Science Learning Activity
"Weathering the Earth"

Classroom Accommodations for Visual Impairments:
***(found throughout lesson in bold and underlined print)**
Visual Impairments-Background Information:

Students with visual impairment either have low vision or blindness. If they have low vision, they use whatever visual perception they possess to access information. Students with blindness are not able to visually gather information. The term "blindness" does not necessarily mean that a child cannot see anything at all. A child who is considered legally blind may very well be able to see light, shapes, colors, and objects. Having such residual vision can be a valuable asset for the child in learning, movement, and life.

Visual impairments can be present at birth or at any time in life from injury. Students with vision impairments often have other vision problems, including high or low sensitivity to normal light, blind spots in their visual fields, color blindness, or a combination of these problems. Visual impairment can cause daily side effects, including headaches, nausea, and fatigue. Overall, visual impairments, even with correction, adversely affect a child's educational performance.

Stefanich, G. P., Keller, E., Payne, C., & Davison, J. (2001). *Science Teaching in Inclusive Classrooms* (pp. 12-14). Cedar Falls, IA: Woolverton Printing Company.

1. **Activity Title**
   Weathering the Earth

2. **Purpose of Activity**
   The purpose of this activity is to discover the destructive effects of soil erosion by water and its impact on the world's agriculture and natural environment. Students will create three different environments that will represent factors that can delay or accelerate soil erosion. Students will record their finding using pictures, simple charts and/or diagrams, and journal entries. This lesson will address the misconceptions that; soil erosion is not a very serious environmental problem, we as humans have no control over the increasing rate of erosion on the earth, erosion and pollution are not related, and soil is very abundant and does not take a long time to form.

   Lesson Goal or Objectives
   By the end of the lesson, students will understand that soil erosion by water is a very serious environmental problem that negatively impacts the natural environment (e.g. pollution). Students will understand the types of environments in which higher rates of soil erosion by water occur. Students will be able to identify and understand what they themselves can do to reduce and or control soil erosion.

   Lesson Inquiry Question
   What effect does soil erosion by water have in different types of environments?

3. **Target Learning Group**
   This activity is appropriate for students in third grade. To use with younger students, only one type of environment should be used (not three different ones) and recording methods should be altered.

4. **Approximate Time**

Teacher preparation is approximately two hours (gather materials and construct potential environment (pop bottles) and investigation journal- one for each student).
Student involvement will range from 60 to 75 minutes.

5. **Background Science Information**

Soil erosion is the process by which soil and rock are removed from the Earth's surface by natural processes and are then transported and deposited in other locations. Moving water is the major agent of soil erosion. For example, rain carries away bits of soil and slowly washes away rock fragments. When soil erosion occurs by water, there are several destructive effects on agriculture, water, and wildlife.

When soil erosion occurs there is a severe loss of topsoil, which is the most valuable and fertile portion of soil. Topsoil retains the nutrients to promote healthy plant growth, so the removal or destruction of topsoil from soil erosion results in land unfit to sustain healthy plant growth. It takes 500 to 1,000 years to produce just one inch of topsoil; it is a nonrenewable resource. The effects of soil erosion are not by any means restricted to the soil and the plants it contains. Soil erosion can also lead to offsite water quality issues. When eroded topsoil passes into water sources, pesticides and other harmful chemicals in the topsoil can also find their way into water sources, leaving the water polluted. The negative effects of soil erosion have a domino effect on wildlife. Since loss of topsoil decreases water quality, fish, algae and animals will suffer the consequences.

Although soil erosion is a natural process, human activities have dramatically increased the rate at which erosion occurs. For example, human land clearing practices, such as deforestation, will erode the topsoil at a rapid rate. Nature cannot replace topsoil at the same pace we as humans can deplete it. Farmers and others who work with the land must take great care of it in order to prevent soil erosion. Topsoil can be washed or blown away anywhere there is no plant cover. Soil erosion will also wash any pesticides and fertilizers farmers use in the soil into streams and rivers, polluting the water. This means that the less pesticides and fertilizers farmers use, the less pollution soil erosion will induce.

Humans can control soil erosion by water in a variety of ways. First, by planting vegetation, trees, ground cover, shrubs, and other plants. The roots from these plants will help hold soil in place on the ground, not allowing for it to be easily washed away from rain. Second, by applying mulch to retain moisture because topsoil is not as likely to be washed or blown away when it is covered by mulch. Also, constructing surface runoff barriers from bricks or stones will minimize the amount of soil that is carried away by groundwater runoff. We can all make an impact on controlling the high rate of soil erosion.

Mann, C. C. (2008, September). Our Good Earth [Electronic version]. *National Geographic*, 1-9.

Pidwirny, M. (2008). Soil erosion and deposistion. In S. Draggan (Ed.), *The Encyclopedia of Earth*. Retrieved February 2, 2013, from http://www.eoearth.org

6. **Grade Level Content Expectations**

Inquiry Process:

S.IP.03.11 Make purposeful observation of the natural world using the appropriate senses.

Inquiry Analysis and Communication:

S.IA.03.13 Communicate and present findings of observations and investigations.

Reflection and Social Implications:

S.RS.03.18 Describe the effect humans and other organisms have on the balance of the natural world.

Content Expectation:

E.SE.03.22 Identify and describe natural causes of change in the Earth's surface (erosion, glaciers, volcanoes, landslides, and earthquakes).

7. **Materials Needed**

Note: This is what is needed for a class of 30 students who are divided into groups of 6 students per group (5 groups with 6 students in each). Make adjustments accordingly. Keep in mind that once the environments are created for each group, they can be reused for next years class or another lesson; do not throw them away.

Materials 1-5 the teacher will use to construct the environments prior to the lesson

1. 15 two liter pop bottles with top portion of bottle cut off from below the top to the very end of the bottle, cap removed: 3 per group
2. 15 pop bottles any size, cut approx. 6 inches from the bottom (keep only bottom portion): 3 per group
3. 5 pieces of foam board or any sturdy board to glue down two liter pop bottles onto: one per group
4. 1 hot glue gun for teacher to glue down pop bottles AND 1 exacto knife to cut plastic bottles
5. 15 pieces of strong string, 8 in. long : 3 per group

Materials 6-9 students will use during investigation

6. Large bag of soil- approx. 50 cups of soil: 9 to 10 cups of soil per group
7. 5 watering cans with small spout holes with room temperature water: 1 per group
8. 5 developed plants, ready to be transplanted: 1 per group
9. 10 cups of dead plant residue (leaves, twigs, bark, dead roots) : 2 cups per group

Materials 10-11 students will use to explore

10. 5 clear cups of water polluted with soil: 1 per group
11. 5 containers/pans of a few dead plants: 1 per group

Materials 12-14 are print materials

12. Print Material-Investigation Journal 4 pages minimum (will use front and back of paper): one per student should be made and ready to hand out (sections/pages include: 1. Observations & Predictions, 2. Questions 3. Create a habitat 4. Design Investigation-question/materials/

procedure 5. observations & data 6. conclusion-question/claim/evidence 7.new questions) **To assist a student with a visual impairment, provide them with an investigation journal that is larger in size and includes heading that are printed in large bold black font.**

13. Photos of soil erosion by water effects (e.g. polluted water): minimum of 5
14. Article reading on soil erosion (source provided below): one copy per student
15. 5 sets of notecards with 5 cards each listing the one of the following jobs on each (soil, plant transplanter, dead plant material, water, runner)

8. References

Mann, C. C. (2008, September). Our Good Earth [Electronic version]. *National Geographic*, 1-9.

Pidwirny, M. (2008). Soil erosion and deposistion. In S. Draggan (Ed.), *The Encyclopedia of Earth*. Retrieved February 2, 2013, from http://www.eoearth.org

Soil Erosion. (2007). In *Science Fair Adventure*. Retrieved January 25, 2013, from http://www.sciencefairadventure.com

Zelman, J. (2011, April 12). Soil Erosion Far Worse Than Reported In America Farmlands. *Huff Post Green*. Retrieved February 3, 2013, from http://www.huffingtonpost.com

9. Safety Considerations

When working with water, ensure that all electronics in the room are far out of reach. Reinforce that soil should be kept away from our eyes. Plastic that has been cut creates a sharp edge; do not run fingers or hands across it and avoid direct contact with the cut edges at all time.

SCIENCE ACTIVITY

1. Pre-assessment and Engage

The teacher should quickly exit then re-enter the classroom and turn off the classroom lights when he/she re-enters to grab the students attention. Tell the students that they have all left the classroom and are now in the rural town of Crop Town, Washington (a make believe town that is known for its great agriculture). Play a soundtrack of a loud rainstorm in the background for about 1 minute. Show the students pictures in print or on a projected screen (smartboard) of rivers polluted from soil erosion by water and the effects of the land from soil erosion by water (be sure that these photos do not include any captions or print) and do not give them any verbal indication of what these pictures are of. **Allow for a student with a visual impairment to hold the pictures in their hands or move up to the projector screen to get a close look at them.** Ask the students what they think is happening in Crop Town right now. What could have caused the effects they are seeing in the photos? Tell the students that we must investigate the problem our town has encountered, just as scientists would! In their investigation journals, have the students record their thoughts and drawings of what they are observing from the sound of the rainstorm and the photos shown (Pg. 1:Observations). **During the lesson, depending on the severity of the students visual impairment, have one student assist them when filling out their investigation journal (e.g. guide their writing utensil to the right page or area on the page).** Allow for students to share their journal entries in their groups. As a class create a KWL chart; "What we think we know", "What we want to know", and "What we learned". Have each group share ideas from their discussion and fill in the portions of the chart pertaining to what they think they know and what they

want to know (leave what we learned for the evaluation). **Use large font and a thick black marker when creating the chart to assist a student with a visual impairment.** Based on the students responses, the teacher may want to adjust the amount of scaffolding. If the students are relating the rainstorm they heard to the polluted water photos they saw, scaffold less because this shows they are making the connection. If they are making no connection, guide them with questions to make this connection.

What do we THINK we know?	What do we WANT to know?	What we LEARNED?

Description of Student Learning Activities

1. Explore

Ask the question, "Still thinking about what is going on in our town, how will this affect our agriculture and environment?" Have the students record their thoughts in their investigation journal (Pg. 1 Predictions).

2. Give each group of students a clear container holding water that is polluted with soil and a few dead plants in an aluminum tin (or any container). Encourage the students to observe the water and plants. Have them record what they see, smell, feel, etc. in their investigation journals adding on to (Pg. 1 Observations). **Encourage a student with a visual impairment to have a classmate share with them what they are seeing, so that they can get another students perspective.** Also, have them create the Pg. 2 Questions section in their investigation journal and have them record their questions, which will include the "what do we want to know" portion of the KWL chart (they can use this to generate questions).

3. Explain

Give each student a copy of an article handout on soil erosion (suggested source to use is: Mann, C. C. (2008, September). Our Good Earth [Electronic version]. *National Geographic*, 1-9.) After reading the article independently, have the groups discuss what they learned from the article. **Have a student with a vision impairment sit with a classmate who can read the article out loud to them.** Ask the students to also discuss how this article relates to what is currently happening in Crop Town, Washington. Explain the definition of soil erosion; the process by which soil and rock are removed from the Earth's surface by processes such as water flow, and then transported and deposited in other locations. Reinforce that there are other processes aside from water flow that can cause erosion, such as wind, but for now the focus of the lesson is only on water flow. Introduce the definition and importance of topsoil; top layer of soil, from which plants generally obtain most of their nutrients.

4. Share the following mnemonic device to help the students understand what soil erosion is. Write it on a flip chart or board in large print and have them copy it down in their investigation journal.

Earth's
Rain washes
Out
Soil
Impacting
Our
Natural environment

5. Discuss as a class how the huge rain storm they heard led to soil erosion in Crop Town. Talk about the type of land and soil that is found in Crop Town, if it is known for having an abundance of agriculture (e.g. fertile, nutrient rich, moist, good source of water, covered with crops). Have them recall the devastating effects and what this means for their agriculture and the people who live in their town (e.g. flooding in areas, carried away topsoil, killed crops, can no longer make sales of crops).

6. Elaborate

Together as a class, develop an investigation to find out if certain types of environments will delay or accelerate soil erosion. Write the question on the board: **"What effect does soil erosion from rainfall have in different types of environments?"** - Have students record this in their investigation journal (Pg. 4 Design Investigation- question).

7. As a class, create a list on the board or flip chart of what materials we would need to create an environment, in which we can observe soil erosion by rainfall. The list may vary, but should contain at least the following (a container, soil, water, trees, plants, dead plant material); if the students do not come up with these on their own, make sure to list them. Have the students record this list in their investigation journal (Pg. 3 Create a habitat/environment).

8. Present to each group the environment apparatus that you have created. There should not be anything inside of the pop bottles at this time. Have the students sketch this in their investigation journal (Pg. 3 Create a habitat/environment).

9. Create a list of materials that will be used in the investigation on (Pg. 4 Design Investigation-materials). The list will include, a piece of foam board, 3 two liter pop bottles (top portion cut off), 3 bottoms to pop bottles, 3 pieces of string from which the bottoms of the pop bottles hang, approx. 6 cups of soil, 1 developed plant, 2 cups of dead plant material, and a watering can filled 1/2 way with water.

10. Write a prediction/hypothesis. At the third grade level give them this format and have them fill in the blank with their own prediction: **I predict that soil erosion will cause (<u>more pollution/ less pollution/ or the same amount of pollution)</u> in the environment with the living plant.** Have the students record their prediction in their investigation journal (Pg. 4 Design Investigation-prediction).

11. Create a procedure. Assign jobs to each student by passing out notecards to each group with the following job titles written on them (runner, soil, plant, dead plant material, and water)

Do this together, step-by-step as a class for the third grade students. Write these simplified steps on a chart/board and have them copy the procedure into their investigation journal(Pg.4 Design Investigation-procedure): **<u>Assign a student with a visual impairment the task of adding dead plant material.</u>**

1. Runner gathers groups materials
2. Add 2 cups of soil to each pop bottle (level it out)
3. Add the living plant to one of the pop bottles on top of the soil
4. Add 2 cups of dead plant material to one of the pop bottles on top of the soil
5. Leave the third pop bottle with only soil inside of it
6. Pour a 1/2 cup of water on top of each of the three bottles (on top of the plant, dead plant material, and soil only bottle).
7. Observe like scientists as water collects into the hanging container!

12. Have the students draw and label pictures of what they are seeing in their investigation journal (Pg. 5 Observations & data)

13. Once the students have recorded their data and observations it is time to analyze them. Ask them what surprised them? Did their results match their predictions? What is our conclusion about the effect that soil erosion from rainfall has on certain types of environments? When rainfall causes soil

erosion, what type of environment will not lose as much of its topsoil? When a smaller amount of topsoil is lost during soil erosion, what does this mean for water pollution?

14. As a class, complete the chart below and have the students record this in their investigation journal (Pg. 6 Conclusion-question/claim/evidence).

Question:	Claim:	Evidence:	How have our ideas changed?

Real-World Connections

Connect the students back to the real life scenario they were given at the beginning of the lesson during the "engagement". They are living in Crop Town, Washington and the town was struck with a huge rainstorm that caused severe soil erosion. What changes can we, as the good citizens who care about our environment, do to ensure that soil erosion will not cause such severe devastation to the land and such a high amount of water pollution? Have them share examples as a class and then relate this to the town or city they currently live in. What can they do at home to reduce soil erosion in their yards (e.g. plant more trees/plants/shrubs). Have them brainstorm about new questions they may have to further their investigation that they did in class; record in investigation journal (Pg. 7 New ?).

Post-Assessment - Evaluate

1. Have the students return to their KWL chart to complete the "what we learned" section. Pass out a post-it note to each student and ask them to write one thing that they learned during the soil erosion lesson. Have the students post them on the class KWL chart when they are finished (do not have the students write their name on the post-it note). Share with the class what the other students wrote down when everyone has posted their post-it note on the chart.
2. The students will use their investigation journals, KWL chart, and acquired knowledge to create a PROPOSAL letter (explain that a proposal is a plan or suggestion) for the local government of Crop Town, Washington on the reduction of soil erosion. Each student will complete their own proposal letter and then they will all be placed into a manila envelope to be "mailed out". Provide students with lined paper, markers, crayons, or colored pencils (if they do not have these materials). Pass out the following rubric to each student and be sure to thoroughly explain it. Provide students with an example you have made on a projector/smartboard.

Proposal Letter Rubric (10 points)

Requirements	Possible Points
Letter includes the date and salutations (to,from)	2 points
Letter states: 1. WHY you care about soil erosion. 2. HOW soil erosion harms Crop Town's agriculture. 3. WHAT you think everyone in the town should do to reduce the negative effects of soil erosion.	5 points
A creative and colorful illustration at the end of the letter (showing what people in the town can do to reduce the negative effects of soil erosion)	3 points