

ACTIVITY SUMMARY:

In this activity we will use tools to learn more about local biodiversity at school or in your backyard. Youth can also experiment with using different apps to assist in plant identification and contribute to local citizen science projects.

This lesson plan was modified by the Keep Austin Beautiful Education team for at-home learning.

UNIT: Clean Creek Campus**GRADES:** 3rd-12th (see modified activity for lower grade levels on page 3)**MATERIALS:**

- Rulers, string, or sticks to measure their own quadrats outside.
- Notebook and pencil to make a chart or printed Biodiversity Quadrat Worksheet (included)
- Calculator
- Optional: Phone or other device with iNaturalist app downloaded and account made with the program.
 - <https://www.inaturalist.org/>

OBJECTIVES:

Youth will be able to:

- Practice basic observational skills, hands-on investigation
- Understand what biodiversity is and why it matters
- Learn some simple measurements for biodiversity on a local level
- Utilize technology as a resource to identify flora on their campus

TEKS CORE CONCEPTS:

3rd grade: 2B-E, 4A, 10C
4th grade: 2B-F, 4A, 10A
5th grade: 2C-F, 4A, 10A
6th grade: 2C-E, 4A
7th grade: 2C-E, 4A, 11A
8th grade: 2C-E, 4A

Introduction (see page 3 below for modified activity for grades K-3rd)

Today we're going to be taking a look at biodiversity in our environment!

What is biodiversity? Diversity, or variety, of living things, like plants or animals.

Why is biodiversity important? Helps ecosystem resiliency and stability.

What might be some threats to biodiversity? Habitat loss, extinction, fragmentation, climate change, invasive plants, etc.

What are native and invasive plants? Native plants – plants from here/native to a specific area, invasive plants – plants not from here that can compete with native plants for resources.

We can measure biodiversity to assess ecosystem health. There are different methods to doing this but we'll be using biodiversity quadrats to investigate biodiversity right here at school.

Activity – Part I – Take it outside!

1. **What is a biodiversity quadrat?** A quadrat is like a small window made to designate a square meter plot to assess for biodiversity. Using this window, we will count how many different kinds of plants we find.
 - Scientists use this to get a glimpse into the larger area that they're trying to study, because it would be impossible to count all of the plants and animals on every inch of the Earth's surface!
 - You can make your own quadrat with any materials you have on hand, and can be creative! A hula hoop is a great option, or use a piece of string or some sticks to designate the space you're working with! (See example photo on page 6)
2. Explain to youth how to keep track of their plant findings using their Biodiversity Quadrat Worksheets or by making their own in their notebook. (See chart below on page 4)
3. Have participants select specific areas to measure out their "quadrats", and then have them record their observations of what is inside.
 - Optional: If phones or tablets are available, check out [iNaturalist](#) or another plant ID app to ID the plants within the quadrat and upload sightings (note: make sure you're investigating an uncultivated area if uploading sightings to iNaturalist!). If iNaturalist unavailable, you can use the [City of Austin's Grow Green guide](#).

- Optional: Include a survey of native and invasive plants around your location. Make a chart comparing the numbers and species of invasive plants that are found.

Activity – Part II – Let's do some math!

Once back inside, begin calculating the biodiversity index for each quadrat recorded.

1. Start by totaling the number of different species found per quadrat as well as the total number of individuals.
2. Define index: *An index is a scale or measurement for something, so by calculating the biodiversity index, we can get a measure of how biodiverse an area is. Our index will be on a scale from 0-1. We are going to use a very simple formula to assess this: number of species in the area ÷ total number of individuals in the area = biodiversity index.*

Discussion: *What does this number tell us? (the higher, the more biodiversity). Why do you think you got the number you had? What kinds of places might have higher biodiversity than others? Less disturbed places. What kinds of places might have lower biodiversity? More disturbed or urban areas. What did you notice when you did your native and invasive plant survey? Why might that be?*

There are some places in the world where there is really high biodiversity for the amount of space. Many of these places are threatened by disturbances such as urban development, invasive species, and climate change. We call places like these biodiversity hotspots. Central Texas – including the Edwards Plateau ecoregion that we call home, is also a biodiversity hotspot, along with many others all over the world! We need to work together to help restore and preserve the biodiversity of this special space. *What can we do to restore biodiversity – Plant native plants, keep our watershed clean, conserve wild spaces, etc.*

By plugging into big citizen science projects like participating in recording sightings on iNaturalist, we can also help further knowledge about the area that we live in so scientists can better understand what our biodiversity looks like!

Modified Lesson for grades K-3rd:**Introduction (5 minutes)**

1. Let youth know that they're going to be exploring the ecosystem that they're in. To start, they will just be doing some broad observations. Have them take 1-3 minutes to silently observe the area. Encourage them to use their animal senses (owl eyes, deer ears), to tap into their sense of touch (carefully!), and sense of smell. Set boundaries for the exploration area but let them know that they can choose to move within the space or find a sit spot and observe from there. Can walk them through guided questions:
 - How many different plants can you observe? What are some differences you see between them? i.e. tall/short, many/few, flowering/grasses
 - What noises are you hearing? What do they tell us about where we are and who shares this space?
 - What animals can you see/hear?

This observation time sets them up to be curious and think about the variety of what is present, and begins to tune them in to what is around them. This is also a great opportunity to use a journal!

2. After the time is up, have them raise their hands and give you observations. Connect it to the next activity, say: *When scientists are studying an area, one of the things they do is count up how many species/types of organisms they find. We are going to be scientists at this station. Now that we have looked at this big space, we are going to look at a small window of plants and see what we can learn about what lives here.*

Quadrats Investigation (15 minutes)

1. Go over basic definitions: **observational science** and **biodiversity**. "We are going to practice **observational science** - what do you think that means? *Where people make observations.* We are going to make observations about the different kinds of plants we find growing to help us understand **biodiversity**. What is biodiversity? *The number and variety of living organisms in a specific area. i.e. Different kinds of living things.* Why is biodiversity important? *Biodiversity is essential for ecosystem stability!*
2. Help youth understand what **quadrats** are and why they are good for sampling. A quadrat is like a small window made to designate a square meter plot to assess for biodiversity. Using this window, we will count how many different kinds of plants we find. (See example photo on page 6)
 - Scientists use this to get a glimpse into the larger area that they're trying to study, because it would be impossible to count all of the plants and animals on every inch of the Earth's surface!
 - You can make your own quadrat with any materials you have on hand, and can be creative! A hula hoop is a great option, or use a piece of string or some sticks to designate the space you're working with!
3. Explain to youth how to keep track of their plant findings using their Biodiversity Quadrat Worksheets or by making their own in their notebook. (See chart below on page 4).

Note: with very young participants – make this as exploratory as possible. Have youth draw all different findings within the quadrat space, whether plant or animal, living or dead material.

4. Review basic safety guidelines and trail etiquette. Have youth look at the single quadrat site unless you have more time and want to do a second site or compare between sites. Also option to have groups compare their findings afterward.
5. Remind youth that it can sometimes be difficult to tell plants apart, and that they will be sharing their findings. Have them try looking at their leaf shape and color or their stem. Try looking at the base - are there actually 20 different plants or are they bunched together in one clump?
6. Have youth work in groups of 2-3 to designate quadrat space and record observations. Have youth investigate their quadrat for 6-10 minutes. Encourage patience and thoroughness in their investigation.

Closing (5 minutes)

1. Call them back over and have youth share observations. The big takeaway for youth is that biodiversity matters and that they become familiar with what's in the backyard!
2. Can also talk about why is it that we saw whatever we saw within the quadrats. *If we put our quadrat on the trail or in a parking lot instead of off-trail – how would that change what we found? What would change if we did this during a different season?*
3. Can discuss how biodiversity may change depending on location, and how it is affected by the things that we do. Any human impact that negatively affects plants or animals is going to impact biodiversity. Can mention biodiversity hotspots and how these are often vulnerable areas.

Extensions and additional resources:

Participate in your local City Nature Challenge using this Educator Toolkit that incorporates iNaturalist in the classroom: <http://citynaturechallenge.org/education-toolkit/>

- Link to main page for the 2020 challenge: <https://citynaturechallenge.org/>

Resources for mapping urban tree data and looking at ecosystem benefits of tree coverage:

- Mapping canopy coverage: <https://canopy.itreetools.org/>
- USDA Data of Urban Forest coverage in Texas: <https://www.nrs.fs.fed.us/data/urban/state/?state=TX>
- Alternate view of tree coverage as canopy perceived in Google Streetview: <http://senseable.mit.edu/treepedia>
- Toolkit through the Vibrant Cities Lab to assess urban tree canopy (advanced): <https://www.vibrantcitieslab.com/toolkit/urban-tree-canopy/>
- Project Learning Tree and US Forest Service Teaching curriculum for High School: Software and lesson plans for identifying and mapping trees in local area: <https://design.itreetools.org/>
 - o <http://www.plt.org/curriculum/teaching-with-itree/>

Biodiversity Quadrat Worksheet

One column is for the plant description and the other is for the tally marks of how many you find of that plant. If you don't know what a plant's name is, that is okay, simply use descriptive words to label it (For younger youth - drawings are okay instead).

	Plant Description	Count
1	Ex: See included example photo: short rounded leaves with yellow flowers (Horse Herb)	III
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		

Plant example: Horse Herb

Description: short rounded leaves with yellow flowers (or have youth draw it!)



Example of quadrat being used in the field

