**Title: Treasure Earth**

Grade Level:  6 Time Frame: 2- 3 hours

**Lesson Overview:**

Treasure Earth is a STEM lesson in which students will work as teams to learn about valuable natural resources in their local environment through exploration and examination of selected examples of resources which people depend upon for survival.  Through the use of a GPS device and GLOBE protocols students will measure, assess or identify these resources. Student groups will attempt to find and complete the challenges contained inside 5-6 caches during approximately 1- 1.5 hours of exploration.  The students will present their findings to peers, and will be assessed or surveyed on what they have learned.

**Teacher Background:**

Humans are constantly searching for treasure, for the next super valuable resource, novelty, talent, energy source, fad, skill, medicine, rock, discovery or lottery ticket.  You can read about it in the news, see it on TV, catch it on the Internet, learn about it at school, or hear it from a friend. We are all about TREASURE, and we all have a bit of treasure hunter in us!  So, what really is truly valuable? What is the GREATEST TREASURE on EARTH?

Tests that may be completed by students:

Collecting rainfall amounts, measuring the humidity, finding the temperature of the soil, air and water, determining the cloud type, measuring the surface temperatures, calculating the amount of impervious surfaces, observing wildlife, calculating the % of canopy cover, testing the soil consistency and color, measuring tree height, tree circumference and tree moisture, observing the biotic diversity of an area, and measuring the wind speed.

**Enduring Understanding & Essential Questions:**

*Enduring Understanding:* A variety of environmental factors determine the health of a watershed.

*Essential Questions:*Why is the health of our watershed important?

How is biod iversity an indicator or watershed health?  How do we monitor the health of the local watershed? What can we do with the data we collect?

**Next Generation Science Standards:**

<http://www.nextgenscience.org/topic-arrangement/mshuman-impacts>

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| Performance Expectation  |
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| **MS-ESS3-3.** | **Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.\***[Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).] |

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| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| [**Analyzing and Interpreting Data**](http://www.nap.edu/openbook.php?record_id=13165&page=61)[Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.](http://www.nap.edu/openbook.php?record_id=13165&page=61)* [Analyze and interpret data to determine similarities and differences in findings. (MS-ESS3-2)](http://www.nap.edu/openbook.php?record_id=13165&page=61)
 | [**ESS3.C: Human Impacts on Earth Systems**](http://www.nap.edu/openbook.php?record_id=13165&page=194)* [Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth’s environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3)](http://www.nap.edu/openbook.php?record_id=13165&page=194)
 | [**Patterns**](http://www.nap.edu/openbook.php?record_id=13165&page=85)* [Graphs, charts, and images can be used to identify patterns in data. (MS-ESS3-2)](http://www.nap.edu/openbook.php?record_id=13165&page=85)
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| Maryland Environmental Literacy Standards    |
| **STANDARD 5: HUMANS AND NATURAL RESOURCES**The student will use concepts from chemistry, physics, biology, and ecology to analyze and interpret both positive and negative impacts of human activities on earth’s natural systems and resources**.** |

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| 5E Lesson **Engage: (Preparation)  Ask students:**What do you think we will do in a class called Treasure Earth?Does anyone know what geocaching is? Has anyone been geocaching?What is a watershed?  How could we determine the health of a watershed?In stream study, you will study the health of the stream which is one part of the watershed.  In Treasure Earth, we will focus more on the land which is the other part of a watershed. **Explain: (Preparation)** 1. Divide students into groups of 4-6.  Students can be assigned to the following roles:Data Collector(records the data), Navigator with the GPS(2), Navigator with the Map(2), Time Keeper, Supply Manager(makes sure lid is closed when completed with test and all supplies are in the cache).  Rotate in the group which member will read the directions found in the cache. 2.  Hand out the maps.  Ask each group to find where we are on the map.  3. Discuss the features of the map and where north is located.4.  To find the locations of the geocaches, a map and GPS are needed.5.  Hand out two GPS per group.Explain how to use the GPS**.** 6.  Hand out one data collection worksheet to the group.  Assign the group the geocaches that they must visit. At Smith Center, assign about 4-5 per group.  At Skycroft, most groups will get through all of the caches. 6.Students should rotate which person has each job while they are collecting data.* Introduce the **protocols** that will be included along with the tools listed below.  Explain that each treasure hunter/student will be in charge of 1 or more tests but everyone participates in each test as there are always a few jobs.  Students will find out what the tests are once they arrive at and find the geo-cache. (You do not need to explain the tests in advance.)
1. Measuring temperature of: soil, surface, air and water
2. Atmospheric tests: humidity, moisture (clouds and contrails), precipitation (rain gauge)
3. ID station:vegetable and animal: ID a common and valuable tree and animal.
4. The Crust of the Earth (upper-lithosphere): Soil tests such as color, texture, moisture and fertility.
5. Flora and Fauna of the area or ecosystem: densiometer for canopy, signs of animals…
6. Trees, what good are they?  How can you measure the size or the health, with simple tools.  First, how to measure the height, second the health through appearance and moisture content.  The health of the water: abiotic tests to determine pH, oxygen, nitrates and phosphates and maybe clarity also.  That is 3 types of tests
7. Human Impact: How have humans impacted the environment at this location? Positive or negative?  How to improve upon or mitigate?
* Introduce **tools** to go with tests
1. Infrared thermometer to test surface temperature
2. Water thermometer and weather station to test water, soil and air temperature
3. Rain gauge, cloud and contrail reading, and hygrometer to measure humidity
4. Animal parts for identifying animal adaptations
5. Soil and tree moisture meters to locate and measure moisture
6. Densiometer to measure tree canopy cover
7. Anemometer to measure wind speed
8. Clinometer to measure tree height
9. Secchi disc or tube for the water quality test

.**Explore: (Action)** Have students travel in groups to collect data found in each geocache.  Remind them to close each box after they have completed the test or tests.  **Explain: (Analyze)** When students return to the classroom, have them look over their data, turn in their GPS, and share data with their classmates.**Evaluate:  (Reflection)**Have students complete and discuss the following questions using their data.  These questions can be found on their data collection worksheet.  **Based on your team and class data, how healthy is this watershed?**1. Is there moisture in the air?                                    Yes       No
2. Is there moisture in the soil? Yes       No
3. Is there diversity of plants and animals? Yes No
4. Did you find more pervious surfaces in your area?     Yes    No
5. Is there moisture in the trees? Yes   No
6. Is the water clear and filled with life?   Yes No

**Based on these results is this watershed healthy?  Why or why not?****What help can you provide for the watershed?****Why would these tests be indicators of a healthy watershed?****What other tests could you do to evaluate a healthy watershed?**Using their data,  have students complete the journal entry on this class.  **Extend:**  Students could plan, develop and/or document a similar learning experience at school.  Students could use the protocols to gather data at school or at a nearby stream.* MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing human impact on the environment. (an extend)
* <http://www.nextgenscience.org/msess3-earth-human-activity>
* The apple activity – to look at percentage of water vs. land; amount of fresh water; amount of fertile soil or just the percentage of earth in the crust (1% - 5-65 KM) / lithosphere - crust and upper mantle (I have lesson plan copy)
* <http://gpm.nasa.gov/education/lesson-plans/freshwater-availability-classroom-activity> - from GPM website,
* <http://gpm.nasa.gov/education/lesson-plans/survivor-earth> **- Survivor Earth Lesson Plan series; lots of water-based lesson plans**
* Soil power point and garden under the lights – plant lights that is.  Try different types of soil, different watering plans, different plants, different lighting, or different slopes…
* Thirst power point and ways to conserve water…
* Document student created products and solutions related to local environmental issues.  **Show at the AFI Theater**, or elsewhere, as part of an environmental film festival with mcps student produced videos.
* Make an anemometer, a densiometer, a rain gauge, and/or any other device we have been using.

 | **Preparation Notes for the Teacher:****Pre-Lesson Options, at School:**1. learn to use a GPS at school, and practice.
2. Practice setting up and using a geocache course.
3. Practice identifying, measuring and assessing natural resources, using the same or similar testing protocols.  *\*Equipment can generally be checked out from the Smith Center if requested in advance.*

The locations are found close to paths.  If they GPS is directing them straight down a hill, tell students to find the closest path.  Students must stay together!!  If you have enough adults, assign an adult to each group.  If you don’t have enough adults, assign the adults to central locations.  Make sure that all groups know when to return to the classroom.   |