Advances in Biology Laboratory Education
Publication of the Association for Biology Laboratory Education
Volume 43, Abstract 47, 2023

The find your park lab for ecology students during a pandemic

Kathleen A. Nolan

St. Francis College, Biology Department, 179 Livingston St., Brooklyn, NY 11201, USA (knolan@sfc.edu)

During the fall of 2020 and, following a resurgence of Covid-19 cases in New York City and State, we were forced to conduct the Ecology lab course online. However, in order to expose the students to ecological concepts through hands-on activities, we required them to participate independently in a lab in which they got to choose a local park/habitat to study. Students chose a variety of parks that were planted with native species such as the High Line in New York City and the Brooklyn Bridge Park, a botanical garden on Long Island, wild chaparral by a student who remained in California and participated in the course remotely. Activities included taking pictures of and identifying plants using iNaturalist and PictureThis, researching whether the plants were native or invasive, learning about the range of the plants and any medicinal uses, determining rates of soil settling in a cup or jar (and thus learning more about porosity and permeability of soils), measuring seed dispersal, setting up a Winogradskey column, and calculating a species diversity index. Students revisited their parks over the semester and noted any changes in vegetation. They then compiled their data into tables and charts and presented their findings in both the form of a lab report and a poster that they presented to the class online over Zoom.

Keywords: ecology, urban ecology, park study, ecosystem study

Link To Original Poster File: https://doi.org/10.37590/able.v43.poster47

Introduction

During the Covid-19 pandemic, students in the Fall 2020 Ecology course at St. Francis College were queried as to whether or not they would participate in outdoor labs. As only a few were willing to attend in person, the professor decided to devise an alternative assignment inspired by Kamen and Leri (2019), who take their students on repeated trips to Central Park, New York, New York and the National Seashore's "Find Your Park" program. The students were assigned to choose a park from a list provided, or to pick their own to study. The list provided included the High Line, Central Park, Brooklyn Bridge Park, the Brooklyn Botanic Garden, the NY Botanical Garden in the Bronx, and Prospect Park. As an optional alternative, the professor also invited students to tour these places with her, as she traveled to a different park every week on her bike. The students were required to photograph and identify plants through iNaturalist, "throw" 100 seeds of the same kind to simulate seed dispersal and measure a subset of these, calculate an average soil settlement time of three different areas in their parks, calculate a species diversity index of a subset of their species, make a Winogradsky column of a soil sample in their park, and re-visit the park and record species found. At the end of the semester, students made posters and presented them to the class on Zoom.

Student Outline

Objectives

Become a citizen scientist by using the INaturalist app.
Collect and analyze data such as soil settling time, seed dispersal distance, and species diversity indices.
Make a Winogradsky column and interpret the results qualitatively.

Introduction

In this extended lab exercise, you will get to know the local flora (and possibly fauna) of a park or natural place near where you live. This is sometimes called “in place learning”. Since you are taking this ecology course remotely because we are in a pandemic, and we think it is very important that you still participate in hand-on lab activities, we have devised this lab project for you to do on your own. Normally, if you were in the lab, you would have access to balances, chemicals, etc. that you could use for your projects. Since you do not have that luxury, we have devised lab activities that you can conduct with no supervision.

You are going to visit a park of your choice, approved by your instructor, three times to observe any seasonal changes. This will most likely be in the form of vegetation. You will take pictures of plants during your initial visit and re-take pictures of the SAME plants and note changes. During your first visit only, you will also conduct a soil settling time experiment and a seed dispersal distance study. Be as descriptive as possible. (If this is not possible for you, you can compare and contrast another area or park). During your second visit (approximately 30 days later), you will collect soil or mud to make a Winogradsky columm. During your third visit (an additional 30 days later), you will conduct a 20-50 m transect and a. count species richness. b. calculate species diversity using the Simpson’s reciprocal diversity index. This means you have to count actual numbers of plants.

Materials

Phone for taking pictures and timing

Small ziplock bags

Sharpie pen for marking your ziplock bags

Spoons

Three jars for three soils samples

Measuring cup, measuring teaspoons

Measuring tape or meter stick

One peer-reviewed research article about plants or seeds in parks.

Scavenger Hunt

I want YOU to make a scavenger hunt PLUS an answer key. This will be the **Results** section of your lab report. You must take pictures of 20 plants, and have at least 10 questions (and answers) about the history, geology and/or animals of the park. Make a table of your 20 plants. In the first column, list the common name, the second, the species name, the third, whether is it invasive or native, and the fourth, the range of the plant, and the fifth, any medicinal uses of the plant. Create an iNaturalist account and upload your pictures into the account. Take screenshots of these and attach them to your report.

Soil Settling Time

Take a spoon with you and surreptitiously dig up a few spoonfuls into ziplock bags (a quarter of a cup of soil should be fine). Do this at three different locations and describe what is at each location. Label the bags with the location. Describe the color and texture of the soil. Were there any organisms in the soil? Take three jars or clear cups or glasses and fill ¾ of the way with water (use the same amount for each cup---3/4 of a cup should be sufficient). Mark down the volume of this water. Take a measured teaspoon of each soil and, having a timer handy, drop the soil into the jar. Start your timer. Immediately take a picture of all three jars. Try to time the settlement of the soil to the bottom of the jars. Which soil settled the most quickly? The most slowly? The finer the particulate matter in the soil, the longer it will take the particles to settle. Clay takes a longer time to settle than sand. This is an indication of the turbidity or clarity of the water and the porosity of the soil.

Seed Dispersal Distance

Collect at least 100 seeds of any plant (these could be acorns, or smaller seeds, or even berries---same type for all the 100). Scatter these seeds outside on the ground by throwing them as far as you can with your arm. Randomly measure the distance that 20 seeds traveled during their dispersal. Enter this data into one column of an Excel spread sheet and find the MIN, MAX (distance traveled) and the average distance dispersed. Can you make any connections between seed dispersal and success of the offspring from the seeds?

Winogradsky Column

A Winogradsky column is a clear cylinder, such as a 1.5-liter soda bottle, that can be filled with soil and nutrients and left in a sunny spot to observe the growth of microbes. Cyanobacteria will migrate to the side of the bottle after at least two weeks' time. You may also see purple bacteria. To make one:

1. collect a soil or mud sample from your park.
2. Cut up a 28 c X 36 cm piece of newspaper in to small pieces.
3. Peel two hard-boiled eggs, and chop into small pieces.
4. Place the newspaper (carbon source) and the eggs (sulfur source) into the bottom of the 1.5-liter soda bottle.
5. Pack the bottle with the mud or a slurry of soil and water.
6. Cap the bottle, but vent the gases out of the bottle once a week
7. Place the bottle in the light

Read the background material about the Windogradsky column and about the type of bacteria you might see in https://www.sciencelearn.org.nz/resources/975-growing-soil-microbes

Simpson Reciprocal Species Diversity Index.

1. Take a measuring tape or meter stick and mark off a 20 meter transect.

2. Record the number of species (species richness) and the approximate number (abundance) of each of those species.
3. Label three columns on an Excel spread sheet: species name, abundance, and proportion (p).
4. Find the sum in the Excel spread sheet of the abundance column, which will give you the total number of organisms.
5. EXAMPLE: Let us say that your species richness is 20. Divide the number of each species by the total using this formula similar to this: =A2/A21 (If you copy the number from the p value of your first cell and select all the cells of that column and paste down, Excel will fill in all the proportions. These will be fractions of your total.

$D = \sum p_i^2$ and p_i = the relative proportion of the ith species in a site. 1/D is the Simpson Reciprocal Diversity value, and the higher the value, the higher the diversity. Diversity is affected not only by the species richness, but the "evenness" of that distribution. In other words if a few species predominate in an area, this site would be less diverse than an area that had a more even distribution of species.

Poster and Lab Report

Write your lab report (and POSTER) in the following way: Poster should be set up as large PowerPoint Slide-with the dimensions 48" X 36".

Title, your name, course and number, and date

Abstract -- a short summary of what you found)

Introduction -- you will incorporate information from your research article into this report and present some data (statistics) about what the authors found. You will relate this information to something you learned about your park that you visited.

Materials and methods -- the Materials are listed above. The Methods state HOW you used the materials.

Results -- this will be your pictures and table, pictures of the soil and observations, picture of the seed dispersal and a table of the 20 measurements (in a longer research paper, the authors also state the results in prose---you do not need to do that now.)

Discussion -- you will write about what you learned about ecology from conducting this project. What types of things did you notice? Any interesting variation? Let us see what you come up with. You may use other research papers as examples. Cite and list your **reference** PROPERLY within and at the end of your report.

Discussion

Because most of the students chose to study remotely during the Covid-19 pandemic and the feelings of the Ecology professor who was teaching the course thought that there should be a hands-on component, the Find Your Park Lab idea was born. The students were required to visit a park of their choosing (approved by the instructor) and conduct a series of observations and experiments there.

This project was informed by the literature: Yli-Panula et al. (2018) explore the connections among biodiversity and human values, which could be further explored in a project such as this. Stroud et al. (2022) lament "The botanical education extinction and the fall of plant awareness" in a viewpoint piece. Kamen and Leri (2019) found a greater retention in STEM after students engaged in a first-year experience course in which they took multiple trips to Central Park to study biodiversity and water quality. This "Find Your Park" project also required the

students to attend “their” park multiple times. The students in the Ecology class used INaturalist and PictureThis apps, which increased their awareness, and their interest in plants, that was evident in their vibrant final presentations. Another intriguing teaching technique to attempt might be to have the students make a blog about their projects. Iriart et al. (2022) found that blogging about plants increased student interest in botany and the environment. In light of the isolation of the pandemic, this practice might provide missing socialization.

The students were encouraged to take ownership of their projects and develop a sense of place. We felt that this would promote not only new ecological knowledge for the student but a sense of future stewardship of their park. The students enthusiastically participated in the project and enjoyed presenting their final posters to the class over zoom. An additional component that could have been added would be bird or other animals (such as frog) recordings on Audacity. Spectrograms could have been examined for patterns.

Materials

Phone for taking pictures and timer

Small ziplock bags

Sharpie pen for marking ziplock bags

Spoons

Three clear jars or cups to observe the settling of three soils samples

Measuring cup, measuring teaspoons

Measuring tape or meter stick

One peer-reviewed research article about plants or seeds in parks.

Notes for the Instructor

Our New York City college was forced to shut down during March 2020 during the pandemic. In Fall 2020 the St. Francis College students were given a choice as to whether or not to attend school in person, and many chose not to do so. The solution for our Ecology course was to devise a mandatory project in which students would perform a series of lab activities in a park/natural area of their choice with instructor approval. The caveat was that, as this project was unsupervised, we had to assume that the students did the project and that the pictures they used were ones that they had actually taken. As no laboratory equipment was available to them, the students had to rely on what they had in their homes for measurement and tools on their cell phones. In order to get buy-in for the project from the students, it was counted as 30% of their grade (10% for an initial lab report after their first visit to the park, 10% for their final lab report, and 10% for their poster and poster presentation).

The final zoom poster session was actually quite enjoyable and informative to all. Alternatively, having students do a PowerPoint presentation would allow them to better show parts of their poster in a more sequential way. Selected results of student work are in Appendix A and the grading rubric is in Appendix B.

Cited References

Iriart V, Forrester N J, Ashman TL, Kuebbing SE. 2022. The Plant Science Blogging Project: A curriculum to develop student science communication skills. Plants, People, Planet, 4(5), 485–498. https://doi.org/10.1002/ppp3.10287

Kamen E, Leri A. 2019. Promoting STEM Persistence Through an Innovative Field Trip– Based First-Year Experience Course. Journal of College Science Teaching. 49(2):24-31

Stroud S, Fennell M, Mitchley J, Lydon S, Peacock J, Bacon K L. 2022. The botanical education extinction and the fall of plant awareness. Ecology and Evolution, 12, e9019. https://doi.org/10.1002/ece3.9019

Yli-Panula E, Jeronen E, Lemmetty P, Pauna A. 2018. Teaching methods in biology promoting biodiversity education. *Sustainability*.10(10): 3812.(1-18).

Acknowledgments

Thank you very much to all of the BIO-2204 Ecology students who participated in this lab project.

About the Author

Kathleen A. Nolan is a Professor of Biology Emerita at St. Francis College in Brooklyn, New York and a long-time member of ABLE. .

Appendix A

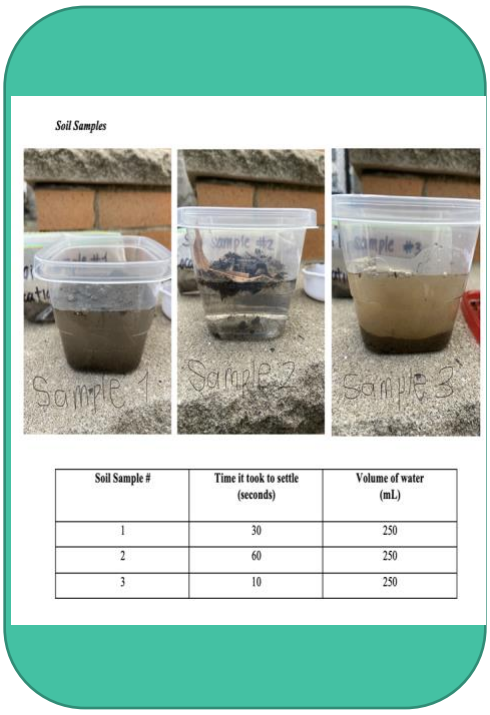
Selected images from student posters

Conference House Park

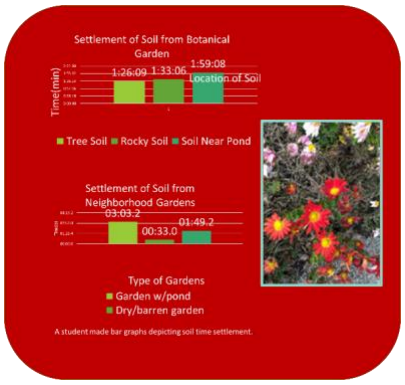
California chapparal

Prospect Park, Brooklyn, NY

Picture	Common Name	Species name	Invasive/Native	Range	Medicinal uses
	Common Earthball	Scleroderma citrinum	Native	Eastern U.S.	N/A
	Ringless Honey Mushroom	Armillaria tabescens	Native	East Coast	Antioxidant effects
	Viscid Violet Cort	Cortinarius iodes	Introduced	Eastern U.S.	N/A poisonous
	Turkey Tail	Trametes versicolor	Native	Most of the U.S Not Midwest Europe Asia	Antioxidant, Fights cancer, gut bacteria balance
	Chicken of the Woods	Laetioporus sulphureus	Native	Eastern U.S. Europe	Anti-carcinogenic Anti-inflammatory Anti-bacterial
	Spotted Wintergreen	Chimaphila mactulata	Native	Eastern Mountain ranges Mexico	Anti-Inflammatory-Arthritis (ursolic acid)
	Wineberry	Rubus phoenicolasius	Introduced/Invasive	Eastern Mountain ranges Western Europe	Anti-Inflammatory Vitamin E, C Immune System Booster



Soil Sample #	Time it took to settle (seconds)	Volume of water (mL)
1	30	250
2	60	250
3	10	250



species name	Counts	p	p^2
Norway maple	8	0.36	0.1296
Scarlet Oak	10	0.45	0.2025
shagbark hickory	3	0.14	0.0196
American Holly	1	0.045	0.002025
species richness:	Total:	Σ p2	
4	22	0.36	
Simpson's Diversity 1/D or 1/Σ p2			
2.77			

Winogradsky column:

Figure 3 – Bottle to left was day 1. Bottle in the middle was 4 weeks later containing the newspaper strips. Bottle to the right was 4 weeks later containing the egg yolk.

Appendix B

Grading rubric for student presentations, which are linked to learning outcomes.

Attractiveness of poster font size, organization, figures and tables	**4 pts** **Exceptional** All components included; content accurate	**3 pts** **Proficient** One item missing from component and/or content	**2 pts** **Approaching** More than one item missing from component and/or content	**0 pts** **No Marks**
Oral presentation Speak clearly; do not read poster; have key points and rationale for project handy; be enthusiastic	**3 pts** **Exceptional** Font size good, not too many words; picture/chart balance	**2 pts** **Proficient** Too many or too few words; too few charts or pictures	**1 pts** **Approaching** Too many words; too few pictures; disorganized	**0 pts** **No Marks**
Oral presentation Speak clearly; do not read poster; have key points and rationale for project handy; be enthusiastic	**3 pts** **Exceptional** Articulate; did not read from poster; presented interesting and key points and rationale behind project	**2 pts** **Proficient** Read from poster, left out some key interesting point and rationale behind project	**1 pts** **Approaching** Read from poster; left out many key points and did not provide rationale for project	**0 pts** **No Marks**
Total Points: 10				

Mission, Review Process & Disclaimer

The Association for Biology Laboratory Education (ABLE) was founded in 1979 to promote information exchange among university and college educators actively concerned with teaching biology in a laboratory setting. The focus of ABLE is to improve the undergraduate biology laboratory experience by promoting the development and dissemination of interesting, innovative, and reliable laboratory exercises. For more information about ABLE, please visit http://www.ableweb.org/.

Papers published in *Advances in Biology Laboratory Education: Peer-Reviewed Publication of the Conference of the Association for Biology Laboratory Education* are evaluated and selected by a committee prior to presentation at the conference, peer-reviewed by participants at the conference, and edited by members of the ABLE Editorial Board.

Citing This Article

Nolan KA. 2023. The Find Your Park Lab for ecology students during a pandemic. Article 47 In: Boone E and Thuecks S, eds. *Advances in biology laboratory education*. Volume 43. Publication of the 43rd Conference of the Association for Biology Laboratory Education (ABLE). https://doi.org/10.37590/able.v43.art47