td colspan="3">Specific Learning Outcomes: (What will the students know and be able to do as a result of this lesson?)
The students will be able to identify biotic and abiotic factors that affect the population.
The students will be able to record observations and identify differences between urban and rural environments
The students will be able to identify and describe similarities and differences between the Eastern Gray squirrel and its color morph(s).
The students will be able to identify patterns within data that describe differences in black and gray squirrel populations between urban and rural environments.</td></tr>
<tr><td colspan="3">Narrative/Background Information</td></tr>
<tr><td colspan="3">Prior Student Knowledge:
Biotic and abiotic factors
graphing and averages</td></tr>
<tr><td>Science & Engineering Practices:

Using Mathematics and Computational Thinking

Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic</td><td>Disciplinary Core Ideas:

LS2.A: Interdependent Relationships in Ecosystems

Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1),(HS-LS2-2)</td><td>Crosscutting Concepts:

Scale, Proportion, and Quantity
The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-LS2-1)</td></tr>
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assumptions. ● Use mathematical and/or computational representations of phenomena or design solutions to support explanations. (HS-LS2-1)	● (NYSED) Carrying capacity results from the availability of biotic and abiotic factors and from challenges such as predation, competition, and disease. (HS-LS2-1),(HS-LS2-2)	

Possible Preconceptions/Misconceptions:

- The squirrels are different species

Teaching Materials: (A list of materials required, including any AV materials, to run your lesson.)

- cell phones
- iPads
- computers

Safety: (Address any safety issues for demos, activities, lab, etc.)

- Students will be outside, in and adjacent to nature. Be aware of allergies and hazards.

LESSON PLAN – 5-E Model

ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions:

1. Tell kids about summer research adventure- slideshow of pics types of things we learned and experienced.
    - Modifications –
        - spend some time introducing the Eastern Gray Squirrel to students (use information found on SquirrelMapper website or squirrel biology PPT available on website)
        - Discuss the natural history of the decrease in EGS populations and genetic variation (articles available in teacher resources)
2. No Data in Oneida but we have squirrels- Need our help- explain project

EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions:

1. Make general physical observations of the black and gray squirrels (make use of SUNY ESF squirrel kits- taxidermied squirrels if available. Modification: use the SquirrelMapper or iNaturalist SquirrelMapper project websites (https://www.inaturalist.org/projects/squirrelmapper) with photos and information to enrich the conversation.)
2. Make squirrel observations with iNaturalist outside around school and in woods
    a. 10 minutes outside with no instruction
3. Make squirrel observations with iNaturalist outside around school and in woods
    a. Mini lesson on squirrels: where they are found, run along, dreys
4. Make squirrel observations with iNaturalist outside around school and in woods
5. Back into classroom
    a. Zooniverse to identify black versus gray squirrels
    b. Intro iNaturalist to add data to into their observations from the field
6. Will collect data all school year, adding location pins into a large map of Oneida on a cork board
    a. Color coded for squirrel color
    b. Compete with high school, separate iNaturalist Project
    c. And TikTok video smack talking

EXPLAIN: Concepts Explained and Vocabulary Defined:

1. Students will make observations regarding the class data that was collected
    a. Brainstorming- individual,small group, class.
        i. Jamboard, whiteboards, etc
    b. What do you notice?
        i. (Hoping to notice pattern of urban versus rural distribution, and perhaps color of fur)

c. Why do you think this is happening?
    i. (Hoping they discuss differences in biotic and abiotic factors.
        1. Predators, food and food sources habitat, tree cover, etc.)
    ii. Biotic and abiotic factors - how they impact the organisms that live in an area
        1. Class consensus with explanations
        2. How would each factor change the population?

2. Working towards idea of carrying capacity
    a. Lab PHET Natural Selection
        i. Complete without intro
    b. Mini Lesson on Carrying capacity

Key vocabulary that you will introduce/use: Carrying Capacity, biotic, abiotic, distribution, genetic variation

ELABORATE: Applications and Extensions:

- Calgary Squirrel Population Assessment
- Isle Royale Moose and Wolves
    - https://www.nps.gov/isro/learn/nature/wolf-moose-populations.htm
    - Slides PLC PC3DOM 10-27-21 - Patterns
    - Apply carrying capacity info to data from Isle Royale
    - Worksheet / plan
        - Northwestern University Lesson 8: Is the Island Royale a stable ecosystem for the wolf and moose populations?
        - BioInteractive - The Wolves of Isle Royale

EVALUATE:

Formative Monitoring (Questioning / Discussion):

- Squirrels Here, There and Everywhere!

Summative Assessment (Quiz / Project / Report):

Differentiation/Modifications:

- Please refer to the current/updated SquirrelMapper website whenever referred to in associated documents

Additional NYS Standards:

Middle School:

- MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.] ???

References: www.squirrelmapper.org and https://www.inaturalist.org/projects/squirrelmapper