



The Material Cycle and Me



Teacher's Guide

Grade: 3 - 5

Lesson: What Role Do I Play in the Material Cycle?

Number of Class Periods: Four to Five 45-minute periods



TerraCycle Curriculum Series was co-created by the Cloud Institute for Sustainability Education and Learner-Centered Initiatives.



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Standards

McCrel National Standards

Geography – Environment and Society - Level II (3-5)

Standard 14: Understands how human actions modify the environment

1. Knows the ways in which the physical environment is stressed by human activities (e.g., changes in climate, air pollution, water pollution, expanding human settlement)

Mathematics Level II (3-5)

Standard 6: Understands and applies basic and advanced concepts of statistics and data analysis

1. Understands that data represent specific pieces of information about real-world objects or activities
2. Understands the basic concept of a sample (e.g., a large sample leads to more reliable information; a small part of something may have unique characteristics but not be an accurate representation of the whole)

Language Arts - Level II (3-5)

Standard 8: Uses listening and speaking strategies for different purposes.

1. Contributes to group discussions
2. Asks questions in class (e.g., when he or she is confused, to seek others' opinions and comments)
3. Responds to questions and comments (e.g., gives reasons in support of opinions, responds to others' ideas)

Standard 9: Uses viewing skills and strategies to understand and interpret visual media

1. Understands the main idea or message in visual media (e.g., graphics, animation, comic books, television)

EfS Standards add performance indicators and narratives if applicable

F 7e: Make a case for why global citizens should understand the basic natural laws and principles including the material cycle

F 7: Make a case for why global citizens should understand the basic natural laws and principles including: the laws of thermodynamics; the basic principles of ecology; carrying capacity; appropriate scale; materials cycle; energy flows; systems develop; material value (value in order); and photosynthesis

I 16: Research the environmental, social and economic impact of the building and operations (inputs and outputs) of their school on their town and on the world, and make recommendations for improving performance.

I 19: Provide evidence of skill development including: data gathering, data collection, organization, interviewing, prediction, estimation, meeting scheduling.

I 20: Communicate their findings accurately and effectively (oral presentation, power point, spreadsheets, graphs, role play, mural, song, etc.).

I 21: Transfer what they have learned to another context (home, other buildings, etc.).

G 7: Make a contribution that solves more than one problem at a time and minimizes the creation of new problems. (Create value.)

G 35: Be accountable for their actions (and inaction) as well as predict and be accountable for the long and short term consequences of those actions.

ENDURING UNDERSTANDINGS

EUI A HEALTHY AND SUSTAINABLE FUTURE IS POSSIBLE

EU9 READ THE FEEDBACK: PAY ATTENTION TO THE RESULTS OF OUR BEHAVIOR ON THE SYSTEMS UPON WHICH WE DEPEND

EU10 IT ALL BEGINS WITH A CHANGE IN THINKING

EUII LIVE BY THE NATURAL LAWS

EU12 WE ARE ALL RESPONSIBLE

LESSON SUMMARY

Students investigate the material cycles of their school, determine and analyze the amounts and types of materials produced. They learn about where material goes and the difference between what happens to what Nature makes versus what happens to what humans make. Based on what they discover, they create and propose a plan for material cycling in their school. Students will apply what they have learned about the material cycles to a problem in their home, school or community.

OVERARCHING QUESTION

What role do I play in the materials cycle?

GUIDING QUESTIONS

HOW MUCH MATERIAL DOES MY SCHOOL PRODUCE?

WHAT TYPES OF MATERIAL DOES MY SCHOOL PRODUCE?

WHAT ARE SOME WAYS OF CONSERVING MATERIALS THAT OTHERS ARE USING?

WHAT IS MY SCHOOL ALREADY DOING TO REUSE ITS MATERIALS?

HOW CAN MY SCHOOL CONSERVE THE AMOUNT OF MATERIALS THAT IT PRODUCES? (EU 1, 12)

WHAT CAN BE RECYCLED? (EU 10, 12)

WHAT CAN BE REUSED? (EU 10, 12)

WHAT PLAN CAN WE PROPOSE FOR CONSERVING, REUSING, AND CYCLING THE MATERIALS THAT OUR SCHOOL PRODUCES? (EU 1)

RESOURCES / MATERIALS FOR THIS LESSON:

- www.youtube.com/watch?v=fAapw1UwhMI&feature=related (4th/5th grade - 3 Rs)
- www.youtube.com/watch?v=loeHhmUh-nE&feature=related (3rd grade 3 Rs)
- www.youtube.com/watch?v=dKdZYYmTT9A (3 Rs - all grades)
- Gyre Animation: <http://www.team847.com/media/animations/2010-animation-operation-gyre>
- Water Animation: <http://www.team847.com/media/animations/2009-animation-purewater-847>
- Earth PowerPoint Slide (attached)

LEARNING OPPORTUNITIES, ACTIVITIES, AND PROCEDURES

DAY 1 - WHAT MATERIALS DO WE PRODUCE?

Diagnostic: Have students complete a concept map of waste (consider what it is, what you do with it, where it comes from, where it goes, etc). (Teacher note: Waste is technically defined as “Any materials unused and rejected as worthless or unwanted” and “A useless or profitless activity; using or expending or consuming thoughtlessly or carelessly” www.myzerowaste.com (UK)

1. Create investigation teams of 2-4 students, and assign them to places in the school (classrooms, offices, the lunchroom, etc.)
 - a. Teams go to their assigned area and ask people what they have thrown away in the last 24 hours, listing all items mentioned. They also empty a trash container into a plastic bag to bring back as a sample.
 - b. Teams analyze the samples that they brought back and use the information to update the lists to include the sampled items as well.
 - c. Then, they tally the items, so they know how many of each item on the list they actually collected.
 - d. Teams cluster their lists into categories and name the categories (e.g. food, paper, plastic, cans, glass, etc), keeping track of the amounts of each item inside the new categories.
 - e. Numbers of items in each category should now be totaled.
 - f. Debrief all groups and compile a single set of categories for the class to refer to. List each category and its list of items on a separate piece of chart paper. Include the sum of all of the groups’ items gathered in each category. Post category chart papers around the room.
 - g. Close with the questions: Which of these categories contain items made by Nature? Which contain items made by people?

[Note to teacher: you may want to reference the K-2 lesson for an introduction to the concept of Nature made materials vs man made materials.]

DAY 2 - THERE'S NO SUCH PLACE AS "AWAY"

1. Ask students where they think their trash goes when they throw it "away."
2. Share photos of local garbage dumps and/or landfills, then show video excerpt from Nightline report on the Pacific Gyre <http://www.youtube.com/watch?v=8a4S23uXlcM>

DISCUSSION QUESTIONS (RESPONSES CAN BE CHARTED AND POSTED IN THE CLASSROOM):

What items did you recognize in the images?

Which categories do what you recognize fit into? (Produced by Nature or Produced by People)

Why do you suppose there's no food in the pictures?

What do all of the items that remain in the dumps and the landfills and the Pacific Gyre have in common?

When you throw things "away" where do the things that were produced by Nature go?

When you throw things "away" where do the things that were produced by people go?



3. MINI LESSON: Explain to the students that materials (matter) [and energy—but we don't need to mention energy here at this time...] do not appear or disappear on this planet. (Teacher Note: Show the slide of the photo of Earth taken from space.) What is here is here for good. We call that the 1st Law. Gravity (the natural force that keeps things near the Earth's surface) also helps keep all the materials here. In light of this and in order to keep life going, Nature taps the power of this limit by cycling the materials it produces again and again over time—each time finding a use for the different stages the materials go through in the cycle, and each time contributing something to the beauty and the health of the ecosystems upon which our health and our lives depend. Examples of natural life cycles of materials produced by Nature include the rocks cycles, water cycles, trees and leaves and plants cycles, food cycles and nitrogen cycles.

Even the materials produced by people will not go “away.” Eventually they will fall apart (we call this the 2nd Law) as they move through the different stages in the materials cycle—but in their case, unless they were designed and made to move through the natural materials cycle like food and plates and paper that can be composted, they will start falling apart in places they can't be useful. That will be harmful to our health and to the health of the animals, the water, the air and the soil in which we grow our food and in which trees and plants grow. So it makes more sense to keep the materials we have produced and used from making this mess by composting what can go back to Nature and by mimicking Nature and creating our own materials cycling system for the rest. That way, the things we produce that can't go into the natural materials cycle can cycle around and around in our own “techno-cycle.” Doing this we are contributing to the beauty and health of the ecosystems that all depend on us, upon which we all depend, and for which we are all responsible.

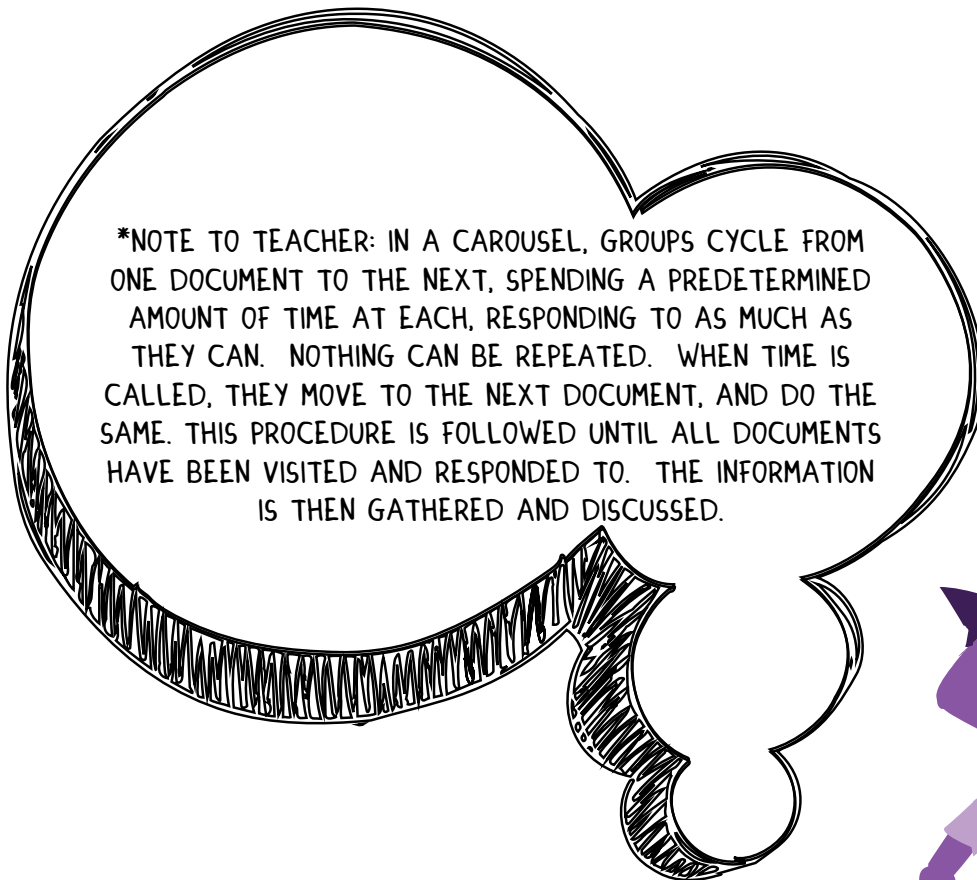
DISCUSSION:

WHO IS RESPONSIBLE FOR TAKING CARE OF THE THINGS THAT WE PRODUCE AND WE USE?

WHAT CAN WE DO ABOUT THIS?

DAY 3

1. Show the video on 3Rs (reduce, reuse, recycle) (EU 1, 10, 11, 12)
2. Return with students to the compiled categories and amounts. Ask them to consider the 3 Rs and think about how reusing and recycling might help the school to reduce its waste. Do they know of anything the school is already doing?
3. Separate the class into enough groups so that there is one group per category. Give each group a different color marker. Operating in a *carousel, each group visits a category poster paper and identifies:
 - A. What item(s) on the list could be reused? How could the school reuse it?
 - B. What item(s) on the list might be able to be recycled?
 - C. What on the list is already recycled or reused by the school?
 - D. What questions do we have about recycling or reusing items in this category?



DAY 4 (and perhaps, Day 5)

1. Groups return to the poster with which they began. Based on the carousel experience, and what they see on their poster, each individual in the group documents thinking and makes recommendations about how to reduce the waste produced in that category through conservation, reuse and/or recycling. Groups discuss the ideas presented and select those to add to the class proposal.
2. Groups share ideas are gathered into a class proposal.
3. Invite the appropriate administrator(s) in to discuss the class findings and proposals.
4. Post Assessment - Have students revisit their concept maps and, using a different color, revise them to reflect their current thinking. When they have completed their revision, ask:
 1. "What do you know now that you didn't know before?"
 2. What would happen if everyone participated responsibly in the materials cycle?
(1, 11,12)
 3. What can we do to contribute to that possibility? (1, 12)

Instructional/Environmental Modifications/Differentiated Strategies

Students who have difficulty with auditory processing or fine motor skills could tape record responses of people instead of physically writing a list. The teacher, an assistant or another student can transcribe the recording later.

EFS ASSESSMENT/SCORING CRITERIA

What do I need to collect or administer to prove that students have grown towards and/or achieved desired outcomes/standards?

F Natural Laws and Ecological Principles	F7e	Diagnostic/Post concept map 1. Post reflections	Rubric for Concept map on next page
		categorization of lists from interviews and items gathered	
		participation on class discussions	
I A Sense of Place F Natural Laws and Ecological Principles	I 16, I 19, I 20 F 7	Proposal that makes recommendations and provides reasoning for actions school can take to reuse or recycling	I 16: Research the environmental, social and economic impact of the building and operations (inputs and outputs) of their school on their town and on the world, and make recommendations for improving performance. I 19: Provide evidence of skill development including: data gathering, data collection, organization, interviewing, prediction, estimation, meeting scheduling. I 20: Communicate their findings accurately and effectively (oral presentation, PowerPoint, spreadsheets, graphs, role play, mural, song, etc.). F7: Make a case for why global citizens should understand the basic natural laws and principles with a focus on the material cycle principle
G Inventing and Affecting the Future I Sense of Place	G 7, G 35 I 21	2. & 3. Post Reflections	G7 Make a contribution that solves more than one problem at a time and minimizes the creation of new problems. (Create value.) G35 Be accountable for their actions (and inaction) as well as predict and be accountable for the long and short term consequences of those actions. I21 Transfer what they have learned to another context (home, other buildings, etc.).



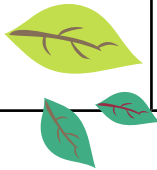
Note to teachers: Student acquisition of enduring understandings can be monitored through responses to questions identified by (EU).



CONCEPT MAP RUBRIC - CITIZENSHIP

(CSETL, 2003)

Dimension	4	3	2	1
<p>Content The extent to which the information included is accurate and relevant</p>	<p>Concept map includes accurate, relevant and important information about the materials cycle, evidencing a deep understanding of what it is, our role in it, where materials come from, where they go.</p>	<p>Concept map includes accurate, relevant information about the materials cycle, evidencing understanding of what it is, our role in it, where materials come from, where they go.</p>	<p>Concept map includes a combination of accurate and inaccurate information about the materials cycle or is partially incomplete, evidencing some confusion related to what it is, our role in it, where materials come from, where they go.</p>	<p>Concept map includes inaccurate information about the materials cycle or is blank, evidencing serious misunderstanding or lack of content, especially as related to what it is, our role in it, where materials come from, where they go.</p>
<p>Elaboration The extent to which the author provides details to support their thinking</p>	<p>Strategic use of details enrich the content provided by the map, going beyond the obvious or predictable.</p>	<p>Consistent use of details support the content provided by the map.</p>	<p>Inconsistent use of details relate to content of the map.</p>	<p>Details are missing, unclear, or so brief that the reader does not know what to make of them.</p>



EARTH

