What's in our "Backyard"?

Lesson narrative:

This lesson was designed for my 8th graders. I teach over 100 students, with classes of 25-30 students at a time. We study the Earth and Environmental Studies throughout the year. We are fortunate because our school is surrounded by woods, and we also are in walking distance of a small glacial lake with a park, as well as being close to the Wehr Nature Center, which has several Wisconsin ecosystems, including a restored prairie and an oak savanna.

The lesson introduces students to the method of quadrats while studying an ecosystem. It has the ability to be used "as is," or better still as a springboard for future inquiry investigations. This technique was originally learned while participating in the Mammals of Nova Scotia expedition, but we were searching for deer droppings at the time. This lesson instead focuses on the flora of the ecosystem, which is more readily available than deer droppings, so every student can get the thrill of finding something for data. I have included extensions at the end of this lesson, so it can be modified or lengthened as needed for your students.

Lesson Title	What's in our "backyard"?
Grade Level	8th grade –can be modified for grades K-12
Content Area	Science
Time Allotted	4 classes (50 minutes each) to more classes depending on modifications and extensions used
Academic Standards	Wisconsin Environmental Education: B.8.6, C.8.2 Wisconsin Science: C.8.2, C.8.3, C.8.4, C.8.6, C.8.9, C.8.10, C.8.11
Abstract	In this lesson, students will learn how to conduct quadrat studies by investigating an ecosystem's flora. Quadrats are a common method to study ecosystems so this would be a start for investigations on local ecosystems. This lesson is intended to be used either as it is written or as a springboard for inquiry investigations. As a result, it has a basic simple structure, but modifications and extensions are included as well so it can be further refined to best suit your students' needs.
Goal	Essential questions: How can we determine what is in an ecosystem in a systematic, efficient, and scientific way? What types of plants are found in a(n) (whatever ecosystem you are studying)?
Performance Indicators	Students will gather and analyze data on plants in a local ecosystem using quadrats Students will explain the results of their investigation of this local ecosystem Students will discuss the strengths, weaknesses, and possible uses of quadrats
Background Information	Students will need to have an understanding of ecosystems and how to use Excel or a similar program for graphing *Note for teachers: Quadrats can vary in size. Oftentimes, it is helpful to have students study a $1m^2$ area. This is great for a prairie or wetland area. However, the area may be increased when studying an area with larger plants, such as a hardwood forest, because some trees might take up a $1m^2$ area. Use your judgment when deciding on the quadrat sizes and also materials. Always try it out yourself BEFORE expecting your students to do the same. For example, another material may be rubber boots if you are studying a marsh.*
Materials	A outdoor space to study the natural environment String (already marked off by meters) or meter sticks to mark off the string later

	Compasses or protractors to help create right angles for quadrats Plant data sheets Blank square paper for sketching location of species found in each quadrat Pencils/pens Reference materials for area plants and/or Internet Computers with Excel (or a similar program)
Technology	Optional: ❑ GPS units to map out quadrats and/or identify locations of quadrats ❑ Digital Cameras to take photos of plants for later identification
Instructional Procedure	**Introduction** ❑ Show students photos of the area you will be studying o Class discussion: How many and what types of plants do you think will be found here? Record students' predictions ❑ Introduce the essential questions: How can we determine what is in an ecosystem (like the one we'll be studying) in a systematic, efficient, and scientific way? What types of plants can be found in a (n) (whatever ecosystem you are studying, for example: prairie) ecosystem? o Elicit students' ideas on what they think would work and why for researching the types of plants in the ecosystem **Activities** ❑ Introduce quadrats o How they work---students can discuss what they predict will be the method's advantages and disadvantages ❑ Practice outside with 10cm x 10cm squares on school lawn o Each student pair will work together to collect the data o Discuss as a class: what techniques worked well, what didn't go well and how can we improve techniques for the future ❑ Work on actual site collecting data o Students will work in pairs to mark off their quadrats o Students will record data on the plant data sheet and a general map of their own quadrat, sketching out the locations of different species on the blank square paper o Students will need to identify the plants they find ▪ Prior knowledge and/or plant resource books used while on site OR take digital photos of plants for later identification in the classroom (using resource books or the Internet) ❑ Analyze the results o With both options, students create graphs using Excel or a similar program ▪ Students make individual graphs and use the collective class data for a second graph---compare and contrast what they found between the two graphs o Additionally: ▪ With option #1: Students place squares next to each other to create large collective grid on classroom wall and observe all the data ▪ With option #2: Students can display their squares in a Gallery Walk format, leaving squares at their desks, while the students themselves travel the room, observing classmates' findings and

	making comparisons and contrasts to their own data ❑ Summarize findings o Think-Pair-Share: What does our data tell us about plants in the area studied? What were some strengths in using quadrats to study an ecosystem? What were some weaknesses? **Closure** Students answer questions in their science journals: (can be modified to be answered orally for certain students) -Were our predictions on plants in a(n) (whatever ecosystem studied) correct? Explain your response. -What were some strengths using quadrats to study an ecosystem? -What were some weaknesses using quadrats to study an ecosystem? -How could we apply quadrats in our class? -What do you have questions about? How could you investigate them?
Assessment	Checklist of observed behaviors Criteria for science journal entry
Connection to Other Content Areas	Math---graphing skills, use of metric system Social Studies---Was there evidence of how humans have had any impact on this ecosystem?
Extensions	❑ Complete transect study and compare data to quadrat study ❑ Study a larger or smaller area ❑ Collect and analyze data on abiotic factors as well ❑ Study different local ecosystems---compare and contrast results ❑ Contact a school in a different part of the world--share information through email, blog, or wiki ❑ Study same area over the course of the year—what changes? ❑ Conduct inquiry investigations stemming from students' observations and questions ❑ Spend time in quadrat area—students will work on their nature journals there over the year ❑ Incorporate a service-learning activity—be sure it is student-driven Here are some possibilities: -identification and eradication of invasive species -trash clean ups -building of bat and/or bird boxes -websites with information about the ecosystem for the general public—connected to school and/or community website
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Submitted by	Marlene McIlheran

Options for the Quadrat Study

1. Organized Grid Pattern

This option has the students working within a marked area that is in a grid pattern. Each student (or student pair) will be assigned an area in the grid to study.

Advantages:

- Information from the drawings can be placed together on the classroom wall after the activity to make a more complete "picture" of the area for data analysis
  - Class may develop a sense of teamwork as they all work together
- Students have the opportunity to practice math skills regarding squares and the metric system as they help lay out the grid system in the area
- Students from different grids may help one another if they are closer together

Disadvantages:

- The lack of randomness can give an inaccurate representation of flora in the area; for example, the class may be working in an area with a clump of only certain species that aren't representative of the entire area (a grove of pine trees in a deciduous forest)
  - Can take care of this by doing the activity several times, randomly selecting where to mark off the large grid in the natural area

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

2. Random Placement

This option will have students selecting their own quadrat area randomly in a larger area than in option #1.

Advantages:

- Emphasizes the idea of randomness in the study, which is important for ecological field studies
  - Can be tied into the math curriculum
- Students can be further apart, so there will be more room for people to work

Disadvantages:

- More initial help will probably need to be given by the teacher as students (if they are further apart) will not be as able to help one another
- Unless the area is mapped out with coordinates for the randomly selected areas, students will have more difficulty piecing together data as a class

Checklist of Observed Behaviors:

- ❑ Student accurately measured out the specified quadrat area
- ❑ Student systematically observed plants in quadrat
  - o Put forth best effort in tallying plants
- ❑ Student put forth best effort to correctly identify plants
- ❑ Student recorded information accurately and neatly on plant sheet
- ❑ Student recorded information accurately and neatly on blank paper—making a sketch of the quadrat

Other:

- ❑ Student worked collaboratively with others
- ❑ Student used time well
- ❑ Student used equipment properly

Criteria for Science Journal:

All students must meet criteria even if that means redoing the assignment after receiving feedback.

1. Were our predictions on plants in a(n _____ ecosystem correct? Explain your response.

__Clearly and accurately explained predictions
__Used data analysis done in class to support response

2. What were some strengths using quadrats to study an ecosystem?

__Clearly and accurately identified strengths of using quadrats
__Offered examples from experience

3. What were some weaknesses using quadrats to study an ecosystem?

__Clearly and accurately identified strengths of using quadrats
__Offered examples from experience

4. How could we apply quadrats in our class?

__Clearly and accurately offered at least one specific and reasonable idea

5. What do you have questions about? How could you investigate them?

__Clearly identified at least 2 questions that could be investigated
__Questions are linked to some aspect of the most recent work
__Identified reasonable ideas by which ideas could be investigated