

Green Girls Curriculum

Lesson 3: Ecosystem Health - Indicator Species Survey

Duration: 2 hrs

Standards:

Next Generation Science Standards: MS-LS: 1-4 ,1-5, 2-1, 2-2, 2-4,2-5; MS-ESS: 3-3, 3-4, 3-5

New York State Science Learning Standards:

MS-LS: 1-4, 1-5, 2-1, 2-2, 2-4, 2-5; MS-ESS: 3-3, 3-4, 3-5

Purpose:

- In Urban Ecosystem Knowledge, students will:
 - Learn about the lifecycle of a dragonfly or other chosen climate change indicator species.
 - Concentrate on the habitats necessary for a dragonfly's healthy life.
- In Analytic Skills, students will:
 - Learn to identify species, conduct a species count and accurately record data.
 - Observe and collect data and compare it to regional trends in indicator species data over time.
- In socio-emotional skills building, students will:
 - Develop self awareness through discussion and reflection
 - Increase social connectedness by working collaboratively and creatively in small groups.

Essential Questions:

1. What are the stages and habitats of the dragonfly life cycle?
2. Why does a dragonfly matter to its ecosystem/food chain?
3. How does dragonfly presence/absence data teach us about our changing climate? (Climate change knowledge)
4. Who is responsible for taking care of dragonfly habitat? (Advocacy** with possible extension)

Session Routine:

Activity	Time	Description
Opening Circle	20 min.	Introduce the day + Journal Prompt
SEL Activity	40 min.	The Dragonfly Life Cycle Show + Lecture!
Activity 1	40 min.	Dragonfly Survey
Activity 2	20 min.	Data and Article Review
Closing Circle	5 min.	Debrief Questions and Discussion

Materials

dragonfly nets, dragonfly life cycle information sheets, dragonfly ID guides, [dragonfly climate change article](#), cameras to document species found (optional) , props for skit (optional), art supplies for potential art presentations.

Some things you should know before you start this lesson:

- Background information relating to the life cycle and natural history of the dragonfly
- What is an indicator species?
- [Field Guide to Migratory Dragonfly- How to ID a Dragonfly?](#)
- Average indicator species presence data over the last 10-50 years
- [Dragonflies as climate change indicators ?](#)
- How to integrate this data collection into local citizen science projects through the local parks department or a scientific agency. OR record the observations in [iNaturalist](#).
- An Ideal setting and circumstances for conducting a survey. Consider contacting your local city, state or national park ranger

Background

This lesson was born out of a scientific survey conducted by NYC Parks Natural Resources scientists. Green Girls were invited to participate for several summers in the counting for the survey alongside a lead scientist. When the formal survey ended we continued to do the lesson because the act of collecting, observing and releasing dragonflies had such a positive impact on the students. Observed closely, our students have found that dragonflies are “cute” and have beautiful wings and colors. This interaction helps to build some affection for insects - a group that our urban students often find unpleasant or scary.

Currently we use iNaturalist to report our observations but we continue to structure this lesson as a formal survey so that students become familiar with one example of scientific protocols commonly used. Any number of what are considered “indicator” species could be chosen in order to adapt this lesson to your local environment. If you choose to survey dragonflies, more information about their life cycle can be found [here](#).

Why do dragonflies matter?

Since dragonflies eat mosquitoes and other insects, they help gardeners and outdoor enthusiasts. Dragonflies help the environment because by eating insects this allows humans to reduce the use of pesticides to kill these insects. They are natural pest controllers. Dragonflies can also be used to help diminish diseases spread by mosquitoes, horseflies and deer flies by releasing dragonflies in areas where infestations of these insects exist.

Dragonflies and Climate Change

Like many other insects, dragonflies are at risk of being highly affected by climate change. As we read about more in our dragonfly life cycle guide, their cycles are very dependent on temperature and climate. Dragonflies in warmer climates lay their eggs much more quickly and go through the nymph stage in a much shorter time span. In general, dragonflies in hotter, tropical climates have a much shorter lifespan than dragonflies in cooler climates. Like monarch butterflies, some dragonflies migrate based on temperature and their migrations may help us learn about climate change².

Based on [climate change experiments](#), dragonfly larval mortality increases with warming temperatures. This may indicate that as the climate continues to warm, dragonflies will not only live for a shorter time in warmer climates but the water may even become too hot for the dragonflies to successfully lay their eggs in the warm water³. In this lesson we consider the ways in which dragonflies and the surrounding ecosystem are impacted by climate change.

Assessment:

Formative:

Exit ticket (see last activity)

[Data sheet](#) (accuracy, thoroughness in process)

Summative:

[Project Rubric](#)

[Pre- and Post-Survey](#)

[Data sheet](#) (accuracy, thoroughness in completion)

Opening Circle: Temperature Check with Facial Expressions

ASK students to show their current emotion on their face/with their body and then simply look around the circle and observe their friends for 30 seconds. No speaking!

ASK students to choose one friend and observe their emotion. Imagine what they might be feeling?

TELL Students: Thanks for your honest emotions today! We're going to get to explore them more with each other later in class.

ASK

- What do you know about dragonflies?
- What habitat do you think dragonflies may live in?
- Have you ever seen a dragonfly around where you live?

EXPLAIN that dragonflies, like most insects, have a preferred habitat and climate in which they live happily and have enough resources. Today we're going to learn more about their life cycle and habitat to understand what pressures they may be facing because of our warming climate. We will be learning how to catch and identify dragonflies in order to conduct a biodiversity study and observe which dragonflies are living in this area.

DISCUSS with students whether or not they believe that dragonflies can survive here in New York City? Where might the dragonflies go once it gets hotter here?

SHOW students the agenda for the day. **ASK** someone to read it aloud and provide time for questions.

Activity 1: Journal (10 minutes):

Materials: journals and pencils

Location: any safe area that has a significant, identifiable presence of the species you are surveying

Journal Prompt: (To be written on a piece of posterboard/whiteboard):

What is the biggest moment of change you have experienced? How did it make you feel? What did you learn from it?

REFLECT

Students pair up and share some thoughts about their journal entries.

Activity 2: The Dragonfly Lifecycle Show

Implementation

1. Split students into small groups of at least 3 students.
2. Hand out sheets with [dragonfly life cycle stages](#) .
3. Tell students they have 15 minutes to create a skit/dance/poem or song about the story of the life of a dragonfly. What does it go through? How does it's life change from egg to nymph to adult? Give these dragonflies personalities and characters!
4. BONUS: Include a scene in your skit that illustrates the impact of climate change on dragonflies.

PRESENT

Student performances and sharing!

**Leadership role for a student, peer mentor or intern: Ask a student to be the MC of the performances.

Activity 3: Dragonfly Survey

Materials

dragonfly nets, dragonfly ID cards, dragonfly life cycle sheets for groups

ASK students:

- Have any of you ever participated in a scientific survey before?
- What was the point of the survey? What information did the survey reveal?
- Based on what we just learned about dragonflies from your performances, what could we learn from surveying these animals? *Hint: think about their habitats, where they like to lay their eggs, how they affect their ecosystem, etc?*

Potential Answers:

- *If we see lots of dragonflies in this area, we can draw some conclusions:*
 - There may be a good habitat for this species here
 - The water temperature may be healthy for larvae
 - The dragonflies are possibly happy with the temperatures here
 - There may be enough of a food source here.
- *If we do not see many dragonflies in this area, we can draw some of the opposite conclusions.*
- *Our survey could help us learn about surrounding water quality and habitat: Dragonflies and Damselflies lay their eggs in fresh water. Presence of these species indicates that the water quality is good*

enough for the species to have a habitat here. Dragonfly eggs will not survive in highly polluted or very active water or water that is too warm.

Catching Dragonflies:

DEMONSTRATE: I'm going to model how to catch a dragonfly. Observe carefully because I will choose one of you to model it after me!

[Dragonfly Catching Instructions Here](#)

[Dragonfly Catching Instructional Video](#)

After the teacher has demonstrated by safely catching and holding a dragonfly, they can pick 1-2 students to model for the rest of the group.

Identifying the Dragonfly

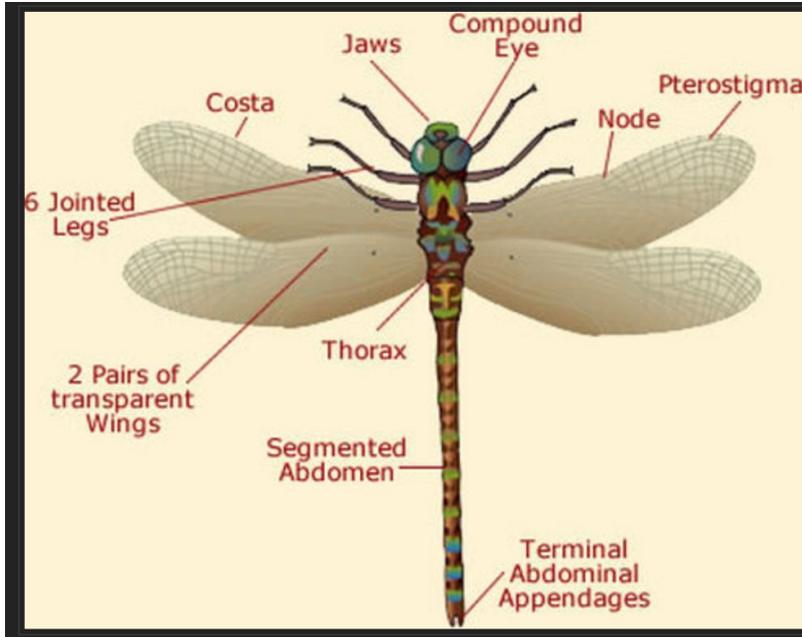
TELL students that now that we've caught the dragonfly, we need to learn how to identify it.

ASK students...

- Have you ever tried to identify another plant or animal before?
- What features did you look for when trying to identify that plant or animal?
- Look at this image of a dragonfly (show image). Which features do you think may be important when identifying the species of dragonfly?

Practice identifying one dragonfly with students using a dragonfly ID guide of your choice.

Key Features:



Source: <http://dragonflylamps.weebly.com/dragonfly-biologyanatomy.html>

[Online Dichotomous Key](#) - helpful for teaching dragonfly identification

[Field Guide to Migratory Dragonflies](#) - helpful for teaching dragonfly identification

[Data Collection Sheet for Each Student](#)

Data Collection:

If possible, SPLIT the group into two, so you have two different study sites. Have the groups go to different areas of the park.

ASK students...

Using your data collection sheet and your new identification skills, make sure to keep an accurate count of all of the species you see. Make sure to indicate how many of each species you saw. You can do this with tally in the boxes on the [data collection sheet](#).

Go through the data collection sheet with students to clarify any questions.

Biodiversity Calculation

Explain to students:

To calculate the biodiversity of dragonflies in this area you will use this formula:

Total number of species ÷ total number of individuals = biodiversity index of this area.

Students will have the following information on their worksheet, but help explain if the concept is challenging.

To get your different variables:

1. *Total number of species:* As a group, tally up the number of different species you saw today. E.g. If you saw 5 Green Darners and 3 Eastern Pondhawks, you saw 2 different species. Your total number of species would be 2.
2. *Total number of individuals:* This is a count of all of the individual dragonflies you saw. If you saw 5 Green Darners and 3 Eastern Pondhawks, you saw 8 individuals.

Example: 2 species ÷ 8 individuals = Biodiversity Index of 0.25

Your turn:

_____ ÷ _____ = _____
(Total # of species) (Total # of individuals) (Biodiversity index for this area)

ASK students...

Debrief questions led by a peer mentor(s) or intern(s):

1. Were there multiple groups conducting surveys in different areas? If so, which group had a higher biodiversity index? Why might this be?
2. How are these dragonflies benefiting the local ecosystem?
 - a. Answer: They are eating insects and pests and lessening the need for pesticides in parks and agricultural areas
3. In some parts of the country, dragonfly populations are decreasing and shifting due to climate change. How will this impact the ecosystem?
4. What can we learn from the biodiversity study? Would you rather have a high or a low biodiversity index of dragonflies in your area?
5. What would happen if a disease came that killed off the one biggest species? Which dragonfly community would still be strongest after the disease?

Closing Circle - Led by peer mentor(s) or intern(s)

- What are two species we identified today?

- How did we figure out which species was which?
- In this activity, we each had the role of a field scientist. What was it like to have that role? Which parts were challenging/fun/enjoyable?

Shout outs: Who...

- helped you out today?
- made you laugh?
- taught you something new?

References:

1. <https://sciencing.com/life-cycle-dragonfly-5398237.html>
2. [Dragonflies Make Epic Migrations, But Climate Change Could Foil Their Itineraries' NRDC.](#)
3. [Simulated climate change increases larval mortality, alters phenology, and affects flight morphology of a dragonfly.](#)