November 3rd, 2014
Climate Change – Final Project

Introduction:
This is only a small sample of a large five week unit in which students will investigate various details surrounding the question: "How does climate change influence our ecosystems, specifically diversity and abundance?". During which students will gain insight into ecology and climate science, with special focus towards population and community ecology since this course is a Biology course. Below one can find a five-day sample of lessons for the unit:

1. What is Climate? - Students will investigate/define climate; gain an understanding of factors that control climate on a consistent basis (such as solar radiation, currents, and winds).
2. How does Climate Change? - In this lesson students will gain insight into how climate changes, specifically drawing reference to plate tectonics, ocean currents, greenhouse gases (i.e. carbon dioxide & methane), and others.
3. What are the Impacts of Climate Change? - Students will investigate how climate change impacts are ecosystems. Looking at how populations will change both in an evolutionary sense and in sheer numbers. Students will need to draw connections between our climate change unit and ecology unit.
4. How do we Stop/Slow Climate Change? - In this lesson students will investigate possible methods to slow or stop climate change from occurring. These methods will focus mostly on reducing our dependency on fossil fuels and reducing our carbon footprint.
5. Final Project - Students will create and present possible solutions to climate change. These solutions will be student generated. These solutions will require students to explain how their solution would minimize/impact climate change and explain how it would impact a particular region or would the effects be globally felt.

Grade Level:
These lesson were designed for a high school level student (specifically honors level freshmen)

Population Characteristics:
This class as mentioned before is an honors level classroom, students are asked to read at very high levels and do many things on their own (rather then direct instruction). The students will need to be sufficient at reading and will need to read at or close to grade level. All readings in this unit have been leveled to meet early high school reading level. In addition, students in this particular class come from a diverse background, many are first or second generation secondary education students and require frequent attention to obtain results.

Lesson Groupings:
Throughout the lesson students will work independently, pairs, small groups (3-4), or whole class. I try to mix it up frequently to keep attention and to gather ideas and drive discussions.

National Standards:
The units are loosely based from the Next Generation Science Standards, unfortunately life sciences only has two standards pertaining to climate change. HS-LS2- 7: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. HS-LS4-6: Create or revise a simulation to test solutions to mitigate adverse impacts of human activity on biodiversity.

Curriculum Links:
This will be the calumniating project for both the ecology and climate change unit. This unit it taught so students can see how ecology works, using a real life example of why we need to care about our ecosystems and why it is so important to take action soon. So in sequence students will begin with ecology, move to climate change, and finally evolution. This scope and sequence was designed so that after students figure out how population numbers change and how they interact, students then can gain an understanding of how human

activity is impacting biodiversity. Once we finish drawing the connections within these two units we conclude with evolution and how species evolve and draw reference to ecology and climate change throughout the unit.

Lesson 1 "What is Climate?"

Step 1: Investigate What is Climate? (25 minutes)

Learning Targets:

- I can define climate
- I can explain how/why sunlight (solar radiation) heats Earth unevenly
- I can describe how energy moves throughout the Earth system
- I can summarize how ocean currents operate in relation to climate

Introduction:

There is a major difference between climate and weather, many people use these term interchangeably. Weather is what is going on right now outside or what might be happening later this week. However climate is something that changes overs hundreds or thousands of years maybe even more. So what factors affect climate? Can you think of any factors that effect climate? In this lesson we will look closely at several factors that effect climate.

Directions:

In this activity you are going to form a group of three-four students and investigate the following questions pertaining to climate. Once you are complete please make sure to share your work with me.

Assign Roles:

- Leader/Time Keeper
- Social Skill Checker
- Recorder
- Fact Checker

Questions to Answer:

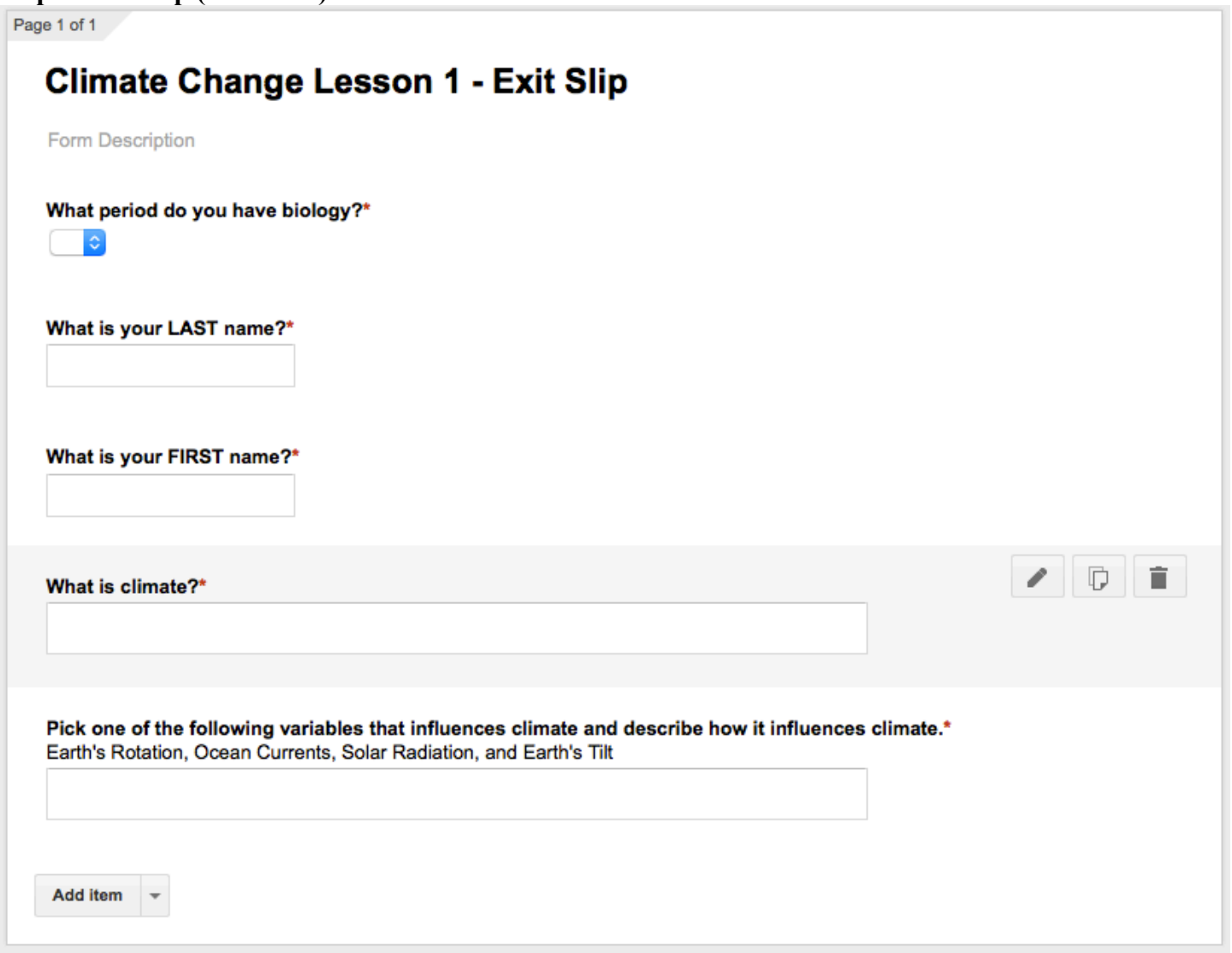
1. What is climate?
2. Do regions on Earth receive more or less sunlight?
3. Which regions receive the most amount of sunlight?
4. Which regions receive the least amount of sunlight?
5. How does sunlight influence climate?
6. How does Earth move energy throughout Earth?
7. Where on Earth are there ocean currents?
8. Do these currents flow a certain why, if so which way?
9. Can currents be warm, cold, or neither?
10. How do currents influence climate?
11. Does the tilt of Earth influence climate?
12. If so, how does the tilt influence climate?
13. How does the rotation of Earth influence climate?

Step 2: Class Discussion about Climate (15 minutes)

Step 3: Watch this Video (Below) (5 minutes)

- **https://www.youtube.com/watch?v=lrPS2HiYVp8#t=208**

Step 4: Exit Slip (5 minutes)



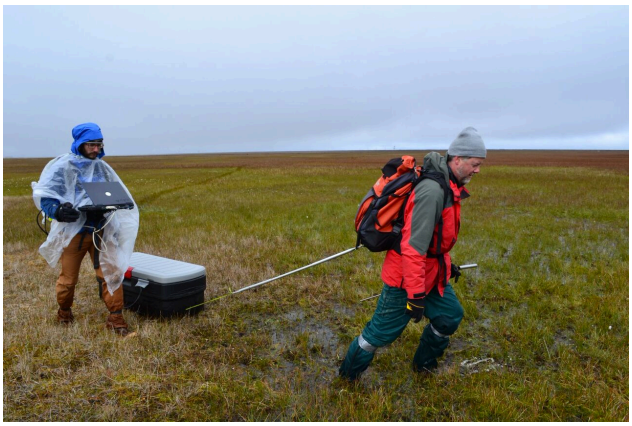
Step 5: Homework
Please read the article below, titled "Mysterious Craters are just the Beginning of Arctic Surprises"

Mysterious Craters are just the Beginning of Arctic Surprises - Article
Biology, 2014

It's not just craters purportedly dug by space aliens in Russia, it's also megaslumps, ice that burns and drunken trees. The ongoing meltdown of the permanently frozen ground that covers nearly a quarter of land in the Northern Hemisphere has caused a host of surprising arctic phenomena.
Temperatures across the Arctic are warming roughly twice as fast as the rest of the globe, largely due to the reduction in the amount of sunlight reflecting off of white, snow-covered ground. "At some point, we might get into a state of permafrost that is not comparable to what we know for 100 years or so, some new processes that never happened before," says geologist Guido Grosse of the Alfred Wegener Institute for Polar and Marine Research in Germany.

The mysterious craters in far northern Russia are just such an example. "There is nothing described in the scientific literature that can really, fully explain those craters," says Grosse, who is headed to the Lena River Delta in Siberia this summer, which hosts a joint German-Russian research station. The most likely explanation for the newly discovered craters in Russia is an accumulation of methane over centuries or more that then burst out of the thawing ground sometime in the last few years. "High pressure built up and [the ground] literally

popped open," explains biogeochemist Kevin Schaefer of the U.S. National Snow and Ice Data Center. "If it is indeed caused by melting methane ice, we should expect to see more."



These craters will then become lakes, which further thaw the permafrost around and beneath them as the water traps yet more heat from the sun. Similar new lakes are forming in depressions in the newly thawing lumpy landscape across the Arctic known as thermokarst. Such thermokarst lakes and surrounding marshes create the muddy conditions favoring microbes that break dead plant material down into methane. That methane then bubbles out of the lakes and ground and, were concentrated, can even be lit on fire, leading to cases of flames dancing above the ice.

Even more widespread than blast craters or burning ice are drunken trees. When permafrost thaws, soil that was once as solid as concrete becomes mud, due to the fact that ice makes up as much as 80 percent of the ground in some parts of the Arctic. And because ice takes up more space than water, the ground subsides, causing trees that grew upright to lean as the ground liquefies beneath them. Whole forests have listed like an army of drunkards as a result. This is also bad news for modern infrastructure in the Arctic as well: Roads, pipelines and building foundations sink into mud and crack or entire landscapes subside. "Long term, there are huge economic and social impacts to permafrost degrading," Schaefer notes.

Where the ground slopes, even worse can occur: slumps, which are like slow-moving mudslides that can undermine areas of 40 hectares or more and stretch more than a kilometer across. The largest megaslumps can eat into the landscape at rates of a kilometer per decade and seem to show no signs of stopping. One slump in Russia that has mystified scientists extends more than 70 meters deep into the permafrost and is still growing after starting in the 1970s, Grosse says.

Perhaps the biggest concern of thawing permafrost is a massive and sudden release of methane from the Arctic Ocean and/or permafrost. Methane traps at least eight times more heat than carbon dioxide over decades, driving global warming even faster. The bad news on the belch front are noticeable upticks in the amount of methane produced in the Arctic — an increase of roughly 8 percent over 30 years at Canada's Alert Station in the Northwest Territories. And ocean expeditions have observed methane bubbling out of methane ice at the bottom of the Arctic Ocean. The good news is that satellite data encompassing broad swathes of the Arctic and stretching back for decades now shows little change in atmospheric concentrations of the potent greenhouse gas. "Why that is, we don't know yet," Grosse says.

Most of the greenhouse gases released by this Arctic thaw will be CO2. And the permafrost thaw will continue as rising levels of greenhouse gases in the atmosphere trap ever more heat, kicking off a feedback cycle that then further melts the Arctic. By mid-century, computer simulations predict that as much as a third of the permafrost area in Alaska could thaw, at least at the surface, with similar amounts in Canada and Siberia. Once the melt has kicked in — and the frozen dead plants that make up the top three meters or so of the permafrost become food for microbes that release CO2 — the process is irreversible. "You can't refreeze it," Schaefer says. "Once the decay turns on you can't turn it off, and it persists for centuries."

The permafrost already holds vast stores of carbon, as much as 1.7 trillion metric tons according to estimates — or more than twice as much as is currently in the atmosphere today. Not all of that will thaw in the near future — some areas of permafrost extend 700 meters deep—but as much as 120 billion metric tons could be released by 2100. That's enough to raise global average temperatures by nearly a third of a degree Celsius. "These are big numbers," Schaefer notes. But "they are in fact small when compared to those projected from burning coal and oil and natural gas. Those emissions are just immense."

The computer models that deliver these estimates of how much of that carbon might come out assume a gradual thaw of the permafrost. That prediction could prove erroneous, based on observations to date. Already, thawing processes like slumps and lakes are happening faster and affecting larger regions than expected. As Grosse puts it: "we might be very conservative in our estimate."

Thawing sets in motion a set of complex natural forces, some of which could run counter to the seemingly inexorable warming trend. Trees and shrubs will continue to move north, thanks to warmer temperatures and a longer growing season. Those trees in turn suck CO2 out of the air. NASA's new Orbiting Carbon Observatory should help clarify how much CO2 this greening of the Arctic will draw down. And even the thermokarst lakes may be burying some carbon, at least over thousands of years as lake sediments bury dead plants and algae.

Even the amount of thawing guaranteed by greenhouse emissions to date remains unclear. "We are trying to figure that out," Schaefer says. And the very rules that have governed Arctic processes during the last 100 years or so of modern exploration may no longer hold. The speed of this ongoing meltdown could accelerate and happen in decades or slowly thaw over centuries and millennia. "What are the limits of permafrost thaw?" Grosse asks. "We don't really know."

There are attempts to expand the monitoring of the Arctic, but huge gaps persist because of its vast extent and harsh conditions. As in most sciences, observations to date are limited to where it is easy for scientists to get to, rather than where one would place monitoring to ensure maximum coverage. Of emerging research questions surrounding the Arctic in the Anthropocene — a putative new geologic epoch tied to relatively recent human impacts on the planet of planetary scope — the fate of the permafrost looms large as a known unknown, as the National Academy of Sciences acknowledged in a report this past April.

One thing is clear, however: the Anthropocene has proved unfriendly to ice so far, and that will get worse as a new Arctic emerges. "This situation is unprecedented," Schaefer says. "The faster you burn fossil fuels, the faster the Arctic is going to warm."

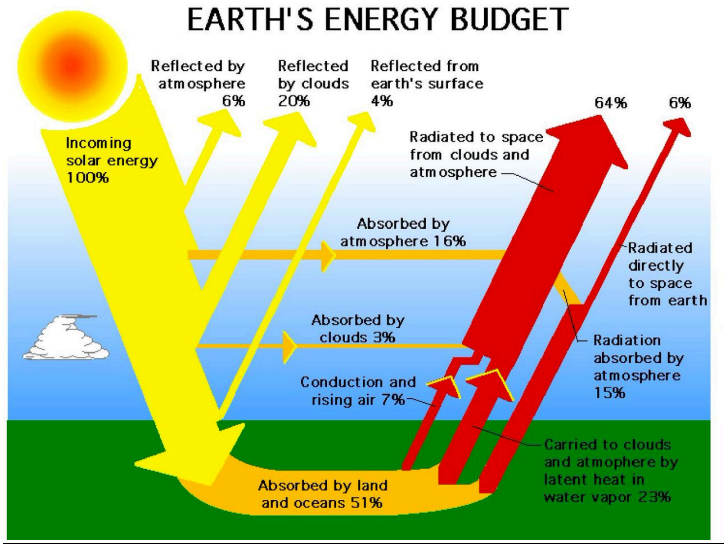
Lesson 2 "How does Climate Change?"

Learning Targets:

1. I can explain how climate is influenced by "climate drivers" (i.e. Earth's Tilt, Ocean Currents, Greenhouse Gases (carbon dioxide & methane), Etc.)
2. I can list examples of "climate drivers"
3. I can define "climate driver"

Step 1: Warm-Up (5 minutes)

Yesterday we looked into "what climate is" and how energy is transferred throughout the biosphere. Take a look at this image below and explain what is going on in this image. Make sure to include details from yesterday's lesson.



Step 2: Investigate an Individual "Driver" of Climate Change (35 minutes)

Directions:

Today you will investigate one of several "climate drivers", climate drivers are factors that affect climate but are not themselves affected by climate in a direct way. So what are some climate drivers? What influences climate? Below you will find a list of some possible drivers:

1. Black Carbon
2. Plate Tectonics
3. Greenhouse Gases (Carbon Dioxide & Methane)
4. Volcanoes
5. Deforestation
6. Earth's Tilt
7. Ocean Currents
8. Aerosols

Pick one of these "drivers" from the list and research it, make sure to answer the following questions about how the driver works. Make sure to include at least two pictures illustrate how your driver operates/functions.

- What climate driver did you select?
- How does your climate driver impact climate?
- What would happen in the worst-case scenario if your driver was to stop working? Or what if it was to go into "overdrive"?
- Are there anyways to slow/stop your driver from occurring?

Please include anything that you feel is important that was not mentioned above, if you have any questions please let me know.

Step 3: Share our Findings with our Base Groups (15 minutes)
Each member of the base group will share his/her findings to the group, please take notes using the Google document I sent out. Please make sure to fill in the table, with group members name, driver, and the significance of that driver as it relates to climate.

Sample: Worksheet:

Base Group - Climate Driver Notes NAME:
Biology, 2014

NAME	DRIVER	NOTES
INSERT NAME HERE	***INSERT DRIVER HERE***	•
INSERT NAME HERE	***INSERT DRIVER HERE***	•
INSERT NAME HERE	***INSERT DRIVER HERE***	•
INSERT NAME HERE	***INSERT DRIVER HERE***	•

QUESTIONS:

1. What was the most interesting driver that your group discussed and why?
2. Do you think any of these are influenced by human activity?
3. Can we stop all of the drivers your group look into from continuing to driver climate?
4. What were three new vocabulary words you learned from today lesson? Please define them as well.

Step 4: Homework
Government and the Impact of Climate Change Laws NAME:
Biology, 2014

PRO/CON: Should the U.S. take the lead in climate change laws?

By Michael E. Kraft and Andrew P. Morris, McClatchy-Tribune News Service: Jan. 23, 2014

PRO: Sweeping action shows world we're serious about deteriorating climate

GREEN BAY, Wis. — In its most recent assessment released this fall, the Intergovernmental Panel on Climate Change (IPCC) said that the warming of the Earth's climate system is both unequivocal and unprecedented, a conclusion that rests on multiple and independent sources of data.

The authoritative IPCC study also found that it was "extremely likely" that human influence, particularly our reliance on fossil fuels, has been the dominant cause of climate change.

At the same time, international meetings — such as the Climate Change Conference just concluded in Warsaw, Poland — struggle to devise broadly acceptable agreements to reduce greenhouse gas emissions that pose grave risks to the world's economy, its environment and public health and well-being.

A major reason for the slow pace of global action is the posture of the United States. As the world's leading emitter of greenhouse gases on a per-capita basis, we simply haven't stepped up to a leadership position.
Nor, for that matter, has China, whose surging economy has pushed it to the No. 1 spot in total greenhouse gas emissions.

What might the United States do to demonstrate convincingly that it is finally prepared to play a leading role in slowing the rate of global climate change and minimizing its effects?

Passing comprehensive national climate change legislation would be a good start.

The United States has hardly been standing still on the issue. More than half of the states and more than a thousand U.S. cities have adopted a diversity of policies that should substantially reduce the release of greenhouse gas emissions. These include innovative actions on renewable fuels, energy efficiency, public transportation, building efficiency and more.

Much has happened at the federal level too. The Obama administration has invested tens of billions of dollars in cutting-edge research on promising renewable energy technologies.

The administration also brokered historic agreements with the auto industry that will raise fuel economy standards for passenger vehicles to 54.5 miles per gallon by 2025. The new standards translate into impressive savings in use of fossil fuel.

Equally important, the White House and the Environmental Protection Agency (EPA) are developing regulations for new and existing coal-fired power plants that promise to begin shifting the nation away from use of coal to other energy resources that emit far fewer greenhouse gases.
Yet the new regulations and policy initiatives are not sufficient to tackle climate change. They also come with no national political commitment that might prod reluctant nations around the world to do their own part. And some actions, notably the EPA power plant regulations, are certain to be challenged in court by the fossil fuel industry.

National climate change policy would send a different and more definitive signal to the world that the United States takes climate change seriously and that it is prepared to step out in front on the issue.
This would be true even with the expected political compromises, such as those evident in the climate change legislation that the House of Representatives approved in 2009.

How likely is it that a highly partisan and polarized Congress can enact climate change legislation? It is certainly not likely at present nor as long as Republicans continue to deny the existence of climate change and defend the fossil fuel industry at all costs.

Nonetheless, it is imperative that Congress at least try to design and approve a national climate change policy — and do so soon. It needs to draft legislation, hold hearings, hear experts and other witnesses, review the evidence, and debate the issue at whatever length is necessary to build support.
Congress should explore all reasonable policy tools, including those that appeal to Republicans and conservatives, such as the use of market incentives and reliance on the private sector. Clearly, this will be an uphill battle, but it is imperative to try.

CON: Rapidly growing economies in China, India will swamp any US efforts

XIAN, China — Congress should not waste time debating a comprehensive climate change legislation in the coming year. First, the combination of the natural gas revolution created by fracking and the economic doldrums we are stuck in have already cut our emissions of greenhouse gases dramatically without Congress doing anything at all. If they did jump in, they'd be as likely to screw that up as make things better.
In addition, we should wait because the current proposals on how to reduce greenhouse gas emissions are all expensive and will be cheaper in the future as technologies improve.

Consider the change in cell phone technology and prices over the past 20 years. When the director of the movie "Wall Street" wanted to emphasize Gordon Gecko's power and wealth, he portrayed him holding a brick-size cellphone.

Today, even schoolchildren carry iPhones, which are orders of magnitude more powerful — and much cheaper. That same innovative process will make both emissions reduction technology and mitigation efforts cheaper and better in the future.

The United States can do next to nothing about greenhouse gas emissions alone, and we should not burden our economy to attempt to do so.

China and India are growing so rapidly that their additional greenhouse gas emissions swamp any reductions possible in the U.S. today.

For example, Chinese car ownership today on a per-capita basis is not even equal to U.S. car ownership in 1920.

When — not if — Chinese consumers close that gap, they'll be driving more than 20 times the number of cars they are driving today. Chinese electricity consumption is similarly growing rapidly too, with new coal-fired power plants opening like clockwork.

Unilaterally cutting U.S. emissions would be pointless, and would handicap negotiators in any effort to reach an agreement with developing economies like China and India.
Those nations will certainly insist on reductions from the developed world as part of the price of any reductions in greenhouse gas emissions they agree to.

If we've already unilaterally cut our emissions in advance of an agreement, we will have to make even more painful cuts to persuade developing countries to sign on.

Finally, this particular Congress is going to be unable to reach agreement on any major legislation before the 2014 elections.

The leaders of the House and Senate are barely on speaking terms with each other. There's plenty of blame to go around, of course, and neither party is innocent.

A serious approach to climate change is going to require legislation touching on many aspects of Americans' daily lives, since reducing greenhouse gas emissions is ultimately going to require substantial changes in our energy consumption.

Since energy touches every aspect of our lives, this is a subject that requires careful consideration and extended debate. We need candidates putting forward specific proposals and debating their merits on the campaign trail so voters can make an informed choice about the type of approach they want to see. That hasn't happened yet and debating something this important requires more deliberation than we've had yet.

Moreover, as the members of Congress gear up for the 2014 election cycle, their attention will be on fundraising.

Starting a new debate on such a significant issue at this point in the election cycle is a recipe for really bad legislation: to suggest writing a major bill that will touch on virtually every sector of the U.S. economy in an election year will be inviting every special interest in the country to a party where the taxpayers get to play the role of the piñata. Deliberation, not speed, is what we need.

Lesson 3: "What are the Impacts of Climate Change?"

Learning Targets:

1. I can determine how climate change will impact the biosphere, specifically freshwater, oceans, and ecosystems
2. I can explain why humans need to brace for the impacts of climate change
3. I can examine various impacts and determine how these impacts will transform our biosphere

Step 1: Warm-Up (5 minutes)
Please answer the following question, how does deforestation and ocean currents "drive" climate, please cite specific examples.

Step 2: Hot-Map Activity (45 minutes)
Complete the following activity within your group of four or five students. Make sure to assign each group member is assigned to one of the following: temperature, ocean, freshwater, people, or ecosystems. Your copy of the document is in your Google Drive, in your Biology folder. Once all group members are complete make sure to discuss the impacts of climate change on those specific factors.

Sample Worksheet:

GCD- Climate Hot Map Web Quest and Jigsaw NAME:
Biology, 2014

Directions: Make a copy of this document and share it with your group members - make sure it is in your Biology Drive folder.

Go to: http://www.climatehotmap.org/

1. **Assign each person in your group to one of the sections listed in the Map:**

Topic to be Explored…	People	Freshwater	Oceans	Ecosystems	Temperature
Person Assigned to Topic					

2. Clear all check marks and select only the topic you have been assigned.

- **Click on at least 8 of the icons (choose some from the US and some from around the world) and read the information for each icon to get a feel for some of the threats GCD is causing.**
- **Write a summary of what you discovered in the table below for your topic.**

Hot Map Exploration:

Topic Explored	Summary of What you learned
People	
Freshwater	
Oceans	
Ecosystems	
Temperature	

3. Click on the Impacts Tab above the map.

- **Click on the links on the left sidebar related to your assigned topic.**
- **Read the information and summarize in the table below.**

Impact Exploration:

Topic Explored	Summary of What you learned
People	
Freshwater	
Oceans	
Ecosystems	
Temperature	

4. Click on the Solutions link Read the Solutions homepage. Each group member should pick their top 4 solutions and in the table below: List your top 4 choices and explain why you believe these are the most important choices to get working on.

Solutions Exploration:

Group Member's Name	Top 4 Solution Choices	Explanation as to Why

5. Divide up the Regions listed on the Left side bar. Then fill out the chart below.

A Look Around the World:

Region Being Explored	Team Member responsible	Greatest threat to this region	Solutions they are working on/ proposing.
Africa			
Asia			
Australia & New Zealand			
Europe			
Latin America			
North America			
Polar Regions			
Small Islands			

6. Share your findings. Share what you have learned with group members and other class members.

Step 3: Homework
Tonight your homework is to watch a documentary title "The 11th Hour" and complete the small group questions individually. Tomorrow we will break off into our base groups to discuss the small group questions and prepare for our fishbowl discussion.

Sample Worksheet:

11th Hour Discussion Questions NAME:
Biology, 2014

Small Group Questions:

1. What fact from the video did you find most interesting?
2. What information from the video did you find most surprising?
3. What information from the video did you find most alarming?
4. What information from the video did you find most hopeful?
5. Leo states that this is the greatest challenge of our time? Do you agree with this statement? Defend why or why not.
6. Explain how the way we are living today and using the land today is different than it was 200 years ago? Do you think we can and should go back to those previous ways?
7. The movie states 'Oil is the basis with which we sustain life, we are subsidized by oil. ' Do you agree with this?
8. What are some effects of Global Climate Change (temp rising 1-2 degrees)?
9. What is the evidence scientists have which supports Global Warming.
10. What are the forces that are blocking change?
11. Earth's life-support system's damaged. The human species at risk. Could this be true?
12. What is the relationship between humans and Earth? How has this relationship been changed over the years?
13. How are humans a part of nature? (OR) How are humans connected with nature?
14. What role do plants play in human existences on Earth?

15. How has human impacted global warming?
16. How might excessive floods or droughts influence the global water cycle?

Fishbowl Questions

1. Paolo Soleri said that the causes of the problem is opportunism and greed. Do you agree? Defend your position.
2. Human mind threw us out of balance with nature. Do you agree? Defend.
3. Our culture is based on the premise that we are superior to other life forms, we are separated from others and nature. Agree?
4. Are we different from other creatures and separate from nature?
5. We are focused on the economy and forgot these ancient truths around living in harmony. We need to treat nature much more gently. Agree?
6. One commentator said "This generation gets to completely change this world." Do you think they can? What are your suggestions of what you see as the critical first step towards that change?
7. What was the turning point in our break from nature?.
8. After the industrial revolution nature was converted to a resource which was seen as being
9. abundant. Do you think that is an adequate description and that this was an Okay way to think of it?
10. What impact does oil have on your life?
11. Can we live without oil? If we need to what steps need to be taken?
12. Many believe man made global warming is the greatest hoax played on the American People. What do you think?
13. The movie states that the problem is a cultural problem about how we are thinking. We are consumers and hugely ignorant of the things we have on earth. Do you think this statement accurately reflects our society? Defend your thinking.
14. Don't believe all life will be eradicated- but humans are the most vulnerable. Do you agree?
15. Do you believe that we have altered the conditions on earth beyond the point where things will be able to adapt quickly enough for most life forms to survive?
16. What do you think the earth's carrying capacity is for humans? Have we reached it? What happens when we do?
17. Is the development of technology a good thing or will technology negatively impact our existence?
18. Do you believe that organisms will be able to adapt to climate disruption?

Group Debriefing Questions:

1. What were the strengths of your group's fish?
2. What improvements would you suggest to the fish for next time?
3. Overall what stood out about this type of format?
4. Spectators how did you feel? Was it difficult to NOT be allowed to participate?
   What is the most important takeaway from the discussion about the movie?

Lesson 4: "How do we Stop/Slow Climate Change"

Learning Targets:

1. I can compare and contrast various scenarios of how to slow or stop climate change
2. I can explain why we our living beyond our means (carbon footprint)
3. I can determine the best course of action to slow or stop climate change

Step 1: Fishbowl Discussion (30 minutes)

How to Structure the Small Group Discussion and Fishbowl

Fish Bowl Directions:

- 4 students per group
- Discuss the questions (time keeper, note taker, encourager, task-master/ question asker)
- Nominate one student from each group to go to the middle (this is your groups fish)
- Now 6-8 students are in the middle of the "fishbowl"

All other students are watching and tallying the following:

- 1/3 will be tallying how much their person participates in the discussion
- 1/3 will be tallying how many times does their groups fish build on someone else ideas or reference someone elses idea.
- 1/3 will be tallying how many times their person encourages others to participate.

Debriefing at the end showing all tallying that took place within the conversation.

Group Debriefing Questions:

1. What were the strengths of your groups fish?
2. What improvements would you suggest to the fish for next time?
3. Overall what stood out about this type of format?

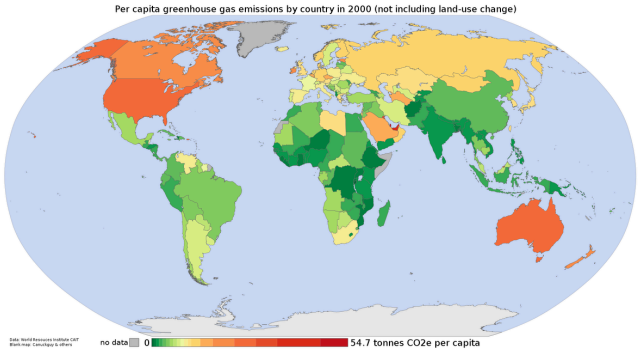
Spectators how did you feel? Was it difficult to NOT be allowed to participate?
What is the most important takeaway from the discussion about the movie?

Step 2: PRO/CON: Should the U.S. Take the Lead in Climate Change Laws – Discussion

Step 3: Homework

Please complete a carbon footprint calculation, and then answer the questions below:

1. How many Earth's does it take to support your life style?
2. Is this above or below the global average?
3. How could you lower your carbon footprint?
4. Look at the map below and note the top three carbon emission countries? What about the bottom three? What do you think accounts for these differences?



Lesson 5: Final Project

Step 1: Final Project
Now it is time to showcase your understanding of climate change and how it will impact our society. Over the last couple of weeks we have investigated various levels of climate change, from the basics of what is climate to understanding how it will re-shape our society.

Global Climate Disruption Culminating Project NAME:
Biology, 2014

Students are working toward a solution to the following problem.

Problem Statement:
How can we predict, prepare for and reduce the impact that Global Climate disruption will have on ecological balance, interactions of organisms, and life cycles of organisms on earth.

In Such a Way that we Consider:
- Distribution of organisms - biome shift, increasing/decreasing numbers of organisms
- Succession
- Food chains and webs… trophic levels
- Increasing diseases
- Pollination…
- Seasonal isolation… driving forces for evolution
- Current biodiversity in our region
- Severe weather patterns
- Population shifts in organisms
- Causes of climate disruption
- Human impact on the problem
- Current fuel use/ future possibilities
- Alternatives to what we are already doing

Primary Focus of Project:
Students have been given the task to inform the public on how to prepare for or reduce the impact of GCD. Students may either have their project focus on ways to reduce or halt GCD or focus on how to prepare for its impact.

Presentation Formats:
- Design a billboard campaign (5 or 6 billboards)
- Run a feature story on a fictitious news show such as 20/20, 60 minutes, Dateline, Rock Center with Brian Williams. (5-10 minute segment)
- Design a website which would inform the public.
- Public Service Announcement campaign TV or Radio (5-6 add spots)
- Social Network Campaign Site
- YouTube video (2-7 minutes)

Special Notes:
Remember that we are asking you to take an in depth, detailed look at one topic. We are looking for innovative and creative solutions that are **not** already being done today.

PSA – Global Climate Disruption Rubric NAME:
Biology, 2014

	Learning Outcome/Skills	Excellent (4 Points)	Standard (3 Points)	Needs Improvement (2 Points)	No Evidence (1 Point)
1	**The students can discuss how global climate disruption impacts the biosphere**	The impact global climate disruption is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	The impact of global climate disruption is stated, described, and clarified so that understanding is not seriously impeded by omissions.	The impact of global climate disruption is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/or backgrounds unknown.	The impact of global climate disruption is stated without clarification or description.
2	**The students can express what humans can do to prepare for/reduce impact of global climate disruption**	Students can express what humans can do to prepare for/reduce impact of global climate disruption in a manor that is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding. Students identify both strengthens and weaknesses in their possible solutions/approaches to global climate disruption.	Students can express what humans can do to prepare for/reduce impact of global climate disruption in a manor that is stated, described, and clarified so that understanding is not seriously impeded by omissions. Students identify either strengths or weaknesses in their possible solutions/approaches to global climate disruption.	Students can express what humans can do to prepare for/reduce impact of global climate disruption in a manor that is unclear and not comprehensive, that is lacking relevant information making it difficult to understand. Students do not identify strengthens and weaknesses in their possible solutions/approaches to global climate disruption.	Student's expression of what humans can do to prepare for/reduce impact of global climate disruption is not stated clearly and is described only superficially, it is lacking relevant information showing little or no understanding of complexity of the issue. Students do not identify strengthens and weaknesses or no solution is presented.

	Learning Outcome/Skills	Excellent (4 Points)	Standard (3 Points)	Needs Improvement (2 Points)	No Evidence (1 Point)
3	**The students need to show clear focus and organization of their topic(s)**	Organizational pattern/ plan (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive. The presentation is focused and all information is relevant to the topic.	Organizational pattern/ plan (specific introduction and conclusion, sequenced material within the body, and transitions) is unclear and sporadically observable and shows some skill and makes the content of the presentation somewhat cohesive. The presentation is shows some focus and most information is relevant to the topic.	Organizational pattern/ plan (specific introduction and conclusion, sequenced material within the body, and transitions) is lacking in one or more of the above areas and makes the content of the presentation hard to follow and comprehend. The presentation has many irrelevant facts and is often off topic.	The project seems disorganized and lacks focus throughout the project. There are considerable gaps in the presentation, and the material is presented in a manor that illustrates a clear misunderstanding or effort.
4	**The students present their findings in an original or creative ways**	Extends a novel or unique idea, question, format, or product to create new knowledge or knowledge that crosses boundaries. Actively seeks out and follows through on untested and potentially risky directions or approaches to the assignment in the final product	Extends a novel or unique idea, question, format, or product to create new knowledge or knowledge that crosses boundaries, however the approach lacks originality	The presentation shows little creativity in showing knowledge and there is little evidence of a novel approach to the presentation.	The presentation lacks creativity in illustrating knowledge and is no evidence of a novel approach to the presentation

	Learning Outcome/Skills	Excellent (4 Points)	Standard (3 Points)	Needs Improvement (2 Points)	No Evidence (1 Point)
5	**The students have a polished presentation style**	The presentation demonstrates practice, professional quality, with little or no mistakes. It appeals to the audience informationally and/or visually. The information is presented in a clear tone/font that is easy to understand. There is obvious evidence of practice and the information is presented in confidence.	The presentation demonstrates some evidence of practice, professional quality, with only a few minor mistakes. It is somewhat appealing to the audience informationally and/or visually. The information is presented in a clear tone/font that can generally be understood. There is some evidence of practice and the information is presented in confidence with only slight reliance on note cards or other aids.	The presentation demonstrates little evidence of practice, professional quality, and has many minor or major mistakes. It is not appealing to the audience informationally and/or visually. The information is presented is confusing and rushed manner it is messy and hard to understand. There is little evidence of practice and the information is presented with some hesitance and without confidence heavily relying on note cards or other aids.	The presentation shows no evidence of practice, professional quality, and does not appeal to the audience informationally or visually. The information is presented in an unclear tone/ font that cannot be understood. There is no evidence of practice and the presenter relies completely on notes or reads the information.
6	**The students show they have participated in the development and presentation of the project**	It is evident that ALL group members had a significant and equal role in the completion of the development, creation, and presentation of the project.	All group members participated, but one or more members seem to have a dominant or more significant role than others in the development, creation, and presentation of the project.	Participation by group members is clearly unbalanced and it is clear that some member's roles were not as significant and their contribution was not equal in the development, creation, and presentation of the project.	It is evident that one or more group members did not contribute to the development, creation, and presentation of the project.

	Learning Outcome/Skills	Excellent (4 Points)	Standard (3 Points)	Needs Improvement (2 Points)	No Evidence (1 Point)
7	**The students show works cited**	The students have three outside sources per group member, all are properly cited in MLA format with annotations (Special Note: additional sources beyond three sources per member does not need to be annotated, but must be in MLA format)	The students have two sources per group member or are missing one annotation or students have 2-3 formatting errors for MLA	The students have one sources per group member or are missing two annotations or students have 3-5 formatting errors for MLA	The students have no outside sources or annotations, 5+ formatting errors for MLA, or have no works cited page
8	**The students are cognizant of the audience being presented to**	The students have a high level of understanding of their audience and have effectively targeted them correctly.	Students have a basic understanding of their audience and have made some attempt to target them correctly.	Student's understanding of their audience lacks clarity, and shows only minimal progress toward targeting them correctly.	Students show no understanding of their audience and do not effectively target them.
9	**The students have included supporting details/facts**	There are 10+ supporting details/facts with extensive depth & clarity which develops and supports your claim	There are 8-10 supporting details/facts with some depth and clarity to develop and support your claim.	There are only 5-7 supporting details/ facts or the details/ facts are lacking in depth and clarity and claim is not adequately supported.	There are little or no supporting details/ facts or there is no depth and clarity to support claim.

Final Thoughts

Assessment:
Students will be assessed on a daily basis from their activities they do in class, daily warm-ups, and exit slips. In addition, students will have one summative quiz in the unit and their final project to demonstrate their understanding.

Conclusion:
I vastly underestimated how long this project would take, I thought that this unit would be about five weeks in length in fact it took almost six and a half weeks to complete. The projects thus far are outstanding however we will not present them for another week or so.

One of the biggest challenges I faced when teaching this material was the misconception that students have about "global warming" students believe that the Earth is only warming, it took sometime to get them to understand that climate change is more then just "global warming". Now, students have a basic understanding that climate change is more then global warming.

As I mentioned before this unit is in the middle of two other major units ecology and evolution. Before this unit began we discussed population and community ecology. With those units we talked about how populations normally operate, for example we talked about predator prey, resources, cycles, food chains/webs, and energy flow in ecosystem. From there we moved into the climate change unit. Once this unit is complete we will move into evolution, and discuss how environments select for certain traits. In addition, we will discuss how climate change might influence evolution, could it skew it one way or another.