Studying Biodiversity

Companion Lesson to X-STEM All Access Episode "Ambassadors of Conservation and the Climate"

Grade/ Grade Band 9-12	**Topic:** Conservation	

Brief Lesson Description: During the lesson, students will examine climate change factors endangering wildlife. Then they will create a computer model illustrating the impact.

Performance Expectation(s):
HS-ESS3-3 Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. (HS-ESS3-3)

Specific Learning Outcomes: Students will design a computer-generated model illustrating how climate change is impacting wildlife.

Narrative / Background Information

Prior Student Knowledge:
Students should be able to describe the causes and effects of climate change.
Students should be familiar with using Scratch to code.
Students should be familiar with the concept of computer-generated models.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
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 assumptions. ● Create a computational model or simulation of a phenomenon, designed device, process, or system. **(HS-ESS3-3)**	**ESS3.C: Human Impacts on Earth Systems** ● The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. **(HS-ESS3-3)**	**Stability and Change** Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. **(HS-ESS3-3)**

Possible Preconceptions/Misconceptions: Students may believe there is no scientific consensus on the existence or causes of global climate change. Students may also believe the climate is always changing or has changed many times before humans began burning coal and oil. So there is no reason to believe humans are causing warming today.

LESSON PLAN – 5-E Model

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

Begin this lesson by showing students the video Ambassadors of Conversation and the Climate with Dr. Mireya Mayor. Ask students to take notes and write a summary of Dr. Mayor's journey to becoming a primatologist.

Ask students to list how they believe climate change impacts wildlife (possibly ans.: droughts/floods impact food production, rising sea levels flood homes along the coasts and increase beach erosion, warming temperatures, and droughts foster wildfires which increase air pollutants and respiratory issues).

EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions: Students will need access to laptops and the internet for this activity.

Students will explore examples of computer models for climate change by playing games on the NASA resource website.
Coral Bleaching: https://climatekids.nasa.gov/coral-bleaching/
Climate Time Machine: https://climatekids.nasa.gov/time-machine/

Allow students ample time to engage with both websites, asking them to record the following in their notebooks:
1. Describe how these games illustrate the impact of climate change.
2. In what ways are these three concepts interconnected?
3. What was the coolest aspect of the games?

4. Could you apply any knowledge you learned to playing the games?
5. Did you learn anything by playing the games?

Next, in small groups, assign students to a specific endangered species i.e., bumblebees, monarch butterflies, Hawaiian honeycreepers, Giant Mountain lobelia, Adelie penguin, White lemuroid ringtail possum, Staghorn coral, cottontail rabbits, red squirrels, and whales. Students will research their species' habitats, reproduction habits, food sources, behavior, the impact of humans on their environment, and any causes that result in changes in population numbers (ie., rising sea levels, loss of habitat; lower temperatures less food; increase human presence, decrease predators). Let students know that this research will be the basis for the computational model of how climate change is impacting the species they are researching.

Here are a few resources to start the research:
Earth Day- 10 Animals Threatened by Climate Change
The Guardian- The 10 species most at risk from Climate Change
Forbes- How Rabbits Could Be The Next Climate Change 'Canary In The Coal Mine'
Fauna & Flora- Which plants and animals are affected by climate change? Some of the names may surprise you.
PBS- Preventing Plant Extinction Caused by Climate Change

EXPLAIN: Concepts Explained and Vocabulary Defined: *Prior to the lesson set up Teacher and Class accounts on Scratch (see below for tutorial).*
Explain to students, scientists use computers to model complex and dynamic phenomena. Computational modeling allows students and scientists to represent invisible agents and overcome any physical limitation to studying a problem. Define computational modeling as representations of systems with interrelated parts.
Ask students to identify the variables that are impacting the population of their assigned species (ex. temperature, precipitation, sea level)
Explain the steps involved in creating a computational model using Scratch:
1. Open Scratch and select Create
2. Choose a background by clicking on the stage in the lower right-hand corner
3. Choose your characters by adding "SPRITES" (here is where students select the character to represent the species studied)
4. Add code by clicking on the "SCRIPTS" tab to code your "Sprites" to control its behavior (i.e., "sprite" moves when temp. changes)
5. Add variables by clicking on the "DATA" tab. The variables are values that change such as precipitation or sea level. You can use variables to control the behavior of your "sprite."
6. Test your simulation by clicking the "Green Flag." Use the sliders to control the variables and record changes in the behavior of your "sprite."
7. Refine your simulation; adjust the code to make the "sprite" respond in a way that is more visually appealing.

Tutorial for the teacher: https://youtu.be/PPHcvbHZtLg
Tutorial for students: https://scratch.mit.edu/projects/837341776/editor

Vocabulary:
Computational modeling- representations of systems with interrelated parts; they represent measurable (quantitative) relationships within systems and change behavior based on different inputs into variables

ELABORATE: Applications and Extensions*: Students will need access to laptops and login to Scratch*
Students will use the information gathered during research to create a computational model that illustrates the impact of climate change on the assigned species of wildlife. The simulation should include variables such as changes in temperature, precipitation, and sea level. Once the simulation is complete, students will use the data generated to analyze the impact of climate change on the assigned species and write a report discussing how these changes could lead to a decline in the population of the species.

EVALUATE:

Formative Monitoring (Questioning / Discussion): discussion about climate issues facing their community; research gathered about assigned species

Summative Assessment (Quiz / Project / Report): computational model; report analyzing data collected during simulations

Elaborate Further / Reflect: Enrichment: Students can create a list of possible solutions to the problem of climate change and its impact on wildlife. They should consider short-term and long-term solutions and discuss the potential benefits and drawbacks of each in a social media campaign.

SOCIAL EMOTIONAL LEARNING ACTIVITY

CASEL Competency: Responsible Decision-Making
Being open-minded is essential to Dr. Mayor's work, climate change, and conservation. Because Dr. Mayor is curious, she can use her voice to help save lemurs from extinction and tell the world about new lemur species. Responsible Decision-Making is making caring and constructive choices about personal behavior and social interactions across diverse situations. It is about demonstrating curiosity, and

open-mindedness, and identifying solutions for personal and social problems. In this activity, students will develop their open-mindedness and responsible decision-making skills.

Use the following materials:

- index cards

Begin by dividing the class into small groups and asking each group to brainstorm and record any social problems they know about in their community or the world. After 5 minutes bring the class back together to discuss the problems they have identified. Next, give each student an index card and ask them to write down a solution they think can address one of the social problems discussed. Collect the index cards and mix them up.
Divide students back into their groups and give each group an index card and 15 minutes to discuss the solution listed and create a presentation. Then each group shares their presentation of the solution and why they think it can be effective.
After every group presents, students then reflect on the activity. Have each student write down one thing they did today that illustrated their ability to be open-minded and one example of responsible decision-making they made during today's activity.

INTERDISCIPLINARY CONNECTIONS/IDEAS

Mathematics
MP.2 - Reason abstractly and quantitatively. (HS-ESS3-3)
MP.4 - Model with mathematics. (HS-ESS3-3)

Materials Required for This Lesson/Activity	
Quantity	**Description**
Per student	Laptops
1 package	Index cards

Lesson Created by Stacy Douglas
For questions, please contact info@usasciencefestival.org