

YEARS OF LIVING DANGEROUSLY



THE YEARS OF LIVING DANGEROUSLY - EDUCATIONAL COMPANION

Provided to you by the *National Wildlife Federation*

INTRODUCTION

About the Series

This groundbreaking documentary event series explores the human impact of climate change. From the damage wrought by Hurricane Sandy to the upheaval caused by drought in the Middle East, *YEARS OF LIVING DANGEROUSLY* combines the blockbuster storytelling of top Hollywood movie makers with the reporting expertise of Hollywood's brightest stars and today's most respected journalists.

Purpose

As the educational partner for the *YEARS OF LIVING DANGEROUSLY*, *National Wildlife Federation*...

How To Get The Most Out Of This Educational Experience

Around the country our schools are providing students with unique, experiential, and applied learning opportunities. The Years of Living Dangerously is one of those opportunities you don't want to miss. As the series unfolds the biggest stories of our time students become emotional involved in the lives of those represented and through your instruction and facilitation will become agents of change, empowered by knowledge and evidence to create and solve our problems today and into the future.

EPISODE 4

EPISODE SUMMARY: ICE & BRIMSTONE

Lesley Stahl of '60 Minutes' travels to Greenland to investigate the effects of global warming in the Arctic. Down south, Ian Somerhalder travels to North Carolina to listen in on both sides of the evangelical community's debate over climate change and finds himself caught in the middle of not only a religious debate, but a familial one: the father is a megachurch preacher who doesn't believe in climate change; the daughter is an activist trying to shut down the local coal-fired power plant.

LESSON SUMMARY

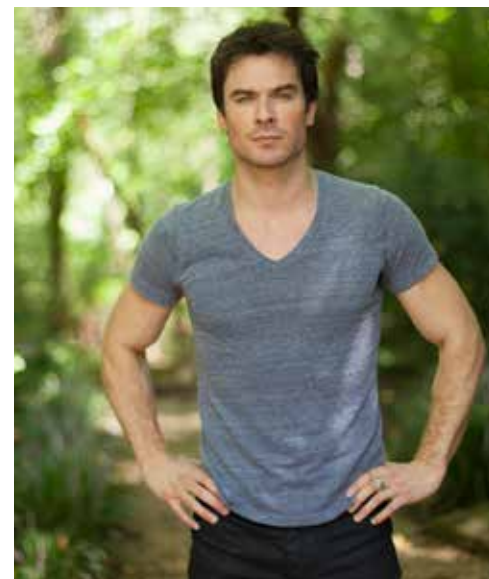
Students will use the stories in episode four to better understand the long term impacts of our energy choices especially its impacts on the Arctic; an Arctic like has never been seen before.

Story 1 – Preacher's Daughter

Correspondent: Ian Somerhalder

Location: Asheville and Charlotte, North Carolina,
Apalachicola, Florida

Story: The father: a megachurch preacher who doesn't believe in climate change. The daughter: an activist trying to shut down the local coal-fired power plant. The daughter's hope: to eventually convince her father that global warming is happening, and even, just possibly, see if he'll make it the topic of his next sermon. Correspondent Ian Somerhalder listens in on both sides of the evangelical community's debate over climate change.



THE YEARS OF LIVING DANGEROUSLY - EDUCATIONAL COMPANION

Story 2- Under the Ice

Correspondent: Lesley Stahl

Location: Greenland, Kirana, Sweden; Washington, D.C.
New York, New York

Story: No place on earth has seen the effects of global warming more than the vast mineral-rich Arctic. As the ice melts, oil companies are scrambling to drill vast quantities of oil and gas that used to be shrouded by impenetrable layers of ice. But what happens to the planet if the oil companies get their way and extract the Arctic's riches? Correspondent Lesley Stahl goes to Greenland to investigate.



LEARNING OBJECTIVES EPISODE 1: LESSON 1

1. Students will gather evidence using NASA satellite data to draw conclusions.
2. Students will analyze and compare data sets to evaluate seasonal and geographic as well as long term trends.
3. Students will understand the connection between snow-ice cover and trends in albedo.

TEACHER BACKGROUND

Earth's albedo is the fraction of incoming radiation (sunlight) that is reflected into space. The Earth has an average albedo, which describes how much sunlight is reflected on average for the whole planet and the whole year. That value is about 0.3. The Earth also has a local albedo, which determines how much of the Sun's light is reflected from a particular place at a particular time. The local albedo depends on the particular local surface, which can change seasonally as vegetation changes. It also depends on more rapidly changing things such as snow and clouds.

For reference, the values of albedo range from 0.0 to 1.0, where a value of 0.0 is for a surface that absorbs all radiation (reflects 0 percent) that strikes its surface, and a value of 1.0 represents a surface that reflects 100 percent of the radiation that strikes it.

Fresh snow has an albedo ranging from 0.75 to 0.90.

Dry dark soil has an albedo of approximately 0.13.

Open ocean has an albedo of approximately 0.10.

How fast the planet warms in response to adding greenhouse gases to the atmosphere depends in part on climate feedbacks. These natural processes can amplify/hasten the warming (a positive climate feedback) or counteract some warming (a negative climate feedback). How snow and ice respond to warming and the resultant impact on surface albedo is an important positive climate feedback. As the climate warms, snow and ice melt, the earth's surface becomes less reflective (especially if sea ice melts, revealing open ocean, which is very dark), more solar energy is absorbed by the earth's surface rather than being reflected back to space, causing the temperature to increase and the cycle to continue.

MATERIALS

1. Science notebook
2. One-to-One or paired use of computer with internet access
3. Visual: Earth's Energy Budget, page 12
4. Maps: ISCCP Satellite - Monthly Snow/Ice Amount, page 13
5. Student handout: Monthly Snow/Ice Amount – Change Over Time data sheet, page 14 and 15

THE YEARS OF LIVING DANGEROUSLY - EDUCATIONAL COMPANION

VOCABULARY

albedo, anomaly, climate, climate change, correlation, energy budget, emissions, evidence, flux, greenhouse gases, impact, qualitative data, quantitative data, total all-sky net flux, trend line

WHAT TO DO

Have students take our online quiz both before and after the lesson. If you'd rather print out a paper copy or project the quiz on your SMART Board see page 6 and 7.

ENGAGE: 30 MINUTES

Students need a basic understanding of Earth's energy budget, basically understanding that the amount of energy coming into our atmosphere must equal the amount of energy exiting our atmosphere. Make sure students utilize their science notebook when communicating about the topic, making observations, and brainstorming.

1. Have students work in pairs to examine NASA's infographic about Earth's energy budget, found on page 12.
2. Pose these questions to students
 - Currently we know Earth's energy budget is out of whack. Using your current knowledge of climate change, what evidence do we have to support this fact? [Evidence is in the amount of carbon currently in our atmosphere; Keeling Curve models the significant rise in CO₂ of the last 50 years.]
 - Albedo. Anyone know what that term means or heard the word before? Albedo is the focus of our learning and to help start you thinking on the right path, I want you to close your eyes and think of a hot summer day. You have a choice between your two favorite shirts, one is white and the other is black. What's the best choice on this hot summer day? Explain. [At this age students understand that heat is absorbed by darker colors whereas light colors tend to reflect more of the sun's radiation. This is key to student understanding of albedo. After this discussion, explain to students that albedo has to do with the proportion of radiation that is reflected from a surface.]
 - Hypothesize what albedo has to do with arctic sea ice melt. Sketch or write your explanation.





EXPLORE: 30 MINUTES

1. Watch episode 4. If you are unable to view episode 4 in its entirety then students will need to watch the following segments to support their learning experience. As students watch each segment have them stop and answer each of the questions below in their science notebook. At the conclusion of all segments, encourage students to add to or modify their thinking.
 - **Minute 13:10 to 17:07**
 - Explain what's happening to cause ice quakes.
 - What is the ripple effect related to calving or breaking off of these large chunks of ice? What will happen in the end?
 - Lesley Stahl said the amount of ice that melted in Greenland in 2012 was equivalent to Niagara Falls running into the ocean for 5 straight years. (Niagara Falls actually flows into Lake Erie and then onto Lake Ontario.) In one second the Niagara Falls spills 750,000 gallons of water. So how many gallons of water melted in 5 years?
A little help – 5 years = 3.156×10^7 seconds
 - **Minute 23:39 to 25:20**
 - Explain the evidence Dr. Tedesco uses to help draw conclusions about what is happening in the arctic.
 - In your science notebook, sketch and label Dr. Tedesco's explanation of albedo and write a definition of albedo in your own words.
 - **Minute 37:41 to 40:03**
 - How did you take Aleqa Hammond's interview? Surprised? Expected? Explain your response.
 - **Minute 43:23 to 47:22**
 - Explain what John Kerry sees as a solution to the environmental pushback we see here in the U.S.

THE YEARS OF LIVING DANGEROUSLY - EDUCATIONAL COMPANION

EXPLAIN: 60 -75 MINUTES

Dr. Marco Tedesco did a nice job explaining albedo and how global warming is causing significant changes to the climate in the arctic. Now we are going to take a closer look at the explanation and science behind albedo.

PART 1

1. Each student needs internet connected access to a computer, i.e. computer lab, mobile device, iPad, tablet, etc.
2. Go to PBS LearningMedia: Earth's Albedo and Global Warming - <http://www.pbslearningmedia.org/resource/ipy07.sci.ess.watcyc.albedo/earths-albedo-and-global-warming/>
3. Encourage your students to take notes and or make sketches as they go through the interactive explanation of albedo. Have students click "Launch" when they are ready to begin.
4. Once students complete the simulation have a discussion using these questions found either at the PBS LearningMedia link above or the questions are written below.
 - What is meant by the term albedo? How does albedo affect the behavior of solar radiation reaching Earth's surface?
 - Why would you expect Greenland to have a higher albedo than its surround areas?
 - What role would seasonality have on Earth's albedo and how does the Earth's albedo change over the course of a year?
 - How do soot particles in the atmosphere affect incoming solar radiation? How might an increase or decrease in the number of particles change the intensity of solar radiation reaching Earth's surface?



The screenshot shows the title "Earth's Albedo and Global Warming" for grades 5-12. It features a satellite-style image of Earth with a "LAUNCH" button over the Arctic region. Below the image are social media icons for Facebook, Twitter, and Pinterest. A short description states: "This interactive activity adapted from NASA and the U.S. Geological Survey illustrates the concept of albedo—the measure of how much solar radiation...". It also includes "See More", "Accessibility: Textual, Visual", and "Permitted use: Stream, Download, Share, and Modify".



PART 2

With a basic understanding of albedo students will now examine an Arctic region that expands north, east, and just west of Alaska. Their goal is to calculate percent change over the time period from 1994 to 2008.

Special Note – this data was taken from a site that puts NASA satellite data into meaningful illustrations. This tool only has usable data from 1994 to 2008.

Besides looking at change over time, this is a good opportunity to discuss limitations of models and the role technology plays in understanding our earth system and science in general. Specifically after they complete the data sheet ask them about which method of data collection and analysis is more efficient, effective, and precise.

Students will make observations about the maps, focusing on change over time. Their observations should be noted in their science notebook. Students will use the **ISCCP Satellite – Monthly Snow/Ice Amount maps**, found on page 13 and the **Monthly Snow/Ice Amount – Change Over Time data sheet**, found on page 14 and 15, to collect their data, calculate their percentages, and answer questions.

Suggestion – have students complete the data collection and percent change over time at home. Leave the questions until you are all together. This will allow time for the most important part of this lesson, the questioning, sharing, and discussing.

1. Handout the **ISCCP Satellite – Monthly Snow/Ice Amount maps**. On the maps have the students locate and label Chukchi Sea, Beaufort Sea, Bering Sea, and the section of the Northwest Passage that lies between Russia and the United States.
2. Make general observations regarding changes, if any in each of the four maps. Students should note these observations in their science notebook. Next briefly discuss these generalizations as a class.
3. Handout the **Monthly Snow/Ice Amount – Change Over Time data sheet**.



THE YEARS OF LIVING DANGEROUSLY - EDUCATIONAL COMPANION

ELABORATE: 30-40 MINUTES

Allow students to choose one of the following articles to read. Provide students with the directions for diving deeper into their reading and the rubric found on pages 16 and 17.

1. Climate Change and Greenland: Where Ice Melt Could Raise Seas by 23 Feet
www.weather.com/news/science/environment/greenland-climate-change-23-feet-sea-level-rise-20140501
2. Judge Suspends Arctic drilling, orders new environmental report
www.latimes.com/nation/nationnow/la-na-nn-arctic-drilling-new-environmental-report-20140424-story.html
3. Greenland's Prime Minister Looks on Global Warming's Bright Side
www.businessweek.com/articles/2014-05-01/greenland-prime-minister-expects-global-warming-mining-riches
4. Climate assessment warns of dire effects in Alaska
www.newsmine.com/news/alaska_news/climate-assessment-warns-of-dire-effects-in-alaska/article_8d905f10-d562-11e3-8764-001a4bcf6878.html
5. Arctic Sea Ice Update: The Melt is on, How Low Will It Go?
www.huffingtonpost.com/bill-chameides/arctic-sea-ice-update-the_b_5187264.html

EVALUATE: 10-15 MINUTES

- A. Justified True/False – see page 8
- B. Online Pre/Post Quiz

Take our online quiz:

1. Albedo has to do with the rate at which carbon dioxide is put into the atmosphere. *True/False*
2. Coal is formed from the decomposition of inorganic materials that have been subjected to geologic heat and pressure over hundreds of years and is considered to be a renewable resources because it can be replenished in our lifetime. *True/False*
3. Soot and ash reflect the sun's radiation. *True/False*
4. In the United States, more than 40 percent of people live in areas with unhealthy levels of air pollution. *True/False*
5. Arctic sea ice melt only impacts those who live in Arctic regions. *True/False*
6. Coal and gas-fired power plants emit more than 2.3 billion metric tons per year of carbon pollution, approximately 40 percent of total U.S. energy-related carbon pollution. *True/False*
7. Sea ice, ice sheets, ice shelves, and icebergs are synonyms to describe what we see in the Arctic. *True/False*
8. There is no way to know what carbon in our atmosphere is natural or human caused. *True/False*
9. The deep blue of the Arctic oceans reflect the sun's solar rays, while the bright white of the Arctic sea ice absorbs the sun's solar radiation. *True/False*
10. The total water used for coal mining in the United States ranges from 70 million to 260 million gallons a day. *True/False*

THE YEARS OF LIVING DANGEROUSLY - EDUCATIONAL COMPANION

Name: _____

Date: _____

Period: _____

JUSTIFIED TRUE OR FALSE STATEMENTS

EPISODE 101 – DRY SEASON

Justified True or False Statements provide a set of claims or statements that are examined by you. You are meant to draw on evidence from what you have learned to analyze the validity of the statements, and then describe the reasoning used to decide whether each claim is true or false.

NOTE Please use grade appropriate spelling and grammar.

STATEMENT	T	F	WHY I THINK SO...
1. 1. Earth's energy budget and the ice-albedo feedback loop are unrelated.			
2. 2. Wildlife is negatively affected by declining amounts of sea ice.			
3. 3. More radiation is reflected from the deep ocean waters than from snow and ice covered areas.			

Use this space to include more evidence to support your claim and or to draw a model if applicable.

Taking Actions and Designing Solutions

Taking actions and/or designing solutions to our local, national, and global problems are a personal journey. Via Facebook and Twitter @YEARSofliving #YEARSproject, share how you are taking action to combat climate change or if you've designed potential solutions share those on Instagram - @YEARSofliving or make a Vine.

Want to engage your school?

Check out these two programs of the National Wildlife Federation, Eco-Schools USA and Schoolyard Habitats www.eco-schoolsusa.org, www.nwf.org/schoolyardhabitats

Want the opportunity to showcase your investigative reporting skills?

Check out National Wildlife Federation's Young Reporters for the Environment-USA www.YRE-USA.org

Are you graduating this year?

Check out our college programs, Campus Ecology and Eco-Leaders www.CampusEcology.org, www.NWFEcoLeaders.org

WRITER'S CORNER

Without language there is no science. To be practicing scientists and derive new knowledge, we need language – reading, writing, talking, listening, enacting, and visualizing. Writing is one way to communicate understanding of our learning while allowing us to be creative in our delivery and provide insight and possible solutions to problems.

1. As climate changes the habitats of many species are impacted. The focus of our work was around Alaska. There several species that are considered endangered or threatened in this part of the United States, including the iconic polar bear, Northern Sea otter, Stellar's Eastern and Western Sea Lion, and many other animal, fish, and plant species. Go to the U.S. Fish & Wildlife Service's Environmental Conservation Online System. http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrenceIndividual.jsp?state=AK&s8fid=112761032792&s8fid=112762573902 Choose a species to learn more about. Investigate how climate change is impacting its survival and look into what scientists are doing now to help save the species and create your own design solutions that can help the species adapt in their changing climate.

2. Our energy practices from extraction to production and from transmission to consumption have a significant impacts on climate change. We see those effects quickest at the poles in the form of ice melt leading to global sea level rise. Go to the Energy Information Administration's site and choose your state. <http://www.eia.gov/state/> Write a summary profiling your states rank on total energy consumption, nonrenewable energy production, and carbon dioxide emissions. Then choose from any number of other pieces of information you feel are important for the public to aware of and better understand.

3. Albedo is a rather foreign word to many people. Craft a 2 minute "elevator speech" that would allow you to effectively explain what albedo is, why it is a considered a cycle without an end, and why it is of concern to you. Your goal after the "elevator ride" is to leave the person wanting to know more about the topic. Education is and will continue to play a major role in how we as individuals and as a nation address climate change.

Special Note – an elevator speech reflects the idea that it should be possible to deliver your topic in the time span of an elevator ride, or approximately thirty seconds to two minutes.

CAREERS – AGENTS OF CHANGE

Inspired by episode 4? Thinking about your future? You have the power to make a difference today and in the future. Check out our episode 3 profile on Dr. Charles H. Greene and look into other careers inspired by the issues presented in Episode 4: Ice and Brimstone.

Episode Career Profile
Dr. Heidi Cullen

Occupation:
Chief Climatologist for Climate Central, Visiting Lecturer at Princeton University and a Senior Research Fellow at the Wharton Risk Management and Decision Processes Center at the University of Pennsylvania

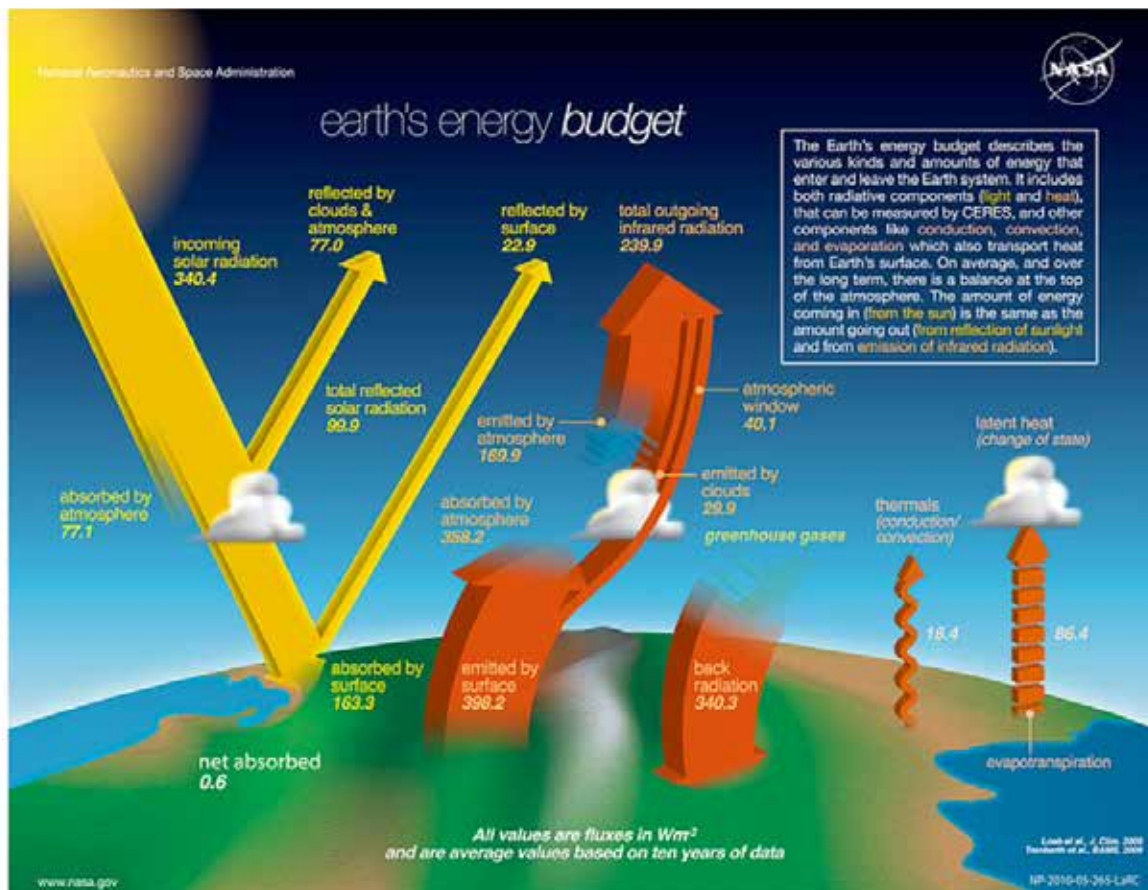
Education:
B.A in Industrial Engineering – Columbia University
Ph.D. in Climatology and Ocean-Atmosphere Dynamics – Lamont-Doherty Earth Observatory of Columbia University



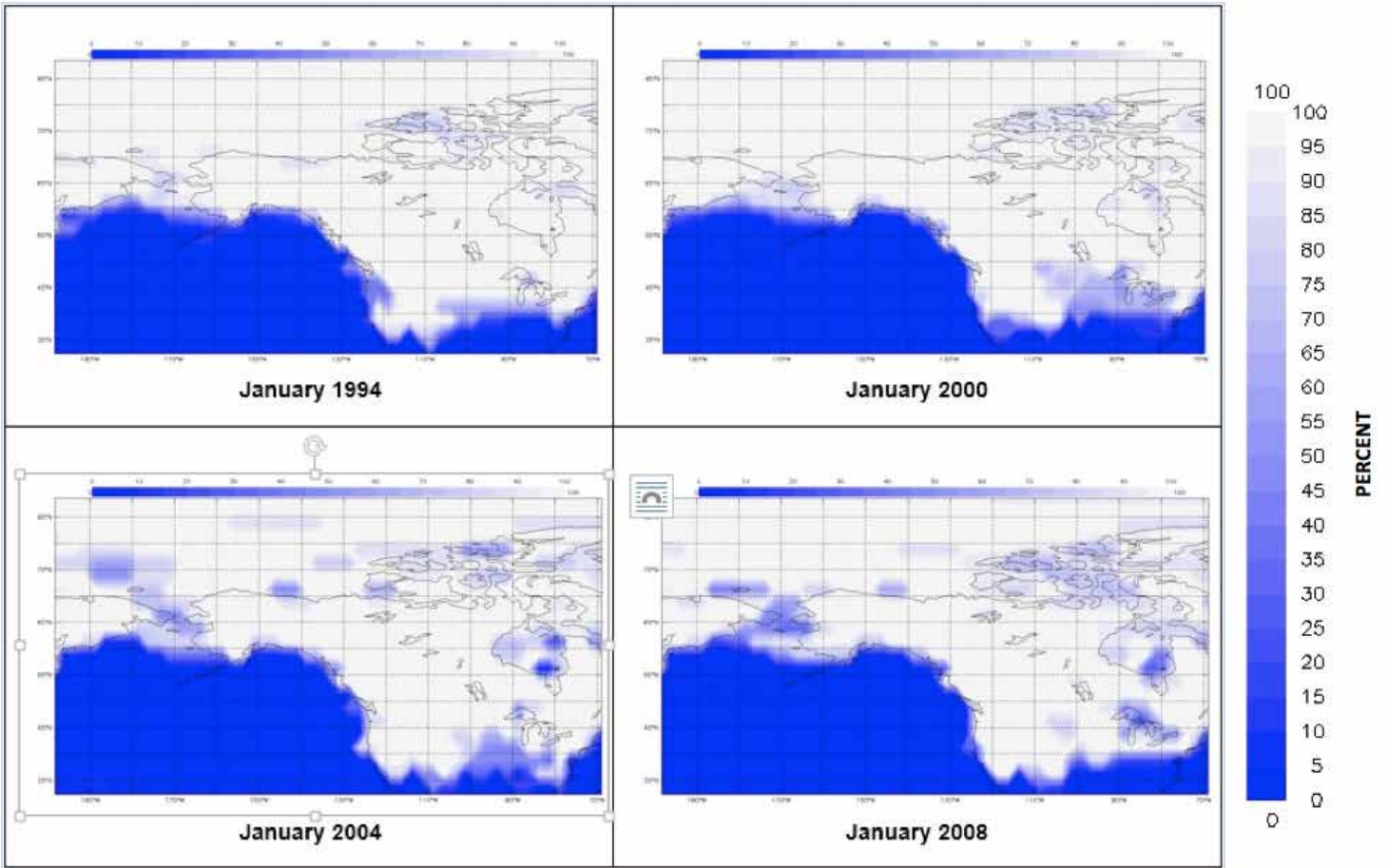
THE YEARS OF LIVING DANGEROUSLY - EDUCATIONAL COMPANION

Why She's Involved: "If we don't like the long-term climate forecast of a hotter, more extreme world – we can change it. We can choose to be smarter about the way we use energy, manage our natural resources and grow our food. We know how to protect our climate and slow the damage that has been done." Learn more about Dr. Heidi Cullen. [<http://yearsoflivingdangerously.com/science-advisor/heidi-cullen-ph-d/>]

- **Climatologist or Atmospheric Scientist** – www.bls.gov/ooh/life-physical-and-social-science/atmospheric-scientists-including-meteorologists.htm Atmospheric scientists study the weather and climate and how it affects human activity and the earth in general. They may develop forecasts, collect and compile data from the field, assist in the development of new data collection instruments, or advise clients on risks or opportunities caused by weather events and climate change.
- **Glaciologist** – www.eco.ca/occupationalprofiles/profiles/glaciologist/25/ Glaciology is the study of snow and ice and their physical properties. More specifically, glaciologists analyze the formation, movement, and effects of the different kinds of glaciers, for example alpine and arctic glaciers, ice caps, ice sheets, and ice shelves. A large part of the research conducted by glaciologists analyzes how glaciers and ice caps move and change in response to climate change and how these changes in turn influence climate and the surrounding environment.
- **Renewable Energy Engineer** – www.bls.gov/ooh/architecture-and-engineering/electrical-and-electronics-engineers.htm the promise of sustainable power depends on our ability to harness renewable resources like wind, sunlight, biofuels, geothermal heat and rivers. The technology needed to harness these natural energy is continually improving, but the demand for workers who can lead us toward a sustainable energy future has far exceeded the supply.



ISCCP Satellite – Monthly Snow/Ice Amount



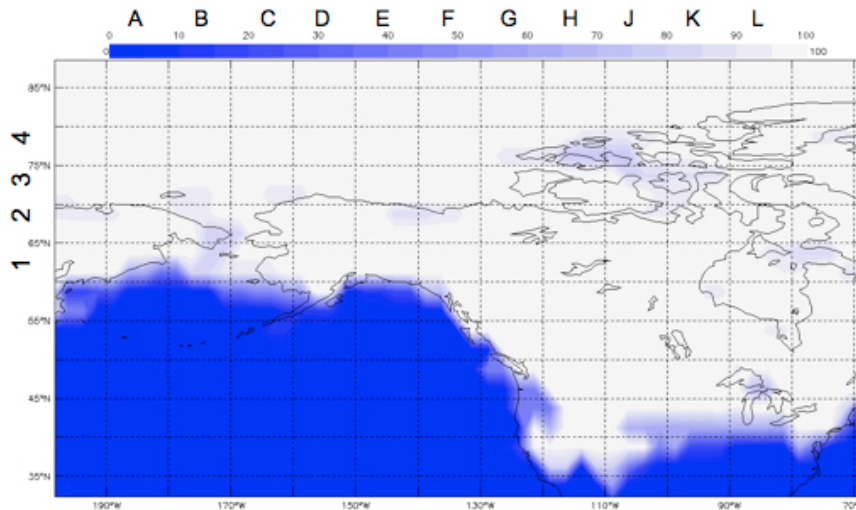
THE YEARS OF LIVING DANGEROUSLY - EDUCATIONAL COMPANION

Name: _____

Date: _____

Monthly Snow/Ice Amount – Percent Change Data Sheet

Please label all your maps as follows...



Special Note – The amount of snow/ice in each box is only an estimated percentage.

1994		2000		2004		2008	
4A 100%	2A _____	4A 100%	2A _____	4A 10%	2A _____	4A 100%	2A _____
4B _____	2B _____	4B _____	2B _____	4B _____	2B _____	4B _____	2B _____
4C _____	2C _____	4C _____	2C _____	4C _____	2C _____	4C _____	2C _____
4D _____	2D 90%	4D _____	2D 100%	4D _____	2D 100%	4D _____	2D 95%
4E _____	2E _____	4E _____	2E _____	4E _____	2E _____	4E _____	2E _____
4F _____	2F _____	4F _____	2F _____	4F _____	2F _____	4F _____	2F _____
4G _____	2G _____	4G _____	2G _____	4G _____	2G _____	4G _____	2G _____
4H _____	2H _____	4H _____	2H _____	4H _____	2H _____	4H _____	2H _____
4J _____	2J _____	4J _____	2J _____	4J _____	2J _____	4J _____	2J _____
4K _____	2K _____	4K _____	2K _____	4K _____	2K _____	4K _____	2K _____
4L _____	2L _____	4L _____	2L _____	4L _____	2L _____	4L _____	2L _____
3A _____	1A _____	3A _____	1A _____	3A _____	1A _____	3A _____	1A _____
3B _____	1B _____	3B _____	1B _____	3B _____	1B _____	3B _____	1B _____
3C _____	1C _____	3C _____	1C _____	3C _____	1C _____	3C _____	1C _____
3D _____	1D 100%	3D _____	1D 80%	3D _____	1D 95%	3D _____	1D 90%
3E _____	1E _____	3E _____	1E _____	3E _____	1E _____	3E _____	1E _____
3F _____	1F _____	3F _____	1F _____	3F _____	1F _____	3F _____	1F _____
3G _____	1G _____	3G _____	1G _____	3G _____	1G _____	3G _____	1G _____
3H _____	1H 100%	3H _____	1H 100%	3H _____	1H 100%	3H _____	1H 100%
3J _____	1J _____	3J _____	1J _____	3J _____	1J _____	3J _____	1J _____
3K _____	1K _____	3K _____	1K _____	3K _____	1K _____	3K _____	1K _____
3L _____	1L _____	3L _____	1L _____	3L _____	1L _____	3L _____	1L _____

THE YEARS OF LIVING DANGEROUSLY - EDUCATIONAL COMPANION

Percent change from 1994 to 2008 4A-4L = _____

Percent change from 1994 to 2008 3A-3L = _____

Percent change from 1994 to 2008 2A-2L = _____

Percent change from 1994 to 2008 1A-1L = _____

Total, all map percent change 1994-2008 = _____

Answer in your science notebook.

1. How has snow/ice coverage changed over time for Northern Chukchi Sea, Beaufort Sea and the Northwest Passage? Explain how you know?
2. What are limitations to the process used for looking at how snow and ice have changed over time?
3. What role could albedo have played in this change from 1994 to 2008. What would you expect this same area to look like today? Explain.
4. Explain how changes in snow/ice amounts could affect the following systems:
 - Wildlife
 - Communities in the region
 - Economy locally and globally



A LOOK INSIDE SCIENTIFIC ARTICLES

DIRECTIONS

REQUIREMENTS

- Using the Student Reading Resources or articles that you allow students to use related to the topic; write a summary meeting the following guidelines.
 - Whole page
 - Double spaced
 - 12pt font size
 - Times New Roman/Calibri/Arial font
- Do not** print out the article. At the end of your summary write an endnote with the correct **bibliographic information**//www.easybib.com/ for your article.

ARTICLE SUMMARY FORMAT

1. Name, date, class, and period

2. Paragraph #1-Introduction

- What is the title of the article (should be in quotes or italics)?
- Who is the author?
- What source or publication did the article come from?
- What is the date of the article?
- Write one to two sentences about what the article is about

3. Paragraph #2-Summary (Abstract) of Article

- Give a summary of the article; what is the article about?
- If necessary, you can write more than one paragraph summarizing the article

4. Paragraph #3- What did you think of the article (critique)

- Do you agree or disagree with the author(s)?
- Did it support or change your opinion of the topic; if not, why or if so, how?
- Did the writer demonstrate that he/she did sufficient research?
- What were some of the facts? Opinions? Any bias?

5. Paragraph #4-Conclusion

- What are your reasons for choosing your particular article and how does it relate to what we are studying now?

THE YEARS OF LIVING DANGEROUSLY - EDUCATIONAL COMPANION

ARTICLE SUMMARY RUBRIC				
CATEGORY	4	3	2	1
Requirements	All written requirements completed accurately and turned in on time.	4 of the 5 requirements were met	3 of the 5 requirements were met.	Only 1 or 2 requirements met.
Spelling, Grammar, and Punctuation	There are no spelling, grammar, or punctuation errors in the summary. <i>Run spell check before printing!</i>	There are no more than 2 spelling, grammar, or punctuation errors in the summary.	There are 3-4 spelling, grammar, and punctuation errors in the summary.	The summary has 5 or more spelling, grammar, and punctuation errors in the summary.
Summary of Article	The summary covers all the main points of the article.	The summary covers all but one of the main points of the article.	The summary covers all but 2 of the main points of the article.	The article is not well summarized. Most main points are missing.
Critique	All four questions under "Critique" are answered clearly and completely.	Three questions under "Critique" are answered clearly and completely.	Two questions under "Critique" are answered clearly and completely.	One or none of the questions under "critique are answered.
Overall Paragraph Construction	All paragraphs include introductory sentence, explanations or details, and concluding sentence.	Most paragraphs include introductory sentence, explanations or details, and concluding sentence.	Paragraphs included related information, but were typically not constructed well.	Paragraphing structure was not clear, and sentences were not typically related within the paragraphs.

Self-Assessment: _____ Grade Equivalent: _____

Teacher Assessment: _____ Grade Equivalent: _____

Student and/or teacher comments:

Total Rubric Points	Grade Equivalent
16-20	A
11-15	B
6-10	C
1-5	F



THE YEARS OF LIVING DANGEROUSLY - EDUCATIONAL COMPANION

21st CENTURY SKILLS	NGSS SCIENCE AND ENGINEERING PRACTICES
LEARNING & INNOVATION	1 Asking Questions & Defining Problems
• Creativity and Innovation	2 Developing & Using Models
• Critical Thinking and Problem Solving	3 Analyzing & Interpreting Data
• Communication and Collaboration	4 Using Mathematics & Computational Thinking
INFORMATION, MEDIA, & TECHNOLOGY SKILLS	5 Constructing Explanations & Designing Solutions
• Information Literacy	6 Engaging in Argument from Evidence
• Media Literacy	7 Obtaining, Evaluating, & Communicating Information
• ICT (Information, Communications, and Technology Literacy)	
LIFE & CAREER SKILLS	
• Flexibility and Adaptability	
• Leadership and Responsibility	

NGSS HIGH SCHOOL

ECOSYSTEMS: INTERACTIONS, ENERGY, AND DYNAMICS

Students who demonstrate understanding can:

HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

EARTH'S SYSTEM

Students who demonstrate understanding can:

HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth's systems.

HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.

EARTH AND HUMAN ACTIVITY

Students who demonstrate understanding can:

HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems;

HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

THE YEARS OF LIVING DANGEROUSLY - EDUCATIONAL COMPANION

CCSS – ELA/LITERACY – HIGH SCHOOL – SCIENCE AND TECHNICAL SUBJECTS AND SOCIAL STUDIES

ENGLISH LANGUAGE ARTS – SCIENCE & TECHNICAL SUBJECTS

RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

CRAFT AND STRUCTURE

RST.9-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–12 texts and topics.

RH.9-12.4 Determine the meaning of words and phrases as they are used in a text, including vocabulary describing political, social, or economic aspects of history/social science.

INTEGRATIONS OF KNOWLEDGE AND IDEAS

RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

RST.9-10.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

RH.9-10.7 Integrate quantitative or technical analysis (e.g., charts, research data) with qualitative analysis in print or digital text.

RH.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.

RH.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claims.

RH.11-12.8 Evaluate an author's premises, claims, and evidence by corroborating or challenging them with other information.

THE YEARS OF LIVING DANGEROUSLY - EDUCATIONAL COMPANION

NCSS – HIGH SCHOOL

Culture

Learner will understand:

- That behaviors, values, and beliefs, of different cultures can lead to cooperation or pose barriers to cross-cultural understanding;
- That awareness and knowledge of other cultures is important in a connected society and an interdependent world;
- That the cultural values and beliefs of societies influence their analysis of challenges, and their responses to these challenges.

Learners will be able to:

- Construct reasoned judgments about specific cultural responses to persistent human issues;

Time, Continuity, and Change

Learners will understand:

- The importance of knowledge of the past to an understanding of the present and to informed decision-making about the future.

People, Places, & Environments

Learners will understand:

- The theme of people, places, and environments involves the study of the relationships between human populations in different locations and regional and global geographic phenomena, such as landforms, soils, climate, vegetation, and natural resources;
- Concepts such as: location, physical and human characteristics of national and global regions in the past and present, and the interactions of humans with the environment;
- Consequences of changes in regional and global physical systems, such as seasons, climate, and weather, and the water cycle;
- The causes and impact of resource management, as reflected in land use, settlement patterns, and ecosystem changes;
- The social and economic effects of environmental changes and crises resulting from phenomena such as floods, storms, and drought;
- The use of a variety of maps, globes, graphic representations, and geospatial technologies to help investigate spatial relations, resources, and population density and distribution, and changes in these phenomena over time.

Learners will be able to:

- Acquire, organize, and analyze geographic information from data sources, geographic tools and geospatial technologies such as aerial photographs, satellite images, geographic information systems (GIS) to determine patterns;
- Evaluate the consequences of human actions in environmental terms.

THE YEARS OF LIVING DANGEROUSLY - EDUCATIONAL COMPANION

NCSS HIGH SCHOOL *Continued*

INDIVIDUAL DEVELOPMENT AND IDENTITY

Learners will understand:

- That each individual has personal connections to time and place.

Learners will be able to:

- Discuss the nature of stereotyping, bias, altruism, and conformity in societies, and their implications for personal, group, and national relationships.

INDIVIDUAL, GROUPS, AND INSTITUTIONS

Learners will understand:

- How various forms of groups and institutions change over time;
- The impact of tensions and examples of cooperation between individuals, groups, and institutions, with their different belief systems;
- How the beliefs of dominant groups tend to become norms in a society;
- How groups and institutions work to meet individual needs, and can promote the common good and address persistent social issues.

PRODUCTION, DISTRIBUTION, AND CONSUMPTION

Learners will understand:

- Scarcity and the uneven distribution of resources result in economic decisions, and foster consequences that may support cooperation or conflict.

Learners will be able to:

- Ask and find answers to questions about the production and distribution of goods and services in the state and national, and in global context.

POWER, AUTHORITY, AND GOVERNANCE

Learners will understand:

- Mechanisms by which governments meet the needs and wants of citizens, regulate territory, manage conflict, establish order and security, and balance competing conceptions of a just society.

Learners will be able to:

- Analyze and evaluate conditions, actions, and motivations that contribute to conflict and cooperation among groups and nations.

SCIENCE, TECHNOLOGY, AND SOCIETY

Learners will understand:

- Science and technology have had both positive and negative impacts upon individuals, societies, and the environment in the past and present;
- That the world is media saturated and technologically dependent;
- Consequences of science and technology for individuals and societies;

THE YEARS OF LIVING DANGEROUSLY - EDUCATIONAL COMPANION

NCSS HIGH SCHOOL *Continued*

- Decisions regarding the uses and consequences of science and technology are often complex because of the need to choose between or reconcile different viewpoints;
- Developments in science and technology may help to address global issues.

Learners will be able to:

- Use diverse types of media technology to access, analyze, evaluate, create, and distribute messages;
- Identify and analyze reactions to science and technology from the past or present, and predict ongoing effects in economic, geographical, social, political, and cultural areas of life.

GLOBAL CONNECTIONS

Learners will understand:

- The solutions to global issues may involve individual decisions and actions, but also require national and international approaches (e.g. agreements, negotiations, policies, or laws);
- The actions of people, communities, and nations have both short – and long-term effects on the biosphere and its ability to sustain life;
- Individuals, organizations, nations, and international entities can work to increase the positive effects of global connections, and address the negative impacts of global issues.

CIVIC IDEALS AND PRACTICES

Learners will understand:

- The theme of civic ideals and practices helps us recognize where gaps between ideals and practices exist, and prepares us to work for social justice;
- That seeking multiple perspectives is required in order to effectively grasp the complexity of issues involving civic ideals and practices;
- The importance of becoming informed as the basis for thoughtful and positive contributions through civic action.

Learners will be able to:

- Ask and find answers to questions about how to become informed and take civic action;
- Research primary and secondary sources to make decisions and propose solutions to selected civic issues in the past and present;
- Identify assumptions, misconceptions, and biases in sources, evidence, and arguments used in presenting issues and positions.



Resources and Links

- Department of Labor Statistics. www.bls.gov/ooh/home.htm
- Earth's Energy Budget. http://science-edu.larc.nasa.gov/energy_budget/
- Eco Canada: Environmental Careers Organization. www.eco.ca/occupationalprofiles/profiles/glaciologist/25/
- EPA: Coal. www.epa.gov/cleanenergy/energy-and-you/affect/coal.html
- Facts About Niagara Falls. www.niagarafallslive.com/facts_about_niagara_falls.htm
- My NASA Data – Live Access Server – Climate Change. mynasadata.larc.nasa.gov/live-access-server/
- National Snow & Ice Data Center. <http://nsidc.org/>
- Niagara Falls Geology Facts & Figures. www.niagaraparks.com/about-niagara-falls/geology-facts-figures.html
- PBS LearningMedia – Earth's Albedo and Global Warming. www.pbslearningmedia.org/resource/ipy07.sci.ess.watcyc.albedo/earths-albedo-and-global-warming/
- Union of Concerned Scientists: Water for Coal. www.ucsusa.org/clean_energy/our-energy-choices/energy-and-water-use/water-energy-electricity-coal.html