

Climate Change Toolkit: A Middle School Science Unit

Recommended Grade Level: 8
Discipline: Earth/Environmental Science
Topic: Climate Change
Time Required: 13-Day Unit
Submitted by: Karen McCabe

Essential Question: What is climate change?

National Science Standards Addressed:

M.D.1 Structure of the earth system

j. Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate, because water in the oceans holds a large amount of heat.

H.D.1 Energy in the earth system

d. Global climate is determined by energy transfer from the sun at and near the earth's surface. This energy transfer is influenced by dynamic processes such as cloud cover and the earth's rotation, and static conditions such as the position of mountain ranges and oceans.

Objective: Students will examine climate change from various perspectives and utilize primary resources to conduct research.

Teacher Notes: To open the climate change discussion, I have compiled a series of short videos which highlight the different viewpoints regarding climate change. The first one is a National Geographic production. It is an excellent example of a balanced approach to explaining climate change. The second one was made by a group called voteclimate.org. It is alarming and will evoke an emotional response in viewers. The last one was produced by the Heritage Foundation. This group acts as a “front man” for big oil and gas companies like Koch and Exxon/Mobile. Students should be able to discern a difference in tone between the three videos and ultimately identify the purpose and intended audience for each of them. Students will complete accompanying handout while viewing videos. Classroom discussion will follow videos. Students will also complete a climate change questionnaire. Students will interview at least two people (one classmate and one parent/guardian). Data from interviews will be compiled and discussed.

A Way Forward: Facing Climate Change

<http://video.nationalgeographic.com/video/player/environment/global-warming-environment/way-forward-climate.html>

Vote Climate Info. Video

<http://www.youtube.com/watch?v=PSip5sJQ0ak>

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Heritage Foundation Video

<http://www.youtube.com/watch?v=Y9pLyCvrGac>

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Recommended Ward's Science Materials

Mini Ice Buckets

Ward's Timer

6" Lab Thermometers

VWR Standard-Grade Beakers, 10mL

GeoBlox Landform Topographic Models

Interactive Whiteboard Science Lessons: Earth's Climate

Ward's Single Probes Temperature Sensor

Ward's DataHub Environmental Science

Item No. 180039

Item No. 150680

Item No. 4701600

Item No. 173500

Item No. 800206

Item No. 740488

Item No. 470014-780

Item No. 9200501

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Name: _____
Date: _____
Day: A or B Period: _____

Climate Change Basics: A Video Journey

Directions: Complete the table below while viewing each of the three videos relating to climate change.

	Describe your feelings while viewing the video segment.	Discuss the main purpose of the group/person that created this video.	Describe the intended audience for this video?
Video #1: A Way Forward			
Video #2: voteclimate.org			
Video#3: Heritage Foundation			

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Name: _____

Date: _____

Day/Period: _____

Climate Change Questionnaire

Directions: Interview at least two people using the form and questions below. You must interview one classmate and one adult (parent/relative/guardian) and record their responses in the spaces provided.

Person A: name _____, age _____

Person B: name _____, age _____

1. Do you feel that the world's climate is changing?
A.

B.
2. Is climate change a result of human activities (like burning fossil fuels)?
A.

B.
3. Is climate change a natural occurrence?
A.

B.
4. What indicators tell you that climate is changing?
A.

B.
5. What is your perception of media coverage regarding climate change?
A.

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B.

Day: 2

Grade Level: 8

Time Required: 90 minutes

Essential Question: Can we use models to simulate the interactions of systems on our planet?

National Science Standards Addressed:

M.U.2 Evidence, models, and explanation

a. Evidence—Evidence consists of observations and data on which to base scientific explanations. The goal is to help students use evidence to understand interactions and predict changes.

b. Models—Models are tentative schemes or structures that correspond to real objects, events, or classes of events, and that have explanatory power. The goal is to help students learn how to make and use many models, including physical objects, plans, mental constructs, mathematical equations, and computer simulations.

c. Explanations—Explanations provide interpretation, meaning, or sense to objects, organisms, or events. Explanations incorporate existing scientific knowledge and new evidence from observations, experiments, or models into internally consistent, logical statements, such as hypotheses, laws, principles, and theories. The goal is to help students create explanations which incorporate a scientific knowledge base, logic, and higher levels of analysis

Teacher Notes: Climate models enable scientists to make reasonable predictions about the interactions of the systems on our planet. They condense large volumes of interconnected data and attempt to mitigate discrepancies that could occur due to those interactions. Current climate models primarily focus on surface and ocean temperatures and carbon dioxide emissions. Making predictions should allow us to prepare for future climate change and examine where our attention should be focused in order to maximize the effectiveness of any efforts we make to ameliorate the problem. This activity will allow students to create their own small scale climate model and test their predictions against what actually occurs when they conduct their experiment.

Objective:

Students will use their knowledge of climate modeling to predict the outcome of their investigation into air temperature and rate of ice melting as it responds to placement in various manipulated climates.

Introduction:

- ✓ Students will view the Teachers Domain video clip: Climate Models found at <http://www.teachersdomain.org/resource/ttv10.sci.ess.climatemodels/>
- ✓ The following essential questions will be addressed during classroom discussion following the video:
 1. What is a climate model and what is its purpose?
 2. What can climate models tell us?

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3. How can climate models help us plan for climate change?

Name: _____

Date: _____

Day/Period: _____

Modeling Climate

Objective:

Students will use their knowledge of climate modeling to predict the outcome of their investigation into air temperature and rate of ice melting as it responds to placement in various manipulated climates.

Materials:

- | | |
|--|--------------------------------------|
| <input type="checkbox"/> Small bucket | <input type="checkbox"/> Ice |
| <input type="checkbox"/> Timer | <input type="checkbox"/> Thermometer |
| <input type="checkbox"/> Computer with internet access | <input type="checkbox"/> Beaker |

Procedure:

1. Fill bucket half full with ice.
2. Measure air temperature in classroom using thermometer and record in data table.
3. Leave bucket in classroom for 30 minutes.
4. Drain any water that has melted into a beaker.
5. Record the amount of melted water in the data table.
6. Discard used ice.
7. Refill bucket half full with ice.
8. Measure air temperature in shade outside using thermometer and record in data table.
9. Leave bucket in shade outside for 30 minutes.
10. Drain any water that has melted into a beaker.
11. Record the amount of melted water in the data table.
12. Discard used ice.
13. Refill bucket half full with ice.
14. Measure air temperature in partial sun outside using thermometer and record in data table.
15. Leave bucket in partial sun outside for 30 minutes.
16. Drain any water that has melted into a beaker.
17. Record the amount of melted water in the data table.
18. Discard used ice.
19. Determine the amount of change in water drained from the classroom, shade and partial shade.

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19. Record the air temperature in full sun.
20. Based on the pattern in amount of water drained from the three data points and the air temperature in full sun create a model of what would happen if the bucket were placed in full sun outside for 30 minutes.
*this can be presented as a mathematical formula, diagram or paragraph
21. Refill bucket half full with ice.
22. Leave bucket in full sun for 30 minutes.
23. Drain any water that has melted into a beaker.
24. Record the amount of melted water in the data table.
25. Compare the actual data with data from model.
26. Graph data.

**Students will examine the following resources while waiting for lab to run:*

1. NOAA

http://celebrating200years.noaa.gov/breakthroughs/climate_model/welcome.html

2. Educational Global Climate Modeling

<http://edgcm.columbia.edu/>

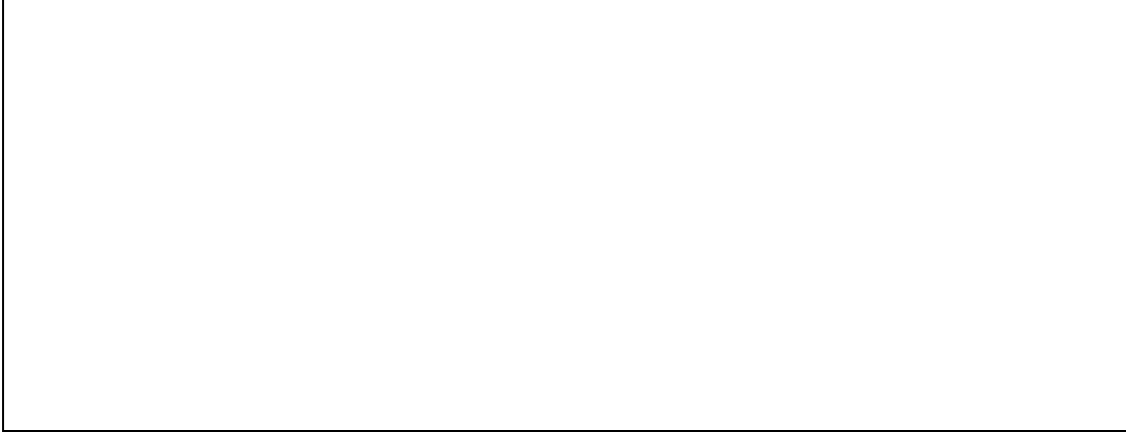
DATA:

Description of "climate"	Air temperature (°C)	Time	Amount of water drained (mL)	Notes
Ice in the classroom		1/2 hour		
Ice in the shade (outside)		1/2 hour		
Ice in indirect or partial sun (outside)		1/2 hour		
Ice in full sun (outside)		1/2 hour		

Mini Climate Model for Full Sun Bucket:

*Be sure to include your data, both actual and predicted.

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Analysis:

1. Was this a well designed investigation? (i.e. Were all variables accounted for?)

2. How did your modeled results compare with what actually happened when the bucket was placed in full sun?

3. Do you feel this is an accurate representation of the way scientists use models to study climate? What factors were missing from your model?

Resources:

CLUE into Climate: KQED Education Network

<http://uw.kqed.org/edresources/plans/lesson-1e-climate-models.pdf?trackurl=true>

Science Daily

http://www.sciencedaily.com/articles/c/climate_model.htm

NOAA

http://celebrating200years.noaa.gov/breakthroughs/climate_model/welcome.html

Teachers Domain: Climate Models

<http://www.teachersdomain.org/resource/ttv10.sci.ess.climatemodels/>

Educational Global Climate Modeling

<http://edgcm.columbia.edu/>

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B. Climate Change and Topography

Day: 3

Grade Level: 8

Time Required: 90 minutes

Essential Question: What is the relationship between climate change and topography with respect to sea level rise?

National Science Standards Addressed:

M.D.1 Structure of the earth system

j. Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate, because water in the oceans holds a large amount of heat.

k. Living organisms have played many roles in the earth system, including affecting the composition of the atmosphere, producing some types of rocks, and contributing to the weathering of rocks.

Objective: Students will use topographic maps and models to determine the extent of vulnerability of the Delmarva Peninsula to climate change, specifically sea level rise.

Teacher Notes: The Delmarva Peninsula is an excellent area to study in terms of the effects of climate change. One of the most pressing concerns as climate changes is sea level rise. The Delmarva Peninsula is an extremely low area and is subject to flooding and erosion already. Students will investigate just how low the Peninsula is and use models to predict the potential impacts of sea level rise on the areas in which they live. Worcester County was “ahead of the curve” in terms of anticipating climate change as they completed a study in 2008 to investigate the effects of sea level rise on various areas. Students will have access to this electronic resource.

Materials:

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- Topographic maps (or access to online topographic maps)
- Computer with internet access

Procedure:

- Students will engage in a brief class discussion about their experiences with flooding. Many students will be able to recount stories of being unable to leave their homes or go to certain areas of the Peninsula due to flooding.
- Students will view the following video segment Antarctic Ice: Sea Level Change found at <http://www.teachersdomain.org/resource/ess05.sci.ess.watcyc.sealevel/>
- Distribute topographic maps and accompanying handouts for students to complete. Students will need internet access to the following site, <http://www.mdmerlin.net/mapper.html>, to complete part 2 of the assignment.

Resources

Teacher's Domain:

<http://www.teachersdomain.org/resource/ess05.sci.ess.watcyc.sealevel/>

Free online topographic maps

<http://www.digital-topo-maps.com/topo-maps.shtml>

MERLIN Maryland Mapping software

<http://www.mdmerlin.net/mapper.html>

Worcester County Sea Level Rise Response Strategy

<http://www.dnr.state.md.us/dnrnews/pdfs/Worcester.pdf>

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Name: _____

Date: _____

Day/Period: _____

Climate Change and Topography

Objective: Students will use traditional and electronic resources to anticipate the effects of sea level rise on the Delmarva Peninsula.

Part 1: Use the topographic map to find the information required below.

1. Locate and determine the elevation of the following locations

- a. Snow Hill, MD _____
- b. Berlin, MD _____
- c. Cedartown, MD _____
- d. Ocean City, MD _____
1st Street _____
142nd Street _____
- e. Assateague Island, MD _____
- f. Libertytown, MD _____
- g. Girdletree, MD _____
- h. Newark, MD _____
- i. Stockton, MD _____

2. Locate and determine the elevation of your home _____

3. Which of the areas listed above would be jeopardized by a sea level rise of:

1 foot: _____

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2 feet: _____
3 feet: _____
4 feet: _____

Part 2: Use the MERLIN website (<http://www.mdmerlin.net/mapper.html>) to examine modeled vulnerability to sea level rise of various magnitudes.

- Click on Interactive Map tab
- Zoom in on Worcester County
- Select Sea Level Rise Vulnerability on the Layer List
- Examine the Legend for an explanation of the coloration differences.

4. How does this model compare to your findings with the topographic map? Explain any differences and/or similarities.

C: Climate Change and Human Health

Day: 4-6

Grade Level: 8

Time Required: 270 minutes

Essential Question: How will human health be impacted by climate change?

National Science Standards Addressed:

H.F.4 Environmental quality

a. Natural ecosystems provide an array of basic processes that affect humans. Those processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. Humans are changing many of these basic processes, and the changes may be detrimental to humans.

Objective: Expert student groups will use their knowledge of the effects of climate change on human health to create presentations detailing specific aspects of the topic.

Teacher Notes:

Students will review the resources listed below to investigate the ways in which climate change could impact human health. The resource review handout (attached) will be completed using this information.

Resources:

<http://www.who.int/globalchange/climate/en/>

<http://www.cdc.gov/climatechange/>

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<http://www.niehs.nih.gov/about/od/programs/climatechange/index.cfm>
<http://www.thelancet.com/series/health-and-climate-change>

Materials:

- Computers with internet access.
- Materials for 2nd portion of assignment will vary with choice.

Procedure:

- Students will be placed in groups based on interest in each of the five aspects of climate change listed below.
 - Group 1-Direct Temperature
 - Group 2-Extreme Weather Events
 - Group 3-Climate Sensitive Diseases
 - Group 4-Air Quality
 - Group 5-Agriculture
- Students will be given one 90 minute class period to collect information regarding their topic using the Data Collection Handout (attached).
- Students will be given one 90 minute class period to create a presentation about their topic.
- Expert student groups will present during the following 90 minute class period. A scoring rubric is included.

Name: _____
Date: _____
Day/Period: _____

Climate Change and Human Health

Directions: Complete this resource review as you conduct research for your topic.

Examine at least the following resources for your research. You may use other resources as you find necessary.

<http://www.who.int/globalchange/climate/en/>
<http://www.cdc.gov/climatechange/>
<http://www.niehs.nih.gov/about/od/programs/climatechange/index.cfm>
<http://www.thelancet.com/series/health-and-climate-change>

1. Which resources did you examine (list at least three)?

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2. Describe three possible implications of climate change on human health.

3. Name and describe three diseases that are expected to increase in frequency due to global climate change.

4. Name at least five agencies that are currently investigating how climate change will impact human health.

5. Explain how socioeconomic status is a factor when considering the impact of climate change on human health.

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Presentation Rubric

	1	2	3	4	Total
Organization	Audience cannot understand presentation because there is no sequence of information.	Audience has difficulty following presentation because student jumps around.	Student presents information in logical sequence which audience can follow.	Student presents information in logical, interesting sequence which audience can follow.	
Subject Knowledge	Student does not have grasp of information; student cannot answer questions about subject.	Student is uncomfortable with information and is able to answer only rudimentary questions.	Student is at ease with expected answers to all questions, but fails to elaborate.	Student demonstrates full knowledge (more than required) by answering all class questions with explanations and elaboration.	
Graphics	Student uses superfluous graphics or no graphics	Student occasionally uses graphics that rarely support text and presentation.	Student's graphics relate to text and presentation.	Student's graphics explain and reinforce screen text and presentation.	
Mechanics	Student's presentation has four or more spelling errors and/or grammatical errors.	Presentation has three misspellings and/or grammatical errors.	Presentation has no more than two misspellings and/or grammatical errors.	Presentation has no misspellings or grammatical errors.	
Eye Contact	Student reads all of report with no eye contact.	Student occasionally uses eye contact, but still reads most of report.	Student maintains eye contact most of the time but frequently returns to notes.	Student maintains eye contact with audience, seldom returning to notes.	
Elocution	Student mumbles, incorrectly pronounces terms, and speaks too quietly for students in the back of class to hear.	Student's voice is low. Student incorrectly pronounces terms. Audience members have difficulty hearing presentation.	Student's voice is clear. Student pronounces most words correctly. Most audience members can hear presentation.	Student uses a clear voice and correct, precise pronunciation of terms so that all audience members can hear presentation.	

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				Total Points:	
--	--	--	--	----------------------	--

Source: <http://www.ncsu.edu/midlink/rub.pres.html>

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C: Climate Change and Agriculture

Day: 7-8

Grade Level: 8

Time Required: 180 minutes

Essential Question: How will agriculture be impacted by climate change on a local and global scale?

National Science Standards Addressed:

H.C.4 Interdependence of organisms

e. Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.

H.F.4 Environmental quality

a. Natural ecosystems provide an array of basic processes that affect humans. Those processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. Humans are changing many of these basic processes, and the changes may be detrimental to humans.

Objective: Students will investigate how climate change will impact a major economic sector of the local economy of the Eastern Shore of Maryland.

Teacher Notes:

Students will use the internet to complete a web quest investigating the impacts of climate change on agriculture and the economy of the Eastern Shore of Maryland. Student knowledge will be extended in the second component. Students will have the option of completing one of three assignments that relate to the topic.

Resources:

<http://epa.gov/climatechange/effects/agriculture.html>

http://www.nass.usda.gov/Statistics_by_State/Maryland/County_Profiles/2010/Worcester.pdf

<http://www.thepoultrysite.com/articles/1498/climate-change-and-poultry-production>

<http://news.ncsu.edu/releases/crop-yields-could-wilt-heat/>

<http://www.ars.usda.gov/is/AR/archive/nov09/soybean1109.htm>

<http://www.msa.md.gov/msa/mdmanual/01glance/html/agrirev.html>

Procedure:

- The handout that accompanies this assignment should be available on each student computer. This will allow students to use hyperlinks to reach each destination.
- Students should complete web quest in one 90 minute class period. The second portion will be assigned as homework, with presentations occurring during the next class period.

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Name: _____

Date: _____

Day: A or B Period: _____

Climate Change and Agriculture: Eastern Shore Style **A Web Quest**

Part I. Use the internet and websites below to complete each task.

1. Use <http://epa.gov/climatechange/effects/agriculture.html> to locate the following information.

Name the five climate factors directly connected to climate change and agricultural productivity. _____

What are the implications of climate change for North America? _____

Use information from this site to both confirm and dispute the following claim “Climate change will be good for agriculture in North America.”

2. Use http://www.nass.usda.gov/Statistics_by_State/Maryland/County_Profiles/2010/Worcester.pdf to locate the following information.

Explain the trend in Maryland farm numbers from 1997-2010. _____

Which commodity had the highest sales value in Worcester County in 2010? _____

List the five commodity crops in Worcester County in 2010. _____

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Where did Worcester County rank in the state for production of the following commodities in 2007?

- Broilers (Poultry) _____
- Corn _____
- Soybeans _____
- Wheat _____

3. Use <http://www.thepoultrysite.com/articles/1498/climate-change-and-poultry-production> to locate the following information.

Complete the following table with information specific to the poultry industry:

Climate Change Challenges	Climate Change Opportunities	Climate Change Adaptation	Climate Change Mitigation

4. Use <http://news.ncsu.edu/releases/crop-yields-could-wilt-heat/> to locate the following information.

Which crops were examined in this study? Why were those crops chosen? _____

Explain the effects of temperature increases on the crops examined in this article. _____

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5. Use <http://www.ars.usda.gov/is/AR/archive/nov09/soybean1109.htm> to locate the following information.

Explain how scientists highlighted in this article are studying the relationship between climate change factors and crop yield. _____

6. Use <http://www.msa.md.gov/msa/mdmanual/01glance/html/agrirev.html> to locate the following information.

Create a pie chart of the data for 2009 agriculture production by commodity using excel. Save the graph under your name.

Part II. You have three options for the second part of this assignment.

- Option 1. Create an electronic presentation of your findings from the web quest.
- Option 2. Conduct an interview with a local farmer regarding climate change and its effects on agriculture. Interview questions will be preapproved.
- Option 3. Write a letter to two political figures (Senators, Delegates, Governor) explaining how climate change could affect the economy of the Eastern Shore and reasons why we should address climate change via legislation.

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D. Climate Change and Weather

Day: 9-11

Grade Level: 8

Time Required: 270 Minutes

Essential Question: How will climate change affect weather patterns on both a local and global scale?

National Science Standards Addressed:

H.C.4 Interdependence of organisms

e. Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.

H.F.4 Environmental quality

a. Natural ecosystems provide an array of basic processes that affect humans. Those processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. Humans are changing many of these basic processes, and the changes may be detrimental to humans.

Objective: Students will investigate the effects of climate change on local and global weather patterns and produce a weather report that highlights the causes and effects of one type of weather disturbance.

Teacher Notes: Students will read through electronic resources and watch video clips related to climate change and weather during the first day. A local meteorologist will be invited in to discuss forecasting and production of the weather segments on the news. Student groups will create and act out a weather report for our area that highlights one of the extreme weather events discussed.

Resources: Climate Communications Website

<http://climatecommunication.org/new/articles/extreme-weather/overview/>

Materials:

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- Computers with internet access
- Summary Table
- Video Recorder
- Presentation software
- Props for weather report reenactments

Procedure:

1. Students will access the Climate Communications site at the address below <http://climatecommunication.org/new/articles/extreme-weather/overview/>.
2. Students will read through all articles and view all videos found under the Current Extreme Weather and Climate Change heading.
3. Students will complete the Summary Table for Current Extreme Weather and Climate Change.
4. A local meteorologist will be invited in to discuss weather forecasting and the production of the weather report.
5. Student groups will develop and act out a weather report that highlights one of the extreme weather events found on the Climate Communications site.
6. Student developed weather reports will be recorded and scored using rubric.

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Name: _____

Date: _____

Day: A or B Period: _____

Summary Table for Current Extreme Weather and Climate Change

Directions: Access the Climate Communications website, <http://climatecommunication.org/new/articles/extreme-weather/overview/>, and summarize the information found in each category in three sentences or less.

Topic	Three Sentence Summary
Heat Waves	
Reduced Cold	
Precipitation	
Floods	

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Drought	
Circulation Changes	
Hurricanes and Summer Storms	
Winter Storms	

Name: _____

Date: _____

Day: A or B Period: _____

Weather Report Assignment

Your team is responsible for developing and acting out a weather report that highlights at least one of the weather topics addressed on the Climate Communications site.

PowerPoint or other presentation software (i.e. Prezi, Keynote) should be utilized as the backdrop for your report. The rubric below will be used to score your projects. Please utilize this rubric in the development and delivery of your weather report.

CATEGORY:	REQUIREMENTS:	SCORE:	COMMENTS:
Content	Title slide lists topic, names, and class period. (2 pts)		
	Students accurately explains the causes/factors of the weather event on a minimum of 2 information slides (10 pts)		
	Student provides 2 pictures relevant to their weather topic with 2 informative captions (4 pts)		
	Student explains how the weather event will impact people on a minimum of 2 information slides (10 pts)		
	The information on the slides is written with correct spelling, punctuation, and grammar. (2 pts)		
	Student presents one of the information slides. (2 pts)		
	Student presents one of the picture slides. (2 pts)		
	Student presents one of the forecast slides.		

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Presentation	(2 pts)		
	Student is rehearsed; knows what he/she is talking about (4 pts)		
	Student makes eye contact with class and does not stare at the screen (2 pts)		
	Student can be heard at the back of the room (2 pts)		
	Student conducts him/herself with maturity. (4 pts)		
	Student demonstrates creativity in script/props/delivery (2 pts)		
Sources	All sources are documented on the final slide (2 pts)		
TOTAL SCORE:			/50

*Adapted from

http://www.curriki.org/xwiki/bin/view/Coll_Group_SanJoseUnifiedTechnologyLeadershipForum/WeatherForecastStudentAssignmentSheetRubric?bc=;Coll_Group_SanJoseUnifiedTechnologyLeadershipForum.6thGradeWeatherForecastProject

E. Climate Change Adaptations and Mitigation

Day: 12-13

Grade Level: 8

Time Required: 180 Minutes

Essential Question: How will Worcester County respond to conditions brought about as a result of climate change?

National Science Standards Addressed:

H.C.4 Interdependence of organisms

e. Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.

H.F.4 Environmental quality

a. Natural ecosystems provide an array of basic processes that affect humans. Those processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. Humans are changing many of these basic processes, and the changes may be detrimental to humans.

Objective: Students will investigate major components of document entitled *The Sea Level Rise Response Strategy for Worcester County, Maryland* and participate in a question/answer session with the county official responsible for the development and implementation of this document.

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Teacher Notes: Worcester County, Maryland is the only county in Maryland that shares a border with the Atlantic Ocean, making us very vulnerable to any change in sea level caused by climate change or other variables. County officials have a vested interest in the ability of the community to adapt to changes brought about by climate change. As a result, they were “ahead of the curve” in developing a response plan for sea level rise in 2008. Students will investigate components of this lengthy (103 pages) document and finally participate in a guided question/answer session with the county official most closely affiliated with development and implementation of the plan.

Resources:

- Hard copies of *The Sea Level Rise Response Strategy for Worcester County, Maryland* which can be found at the following url:
<http://www.dnr.state.md.us/dnrnews/pdfs/Worcester.pdf>
- Handout
- Representative from The Worcester County Department of Comprehensive Planning

Procedure:

1. Students will be given copies of *The Sea Level Rise Response Strategy for Worcester County, Maryland* and accompanying handout.
2. Students will review major components of the report and complete handout.
3. Students will generate three questions that will be used for question/answer session on the following day.
4. Student questions will be reviewed and compiled by instructor.
5. Each student will be responsible for asking one question of county official during the presentation on the following day.

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Name: _____

Date: _____

Day: *A or B* Period: _____

**Analysis: The Sea Level Rise Response Strategy
for Worcester County, Maryland**

Directions: Use your copy of *The Sea Level Rise Response Strategy for Worcester County, Maryland* to complete the following.

I. Sea Level Rise Scenarios

1. What is the purpose of this study?

2. What is the current rate of sea level rise in Maryland and why is it higher than many other coastal states?

3. Using the Worcester County Sea Level Rise Inundation Model (1.1) determine the level of sea level rise (m) for each of the following:

Max Rate

2050	
2100	

Accelerated Rate

2050	
2100	

Steady State Rate

2050	
2100	

II. Projected Sea Level Rise Impacts

1. List the five direct impacts of sea level rise in Worcester County as identified by the study.

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2. Examine Tables 2.1, 2.2 and 2.3. Discuss the data presented in one of those tables in the space below.

3. Which infrastructure and public facilities were examined for vulnerability to sea level rise impacts?

4. List the four categories of stress on coastal environments found under Section 2.3 below. Pick one of those stressors to explain in detail.

III. Potential Response Options

1. What are the four major categories of response options to sea level rise?

2. Name 4 potential response options for coastal properties and areas within the potential inundation zone.

3. Explain what a rolling easement is.

4. Why is retreat an improbable response option in Worcester County?

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IV. Questions: Compose three thoughtful, original questions that could be asked of a representative of the Worcester County Comprehensive Planning Commission. You will be responsible for posing one of your questions during the classroom visit. Write your questions below.

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