Content: Environmental Science—Ecosystems
5th grade Time: 10 meetings, each meeting 60-105 minutes
Unit: Natural Recycling

Stage 1: Identify Desired Results

Unit Description and Rationale

This two-week unit study of ecosystems was developed employing the method of backwards design by Wiggins' and McTighe's (2005). The enduring understandings are adopted from the current version of American Association for the Advancement of Science's *Benchmarks for Science Literacy* (1993) where

> Students should explore how various organisms satisfy their needs in the environments in which they are typically found. They can examine the survival needs of different organisms and consider how the conditions in particular habitats can limit what kinds of living things can survive. Their studies of interactions among organisms within an environment should start with relationships they can directly observe. By viewing nature films, students should see a great diversity of life in different habitats (AAAS, 1993).

The goal of the unit is to nourish students' scientific dispositions in ecosystems by actively engaging them and enhancing their skills of inquiry, observations, and reflection. This unit allows students to learn science by doing science, and it encourages students to further question and test their thinking. Lessons in this unit are in accordance with the National Research Council's grades 5-8 Life Science Content Standard C: Populations and Ecosystems of the National Science Education Standards (1996). The formative and summative assessments in this unit are varied and depict students' understanding of the concepts while allowing them to portray their process skills. Assessment tools including checklists and rubrics are used throughout the unit for ongoing formative assessment. The summative assessment allows students to choose how they may best exhibit their learning and mastery of enduring understandings.

Content Standards

NSES Grades 5-8 Life Science Content Standard C: Populations and Ecosystems

1. A population consists of all individuals of a species that occur together at a given place and time. All populations living together and the physical factors with which they interact compose an ecosystem.
2. Populations of organisms can be categorized by the function they serve in an ecosystem. Plants and some microorganisms are producers—they make their own food. All animals, including humans, are consumers, which obtain food by eating other organisms.
3. Decomposers, primarily bacteria and fungi, are consumers that use waste materials and dead organisms for food. Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem (NSES, 1996).

Enduring Understandings (adopted from the Current Version of Benchmarks).

1. Insects and various other organisms depend on dead plant for food. 5D/E2
2. Organisms interact with one another in various ways besides providing food. 5D/E3a
3. Almost all kinds of animals' food can be traced back to plants. 5E/E1
4. Most microorganisms do not cause disease, and many are beneficial. 5D/E5

Essential Questions

How do components of an ecosystem affect organisms living in the ecosystem?
How does human interference affect an ecosystem?
What connection do ecosystems and organisms in a given ecosystem have with other living things?

Content Knowledge & Skills

Students will be able to:

- observe and identify things as abiotic or biotic in an ecosystem
- explain how organisms interact with other components of an ecosystem.
- identify the relationships among producers, consumers, and decomposers in an ecosystem.
- evaluate the effect of microorganisms
- evaluate the impact of personal activities on the local environment.

Student Misconceptions

Student misconceptions are non-scientific beliefs or preconceived notions that are misunderstandings. Some common misconceptions that pertain to ecosystems may be:

- Dirt is not the same as soil (Hapkiewicz, 1999).
- Soil comes from rivers, result of volcanic action, or was there since Earth formed (Hapkiewicz, 1999).
- Plants, fungi, eggs and seeds are not living (Berthelsen, 1999).
- Carbon dioxide, water, and minerals are food (Berthelsen, 1999).
- Plants feed by absorbing food through their roots (Berthelsen, 1999).
- A species high on the food web is a predator to everything below it (Berthelsen, 1999).
- Plants absorb water through their leaves (Berthelsen, 1999).

Stage 2: Assessment Evidence

Summative Performance Assessment (EU 1-4)	
Goal	Students synthesize their learning about the way organisms interact with biotic and abiotic things in their environment, for survival.
Role	Students act as a soil scientist who proposes the idea of making one's own fertilizer for the use of a home garden.
Audience	The intended audience is other gardeners and small-scale farmers (peers, parents, instructor).
Situation	Students are soil scientists who are to convince gardeners and non-gardeners that it is easy and affordable to have a healthy garden.
Product	A tri-fold exhibit, PowerPoint slide show, or podcast commercial of a proposal and presentation to the audience.
Standards	Students are given a scoring rubric that discusses the criteria of the assessment. See Appendix A. They are evaluated on their proposal/commercial and their presentation skills. 1. Proposal or Commercial – Content – Organization

– Attractiveness – Mechanics 2. Presentation Skills – Organization – Understanding of topic – Engagement – Posture – Eye contact – Voice See Appendix A for scoring rubric.

Formative Performance Assessment 1 (EU 1, 2, 4)	
Goal	Students synthesize their learning of how nutrients are recycled when organic material is decomposed.
Role	Students act as experimental scientists who prepare a laboratory experiment to look at plants growth in different planting conditions.
Audience	The intended audience are peers and the instructor.
Situation	Students are experimentalists who are testing various materials to determine which is more conducive to plant growth.
Product	A completed laboratory report. See Appendixes G and J for task.
Standards	Students are evaluated on their ongoing participation in the experiment and the final laboratory report, and post-lab synthesis questions. – Predictions – Observations – Experimental skills – Understanding – Environmental stewardship See Appendix J for scoring rubric.

Formative Performance Assessment 2 (EU 1-4)	
Goal	Students show how nutrients are recycled between organisms.
Role	Students act as an artist (painter, illustrator, cartoonist, computer graphics artist, etc.) to diagram and demonstrate how nutrients get recycled.
Audience	The intended audiences are their peers and younger students.
Situation	Students are to explain how nutrients are recycled between organisms to younger students and their peers that have no understanding of producers, consumers, decomposers, or the food chain.
Product	A diagram or scrapbook of a food chain diagram See Appendix K for task.
Standards	Students are evaluated on the assessment criteria of Decomposers & Recycling of Nutrients (Appendix D) and using the scoring rubric (Appendix K): – Nature's recyclers—scavengers, fungi, and bacteria—carry out the process of decomposition. – Decomposers get their nutrients from organic remains. – As decomposers decompose organic remains, some nutrients are released back into the soil or water.

– Nutrients are recycled continually through soil or water to producers, consumers, decomposers, and soil/water again.

Preconceptions Survey	1. Do you think insects eat dead plants for food? 2. What is an organism? 3. Do you think one organism interacts with another organism? 4. Do you think animals eat plants? 5. What is a microorganism? 6. Do you think microorganisms cause diseases? 7. Do microorganisms do anything beneficial?
Pre-Assessment	Lessons 1 and 2 (See Appendixes C and D).
Quizzes, Tests, Academic Prompts	1. Pre-assessment 2. Preconceptions survey 3. Growing plants in different planting materials lab report 4. A diagram or scrapbook of a food chain diagram 5. Summative performance assessment
98Other Evidience	1. 3 science journal reflections in Lessons 1, 2, and 7 2. Ongoing student discussions with the use of ongoing assessment rubrics

Stage 3: Experiences and Instruction

Adopted from *Science Companion*, 2005.

Where	Standards, benchmarks and enduring understandings will be posted in the classroom and in student science journals for the duration of this unit. Students will be reminded of the enduring understandings, how the content is linked to their lives, and why the understanding of ecosystems is important to them as a part of each lesson's reflection discussion.
Hook	Students discuss what they already know about ecosystems and the living and nonliving things within a given ecosystem, and they brainstorm questions that they hope to be answered in the unit. In the beginning of each lesson, students will be engaged through the "hook" of the lesson. The hooks differ from lesson to lesson as shown below.

Lesson 1: Decomposition, Pre-assessment	
Hook	Students gather and observe decomposing plant material. Students explain what they think is occurring to the objects as they answer the following questions in small groups: – Why is change occurring? – What will eventually happen to the object? – What is the term to describe this process? – When do organisms decompose?

	– Why do things decompose – Do things disappear completely when they decompose? – Is it possible to prevent something from decomposing? – What affects the speed at which something decomposes?
Experience	Students map how organisms decompose as they look at several illustrations of a tree and an animal. They organize each set of illustrations into a sequence that shows the depicted organism decomposing over time.
Reflect	Once students have arranged their illustrations, share their sequences in small groups, and discuss any differences in opinion, students then glue the illustrations in sequence into their science notebooks. Students discuss and record their ideas of how the tree and animal changed during each stage and what might have caused the changes.
Exhibit	See Appendix B and C to evaluate students' discussions and their work in their science notebooks.

Lesson 2: Decomposers (EU 1)	
Hook	Students discuss what causes or promotes decomposition and what animals feed on organic remains.
Experience	Students observe and investigate examples of scavengers that feed on dung and carrion such as beetles, and decomposers such as fungi, and bacteria through a guided webquest. http://www.brandonsd.mb.ca/riverheights/tutkaluk/webquest.htm.
Reflect	Students independently brainstorm and visualize what a yard, playground, or park would look like if there were not any scavengers. Students then illustrate their visualization in their science journals and include a caption explaining their illustration.
Exhibit	See Appendix B and D to evaluate students' discussions and their work in their science notebooks.

Lesson 3: Observing Worms	
Hook	Students observe the teacher assemble a worm bin while the teacher explains about composting worms, an example of a decomposer.
Experience	Students closely examine live composting worms with exploration tools (magnifying lens, flashlight), and then they record their observations in drawings and descriptions.
Reflect	Students discuss their observations. – Describe what they saw when they shined a flashlight through the worm – Identify the parts of a worm that they observed – Share observations
Exhibit	See Appendix B and E to evaluate students' work.

Lesson 4: Feeding Worms (EU 3)	
Hook	Students discuss what will happen to the newspaper and some cucumber pieces if they were left out in nature and what might composting worm do with these items.
Experience	Students set up decomposition cups to discover what effect worms will have on the

	decomposition of plant remains. They will return to compare the results in each cup and record results in 5-7 days.
Reflect	Students share their observations in small groups. – Did their results turn out like they predicted/hypothesized? Why or why not? – What happen to the cucumber pieces in each cup? – What new substances, if any, were produced in the cups? – How do castings affect plant growth? Are they harmful or beneficial to plants? Why?
Exhibit	See Appendix B, E, and F to evaluate students' work.

Lesson 5: Decomposers to Soil	
Hook	Students examine and record observations of a variety of unidentified organic and inorganic samples of planting material with exploration tools: – Potting soil – Humus – Partially composted material – Sand – Pebbles or gravel Students discuss the samples and share their written observations and predictions of which sample is what. Teacher identifies ingredients of each sample and clarifies questions and misconceptions.
Experience	Students use the scientific process, set up experiments by planting seeds in materials or a mixture of materials to observe the plant growth over several weeks.
Reflect	Students share their predictions about the different planting environments. Students use questions to synthesize and clarify the scientific process: – What am I testing? – What parts of the setup are exactly the same? – Which parts of the setup are different? – Why do I need a planting cup for each type of material to test differences in plant growth?
Exhibit	Pre-lab work, "Setting up the experiment" and science notebook observations. See Appendixes B, F, and G to evaluate students' work.

Lesson 6: Agents and Evidence of Decomposition (EU 1, 2)	
Hook	Students listen to the teacher read-aloud: *Compost Critters* by Bianca Lavies about the organisms that decompose organic materials. Students discuss: – Agents of decomposition – Smallest decomposers – Signs of decomposition and microbial activity
Experience	Students visit a field site (a garden, the woods, etc. were there is evidence of invertebrates, fungi, and bacteria) to observe decomposers' habitats and evidence of decomposition. Students may also practice environmental stewardship such as:

	– Picking up litter and trash – Showing respect for the living things in the field and not disturbing them – Replacing any overturned logs or rocks
Reflect	Students discuss and share their observations they made during their exploration. – What did I see being decomposed? – What evidence let me to know decomposition was happening? – What agents were doing the decomposition work? – What other organisms did I detect living and feeding in the same location?
Exhibit	Students' science journal observation notes on Nature's Recyclers. See Appendixes B, C, E, and I to evaluate students' work.

Lesson 7: Nutrients for Plants (EU 1-4)	
Hook	Students revisit their journals and their pre-lab work, "Setting up the experiment". Students reconsider their investigative question and decide whether plants in different material grow differently.
Experience	Students observe the plants and consider the following: – Leaf development: number, size, color, texture – Height of plant: measurements and rate of growth – Sturdiness of stalk and plant: weak, average, strong, robust – Seed survival: one, two, three, or none – Root structure: length, thickness, color, spreading – Unexpected stress: neglected, disturbed, denied of water or light Students complete their experiments with final observations and drawings of their plants. Students then review their data, organize it, and make conclusions about the results of their investigation.
Reflect	Students discuss their observations and share their written conclusions. – Did the plants grow differently in different materials? How so? – Did the results match my initial predictions? – Did I find any of the results surprising? Why? – If two groups followed the same data, did they get the same results? – Does this happen in the real-life practice of science? How so? – What new questions do I have as a result of the experiment?
Exhibit	Students' input entries and completed lab report. See Appendixes B, C, D, E, F, G, H, J.

Lesson 8: Following a Food Chain	
Hook	Students participate in a matching game. A list of content words is listed the left, and a list of definitions is listed on the right. On a projector, students draw a line from the word to the definition of the word. Students self-correct or ask for peer assistance if necessary. Project on a screen (as a transparency or on a SMART board): *Match the vocabulary word to its definition.*

	consumer	A chain of organisms in which each organism is food for the next organism in the chain
	food chain	All the food chains in a community of living organisms
	food web	A consumer that eats both plants and animals
	herbivore	A consumer that eats only animals
	omnivore	An organism that makes its own food; all green plants are this
	producer	A consumer that eats only plants
Experience	Students discuss what they know about herbivores, carnivores, consumers, and producers. Clarify and explain to students what each term means and how they are connected using a diagram. Students observe an example of a food chain and a food web and discuss which is which and the characteristics of each. Students then add the missing organism to the food chain and web: decomposers, scavengers.	
Reflect	Students discuss where they think nature's recyclers would fit in the food chain and how the addition changes the food chain.	
Exhibit	Students create their own food chain. See Appendixes D and K to evaluate student work.	

Lesson 9: Recycling Nutrients Closure & Introduction to Summative Assessment	
Hook	Students recap the various activities that they have experienced in the unit through a discussion. – Why is decomposition important? – What are some organisms that help the waste and remains of living things decompose? – How do dead organisms help make new life possible? – What activity did the class do that showed how nutrients released by nature's recyclers helped make new life possible? – How did the nutrients in the worm castings affect the growth of the seeds?
Experience	Students apply what they learned in the unit by creating a model, a Mobius strip, that demonstrates how producers, consumers, and decomposers work together to create a nutrient cycle in nature.
Reflect	Students refer to the Mobius strip that they created to discuss: – Are nutrients ever wasted in nature? – How do producers, consumers, and decomposers depend on one another in the nutrient cycle? – Would this type of model help other students to understand the nutrient cycle? Why or why not?
Exhibit	Students create their own Mobius strip. See Appendixes D evaluate student understanding.

Additional Resources

Griffel, S.J. (2003). *The Cleanup Crew: Nature's Recyclers*. Newbridge Educational Publishing.
This book contains appealing photographs of the scavengers and decomposers that live in various ecosystems including the woodlands, desert, and ocean.

Pfeffer, W. (1997) *A Log's Life*. New York, NY: Simon & Schuster Books for Young Readers.
This narrative nonfiction illustrates the details the life, death, and decay of an oak tree, traces how animals use the log for food and shelter, and shows how the log eventually crumbles and becomes soil. This supports decomposition lessons.

Lauber, P. (1995) *Who Eats What? Food Chains and Food Webs (Let's Read and Find Out Science*. New York, NY: HarperCollins Children's Books.
This book discusses food chains and webs, is a good reference book, and discusses the importance of having ample nutrients in the soil in order for plants to grow.

Pfeffer, W. (2003). *Wiggling Worms at Work*. New York, NY: Harper Collins Publisher.
This narrative nonfiction discusses the earthworm's habits, anatomy, locomotion, food, and life cycle, as well as explaining the importance of castings and tunneling in maintaining soil richness, moisture, and aeration. It is ideal to use in conjunction with the composting activity.

Payne, B. (1997). *The Worm Cafe, Mid-Scale Vermicomposting of Lunchroom Wastes*. Flower Press.
Ziefert, H. (1987). *Worm Day (Mr. Rose's Class)*. Little, Brown and Company.
These books provide background knowledge and encouragement for teachers and students who use this unit of study.

http://www.fossweb.com/modules3-6/Environments/index.html
This site includes a list of web resources, clips and images, and a question and answer forum. There is also a virtual aquarium activity where students learn which factors are important for the survival of living organisms and conduct experiments to determine what these factors are. The activity allows students to set up a virtual aquarium and try to create a good environment for three different fish.

http://coe.nevada.edu/sstewart/
http://www.kn.pacbell.com/wired/fil/pages/webecosysteto.html
http://www.teacherwebquest.com/CA/USF/Adaptions/index.html
http://www.teachnet.ie/hjones/x-ploringscience/pdfs/ecoquest.pdf
These are a pre-made ecosystem webquest that can be used as a summative assessment.

http://www.barwonbluff.com.au/education/csf/..%5Cactivities%5Csurvival%5Cabiotic%20factors%20cube.pdf
This is a great document to use as a review activity on abiotic factors affecting the survival of living things.

Appendix A

Summative Assessment : Soil Scientist Proposal

Task: You are a soil scientist who knows secrets to gardening that a layperson may not know because they do not understand the science behind soil, decomposition, and decomposers. You are going to present a proposal to gardeners and non-gardens to teach them how they can manage a home garden without spending a lot of money. Your proposal will be presented to your townspeople, and you will create a visual (tri-fold poster, powerpoint, or podcast) for them to better understand what you are explaining.

Content: Include what you have learned in this ecosystems unit and be sure to include your understanding of

- how and why insects and various other organisms depend on dead plant and animal material for food
- how organisms interact with one another in various ways besides providing food
- why changes in an organism's habitat are sometimes beneficial to it and sometimes harmful
- understand that most microorganisms do not cause disease, and many are beneficial

Appendix A

Summative Assessment : Soil Scientist Proposal/Commercial

Scoring Rubric: Trifold/PowerPoint/Podcast

	Exceeds	**Meets**	**Developing**	**Needs Improvement**
Content	Covers topic in-depth with details and examples. Subject knowledge is excellent.	Includes essential knowledge about the topic. Subject knowledge appears to be good.	Includes essential information about the topic but there are some factual errors.	Content is minimal OR there are many factual errors.
Organization	Content is well organized using headings or bulleted lists to group related material.	Uses headings or bulleted lists to organize, but the overall organization of topics may be flawed.	Content is logically organized for the most part.	There is no clear or logical organizational structure, just lots of facts.
Attractiveness	Makes excellent use of font, color, graphics, effects, etc. to enhance the presentation.	Makes good use of font, color, graphics, effects, etc. to enhance the presentation.	Makes use of font, color, graphics, effects, etc. but occasionally these detract from the presentation content.	Use of font, color, graphics, effects etc. but these often distract from the presentation content.
Mechanics	No misspellings or grammatical errors.	Few misspellings and/or mechanical errors, but they do not distract from meaning.	Few misspellings and/or mechanical errors, but they may distract from meaning.	Many misspellings and/or mechanical errors, and they distract from meaning.

Appendix A

Summative Assessment: Soil Scientist Proposal/Commercial

Scoring Rubric: Presentation

	Exceeds	**Meets**	**Developing**	**Needs Improvement**
Organization	Presenter is exceptionally organized and uses the tri-fold as a visual the information provided.	Presenter is organized and uses the tri-fold as a visual the information provided.	Presenter is somewhat organized and refers to the tri-fold.	Presenter is disorganized or does not use the tri-fold as a visual aid.
Understanding	Presenter demonstrates a superior understanding of the topic and responds to questions fluently and precisely.	Presenter demonstrates a thorough understanding of the topic and responds precisely to questions.	Presenter demonstrates an understanding.	Presenter demonstrates a general or lack of understanding.
Engagement	Presenter engages the audience's attention throughout the presentation.	Presenter engages the audience's attention.	Presenter generally engages the audience's attention.	Presenter does not engage the audience.
Eye Contact	Presenter makes eye contact with the entire audience throughout the presentation.	Presenter makes frequent eye contact with the audience.	Presenter makes some eye contact with the audience.	Presenter makes infrequent or no eye contact with the audience.
Voice	The audience is able to hear the presenter clearly throughout the presentation without having to ask the presenter to repeat her/himself.	The audience is able to hear the presenter clearly without having to ask the presenter to repeat her/himself.	The audience has difficulty hearing the presenter, but the presenter speaks more clearly after directed to do so.	The audience is able to hear the presenter for most or all of the presentation.

Appendix B

Content criteria scoring scale

Score	Level of Learning	Student Understanding
1	Beginning	Student has no previous knowledge of lesson content.
2	Developing	Student shows increasing competency with lesson content and resolution of content misconceptions.
3	Secure	Student understands content at the level presented in the lesson.
4	Exceeds	Student explores content beyond the level presented In the lessons.

Appendix C

Pre- and Post-assessment: Decomposition

	Assessment Criteria:		
	1. Decomposition is the process in which organic remains rot, decay, or break down.	**2. The organic remains of all living things decompose.**	**3. Nature's recyclers—scavengers, fungi, and bacteria—carry out the process of decomposition.**
Student Name			

Appendix C

Ongoing assessment: Decomposition

	Assessment Criteria:											
	1. Decomposition is the process in which organic remains rot, decay, or break down.				**2. The organic remains of all living things decompose.**				**3. Nature's recyclers—scavengers, fungi, and bacteria—carry out the process of decomposition.**			
Dates												
Student Name												

Lessons 1, 2, 4, 6, 7

Appendix D

Pre- and Post-assessment: Decomposers & Recycling of Nutrients

	Assessment Criteria:			
	1. Nature's recyclers—scavengers, fungi, and bacteria—carry out the process of decomposition.	**2. Decomposers get their nutrients from organic remains.**	**3. As decomposers decompose organic remains, some nutrients are released back into the soil or water.**	**4. Nutrients are recycled continually through soil or water to producers, consumers, decomposers, and soil/water again.**
Student Name				

Appendix D

Ongoing assessment: Decomposers & Recycling of Nutrients

	Assessment Criteria:															
	1. Nature's recyclers—scavengers, fungi, and bacteria—carry out the process of decomposition.				**2. Decomposers get their nutrients from organic remains.**				**3. As decomposers decompose organic remains, some nutrients are released back into the soil or water.**				**4. Nutrients are recycled continually through soil or water to producers, consumers, decomposers, and soil/water again.**			
Dates																
Student Name																

Appendix E

Assessment: Observing and Describing

	Assessment Criteria:		
	1. Observations, descriptions and drawings are accurate; they reflect actual properties or events.	**2. Observations, descriptions, and drawings incorporate details.**	**3. Student uses multiple perspectives and senses when making observations.**
Student Name			

Lessons 3, 4, 6, 7

Appendix E

Ongoing assessment: Observing and Describing

	Assessment Criteria:											
	1. Observations, descriptions and drawings are accurate; they reflect actual properties or events.				**2. Observations, descriptions, and drawings incorporate details.**				**3. Student uses multiple perspectives and senses when making observations.**			
Dates												
Student Name												

Lessons 3, 4, 6, 7

Appendix F

Assessment: Predicting

	Assessment Criteria:		
	1. Student makes relevant predictions.	**2. Student provides rationale for predictions using related understandings, observations, and/or data.**	**3. Student revises predictions as pertinent information is discovered.**
Student Name			

Appendix F

Assessment: Predicting

	Assessment Criteria:											
	1. Student makes relevant predictions.				**2. Student provides rationale for predictions using related understandings, observations, and/or data.**				**3. Student revises predictions as pertinent information is discovered.**			
Dates												
Student Name												

Lessons 4, 5, 7

Appendix G

Lab: Growing Plants in Different Planting Materials
Pre-Lab: Setting Up the Experiment
Page 1 of 6

Investigative question: Will plants in the _____ grow differently than those grown in the _____? Choose two different types of material or mixture of material to test.

Possible types of data to collect: List different kinds of data that you could collect about plant growth. Circle the one or two items that you will be observing.

_____
_____
_____
_____
_____
_____
_____
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Predictions or hypothesis: Explain what you think will happen to the plants grown in each material or mixture of material.

_____
_____
_____
_____
_____
_____
_____
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Lesson 5

Appendix G

Lab: Growing Plants in Different Planting Materials
Plant Growth Observations
Page 2 of 6

Date	Plants in _____	Plants in _____

How are your plants doing at this time? Include details of anything you notice.

Appendix H

Assessment: Experimental Skills

	Assessment Criteria:					
	1. Student identifies one variable to be tested at a time.	**2. Student keeps all variables (except the one being tested) the same.**	**3. Student follows procedures carefully.**	**4. Student is careful and detailed when collecting and organizing data.**	**5. Student bases conclusions on observations and other data rather than personal opinions.**	**6. Student communicates conclusions clearly and offers an explanation for the results.**
Student Name						

Appendix H

Ongoing assessment: Experimental Skills

	Assessment Criteria:																	
	1. Student identifies one variable to be tested at a time.			**2. Student keeps all variables (except the one being tested) the same.**			**3. Student follows procedures carefully.**			**4. Student is careful and detailed when collecting and organizing data.**			**5. Student bases conclusions on observations and other data rather than personal opinions.**			**6. Student communicates conclusions clearly and offers an explanation for the results.**		
Dates																		
Student Name																		

Appendix I

Assessment: Environmental Stewardship

	Assessment Criteria:		
	1. Student develops an awareness of the environment.	**2. Student shows respect for all living things that are part of the classroom or field trip activities.**	**3. Student takes action to care for the environment.**
Student Name			

Appendix J

Lab: Growing Plants in Different Planting Materials
Results
Page 3 of 6

Draw each of the plants as accurately as possible. Label the parts in your drawing and use color.

Plants Grown in _____	Plants Grown in _____

Appendix J

Lab: Growing Plants in Different Planting Materials
Analyzing Results
Page 4 of 6

Using the data you collected from your observations of the plants, complete the following table to compare the growth of your plants.

1. List the things that you observed in the first column.
2. Add details about your observations in the "Plants in _____" columns.
3. Write "yes" or "no" in the last column if you noticed any differences between the plants.
4. Answer the questions on the next page.

Observations	Plants in _____	Plants in _____	Different?

Appendix J

Lab: Growing Plants in Different Planting Materials
Making a Conclusion
Page 5 of 6

Were the plants grown in _____ different from the plants grown in _____?

Conclusion: I think the plants grew _____

_____

because _____

_____

_____

_____

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Appendix J

Lab: Growing Plants in Different Planting Materials
Post-lab Synthesizing Questions
Page 6 of 6

1. What was in the one planting material that made it more nutrient-rich for plants to grow in?

_____

_____

_____

_____

2. How do worm castings get into soils?

_____

_____

_____

_____

3. Why should plants grown in soil with humus (or potting soil) be healthier than those grown in other materials?

_____

_____

_____

_____

_____

4. What might happen if the same nutrient-rich soil was used over and over again to grow the same type of plant?

_____

_____

_____

_____

5. Is an earthworm one of nature's recyclers? Why?

_____

_____

_____

_____

_____

Appendix J

Lab: Growing Plants in Different Planting Materials
Scoring Rubric

	Exceeds	Meets	Developing	Needs Improvement
Predictions	Student makes relevant predictions, provides elaborated rationale for predictions using related understandings, observations, and/or data, and revises predictions as pertinent information is discovered.	Student makes relevant predictions, provides rationale for predictions using related understandings, observations, and/or data, revises predictions as pertinent information is discovered.	Student makes relevant predictions, provides insufficient rationale for predictions, and may not revises predictions as pertinent information is discovered.	Student makes irrelevant predictions, provides insufficient rationale for predictions, and/or does not revise predictions as pertinent information is discovered.
Observations	Student's observations, descriptions and drawings are accurate and detailed; they reflect actual properties or events as the student uses multiple perspectives and senses when making observations.	Student's observations, descriptions and drawings are accurate and has sufficient detail; they reflect actual properties or events as the student uses more than one perspectives and senses when making observations.	Student's observations, descriptions and drawings are accurate and may lack detail; they reflect actual properties or events as the student uses only one perspectives and senses when making observations.	Student's observations, descriptions and drawings are inaccurate and/or lack detail; they may not reflect actual properties or events.
Experimental Skills	Student identifies one variable to be tested at a time, keeps all variables (except the one being tested) the same, follows procedures carefully, is careful and detailed when collecting and organizing data, bases conclusions on observations and other data rather than personal opinions, communicates conclusions clearly and thoroughly while offering an explanation for the results.	Student identifies one variable to be tested at a time, keeps all variables (except the one being tested) the same, follows procedures, is detailed when collecting and organizing data, bases conclusions on observations and other data, communicates conclusions clearly, and offers an explanation for the results.	Student identifies one variable to be tested at a time, tries to keep all variables (except the one being tested) the same, follows procedures, collects and organizes data, bases conclusions on observations, communicates conclusions unclearly, and may not offer an explanation for the results.	Student identifies one variable to be tested at a time, tries to keep all variables (except the one being tested) the same, follows procedures improperly, is disorganized when collecting data, may base conclusions on opinions, fails to communicate conclusions, and/or may not offer an explanation for the results.
Understanding	Throughout the experiment and in the written responses on the lab report, the student exemplifies a clear and thorough understanding of decomposition, the role of insects and microorganisms in the recycling of nutrients.	Throughout the experiment and in the written responses on the lab report, the student exemplifies an understanding of decomposition, the role of insects and microorganisms in the recycling of nutrients.	Throughout the experiment and in the written responses on the lab report, the student exemplifies a vague understanding of decomposition, the role of insects and microorganisms in the recycling of nutrients.	Throughout the experiment and in the written responses on the lab report, the student exemplifies a lack of understanding of decomposition, the role of insects and microorganisms in the recycling of nutrients.
Environmental Stewardship	Student has an awareness of the environment, shows respect for all living things that are part of the classroom and field trip activities, and independently takes action to care for the environment.	Student has an awareness of the environment, shows respect for all living things that are part of the classroom and/or field trip activities, and takes action to care for the environment.	Student may not have an awareness of the environment, show respect for all living things that are part of the classroom or field trip activities, or take action to care for the environment.	Student is unaware of the environment, shows a lack of respect for all living things, and does not take action to care for the environment.

Appendix K

Following a Food Chain: How Nutrients Get Recycled

Goal: Show how nutrients are recycled between organisms.

Directions: Choose at least one example each of a plant, herbivore, carnivore, scavenger, and decomposer. Label their names or draw, find, or generate pictures of the organisms. Use arrows to show how nutrients recycle between them. You may use any medium including computer graphics for your diagram. Use the space below to do your planning.

PRODUCERS **CONSUMERS**

plants **herbivores** **carnivores**

NATURE'S RECYCLERS

decomposers **scavengers**

Appendix K

Following a Food Chain: How Nutrients Get Recycled
Scoring Rubric

	Exceeds	**Meets**	**Developing**	**Needs Improvement**
Content	Detailed and multiple examples are used. Subject knowledge is excellent.	Includes essential knowledge about the topic. Subject knowledge appears to be good.	Includes essential information about the topic but there are some factual errors.	Content is minimal OR there are many factual errors.
Organization	Content is well organized using headings to group related material.	Uses headings, but the overall organization of topics may be flawed.	Content is logically organized for the most part.	There is no clear or logical organizational structure, just lots of facts.
Attractiveness	Makes excellent use of font, and color, graphics to enhance the presentation.	Makes good use of font, and color, graphics to enhance the presentation.	Makes use of font, or color, but occasionally these detract from the presentation content.	Use of font, color, graphics, effects etc. but these often distract from the presentation content.
Mechanics	No misspellings or grammatical errors.	Few misspellings and/or mechanical errors, but they do not distract from meaning.	Few misspellings and/or mechanical errors, but they may distract from meaning.	Many misspellings and/or mechanical errors, and they distract from meaning.

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