Planted Podcast Season 2, Episode 1 Lesson Plan
The Importance of Biodiversity – One Million Species at Risk

Objectives:

- Students will understand the importance of biodiversity and how people, plants, and animals are interconnected.
- Students will be able to draw connections to Dr. Silvia Alvarez-Clare's research and answer critical questions about the concerns raised in the United Nations report regarding the risk of extinction for one million species worldwide.

Next Generation Science Standards:

- HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
- HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

Materials:

- Each student needs a pen or pencil, as well as access to the internet.
- Each student should be provided a printed (or online) version of the article, and printed versions of the Anticipation Guide and the Reading Guide (provided).
- Article for the activity:
    - Leahy, S. (May 6, 2019). One million species at risk of extinction, UN report warns. *National Geographic*. Retrieved from: https://www.nationalgeographic.com/environment/2019/05/ipbes-un-biodiversity-report-warns-one-million-species-at-risk/

Background:

- In this episode of *Planted: Finding Your Roots in STEM Careers*, Dr. Silvia Alvarez-Clare, Tree Conservation Ecologist at The Morton Arboretum, discusses how vital collaboration is to her work towards saving *Quercus brandegeei* from extinction. For more information check out Silvia's Plant Profile, Photo Profile, and the Career Canopy Chronicles.

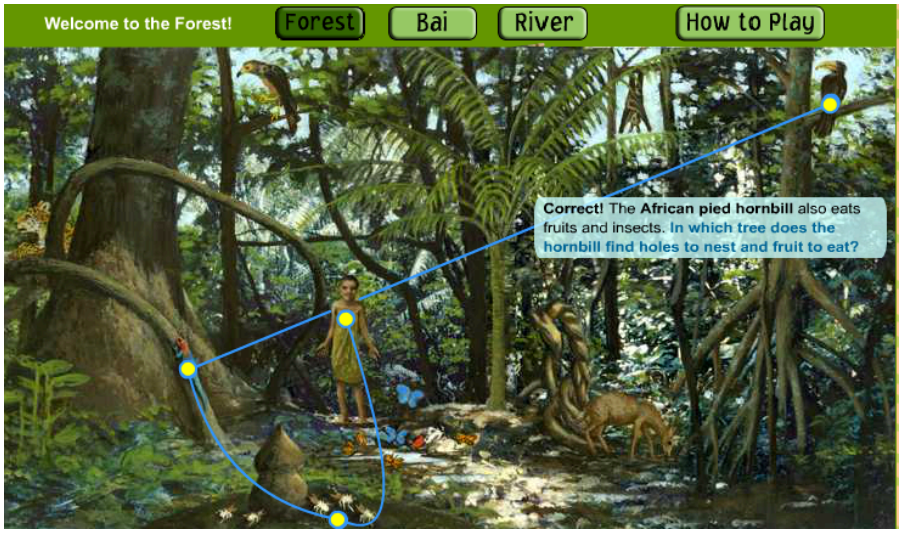
Procedure:

Part 1: Biodiversity Introduction

- Using the online activity from the American Museum of Natural History, students will learn about the different habitats of the Dzanga-Sangha rainforest and discover how people, animals, and plants are interconnected.
- Use this link to access the online activity: https://www.amnh.org/ology/features/dzangasangha/index.php
- To complete the first activity, instruct students to click on the "What's it like to visit the Dzanga-Sangha?" Students should click on the different photos to see stories from the various people who have conducted research in the Dzanga-Sangha rainforest.

- Instruct students to complete the Connect the Dots activity by having them click on the button in green: “Play Connect the Dots.” First, students must choose a habitat (forest, bai, or river). Once they have chosen, they will follow the clues to see how different organisms depend on each other. When they have the answer to the clue, they will click on the correct organism. Students should keep following clues until they have connected all the dots in the habitat. Instruct students to complete the activity for all of the different habitats.

Step 1:



(Dzanga-Sanga rainforest, Connect the Dots activity. The Interactive activity is from The Natural Museum of History. Retrieved from: https://www.amnh.org/ology/features/dzangasangha/index.php Screen capture, provided by staff at The Morton Arboretum.)

Step 2:



(Dzanga-Sanga rainforest Connect the Dots activity. The Interactive activity is from The Natural Museum of History. Retrieved from: https://www.amnh.org/ology/features/dzangasangha/index.php Screen capture, provided by staff at The Morton Arboretum.)

Part 2: Before Reading the *National Geographic* Article

- Instruct students to complete the first column of the Anticipation Guide. Each row contains a true or false statement that pertains to the reading.
- Also, have students answer the "Before You Read" questions found in the Reading Guide.

Part 3: Read the *National Geographic* Article

- Students should complete the "While You Read" questions, which can be found in the Reading Guide, to follow-along with as they read the article.
- The article can be accessed online here: https://www.nationalgeographic.com/environment/2019/05/ipbes-un-biodiversity-report-warns-one-million-species-at-risk/

Part 4: After Reading the *National Geographic* Article

- Instruct students to answer the "After You Read" questions found in the Reading Guide.
- Next, ask students to review their Anticipation Guide to verify or change their answers in the third column of the Anticipation Guide, labeled after.
- Challenge students to make notes and/or think about how the reading changed the way they had previously thought about the statements.
- The Reading Guide can be used to stimulate a discussion about the article.

Part 4 (Optional): Explore the Biodiversity in Your Neighborhood

- This activity asks students to observe a local ecosystem (backyard, park, etc.) and take notes of the different organisms they discover.
- Use this link to access to the activity: http://sciencenetlinks.com/student-teacher-sheets/explore-outdoors/

Additional Resources:

Jerome, D. Beckman, E. Kenny, L. Wenzell, K. Kua, C. (2017). Westwood, M. The Red List of US Oaks. *The Morton Arboretum*. Retrieved from:
https://www.mortonarb.org/files/Westwood_2017_Red%20List%20of%20Oaks.pdf

- This report documents the oaks in the U.S. that are at risk of extinction, using the International Union for Conservation of Nature's Red List criteria. It is useful to communicate the oak species that are locally at risk.

Preshoff, K. Why Biodiversity Matters. *TED-Ed.* Retrieved from:
https://www.youtube.com/watch?v=GK_vRtHJZu4

- This TED-Ed talk provides a great introduction to the concept of biodiversity and why it matters.

Tucker, N. (May 7, 2019) Local Tree Experts Talk UN Report On Declining Biodiversity. *WBEZ 91.5 Morning Shift.* Retrieved from:
https://www.wbez.org/shows/morning-shift/local-tree-experts-talk-un-report-on-declining-biodiversity/77d927f5-398b-41d8-a55f-1e12d1b1a43e

- WBEZ interview with Dr. Murphy Westwood, the Director of Global Tree Conservation at The Morton Arboretum, where she discusses the aspects of the U.N. report that deal with tree diversity. It is a good resource to use for students to understand the current state of trees.

Canopy Career Chronicles: Monica, the Conservation Leader. *The Morton Arboretum*. Retrieved from:
https://www.mortonarb.org/canopy-career-chronicles/monica

Canopy Career Chronicles: Dina, the Conservation Advocate. *The Morton Arboretum*. Retrieved from:
https://www.mortonarb.org/canopy-career-chronicles/dina

- The Canopy Career Chronicles, created by The Morton Arboretum, are an excellent resource for students to explore different STEM and plant-focused careers. Students can follow along with each plant professional's story as they learn about the skills and qualities of each particular professional, how they discovered this certain career path, and how they got there to their current position. For this episode, Monica's and Dina's are good profiles to explore because they are most relevant to the podcast episode and this lesson plan.

One Million Species at Risk
Anticipation Guide

Anticipation Guide – One Million Species at Risk:

- Read each statement and decide if the statement is true or false.

Before	Statement	After
	The loss of species is due to the direct or indirect impact of human activities.	
	100 percent of earth's animal and plant species are known and have been discovered.	
	Humans can survive without other living species.	
	Many areas of the ocean are completely dead.	
	Humans have impacted the ocean more significantly than land areas.	
	Protected areas do not allow the sustainable use of natural resources.	
	Economies are dependent on the health of ecosystems.	
	Corals have the highest species declines in the current climate conditions.	
	Reforestation projects can help protect the remaining biodiversity.	
	Government and private institutions are better at managing natural areas than indigenous peoples and local communities.	

One Million Species at Risk
Reading Guide

Reading Guide – One Million Species at Risk:

Before You Read

1. How would you define biodiversity?

2. Why is biodiversity important?

While You Read

3. How have human activities led to so many species becoming at risk of extinction? What are the major drivers of species decline?

4. How are the oceans impacted by humans?

5. Why should indigenous peoples be included and/or considered in policies and decisions made by governments that are making programs to combat species and biodiversity loss?

6. What are countries doing to address the problems that have led to widespread species extinction?

After You Read

7. What measures can humans take to safeguard biodiversity and a healthy planet?

8. How can you personally make a difference to protect plant and animal species?

One Million Species at Risk
Anticipation Guide – Answer Key

Anticipation Guide – One Million Species at Risk:

- Read each statement and decide if the statement is true or false.

Before	Statement	After
	The loss of species is due to the direct or indirect impact of human activities.	True
	100 percent of earth's animal and plant species are known and have been discovered.	False
	Humans can survive without other living species.	False
	Many areas of the ocean are completely dead.	True
	Humans have impacted the ocean more significantly than land areas.	False
	Protected areas do not allow the sustainable use of natural resources.	False
	Economies are dependent on the health of ecosystems.	True
	Corals have the highest species declines in the current climate conditions.	True
	Reforestation projects can help protect the remaining biodiversity.	True
	Government and private institutions are better at managing natural areas than indigenous peoples and local communities.	False

One Million Species at Risk
Reading Guide – Answer Key

Reading Guide – One Million Species at Risk:

Before You Read

1. How would you define biodiversity?
   Biodiversity is the variety and variability of life on Earth. Biodiversity is a measure of variation at the genetic, species, and ecosystem level.

2. Why is biodiversity important?
   Biodiversity is vital to ecosystem health; therefore, biodiversity ensures that ecosystems adequately provide the services that humans, animals and plants depend on. Ecosystem services may include: fresh water, clean air, pollination, soil fertility, food, and medicine.

While You Read

3. How have human activities led to so many species becoming at risk of extinction? What are the major drivers of species decline?
   Scientists ranked the major drivers of species decline as land conversion, including:
   1. Deforestation
   2. Overfishing
   3. Bush meat hunting and poaching
   4. Climate change
   5. Pollution
   6. Invasive alien species

4. How are the oceans impacted by humans?
   66 percent of the oceans have suffered significant human impacts. As everything is connected, activities on the land can impact the oceans, due to runoff. As such, industrial agriculture has resulted in more than 400 dead zones across the world's oceans and lakes. A dead zone is a low-oxygen area in an ocean or lake, caused by eutrophication, which occurs when a body of water receives an influx of nutrients (phosphorus or nitrogen) making the body of water inhospitable for aquatic organisms. In addition, overfishing, water pollution and air pollution contributed to the decline of aquatic ecosystems and ocean acidification.

5. Why should indigenous peoples be included and/or considered in policies and decisions made by governments that are making programs to combat species and biodiversity loss?
   It is important that indigenous people are included in the decision making processes that go into preserving biodiversity because at least a quarter of the global land area is traditionally owned, managed, and used by indigenous people. It is important that indigenous peoples land rights are respected. Additionally, indigenous people are often good partners for managing nature. Indeed, evidence shows that nature managed by local communities and indigenous peoples is in generally better condition that nature managed by government or private institutions.

6. What are countries doing to address the problems that have led to widespread species extinction?
   The Paris Climate agreement, which achieves many of the UN's Sustainable Development Goals for the world, aims to protect half of the planet's land and water areas by 2050.

After You Read

7. What measures can humans take to safeguard biodiversity and a healthy planet?
   Nearly 100 groups around the world–including indigenous peoples, conservation organizations, and philanthropic foundations–have endorsed the goal of protecting half of the planet land and sea area by 2050. Recently, scientists published a study to make a science-backed plan for an interim step that would protect 30 percent by 2030 under what's called a Global Deal for Nature. The plan does not completely stop economic activities in these protected areas but rather allows for sustainable use and resource extraction in all but the most sensitive areas.

8. How can you personally make a difference to protect plant and animal species?
   This is a personal response. A sample response may read something like this: Making personal sustainable choices, including reducing my own environmental footprint by making better choices in regards to my energy consumption and diet can make an impact that will reduce deforestation, pollution and climate change, which has a positive effect on biodiversity. Additionally, a career in the biological sciences, conservation, environmental justice, or environmental communications will also positively affect biodiversity and environmental health.