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| **Climate Change Global Case Studies** |
| Prepared by: Shane Heath School/Location: Northfield Middle High School |
| Subject: AP Biology (post AP test unit) Grade: 11-12 Unit Title: Ecology/Climate Change Time Needed: 5-6 weeks |
| Unit Summary: After completing a unit on ecology and environmental biology [which utilizes examples from ‘natural’ ecosystems and consideration of keystone species that have a disproportionate effect on their natural communities (e.g. gray wolves, elephants)], I want to flip the table on my students and have them explore topics related to human ecology, or the transdisciplinary study of the relationship between humans and their natural, social, and built environments. I want students to examine how human-induced climate change is affecting different nations around the world in terms of biodiversity, natural resource stability, drought, food security, water availability, and environmental refugees, as well as political stability and economics. I think bringing a recognition that human activities (burning fossil fuels) are having immense and disproportionate consequences to different regions of the world (Third World countries, island nations) and that also, through globalization, these consequences are already affecting so many aspects of our global environment. Students will also investigate proposed solutions to various elements of the climate change paradigm, ranging from biodiversity, energy, food, etc. “The science of relationships is called ecology, but what we call it matters nothing. The question is, does the educated citizen know he is only a cog in an ecological mechanism? That if he will work with that mechanism his mental wealth and his material wealth can expand indefinitely? But that if he refuses to work with it, it will ultimately grind him to dust? If education does not teach us these things, then what is education for?” Aldo Leopold, Sand County Almanac  |
| **Stage 1 Desired Results** |
| ESTABLISHED GOALS:1. Research an environmental problem affecting their assigned country and investigate the science behind the problem (both cause and effect) .
2. Examine the environmental, cultural, political, and economic effects of the environmental disruption (ex. Drought in sub-Saharan Africa, coral bleaching in the Pacific, loss of land in Bangladesh/island nations).
3. Participate in a digital (discussion board/padlet) UN style debate focusing on the implementation of an international climate treaty where students advocate for the needs of their assigned country.
4. Create a short ‘public service address’ type digital publication or video that introduces the plight of the people of assigned country.
5. Pick one anthropogenic source of the problem and propose social or technological solutions (solar energy, electric cars, responsible resource management, etc.)

GLOBAL COMPETENCY: 1. Investigate/Research
2. Consider perspectives from various stakeholders
3. Communicate ideas using a multitude of digital formats

RESOURCES: <https://www.pinterest.com/shaneheath1/tgc-international-environmental-issues/><https://www.pinterest.com/shaneheath1/tgc-technology/> | ***Transfer***  |
| *Students will be able to independently use their learning to explain relationships between biological systems and human activities and to actively explain how the people of a specific nation are being affected by anthropomorphic alterations to land/climate. Using WeVideo or a digital storyboard, students will make a public service address-type message to bring awareness to their issue and make a proposal for a potential solution for a sustainable outcome.* 1. Investigate/Research
2. Critical Thinking/Analyze Data to associate cause and effect(climate, economics, weather, etc.)
3. Communicate ideas interactively, in a digital format
4. Take Action: WeVideo documentaries on the plight of nations in light of climate change
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| ***Meaning*** |
| UNDERSTANDINGS * *Students will understand that different nations are comprised of individuals of different cultures, standards of living, population pressures, living standards, natural resources*
* *Students will understand that increases in greenhouse gas concentrations are resulting in a multitude of climate-related effects, with different effects occurring disproportionately around the world.*

  | ESSENTIAL QUESTIONS 1. What are the effects of increased greenhouse gas concentrations in our atmosphere on our climate.
2. How are these climactic shifts manifesting themselves in different regions/countries of the world (weather, storms, biodiversity, energy, invasive species, drought , agriculture, etc.)
3. What are the country-specific cultural/societal/economic/political ramifications of these changes
4. What technologies are available to ameliorate the consequences of climate change, and what political/societal/international steps need to be advocated for to produce change.
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| ***Acquisition*** |
| *Students will know…* 1. Culture, religion, socio-economic conditions, natural resources, infrastructure of a selected nation.
2. The causes and effects of greenhouse gas emissions on our planet.
3. Technological innovations that could be applied towards a solution for the climate change crisis.
 | *Students will be able to…* 1. Analyze climate data to determine cause and effect.
2. Write persuasively as an advocate of their assigned nation to communicate the consequences of climate change.
3. Create a WeVideo documentary, at least 5 minutes in length.
4. Communicate potential technological solutions to mitigate climate change.
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| **Stage 2 - Evidence** |
| **Assessment** | **Evaluation Criteria (Learning Target or Student Will Be Able To)** |
| Assessments **FOR** Learning: * Graphs and statistical analysis of climate data
* Graphic Organizer guide for research of assigned country (culture, religion, economics, standard of living, government, natural resources, etc.)
* Observation of group work and digital expression
* Skills associated with using all the features of WeVideo and Padlet.
 | 1. Research completion: graphic organizer
2. Excel graph completion
3. Digital communication skills (Padlets, blog posts)
4. Using supporting information (scientific data/analyses) to strengthen arguments
5. Technology snapshots: sample practice assignments for using digital tools (e.g. 30 second WeVideocommercial describing you, or the school, or a pet, etc.)
6. Informational editing and synthesis🡪 graphic organizer to cogent argument
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| Assessment **OF** Learning: 1. Discussion Board/Padlet blog posts written from 1st person perspective of assigned nation in context of need for international climate treaty: (1) describe your countries cultures, religions, government, etc. (2) Describe how climate change and its corollaries (energy use, vehicles, fossil fuel extraction, etc.) are affecting your community and your country. (3) Advocate for changes (technological, political, international) that must be implemented to mitigate effects of climate change and the need for international cooperation.
2. WeVideo documentary that essentially synthesizes the 3 discussion board prompts above into a ‘take action’ style commercial advocating for the need for an international treaty for climate change.
 | 1. Checklist-style rubric for each blog post to ensure proper information is included and expressed in a relevant manner
2. Responses to the blog posts of other global citizen posts (their peers) to express support or constructive criticism are conducted in a professional manner
3. WeVideo documentary/advocacy commercial Rubric
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| **Stage 3 – Learning Plan** |
| *Summary of Key Learning Events and Instruction ( Make this a useful outline or summary of your unit, your daily lesson plans will be separate)****Weeks One and Two:*  Introduction to Climate Change.** * Students will analyze CO2 atmospheric data collected from eddy-covariance towers (in Hawaii during the past 70 years) as well as data collected from ice cores (going back tens of thousands of years) from around the world to describe trends in CO2 concentration, and compare these trends to changes in average global temperature.
* Students will investigate how isotopic abundance of Carbon-14 can be compared with abundance of Carbon-12 to distinguish between CO2 emitted via human activity (fossil fuels) and ‘natural’ sources of CO2 from the carbon cycle. Students will also investigate changing concentrations of nitrous oxide, methane, and ozone to analyze their role in climate change.
* Greenhouse Effect Lab: Students will complete laboratory simulation of greenhouse effect
* Students will now investigate ‘correlation with causation’ by analyzing data from disappearing glaciers, the Arctic and Antarctic Ice sheets, and what that means specifically for sea level rise and increased incidence of severe storms.
* Case study: Ocean acidification and Coral Bleaching. Students will complete laboratory exercise on the effects of higher atmospheric CO2 concentrations on carbonic acid concentrations in the oceans (Oceans as carbon sinks) and the resulting effects on calcium carbonate availability (and thus ability for marine organisms to grow). Students will also investigate the effects of warmer ocean water temps on corals.
* *Student mini-presentations: Students will each pick from a multitude of documented ‘effects’ from climate change and complete a mini-presentation of 60 second duration (WeVideo). Topics could include (1) increase in disease transmission via insect vectors, (2) disruption of animal migrations, (3) increased incidence of drought, (4) effects on agricultural production, (5) effects on endangered species (polar bear, etc.), (6) loss of land, (7) salinization of freshwater, etc.* **[Lesson Plan featured below]**
* Watch “Climate Refugees” documentary ( <http://www.snagfilms.com/films/title/climate_refugees>)
* Explore case studies of environmental refugees and environmental justice
* Discuss Energy Policy (Renewables vs. Nonrenewables), government subsidies, and technological innovations in green energy (Billions in Change, <http://billionsinchange.com/>), and the energy portfolios of different countries around the world.
* Analyze the pros and cons of wind, solar, geothermal, and nuclear as alternatives to fossil fuel energy production. Also electric cars, hybrid cars, and biodiesel will be examined.

***Week Three: Introduction to Cultural Perspectives on Climate Change, Blog Style**** Watch segments of various episodes of “Years of Living Dangerously” series ( <http://www.sho.com/sho/years-of-living-dangerously/home> ) to gain perspective of how climate change is manifesting in other countries.
* Students are assigned a country to research. Countries will range from developing to developed (U.S., Australia, Japan, China) along the spectrum of energy consumption, to include multiple coastal and island nations experiencing a range of effects from climate change (present and future). Students will create a fictional climate change activist citizen from their selected nation and write in the first person on a series of topics. Students will create a blog for their citizen (written in 1st person) that describes the culture, economy, government, religious diversity, natural resources, energy infrastructure, and economics of their country.
* In addition, students will research the primary effects climate change is having on their nation (loss of land, environmental refugees, effects on economy, agriculture, jobs, natural resources/biodiversity, identity) 🡪 to use in week 4 “Climate Summit” post

***Week Four: Participation in Online Discussion Board in Global Climate Summit simulation**** Students and their alternate egos from their selected nations are invited to a digital climate change summit to try to hash out some international actions that can be taken to mitigate climate change
* The specific writing prompts for the digital padlet or discussion board still need fleshing out, but may include (1) describe how climate change is affecting your nation, (2) describe one way in which your own [assigned] country can take steps to reduce the release of greenhouse gases, (3) propose an aspect of an international agreement among all nations that would significantly reduce the release of greenhouse gases and prevent the most severe of climate change scenarios from unfolding. Students would need to cite specific research and technological solutions to support their arguments.
* The final ‘day’ of the summit would move from the digital world to the classroom, where students would discuss/debate/lobby with each other (trying to form coalitions) to make an agreement that both representatives from developed and developing nations can agree to.

***Week Five: Production of a WeVideo Documentary advocating for specific climate and energy action, both domestically and internationally.*** * Students will then synthesize all their research on (1) their nation (from week 3), (2) how citizens/communities/natural resources/etc. of that country are being affected by climate change, and (3) proposed technological and international cooperative solutions to reduce greenhouse gas emissions in a hopeful WeVideo documentary that advocates for positive change.

*\*adapted from Understanding by Design Model* |

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| **TGC FELLOWS UBD Lesson Template** |
| Lesson Title: Consequences of Climate Change: Global Case Studies mini-documentary  Subject: Biology Prepared by: Shane Heath Materials Needed: students’ 1x1 laptops, WeVideo subscriptionsGlobal Competencies: (1) Investigation and (2) Communicate IdeasTime Needed: Two class periods |
| **W**here is the lesson going?(Learning Target or SWBAT) |  Students will follow up on our general assessment of climate change science [analysis of atmospheric CO2 data, correlation of CO2 and temperature, and overview of 3 major global climate change effects (melting ice sheets, higher frequency of storms, and ocean acidification)] with more region-specific consequences of climate change around the world.  **SWBAT investigate a localized effect of climate change in a developing country or region and produce a 60 second WeVideo trailer for their upcoming WeVideo mini-documentary, with the intent to inform viewers of the specific climate change-induced consequence. Examples could include drought (Lake Chad), sea level rise (Bangladesh), disease vectors (sciedu.ucar.edu), agriculture (Malawi), storm-surge (Philippines, Nigeria), etc.** This lesson will be a prelude for the much longer and more comprehensive 5 minute documentary students will construct beginning in week 5. This shorter video will focus exclusively on the direct association with climate change for the country/region.  |
| **H**ook:  | **T**ailored Differentiation: |
| We’ll watch the trailer for “Island President” as an exemplar example of the tone for their informational WeVideo.https://www.youtube.com/watch?v=ryhr\_T7cRnY | Modifications for the presentation requirements can be made based on a variety of learning needs. Prezis or Powerpoints could be substituted for WeVideos, if appropriate. The rubric checklist will be easily modified to add/omit requirements for information to include in this initial short video. |
| **E**quip: |
|  Students will be reminded of digital library resources available for their research as well as provided a clearinghouse of websites with appropriate information. Students may select their own country and associated climate effect, or else choose from a provided list of potential countries/topics. Students have 1:1 laptops. Students will also be given a refresher tutorial for constructing a WeVideo from a series of digital images, including editing effects like animation, green screen, captions, voicetracks, and soundtracks. Students each have a subscription/login for WeVideo provided by the school. |
| **Rethink and revise:** |
| Students will be assigned to three-person production committees, to outline their scripts and to review early WeVideo drafts and solicit feedback from one another using the provided rubric. Students will then have opportunity to revise their videos prior to showing it to the entire class and posting it to the class website. |
| **Evaluate:**  |
| After completing the assignment, students will submit their own scored rubric for their project and, after viewing videos from their peers, reflect on components (content or production) that could be added to their final WeVideo documentary that will incorporate both cultural elements from their country and proposed technological/policy changes.  |
| Resources: <http://scied.ucar.edu/longcontent/climate-change-and-vector-borne-disease><http://www.ictsd.org/sites/default/files/research/2011/12/climate-change-and-developing-country-agriculture.pdf><http://www.cgdev.org/publication/climate-change-and-future-impacts-storm-surge-disasters-developing-countries-working> |
| **O**rganization:  |
| Videos will all be stored on the class Video channel. Student will store all their project work in a digital folder, as they will likely build on their initial WeVideo at the end of the unit to produce their full country documentary. |