Final Project Lesson Plan

Plan Title:
Climate Change: How do Humans Impact Climate Change?

Introduction

Students need to have an understanding of the greenhouse effect and how the atmosphere is heated, and then they will examine various forces within the climate system in order to begin to realize the myriad of forcings that impact the various climate change models and their influence on climate change. In this unit, students will not only learn how the greenhouse effect works on Earth, but they will also examine how the greenhouse effect is impacted by various human related and natural phenomena. They will research drivers of climate such as plate tectonics, carbon dioxide, volcanoes, aerosols, and solar cycles, after which they will look at varying surface albedos due to changing landscapes (both natural and anthropogenic.) With the changing landscapes, students will infer and defend how changes in the Earth's surface will impact climate change in the future. Finally, students will discuss how changes in the poles will have resounding impacts on the global climate system in terms of rising ocean levels, changes in carbon dioxide removal from the atmosphere, and they will finish the unit with a project to investigate how they can personally reduce their impact on Earth in substantial and meaningful ways.

Lesson Outline:

1. Students brainstorm ways humans impact the Earth
2. Students will research various climate drivers using a jigsaw model
3. Students will study the various albedo of various landscapes
4. Students will analyze the effects of changing albedos on polar regions
5. Students will build a "village" on a quarter piece of sod while using a variety of materials to see first-hand the impacts humans have on a small piece of land
6. Students will put all of their villages together to create a "living" enviroscape where they will discuss the impact of human's ordinary life on the environment (complete mini-enviroscape lesson)
7. Students will use computers to calculate their own personal ecological footprint http://www.footprintnetwork.org/en/index.php/GFN/page/calculators/
8. Students will take a "field trip" on the LEED sustainability trail (at our local watershed—LEED certified building) to uncover ways in which humans can reduce their impact on Earth
9. Brainstorm how they can use methods from the field trip to reconstruct/re-vamp their villages to be more eco-friendly and sustainable
10. Students implement their ideas on their sod village using various materials
11. Students will share the ways in which they made improvements to their village
    a. this final share should be museum style, where half of the group stays with the reconstructed village and the other half "tours" the other groups

b. next, students should trade places and the touring students should present to the new group of students who were first-round presenters

Define Learners:
• **Grade Level:** Middle School Science

• **Population Characteristics:** Students are upper/middle class learners, some of which have special needs and some of which do not. Modifications will be made as necessary to meet the needs of individual learners.

• **Lesson Groupings:** There will be various levels to this unit depending on each lesson. There will be work as individuals, in pairs, in small groups, and as a whole class.

Standards:
Curriculum Links/Topic:

I teach Environmental Science and Earth Science, so I this unit will serve as a culminating unit during which students can demonstrate understanding of myriad of skills and learning of content. Students will not only be learning valuable science content, but they will work on mastery of research skills, constructing nonfiction writing pieces, defending an argument, and analyzing scientific information (all 21st century skills). Students will discover new information about climate change and its impact on Earth, and they will also have to apply science content about convection and its impact both in the air and underground, and then relate it to climate change.

Objectives

NGSS Standard
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).]

Disciplinary Core Idea:
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)

Objectives:
- Analyze surface albedos and relate the impact to climate
- Identify and describe various climate drivers
- Students will identify how humans' consumption of resources is directly related to environmental issues

    - Explain the various ways in which humans impact the world (specifically) in terms of water consumption, land usage, and pollution
- Assess how humans impact the world
- Design solutions to remediate human impact on the natural world

Materials
What will you need to teach this lesson, which supplies, technologies, tools and resources will you need to access or create?

• computers with internet access
• sod (¼ piece per group)
  o prepared with:
  o stream through sod piece (foam pipe insulation cut in half)
  o fake trees
  o small "animals" that inhabit the area--bunnies, deer, frogs, fish, fox, **birds attached/in the trees etc.
• spray bottles filled with water
• LEGOS (as many as possible to be able to construct buildings for the property)
• micro machine sized cars
• Laminated aerial photos of the area (wooded before people inhabited the area)--1 per group of 4 students
• scissors
• multi-colored construction paper
• handouts accompanying lesson
  o LEED trail note guide (supplied by watershed guide)
  o Human Impact Brainstorming sheet
  o Ecological Footprint Recording Sheet
  o Reconstruction Brainstorm Sheet
	• materials for "town" construction
	  o LEGOS
	  o toothpicks
	  o cardboard
	  o sand
	  o black plastic trash bags
	  o rocks
	  o paper
	  o gravel
	  o craft sticks (large and small)
	  o pipe cleaners
	  o straws
	Optional:
	Each piece of sod can be placed into a small clear plastic container so when the students create their enviroscape it is easily placed together to create a full picture and they can actually see pollution percolate down through the soil.

Anticipatory Set:

Do humans affect the Earth in any way?

- Students will brainstorm in small groups all of the ways they think we impact the Earth (can be positive or negative though I would encourage and lead towards negative).
    - give each small group a poster paper and marker to record ideas
- Hang posters around room and have students share ideas
    - *Hint*: each group should share one item, and then another group should share
    - students should not repeat anything that has already been shared, and they should ADD the items to their own posters if they don't already have them

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Activity A: Students will research the various climate drivers and their impact on climate (specifically the polar regions)

- Divide students into six "expert" groups and have each one research a climate driver
- Students share all information they found and truly become "experts" on the topic (Use worksheet as an outline)
- Have one member from each group re-group with a members from each of the other groups in the room (jigsaw) so that there are new groups formed (each student in the new group of six will be an "expert" on one topic, but they will learn and discuss the other drivers with the other "experts" in the group)
- In their new "expert" groups, students will identify the various albedos and then explain how they impact climate
- As a group, students will present the effect of rising temperatures on polar regions and connect how these effects will gradually impact the global community
    - Rising temperatures→decreased reflective surfaces (increased water surfaces)
    - Rising temperatures→melting ice caps
    - Melting ice caps→decrease in ocean density (and impacts on sinking CO2 in the ocean)
    - Warmer water temperatures→slowing of ocean currents
    - Warmer water→ocean convection
- To conclude, students will infer and explain how changes in the poles impact the entire Earth

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Activity B: In order to link the idea of human impact on the world, students are going to build a small village on a piece of sod

- Building a village
    - students will be given a piece of sod (one portion per group)
        - one piece of sod cut into fours or two
    - Examine aerial photos of the actual area before humans inhabited the area (heavily wooded)

- Encourage them to think that each piece is what the Earth was originally like
  - all of the grass, tree, and the clean river flowing through it
- Students will design a town (including homes, roads, parks , farmlands, school, playground, etc.)
  - During their construction they should write down each things that they remove and make changes to
    - one of the people in the group can be the recorder that is designated to write down the changes that are being made to the scape as they are moving through the process

-They have the freedom to put as much as they think is necessary for them to live in this village
-As they build, students should actually remove the soil, cut the grass, etc, (thus damaging the natural environment that was originally there)
-Once they have built their sod villages, have them place all of their pieces of sod together to form a village (very similar to a "real" enviroscape).
-They will then get to talk about and treat this like an enviroscape

- the goal of this getting them to visual how much pollution is going to go to the water, seep into the ground, etc.(the many ways we are affecting the environment)

-Have them share how their plot is affecting other areas and why? How did we influence the environment based on what we did?
-This is all pretty realistic however…
-you didn't clear the land, your house was most likely already there as was the park, the school ,etc
-Have this discuss help lead into the next question:
-How do you as individuals (and as a family in your own home) influence the environment?
-have them brainstorm ideas individually then pair/share their ideas
-We can do a full group share to illicit ideas that people may not have considered
-This will lead into the "Ecological Footprint Activity" so they can see how they as individuals are affecting the world and how many Earth's it would take to support their habits (or ways of life)

Activity C: Ecological Footprint

- Ecological Footprint: explain to them that there is a way that they can measure their impact on the Earth. (this will need to be done on the computer).
  - have them complete and record each of their ecological footprints.
  - Once they complete this let them interact with each other about their results - why do these matter? What do you notice? Is there are problem? Why did someone score better then you?
  - They can discuss their results with each other, which can help them see ways that they can improve or lessen their footprint.

- students should now have a combination of ideas regarding how they influence the world and how humans living on the planet influences the world

Activity D: LEED Trail

- What can we do?
  - This will lead into the LEED trail at the building allowing the students to see first hand how the watershed is utilizing all of the new technology to help reduce human impact on the local environment
    - students will tour the sustainability trail in order to visualize the different ways that exist to be more "sustainable" and have less of an impact.
      - the trail should include all of the technologies that are being used, how they work, along with the rain garden and barrel ideas, while also including simplistic ideas of the type of light bulbs (since they don't get to see a lot on LEED and what it does), composting, recycling, etc
        - the goal is for the students to see that there are a variety of ways to have less of an impact and not all of them cost a ton of money or require a huge amount of construction or reconfiguration of the current system

Activity E: Reconstruction and Re-creation

- The students will go back to their enviroscape and look at their original sod village.
  - they will be receiving their piece of sod back to do some "reconstruction"
    - they should begin with their group by brainstorming and sketching out ideas of what they are going to change
    - they should have a goal in mind of applying something they learned during their ecological footprint along with the LEED trail to their ideas to make their village have less of an impact on the Earth.
      - this is going to be very challenging for many of them so really encourage them to think about what they saw in terms of the affect their village had on the environment in general and then the affect their village had once placed with all of the other villages.

-Once they have finished, one student can stay with their landscape as other students go around and examine other students landscape improvement ideas (museum style of sharing)
-If the students would like, they can have more time to implement some of the ideas they got as they walked around and heard about their peers' ideas
-To close, students should make a personal connection to this activity:

--Students should write down how this enviroscape connects to themselves
--How do you impact the world (as in your enviroscape)?

Time

This unit plan can be covered in varying amounts of time depending on grade level, amount of time provided in each school day, and depth of information. For my purposes, since I teach sixth grade, I believe it will take between two and three weeks of our regularly scheduled class periods.

Scope and Sequence

PRIOR to this unit:

1. KWL chart of climate change—What do students KNOW about climate change?
2. Students will construct a diagram (step-by step) of how the atmosphere traps heat (as a positive thing in the greenhouse effect)
3. We will also diagram how and where ozone forms and how it is both helpful and harmful depending on its location in the atmosphere.
4. Students will use a mason jar to model how heat is trapped and explore the temperature differences inside and outside of the jar when exposed to heat

Assessment of Students

How will you grade or otherwise evaluate students' participation in this lesson?
-group work rubric to regularly gauge participation in group work

Evaluation of the Lesson

How will you judge whether or not the lesson was successful?
-application of learning on the final portion of the project
-writing an essay explaining human impact on the environment and how it can be reduced, how polar changes impact the global environment, and how changing surface albedo is a climate driver

Rubrics for Assessment:

Collaborative Work Skills : Collaborative Work Skills

Teacher Name:

Student Name: _____

CATEGORY	4	3	2	1
Working with Others	Almost always listens to, shares with, and supports the efforts of others. Tries to keep people working well together.	Usually listens to, shares, with, and supports the efforts of others. Does not cause \"waves\" in the group.	Often listens to, shares with, and supports the efforts of others, but sometimes is not a good team member.	Rarely listens to, shares with, and supports the efforts of others. Often is not a good team player.
Focus on the task	Consistently stays focused on the task and what needs to be done. Very self-directed.	Focuses on the task and what needs to be done most of the time. Other group members can count on this person.	Focuses on the task and what needs to be done some of the time. Other group members must sometimes nag, prod, and remind to keep this person on-task.	Rarely focuses on the task and what needs to be done. Lets others do the work.
Quality of Work	Provides work of the highest quality.	Provides high quality work.	Provides work that occasionally needs to be checked/redone by other group members to ensure quality.	Provides work that usually needs to be checked/redone by others to ensure quality.
Contributions	Routinely provides useful ideas when participating in the group and in classroom discussion. A definite leader who contributes a lot of effort.	Usually provides useful ideas when participating in the group and in classroom discussion. A strong group member who tries hard!	Sometimes provides useful ideas when participating in the group and in classroom discussion. A satisfactory group member who does what is required.	Rarely provides useful ideas when participating in the group and in classroom discussion. May refuse to participate.

Research Report : Research and Reporting

Teacher Name:

Student Name: _____

CATEGORY	4	3	2	1
Paragraph Construction	All paragraphs include introductory sentence, explanations or details, and concluding sentence.	Most paragraphs include introductory sentence, explanations or details, and concluding sentence.	Paragraphs included related information but were typically not constructed well.	Paragraphing structure was not clear and sentences were not typically related within the paragraphs.
Quality of Information	Information clearly relates to the main topic. It includes several supporting details and/or examples.	Information clearly relates to the main topic. It provides 1-2 supporting details and/or examples.	Information clearly relates to the main topic. No details and/or examples are given.	Information has little or nothing to do with the main topic.
Sources	All sources (information and graphics) are accurately documented in the desired format.	All sources (information and graphics) are accurately documented, but a few are not in the desired format.	All sources (information and graphics) are accurately documented, but many are not in the desired format.	Some sources are not accurately documented.
Diagrams & Illustrations	Diagrams and illustrations are neat, accurate and add to the reader\'s understanding of the topic.	Diagrams and illustrations are accurate and add to the reader\'s understanding of the topic.	Diagrams and illustrations are neat and accurate and sometimes add to the reader\'s understanding of the topic.	Diagrams and illustrations are not accurate OR do not add to the reader\'s understanding of the topic.

Cite References

**I have been working with a colleague on the construction of this plan, but all ideas are our original thoughts and work, unless otherwise stated (ecological footprint website).
http://www.footprintnetwork.org/en/index.php/GFN/page/calculators/

Rubric maker: http://rubistar.4teachers.org/index.php?screen=NewRubric

Conclusion:

-At this point, I believe my greatest challenge is to actually coordinate a field trip and all associated costs with our local watershed. They are VERY excited about the idea of the trip, so I feel that there is a great chance that I can accomplish this portion.

-Once I am able to get the field trip funded, the question of materials arises, so both the watershed organization and I are both working on outside funding from a grant in order to procure all of the necessary materials to make this unit a success.

-The unit as it stands now seems to be a great culminating experience for my students and one in which I think could really change their mindsets and how they impact the environment.