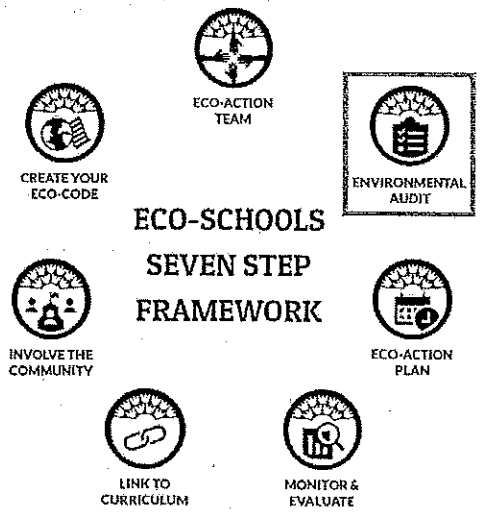
Biodiversity Pathway

BEFORE, DURING AND AFTER THE AUDIT, GRADES 3-5

BEFORE

BE PREPARED

- Read through this document, the baseline audit and the post-action audit.
- Invite community experts to participate.
- Gather science tools (if applicable) and print materials.
- Conduct mini-lessons (if needed) to strengthen concept foundation.



ENDURING UNDERSTANDING

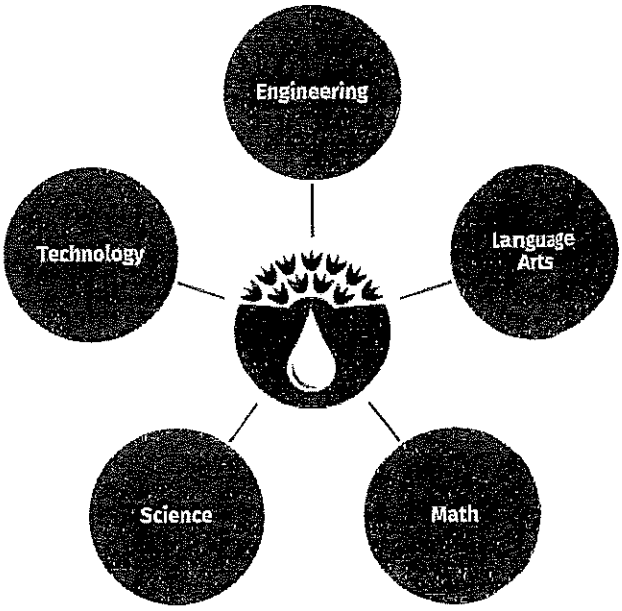
1. All living organisms have certain needs and structures with functions that allow them to survive.
2. All living organisms depend on each other and their environment to meet their needs.
3. A greater varieties of plants and animals positively impact and benefit an ecosystem.
4. Humans impact biodiversity in either beneficial or harmful ways.

COMMUNITY AND CULTURE

- The loss of cultural diversity (including languages) and traditional knowledge -- of farm communities and indigenous cultures -- is intricately linked to the loss of biological diversity. Indigenous peoples and farming communities are the creators, custodians and continuing innovators of biological knowledge and resources. [1]
- Almost 75% of the world's poor are affected by land degradation. [2]
- Cultural diversity is a source for learning sustainable practices.
- Intercultural dialogue should be a guiding principle in developing solutions, raising awareness and promoting action.
- Create an equitable, inclusive and safe space for Eco-Action team members and others within and outside of the school community to participate.

INTERDISCIPLINARY CONNECTIONS

- **Language Arts** – Read picture books, poetry and novels that support animal biodiversity and habitat, such as Wild, What if There Were No Bees?, When Green Becomes Tomatoes: Poems for All Seasons, and Hoot.
- **Math** – Measure current garden perimeter and area or measure and calculate the dimensions of a new or planned expansion garden. Based on the dimensions students can determine plant spacing and placement of types of plants based on average width and height growth.
- **Technology** – Use nature-based applications to identify and track plant in and animals using the school's garden space(s), i.e. iNaturalist, Seek and eBird.
- **Engineering** – Engineers can play a unique role in recreating natural spaces and wildlife habitat. Have students think of the conservation work of zoos and aquaria. Have students identify a species and using engineering design, create a biodiverse habitat that includes all the required elements.



SUSTAINABLE DEVELOPMENT GOALS

In 2016, seventeen Global Goals for Sustainable Development were adopted by world leaders at a United Nations Summit. These goals universally apply to all countries, therefore Eco-Schools USA is committed to doing our part. Over the next fifteen years, efforts will be made by governments, institutions and citizens all across the globe to end all forms of poverty, fight inequalities and tackle climate change, while ensuring nobody is left behind.

Conserve and sustainable use the oceans, seas and marine resources for sustainable development.

Protect, restor and promote sustainable use of terrestrail ecosystems, sustainably manage forests, combat desertification and halt and revers land degradation hand biodiversity loss.

Learn more at globalgoals.org

ECO-SCHOOLS USA
NATIONAL WILDLIFE FEDERATION

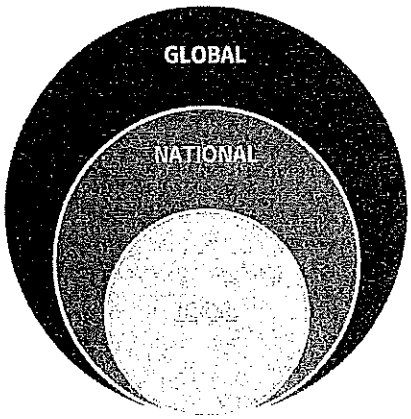
DURING

GATHER THE FOLLOWING MATERIALS

- student worksheet(s)
- audit form
- clip boards
- school map – outside
- measuring tape (50m)
- stakes and flags
- 1/16 cotton twine rope
- binoculars (8-10 pairs)
- iNaturalist application (optional)
- lumiloupe magnifiers (per student pair) (optional)
- plastic forceps (per student pair)

PROCEDURE

1. Before the audit, contact local experts who are willing to assist. These individuals can provide more in depth understanding and can help direct the team when questions arise and/or concerns arise.
2. Read through the audit. As an Eco-Action Team determine, based on the area being investigated, how much time will be needed to complete the baseline or post-action audit.
3. Highlight the locations on a school map where teams will collect data.
4. Conduct the baseline audit and make plans to conduct the post-action audit.
5. Analyze the results and develop an action plan.
6. Frequently communicate results and plans with the school and community.



AFTER

1. NEXT STEP: DEVELOP AN ACTION PLAN

Move into Step 3 of the Seven Step Framework by using the audit results to develop an action plan.

Identify community leaders, experts, advocacy organizations who can assist students with solution implementation and advise the Eco-Action Team how to address issues of social justice.

2. UPDATE YOUR DASHBOARD

Login to the school's dashboard and complete the following tasks.

- Upload your audit results and your action plan.
- Add any related photos or videos.
- After completing the post-action audit and moving through the Seven Step Framework apply for an award.

3. RANGER RICK, A MENTOR FOR TODAY'S KIDS

Ranger Rick, the National Wildlife Federation's friendly raccoon, helps children of all ages discover and connect with nature so they become good stewards of the environment.

- Ranger Rick for ages 7-12, classroom subscriptions
- Ranger Rick Photo Contest
- Ranger Rick Educator Guide
- Ranger Rick Zoobooks

4. NEXT PATHWAY

Climate Change Pathway –
Climate change is any significant change in climate lasting for an extended period of time and includes major changes in temperature, precipitation, or wind patterns, among other effects that occur over several decades or longer. School communities can mitigate their carbon footprint and improve their buildings resilience.

Schoolyard Habitats® Pathway –
Water is a critical habitat element and plays an important role in the preparation, implementation and maintenance of gardens for wildlife.

5. CONNECT TO THE GLOBE PROGRAM

The Global Learning and Observations to Benefit the Environment (GLOBE) Program is an international science and education program that provides students and the public worldwide with the opportunity to participate in data collection, the scientific process, and contribute meaningfully to our understanding of the Earth system and global environment.

Atmosphere
aerosols | air temperature | precipitation | surface temperature

Biosphere
green up-green down | land cover classification | Ruby-Throated hummingbirds

Hydrosphere
conductivity | dissolved oxygen | freshwater macroinvertebrates | nitrates | pH | water temperature

Pedosphere
soil fertility | pH | soil temperature

ECO-SCHOOLS USA
NATIONAL WILDLIFE FEDERATION
FOUNDATION FOR ENVIRONMENTAL EDUCATION

BIODIVERSITY

BASELINE AUDIT, GRADES 3-5

Consider contacting local, regional or state non-profits, natural history museums, tribal leaders and master naturalists for assistance conducting your audit. Their involvement is a great way to connect to the community, inspire students and demonstrate career possibilities while sharing resource expertise.

Invite parents and community members to participate in the auditing process. Students can take on the role of educator by working with volunteers on citizen science projects. This experience is a great way to build community.

Before starting the Biodiversity audit or going further, survey your students. Record the average response.

1. I can define biodiversity. ☒ Yes ☐ No
2. On a scale from 1-10, 10 being the most important and 1 being the least important, how important is biodiversity to a healthy ecosystem? 10
3. Can students help increase biodiversity? ☒ Yes ☐ Maybe ☐ No

LB School District Land Percentages: (From Page 10 wiki watershed)

Open Water	15.88%
Developed Open Space	7.79%
Developed Low Intensity	26.35%
Developed Med. Intensity	34.90%
Developed High Intensity	11.67%
Barren Land	2.40%
Forest	.42%
Grasslands	.14%
Pasture	.14%
Wetlands	.31%

BIODIVERSITY

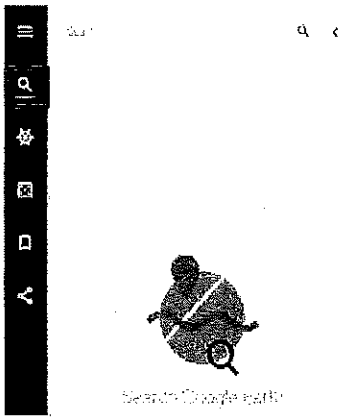
BASELINE AUDIT, GRADES 3-5

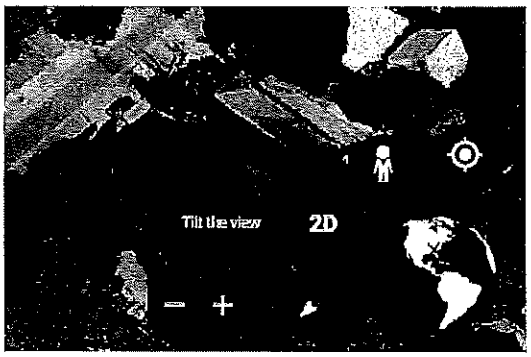
GETTING READY TO ASSESS BIODIVERSITY

As schoolscapes are as diverse as they are numerous across the United States, it is hard to prescribe space dimensions that will universally work nationwide. That said, our National Wildlife Federation biologists suggest calculating a **minimum inventory site** based on the overall size of the school's footprint. The advantage of doing so will demonstrate the scale dependencies of assessing biodiversity. Small school areas will have small inventory sites and large school areas will have large inventory sites.

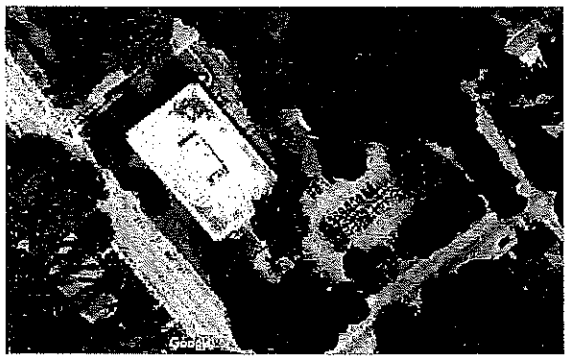
To calculate your school's area (buildings, parking lots, grounds), teams will use Google Earth, www.google.com/earth.

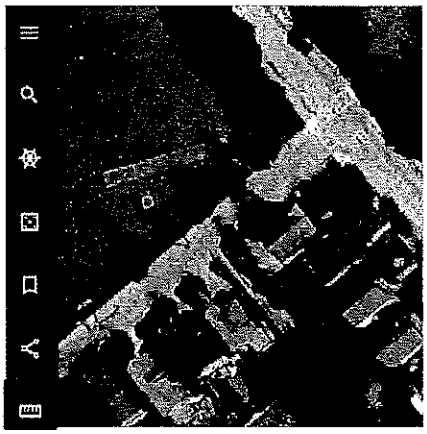
1. Launch Google Earth in Chrome.
2. In the search area, type your school's name or address and click enter. Use the plus sign to zoom in a little closer to your school. Next click, in the bottom right hand corner, 2D.





3. In this view, you will see your school from a "birds-eye" or top-down view. Next click on the ruler icon, found in the left-side navigation.



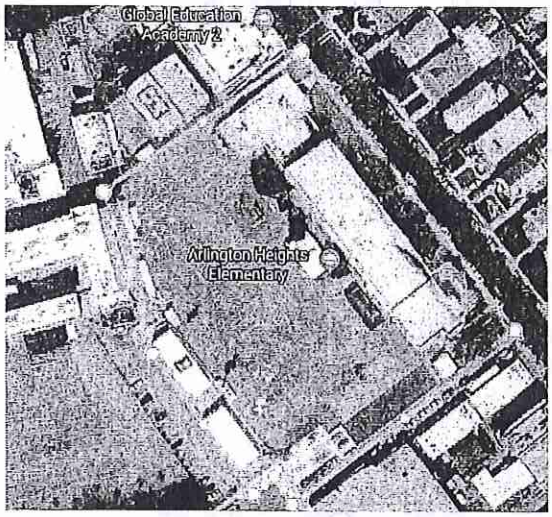


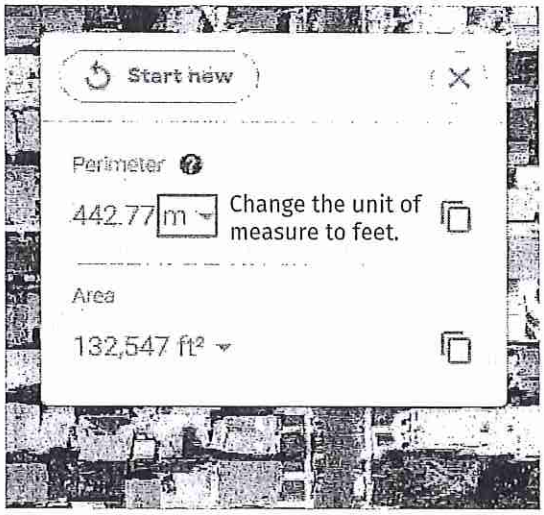
BIODIVERSITY

BASELINE AUDIT, GRADES 3-5

GLC: Perimeter 1,489 ft.
Area 138,254 ft.² ≈ 138,000

4. Click to drop the yellow marker on the start of the perimeter or irregular perimeter you are measuring. Click at each corner or turn that's needed, until you end where you started. Once complete a yellow box will outline the perimeter. Once the perimeter is closed, Google has calculated the perimeter and area in meters. If required, change the unit of measure to square feet.



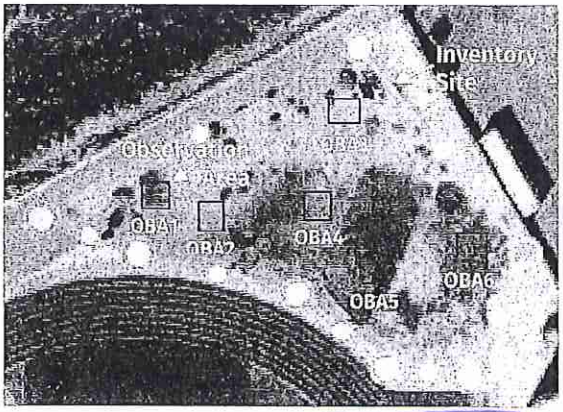


GLC 138

5. Calculate your inventory site. What is .1% of your school's area? The area of the school above is 132,547 ft². Round this number to the nearest thousand, 133,000 ft². The formula is, .1% of 133,000 (1/1000 x 133 is 133 ft². Want to check your math? https://percentagecalculator.net/). Once you have the square footage you can derive the perimeter; the inventory site for this school is approximately 33 feet by 33 feet (133 ÷ 4 = 33.25). **If .1% of the school's area is less than 25 ft², then use 25ft² to identify and mark the inventory site.** Once the perimeter is marked, have students create a minimum of 3, 3 foot (1 meter) by 3 foot (1 meter) observation areas within the larger inventory site to use while assessing plants and fungi and animals, *Tables 3 and* 4. The entire inventory site will be used to assess trees and shrubs.

$$\frac{1}{\cancel{1000}} \cdot \frac{133,\cancel{000}}{1} = \frac{133}{1} = 133$$

During periods of observation, students will determine the inventory site's richness and evenness of plant and animal life. **Richness** is the number of species per sample - the more species present in a sample, the richer the sample. **Evenness** is the measure of the abundance of the different species making up the richness of the site. The team needs to observe the entire space. Ask students to slowly look up, down and all around their site. When they look up, do they see birds flying by? Is there a lizard on the tree in the observation area? How many different plants (richness) are in the observation area?



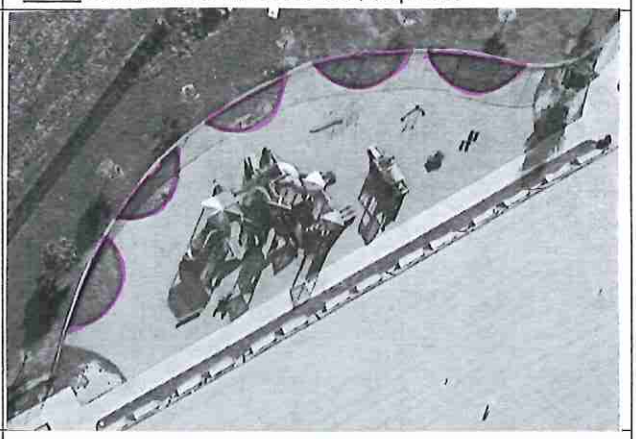
Inventory Site: Perimeter 71 ft.
Area 237 ft.² x 5 beds = 355 ft.
1,185 ft.²

TOTAL Inventory Site.

BIODIVERSITY

BASELINE AUDIT, GRADES 3-5

TABLE 1. DEFINING THE STUDY SITE

1. What are the GPS coordinates for your study site? Use you smartphone's GPS or go to: https://nomessgps.com/ to find the coordinates.	Latitude N 40.270392 Longitude W -73.998196
2. Is your school considered to reside in an urban, suburban or rural community?	Suburban
3. After identifying the area(s) for use and while investigating biodiversity, mark all the boxes that describe the land cover observed in the investigation site.	☒ concrete ☐ asphalt ☒ bare soil ☐ trees ☒ grass ☐ rocky/pebbles ☒ garden ☐ stream/river ☐ pond ☐ containers on concrete/asphalt
4. Add a picture of the investigation site and identify the observation areas teams used to gather data (See page 3).	
5. What is the area of the **inventory site**?	1,185 ft²
6. What is the perimeter of each **observation area**?	71 ft x5 = 355ft.

Think about the following question as you summarize the information in Table 1.

1. What are student/team ideas about how land cover type might impact biodiversity of plant and animal life?

BIODIVERSITY

BASELINE AUDIT, GRADES 3-5

TABLE 2. TREES AND SHRUBS-INVENTORY SITE

THIS TABLE SHOULD REFLECT THE DATA COLLECTED FROM THE COMBINED DATA FROM TEAM WORKSHEETS.

Use the iNaturalist SEEK app or the Google Lens app, local field guides and/or local experts to provide identification assistance. If the name of the tree or shrub cannot be found enter a description.

Need more space than what's been provided? Include more trees and shrubs on the blank page at the end of the audit.

1. CATEGORY (TREE OR SHRUB)	NAME OR DESCRIPTION	QUANTITY	ALIVE	DEAD	HOLLOW
EXAMPLE. TREE	BLACK GUM	3	3		
N/A					
	TOTALS	0			

2. **Total number** of trees and shrubs combined from the inventory site. 0 (If great than 50, write 50+)

3. **Richness**
Number of different tree and shrub types N/A

4. **Evenness**
Number of each tree and shrub types. For example: 1 oaks, 2 butterfly bush, 1 Japanese maple

N/A

BIODIVERSITY

BASELINE AUDIT, GRADES 3-5

TABLE 3. PLANTS AND FUNGI-OBSERVATION AREAS

THIS TABLE SHOULD REFLECT THE DATA COLLECTED FROM THE COMBINED DATA FROM TEAM WORKSHEETS.

Use the iNaturalist SEEK app or Google Lens app, local field guides and/or local experts to provide identification assistance. If the name of the plant or fungus cannot be found enter a description.

Need more space than what's been provided? Include more plants and fungi on the blank page at the end of the audit.

1. CATEGORY (PLANT OR FUNGUS)	NAME OR DESCRIPTION	QUANTITY	ALIVE	DEAD
EXAMPLE: PLANT	PINCUSHION	5	4	1
Plant	Wild Flowers (Daisies, Sunflowers, Asters)	10	8	2
Plant	Common Groundsel	4	4	0
Plant	Clovers	20	18	2
Plant	Fringe Rush	5	5	0
Plant	Irises & Agaves	8	8	0
	TOTALS	47	43	4

2. **Total number** of plants and fungi combined from all observation areas within the inventory site. 47

3. Richness
Number of different plant and fungus types 8+

4. **Evenness**
Number of each different type of plant and fungus. For example: 3 swamp milkweed, 5 sea oats, 10 compact nandina, 5 yarrows, 2 little blue stem, and 0 fungi.
10 Wild Flowers, 4 Common Groundsel, 20 Clovers, 5 Fringe Rush, 8 Irises & Agaves

BIODIVERSITY

BASELINE AUDIT, GRADES 3-5

TABLE 4. ANIMALS-OBSERVATION AREAS

THIS TABLE SHOULD REFLECT THE DATA COLLECTED FROM THE COMBINED DATA FROM TEAM WORKSHEETS.

Use the iNaturalist SEEK app or Google Lens app, local field guides and/or local experts to provide identification assistance. If the name of the animal cannot be found enter description.

Need more space than what's been provided? Include more animals on the blank page at the end of the audit.

1. CATEGORY (BIRDS, MAMMALS, INVERTEBRATES, AMPHIBIANS, REPTILES, FISH)	NAME	QUANTITY	ALIVE	DEAD
Birds	Cardinal	1	✓	
Birds	Bluejay	1	✓	
Birds	Robin.	3	✓	
Mammals	Squirrel	2	✓	
Mammals	Chipmunk	1	✓	
	TOTALS	8	✓	

2. Total number of animals combined from all observation areas within the inventory site. 8

↳ during 1 observation - these NJ Birds & Mammals frequent the inventory site & surrounding school grounds

BIODIVERSITY

BASELINE AUDIT, GRADES 3-5

TABLE 4. ANIMALS, CONTINUED

RICHNESS

3. Number of different bird types 3	4. Number of different mammal types 2
5. Number of different invertebrate types N/A	6. Number of different amphibian types N/A
7. Number of different reptile types N/A	8. Number of different fish types N/A

EVENNESS

9. Number of each different type of bird. For example: 5 crows and 2 blue jays 1 Cardinal, 1 Bluejay, 3 Robins
10. Number of each different type of mammal. 2 Squirrels, 1 Chipmunk
11. Number of each different type of invertebrate. N/A
12. Number of each different type of amphibian. N/A
13. Number of each different type of reptile. N/A
14. Number of each different type of fish. N/A

Think about the following questions as you summarize the data in Table 2-4.

1. After the team has spent time analyzing the data, provide a summary about each of the following:
   Plant and animal richness (the number of species in a sample area) –
   We have a few indigineous flora & fauna, but due to the space not being utilized as a space for wildlife, it doesn't attract much. We do have some wildlife, but our focus will be on bringing more monarchs & other pollinators to the immediate area, elevating the plant & animal richness at our school & in our community
   Plant and animal evenness (the number of each species type) -
   The evenness of plant and animals is pretty average - most species of plants & animals seen in the immediate area are seen frequently. We are looking to increase evenness & richness.

BIODIVERSITY

BASELINE AUDIT, GRADES 3-5

2. Base the team's response to the following scale on over all observed species richness and evenness (with the understanding that the greater the species richness and evenness, the better the biodiversity. On a scale of 1 to 5, where **1 is poor biodiversity and 5 is excellent biodiversity**, where does the school's inventory site lie on that scale?

☐ 1 ☒ 2 ☐ 3 ☐ 4 ☐ 5

3. What other investigations and/or research might the team need to conduct in order to answer questions or determine how best to move forward?

Insects → our biodiversity team is focusing on the decline of Monarch Butterflies in NJ, which is affecting pollination. Monarchs & other pollinators need to fuel up in NJ during their migration to Mexico.

4. Who are the local experts and what resources may be useful as the team develops its Eco-Action Plan? Be mindful that experts do not only belong to specific organizations, but are members of communities and groups throughout the region with historical knowledge, especially the indigenous community.

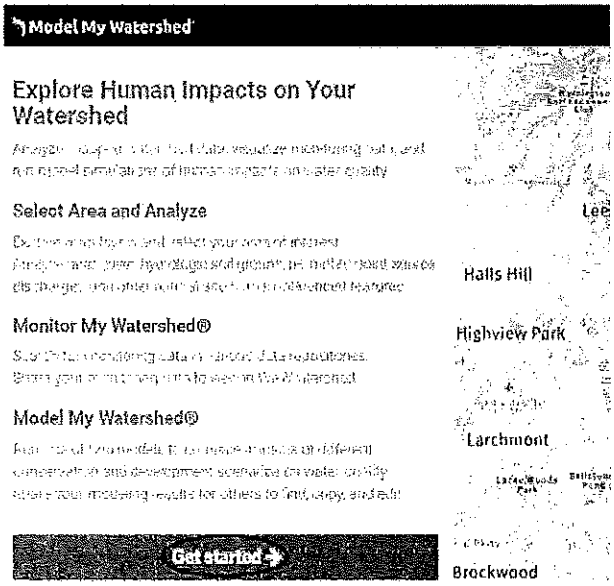
Debbie Smith - President of Oceanport Garden Club - this club has helped the students in Long Branch, NJ through plant donations, resources, & a virtual assembly on pollinator gardens. We learned about the local need for indigenous plants, specifically milkweed, to help Monarchs, & other pollinators.

Prepare to answer the following questions in the post-audit.

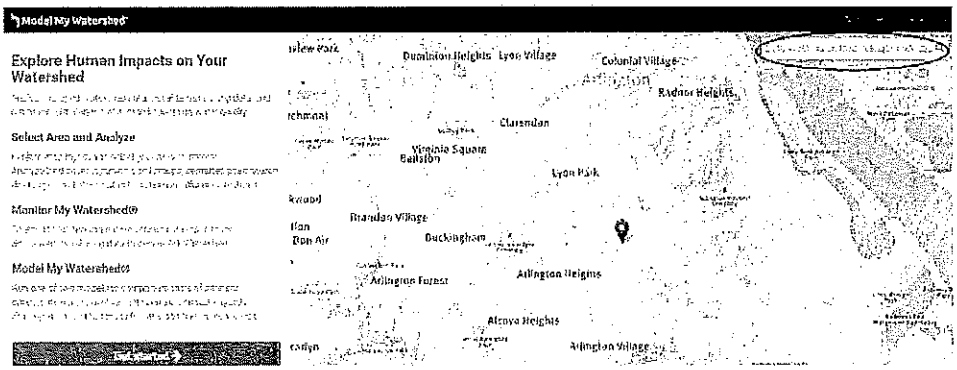
1. Explain the role **systems and system models** play in understanding biodiversity.
2. Explain **patterns** students have identified through their investigations.
3. Explain any **relationships** students identified between biodiversity and land use.

HOW TO WIKIWATERSHED

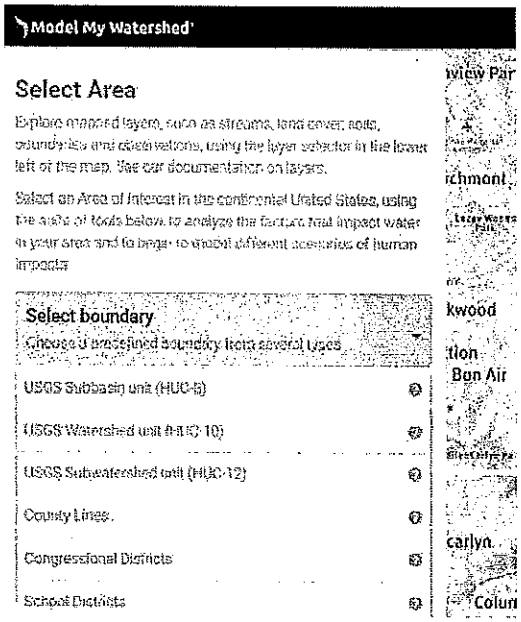
1. Go to, https://modelmywatershed.org.
2. Click the Get Started button.



3. Enter the school's address.

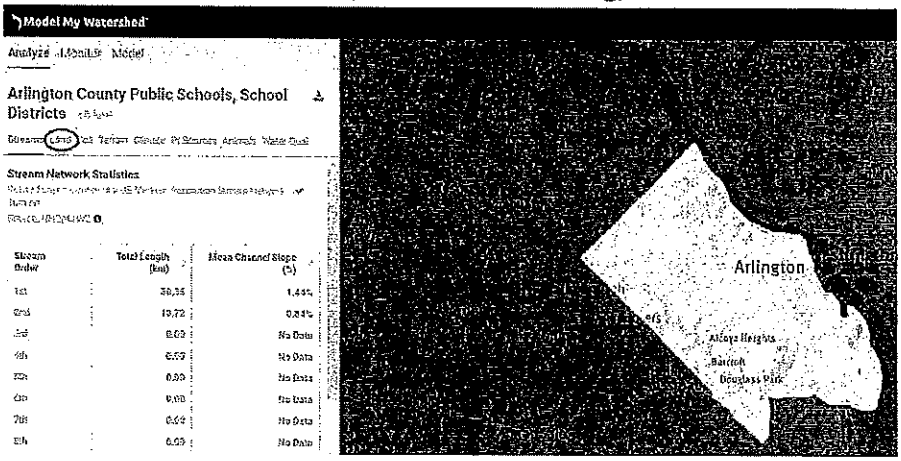


4. Open the *Select Boundary* drop down and choose *School Districts*.

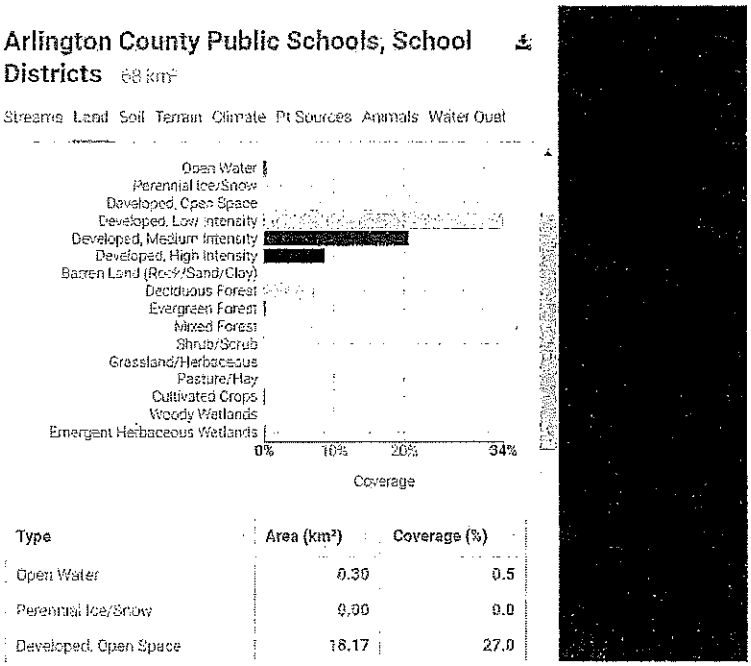


5. Place your cursor to the left of the blue marker (blue marker pinpoints school location) and click one time. In a moment you will be taken to a new screen that outlines your district and provides new district specific data.

6. From the navigation under your district heading, choose *Land*.



7. Now go back to page 1 of the audit and record the percentages for the land types found in your school district.



Type	Area (km²)	Coverage (%)
Open Water	0.30	0.5
Perennial Ice/Snow	0.00	0.0
Developed, Open Space	16.17	27.0

This blank page can be used to record more data, record notes, or answer questions.