



Study Guide Pilot 2015

CLIMATE CHANGE

B I O N E E R S S T U D Y G U I D E 1

Working collectively in crafting creative solutions to pressing environmental and biocultural challenges. Join us in the global conversation on the future of our world and our role in shaping it.



INTRODUCTION

FEATURING BIONEERS BILL MCKIBBEN & MICHAEL BRUNE

THE BIONEERS



BILL MCKIBBEN

The Climate Fight Gets Hotter

Bill McKibben is the Founder of 350.org, the first planet-wide, grassroots climate change movement.

MICHAEL BRUNE

emPOWERed

Michael Brune is the Executive Director of The Sierra Club, as well as an author, speaker, and active environmentalist.

CLIMATE CHANGE

Definition:

n., because Earth's climate is never static, the term is properly used to imply a significant change from one climatic condition to another and often used synonymously with "global warming." Scientists can use "climate change" in the wider sense to also include natural changes in climate.

TOPIC OVERVIEW



When Russian cosmonaut Yuri Gagarin became the first man in space and orbited Earth, he exclaimed, “I see Earth! It is so beautiful!” This took place in 1961. Fast forward several decades and Earth is still beautiful, but at risk. Earth itself is complex, but self-sustaining. Various human actions have led to the pollution of its water and air, the contamination of its soil, and, ultimately, a change in the very processes that help make Earth home for so many lives.

Although climate change is often seen as a controversial subject, the science and evidence is hard to ignore. Some lakes and rivers are drying up while others experience higher amounts of flooding. Plants and animals unable to adapt to their changing surroundings must fight for their survival. Storms, droughts, wildfires, and record temperatures are increasing in frequency. The ocean, which covers more than 70% of Earth’s surface, has become more and more acidic as time goes on.

It is true that human activities and our ‘need’ for fossil fuels are largely to blame for climate change. It is also true that human actions can help. Recycle. Use renewable energy sources. Grow (even some of) your own food. Walk or bike more often. Small, positive steps are still progress. As Carl Sagan said, “Anything else you are interested in is not going to happen if you can’t breathe the air and drink the water. Don’t sit this one out. Do something.”



INTRODUCTION



Climate change is a topic about which almost everyone has an opinion — some know it to be true while others deny its reality. The fact is that living with the dire effects of climate change will not depend on belief or disbelief, nationality, social status, race, creed, age, location, or educational background. The only requirement to experience the repercussions of man's unintentional damaging actions to the climate is to be a citizen of Earth.

Scientific facts point to a dismal future for man and our home if we do not prevent the raising of Earth's temperature by a mere 1 degree. Reducing, and eventually eliminating, use of fossil fuels is our only recourse since it was (and is) their extraction and use that created and continues our current quandary.



INTRODUCTION



As always, when things get rough, some passionate souls enter the arena and willingly give their time, energy, and spirit to make things right. Fortunately for all of us, many are taking on this daunting task. Thankfully, that group includes the tireless, passionate, dedicated, and determined Bill McKibben and Michael Brune.



Bill McKibben's mode of operation is one of educating and organizing. He has authored more than a dozen books and started 350.org to help people join the global climate movement. He and his staff have organized everything from grassroots coalitions to civil disobedience demonstrations (e.g. over 1,200 peaceful demonstrators around the White House in 2011 and over 15,000 rallies in 188 countries since 2009). McKibben is determined to educate the masses not only so they know what's going on and what the future might hold, but to enlist their help in fighting the "power that doesn't yield easily." He is a peaceful warrior who knows this is not one man's battle. It will take everyone doing his or her part to win.



As Executive Director of Sierra Club, Michael Brune's approach to alleviating the global problem of climate change is often through the legal system. Petitions have already retired 190 coal plants. Lobbying while at Rainforest Action Network stopped Home Depot and similar stores from using lumber from old-growth forests. Barnstorming has led to education of locals, organization of coalitions, and furthering of the movement. Beneath all of this activity is a fear—a fear of the kind of world and life his and our children will inherit. Yet as great as that fear is, it is no match for his passionate drive and dogged determination to make sure his/our children and grandchildren will always experience the beauty of our world. He speaks with genuine emotion---an emotion that draws all ages to join the global movement.

Two men, two approaches. Yet both capture people's attention, draw them to action, and open their hearts to the fight for the planet and our future. They make it personal. They make it scary. Yet both let us know it's possible to win this fight of a lifetime.

As Bill McKibben said, "...when I look at people all over the world now engaged in this fight, some part of me really likes our odds."



Map revealing progression of changing global surface temperatures from 1880 to 2005.

BILL MCKIBBEN

THE CLIMATE FIGHT GETS HOTTER

BIONEER: BILL MCKIBBEN



BILL MCKIBBEN

Author & Environmentalist

Bill McKibben is a globally renowned author and journalist whose primary focus since the late 1980s has been climate change. After writing his first book, *The End of Nature*, the first major popular text on the subject in 1989, he has gone on to write many tomes, including *Eaarth*, and to found 350.org, a groundbreaking global NGO seeking to build a worldwide citizen movement to shift climate policy and move to clean energy that has coordinated 15,000 rallies in 188 countries since 2009. In 2010, the Boston Globe called him "probably the nation's leading environmentalist" while Time magazine described him as "the world's best green journalist."

VIDEO: THE CLIMATE FIGHT GETS HOTTER



Movie 2.1 The Climate Fight Gets Hotter



BILL MCKIBBEN

In early May of 2013, we learned that we'd reached the frightening benchmark in human history of 400 ppm of carbon dioxide in Earth's atmosphere. This goes beyond the tipping point of 350ppm that Bill McKibben has been warning about for years. It seems timely to revisit Bill's plenary talk at the 2012 Bioneers Conference, *The Climate Fight Gets Hotter*.

In this video, Bill offers up not only a warning to us all to get more serious about our involvement in the climate movement, but gives a shot of optimism that we're not alone, that we have a wide, diverse, and beautiful beloved international community committed to healing our planet.

The award-winning environmental journalist, author, Co-Founder of 350.org, and leading global climate activist surveys the landscape of climate action, including the remarkable holding action by 350.org and others to suspend approval of the Keystone XL pipeline carrying Canadian "tar sands" oil, the "biggest carbon bomb" on the planet.

FACTS & STATISTICS



Stated Fact or Statistic	Update, More Information, and/or Source
Over the past five years, "for the first time in 150 years, there are more farms instead of fewer in the United States."	Likely speaking of data from 2007's USDA AgCensus Report when the number of U.S. farms increased from 2.13 million to 2.20 million (agcensus.usda.gov). The number of farms has since decreased to 2.11 million according to the 2012 AgCensus Report. ³
"By the end of this summer (2012), there was about 75% less ice by volume in the Arctic than there had been 40 years ago."	Arctic Ice extent (growth and retreat) differs annually. Updated numbers from the IPCC report suggest anywhere from 36.6% to 54.4% less ice over the past 40 years. ⁴ Higher levels in 1972 and the fact the summer of 2012 saw a large drop (then record low) in Arctic Ice volume likely explains McKibben's statement, although he could have been speaking about a particular location or type of Arctic Ice (ice sheets, etc.).
"Scientists are very clear that unless we get off coal and and gas oil far more quickly than any government now plans, that 1° will be 4° or 5° before the century is out."	According to the World Bank Group's report <i>Turn Down the Heat</i> published 11/23/14, "Without concerted action to reduce emissions, the planet is on pace for 2°C warming by mid-century and 4°C or more by the time today's teenagers are in their 80s." ⁵
Agronomists from Stanford in 2011 said "simply that rise in temperature from this point on, each degree in global average temperature should cut grain yields around the world about 10%."	Updated numbers published in the journal <i>Nature Climate Change</i> in 2014 indicate a 6% decrease (1.6 billion bushels according to the USDA) in wheat production for each 1°C increase in global temperatures. ⁶
Regarding the Maldives, "the highest point in that country is a couple of meters above sea level."	The Maldives is a group of ~1,200 coral islands (atoll) with the highest point in the country being not quite 8 ft. (~2.4 m), which is the 'Lowest Highest Point in the World.'
"Exxon made more money last year (2011) than any company in the history of money."	ExxonMobil made \$41.1 billion in 2011, which was the largest profits of the Big Five oil companies (ExxonMobil, Shell, Chevron, BP, ConocoPhillips). According to ExxonMobil, 2014 profits were \$32.5 billion. ⁷
Keystone XL Pipeline demonstration	350.org organized a "sit in" in front of the White House from late August to early September 2011 as part of the Tar Sands Action. As of March 2015, President Obama vetoed a bill that would have approved construction of the Pipeline and the Senate was unable to overturn the veto.
"The world has agreed...that 2°C rise would be too much. Everybody has signed off on that, even the US."	This statement agrees with the IPCC Summary (IPCC AR5), which was established by the United Nations Environment Programme and the World Meteorological Organization and contributed to by scientists from over 80 countries. ⁴
"We know how much more carbon roughly we can put out into the atmosphere and have any hope of staying below 2°C. It's about 560 more Gigatonnes (Gt)." (Stated in 2012)	This statement supported by information from the April 2009 <i>Nature</i> article " Greenhouse-Gas Emission Targets for Limiting Global Warming to 2°C " written by a group of researchers from Germany, the UK, and Switzerland and led by Malte Meinshausen , a climatologist at Germany's Potsdam Institute for Climate Impact . ⁸ New estimates from the IPCC AR5 suggest emissions should remain below ~1,000 GtCO ₂ after 2011. ⁴
"Group of financial analysts in the UK added up how much carbon all the fossil fuel companies in the world had and the number they came up with was ~2,800 Gt in their reserves."	From the Carbon Tracker Initiative's report <i>Unburnable Carbon</i> published in 2011: "The world's top 200 fossil fuel companies have 2,795 Gt of CO ₂ trapped in their fossil fuel reserves — and that didn't include sources such as the tar sands, oil shale, or methane hydrates." ⁹
Dead Sea's change in water level	In 1930, the Dead Sea was 1,280 ft below sea level. In 2008, it was 1,381 ft below sea level. In 2014, it was 1,403 ft below sea level. (changes: 101 then 22) ¹⁰

VIDEO GUIDE



- Beginning: Introduction by Kenny Ausubel
- Bill McKibben ~4:20
- USDA on Farm Statistics ~5:30
- “We’re losing.” ~7:20
- Arctic Ice ~8:10
- Vast Oceans & pH Strips ~8:35
- “Hot, sour, and breathless” ~9:00
- Holocene Period ~9:20
- “Loaded the Dice” ~9:45
- Increase of Earth’s Temperature by 1° ~10:30
- “The biggest thing that human beings have ever done...” ~11:20
- 350.org beginning and demonstrations ~11:40
- Ethiopian Demonstration ~12:40
- “Educational net” and Flickr pictures ~13:30
- Various Descriptions of “Environmentalists” ~14:40
- Maldives ~15:50
- “Our leaders are not getting the job done...” ~16:30
- “Power doesn’t yield easily...” ~17:10
- Exxon ~17:40
- Pipeline Demonstrations ~18:10
- “A temporary win...” ~19:00
- James Hansen and the Tar Sands ~19:35
- Other currencies ~20:00
- “Cannot stop global warming...” ~20:30
- 2° Rise, math, and carbon reserves ~21:20
- “Rogue Industries” ~23:15
- 350.org Future Plans, Message, and “Moral Crisis” ~24:00
- Call to Action ~26:30
- Dresses, Neckties, and “Radicals” ~28:30

DISCUSSION GUIDE



THE CLIMATE FIGHT GETS HOTTER

General Questions

Refer to specific points, questions, and issues highlighted in the video



Insight Topics

Topics that touch on current issues for discussion that cross academic disciplines

Critical Thinking Questions

Questions that encourage students to think beyond the page and the video to address issues and find creative solutions

Conversation & Paper Starters

Topics that could be posed for a class discussion or as a thesis for an individual paper or group report

GENERAL QUESTIONS



1. How is an increase in farms in the U.S. beneficial to the earth? To the economy?
2. When was the *End of Nature* written?
3. What did McKibben mean by the phrase “loaded the dice” in regard to climate change?
4. List multiple examples of how McKibben implied that environmentalism is not something only “rich, white people do.” Why is this important? Specify five to eight different groups of people mentioned.
5. Although the Ethiopian demonstration was 10,000 strong, why was the leader upset with its timing?
6. In your own words, describe the “educational net” and explain its importance.
7. According to James Hansen, what would mean “Game Over for the climate?”
8. Scientists agree that a two degree rise in the global temperature would be devastating for Earth’s climate. Describe several changes that would likely come about due to this increase.
9. Explain why climate change can be viewed as a “moral crisis.”
10. What is the significance of McKibben’s request that demonstrators in Washington, DC wear a necktie or dress?

INSIGHT TOPICS



1. To what do the terms “hot, sour, and breathless” refer? Explain the significance of each descriptor.
2. Why is it imperative for people to act now?
3. Why do you think McKibben stated that a temporary win is “the only kind of win environmentalists ever get.”
4. Why does McKibben consider fossil fuel industries “rogue industries” and “outlaws.”
5. What did McKibben mean when he said the Holocene “underwrote the rise of human civilization?”
6. Do you agree with McKibben’s method (i.e. civil disobedience) to bring about progress for the Climate Change movement?
7. List several sites in addition to the Maldives that are at risk for flooding due to even a small rise in sea level.

CRITICAL THINKING QUESTIONS



1. McKibben said, “The tough part, of course, is in realizing there are fifty other things like those Tar Sands around the world.” Why did he describe this as “tough?” Do you feel the Tar Sands are worth protecting? Why or why not? Fully support your stance.

2. Explain the following quotes and answer the questions:

“I don’t know for sure that we’re gonna win this fight, but I know that we’re gonna fight it.”

“Some part of me really likes our odds.”

Although these suggest different possible outcomes, why do you believe McKibben included both in his speech? Do you believe this fight can be won? Why or why not?

3. In addition to Arctic ice and the oceans mentioned in the video, name two or three other “Great Physical Features of the Earth?” Defend your choices.
4. McKibben stated, “Power doesn’t yield easily, it turns out. If it did, we would have won this fight long ago. For two decades, scientists and economists and everybody else had been saying ‘Here’s what we need to do: We need to put a price on carbon. We need to quickly move to renewable energy. We need to move fast because we have no other choice.’” Do you agree progress to decrease human’s effect on climate change has been slow? Justify your response. If you agree, why do you believe it has taken so long to gain movement even though many people believe this topic is vitally important?

CONVERSATION & PAPER STARTERS



1. McKibben has said, “Climate change is the single biggest thing humans have ever done on this planet. The only thing that needs to be bigger is our movement to stop it.” Do you agree or disagree? Support your answer using at least three examples.
2. Analyze several alternative sources or methods that could be used to replace fossil fuels.
3. Based on research of the current rate of global climate change, predict how it will affect your region by 2050. By 2100?
4. Discuss the different points of view between those living in developed countries and those in less-developed countries in regard to climate change policies on carbon emissions.



MICHAEL BRUNE

EMPOWERED

BIONEER: MICHAEL BRUNE



MICHAEL BRUNE

Author & Environmentalist

Michael Brune is the Executive Director of the Sierra Club, America's largest and most influential grassroots environmental organization. Brune's first environmental job was as an organizer for Greenpeace. In 1998, Brune joined Rainforest Action Network, where he ultimately served for seven years as Executive Director.

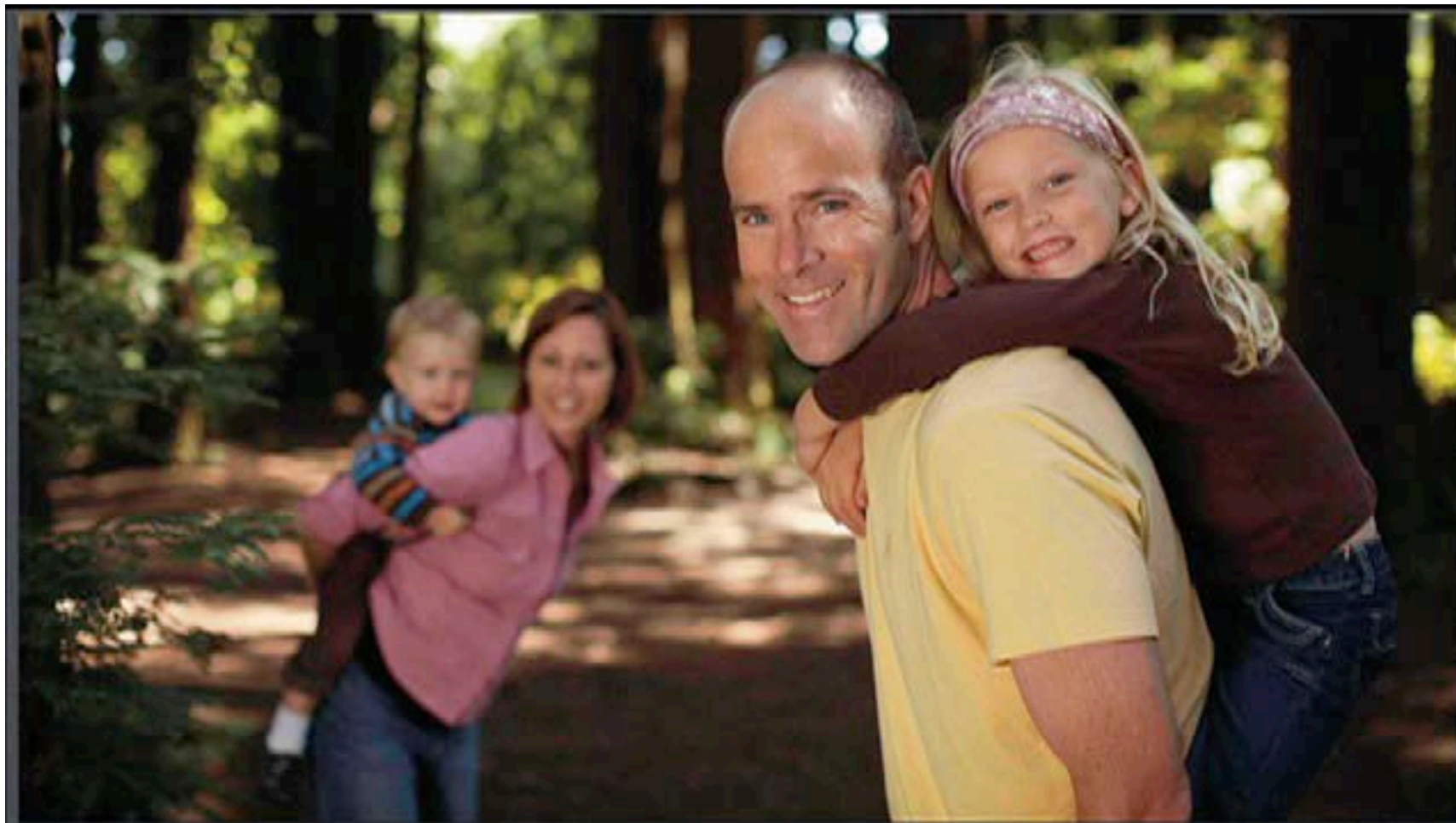
In 1999, while working at Rainforest Action Network, Michael Brune ran a successful campaign that pressured Home Depot stores to stop purchasing and selling wood from old-growth forests. Time magazine listed this as its top environmental story of that year.

He is a regular contributor to the Huffington Post and Daily Kos. In 2008 he published the book, *Coming Clean — Breaking America's Addiction to Oil and Coal*.

VIDEO: EMPOWERED



Movie 3.1 emPOWERed



Plenary Speech by MICHAEL BRUNE from 2012.
Introduction by James Gollin, Rainforest Action Network Chair of the Board.

MICHAEL BRUNE

Hungry for good news? Sierra Club Executive Director Michael Brune tells the story of how an inspiring grassroots coalition has achieved hundreds of victories against Big Coal over the last several years. He depicts a new, localized approach to fighting climate change effectively and outlines what each of us can do to help clean energy such as solar and wind become the dominant source of power by the end of this decade.

FACTS & STATISTICS



Stated Fact or Statistic	Update, More Information, and/or Source
"Because water temperature around the world has warmed so much, we now can expect 100-year hurricane events every 10 years — hurricane-like, powerful storms will be happening with more frequency and more intensity."	This study by a group of international researchers supports the idea that an increase in global temperatures (and, thus, a change in regional sea surface temperatures) is the primary cause of hurricane variability. ¹¹ An increase in Earth's temperature will likely cause more destructive storms.
"In Beijing, 21" of rain fell in just a few hours."	Although measurements varied by area, the final rainfall measurement for Beijing's Fangshan district was 18.1 inches in less than a day. ¹²
"In Burma and Thailand, 100,000 people killed because of violent and extreme storms." & "In Bangladesh, there has been almost permanent flooding that's displaced 100s of 1,000s of people...that's happening every year."	Due to geography and other factors, Thailand, Burma (Myanmar), and Bangladesh have experienced worsening storms and/or flooding that have affected more people in recent years.
"...some of the worst wildfires in our (United States') history."	According to NOAA's National Climatic Data Center, Texas had more than 10,600 wildfires in 2012. Over 1.5 million acres burned in Idaho and more than 1.2 million acres in both Oregon and Montana. In 2012, the High Park Fire was the second largest fire in Colorado's history and the Waldo Canyon Fire was considered the state's most destructive. ¹³
"Sixty percent of our country facing severe drought. This doesn't just impact water supplies. It impacts farmers; it impacts food supplies, the stability of how we relate to each other as a country and around the world. Shortages of corn, wheat, and soybeans are exacerbating world hunger, driving up food prices."	Also according to NOAA, by the end of September 2012, around 64.6% of the contiguous U.S. (~54% of the U.S. and Puerto Rico) was experiencing 'moderate-to-exceptional' drought. ¹⁴
"More than 400,000 people died because of climate-related causes in 2010."	From the World Health Organization: "Measuring the health effects from climate change can only be very approximate. Nevertheless, a WHO assessment, taking into account only a subset of the possible health impacts, and assuming continued economic growth and health progress, concluded that climate change is expected to cause approximately 250,000 additional deaths per year between 2030 and 2050; 38,000 due to heat exposure in elderly people, 48,000 due to diarrhea, 60,000 due to malaria, and 95,000 due to childhood undernutrition." ¹⁵
James Hansen believes coal is the biggest contributor to climate disruption.	As suggested in "Coal-fired power stations are death factories. Close them." ¹⁶
"We have already reduced them (greenhouse gas emissions) to 1992 levels."	According to the U.S. Energy Information Administration, U.S. CO2 emissions due to the consumption of coal were ~1,822 million metric tons in 1992 and ~1,656 million metric tons in 2012. ¹⁷
"According to the International Energy Agency, the United States, over the last six years, we have reduced greenhouse gas emissions more than any other country on the planet."	According to the U.S. Energy Information Administration, total CO2 emissions from the consumption of energy fell by 653 million metric tons between 2006 and 2012. ¹⁷
"In Iowa, windmills are now supplying more than 25% of our power, the entire state."	As of 2013, Iowa generated 27.4% of the state's energy through wind power. (Source: American Wind Energy Association) ¹⁸
"In South Dakota, it's almost 30%."	South Dakota received 26% of the state's energy from wind power in 2013. ¹⁸
"Nine states across the country get at least 10% of their power from wind."	In 2013, Oregon, Idaho, Colorado, Oklahoma, Kansas, North Dakota, South Dakota, Minnesota, and Iowa generated more than 10% of their state's energy requirements through wind power. ¹⁸
"On sunny days in Germany this summer (2012), they were getting 50% of their power coming from the sun."	Germany's solar power generated the equivalent of 50.6% of the country's required energy on June 9, 2014. ¹⁹
In 2012, "the second largest wind farm in the country, Shepherds Flat, was installed and finalized in Oregon..."	Shepherds Flat has 338 wind turbines and generates ~845 megawatts of power — the equivalent of more than 220,000 homes. ²⁰
chemical plant in Toms River, NJ	According to the EPA, a plant that manufactured dyes, pigments, resins, and epoxy was located in Toms River, NJ. The processing waste (containing potentially harmful contaminants) was disposed of onsite and seeped into the ground water. ²¹

VIDEO GUIDE



- Beginning: Introduction by James Gollin, President of Rainforest Action Network's Board
- Michael Brune ~4:30
- Thanks, speech ~5:50
- On talking with kids about climate change ~6:50
- Other climate change scientists and advocates ~8:15
- Various Examples of the Effects of Climate Change ~8:45
- "The threat of climate disruption is real." ~10:40
- "These are villains in the story..." ~11:00
- "Clean Energy Prosperity" ~12:00
- "Tipping Point" ~12:30
- "The future has become the present." ~12:50
- Bush-Cheney administration ~13:30
- "Coal is dirty..." and James Hansen on coal ~14:30
- Sierra Club's fight against coal plants ~15:00
- Expanding the fight and "Barnstorming" ~16:15
- Sierra Club and Building the Coalition ~17:10
- Victories ~18:00
- Greenhouse Gas Emission Statistics ~19:50
- "Once we start, we're not gonna go back." ~20:10
- Fracking ~20:50
- Tar Sands Pipeline and Tea Party ~21:30
- "A movement of people, of humans." ~22:00
- "The spell has been broken." ~22:20
- "We want to burn less and collect more." ~23:20
- Obligation vs Opportunity ~24:20
- Shepherds Flat ~25:00
- "Don't believe folks..." ~26:00
- New Jersey Beach and Toms River ~27:00
- "Industrial-sized story of redemption" ~28:45
- Hope and "We can accomplish so much." ~29:10

DISCUSSION GUIDE



EMPOWERED

General Questions

Refer to specific points, questions, and issues highlighted in the video



Insight Topics

Topics that touch on current issues for discussion that cross academic disciplines

Critical Thinking Questions

Questions that encourage students to think beyond the page and the video to address issues and find creative solutions

Conversation & Paper Starters

Topics that could be posed for a class discussion or as a thesis for an individual paper or group report

GENERAL QUESTIONS



1. Explain what Brune meant by “Clean Energy Prosperity.”
2. List several effects mentioned in the video due to Earth’s temperature rising one degree.
3. Droughts are one of the obvious results of climate change. List several impacts of droughts.
4. Explain what Brune meant when he stated, “Coal is dirty. It’s dangerous. It’s deadly.”
5. Describe “barnstorming.” Do you believe it is an important and legitimate method toward progress?
6. Give a brief summary of the Sierra Club’s fight against coal.
7. To what was Brune referring when he said, “Once we start, we’re not gonna go back.”
8. Fully explain “Burn Less. Collect More.”
9. In your own words, define “cancer cluster.”
10. Identify and summarize the “Industrial-sized story of redemption” mentioned in the video.
11. Brune mentioned multiple positive outcomes in the fight against climate change. List several.

INSIGHT TOPICS



1. Compare climate disruption and climate change.
2. James Hansen calls coal “the biggest contributor to climate disruption all around the world.” Give several examples that support this statement.
3. What do you think Brune meant when he stated, “The spell has been broken?” Who cast it? How was it cast? Who broke it? How?
4. Why is the mention of “Tea Party” both unexpected and important?
5. Explain how the phrase “tipping point” relates to both climate change and renewable resources.
6. The U.S. has already “reduced greenhouse gas emissions more than any other country” when it comes to coal usage. Why is it important we continue doing so?

CRITICAL THINKING QUESTIONS



1. Brune clarified he was “not just throwing rhetoric at you.” Why is the inclusion of this statement important?
2. Compare the phrases “obligation to act on climate change” and “opportunity to invest in clean energy.”
3. Brune described the difficulties in explaining climate change and the present state of the world to children when he said, “How do you simultaneously present a very clear, realistic, rational look at the world but also let them know that they can change it, that their future isn’t sealed, that their fate is not predetermined?” Develop and outline the explanation you would give a child.
4. Do you believe it is an option to “plug our noses and wear wet suits” in regard to both water quality and climate change? Why or why not?

CONVERSATION & PAPER STARTERS



1. Construct an argument against coal plants as if you were a member of a fence line community group, an environmental justice group, and/or a healthcare professional. Defend your position.
2. Explain what Brune means by the statement, “The future has become the present.” Expand by detailing supporting examples.
3. Brune stated the following in reference to the Bush-Cheney administration: “We are still recovering from the effects of the worst environmental administration in our country.” Do you agree or disagree? Defend your position with supporting evidence.
4. Define and discuss fracking. Include both pros and cons in your description. Do you think fracking should be permitted? Why or why not?
5. “Don’t believe folks who say you’ve gotta have some coal, you’ve gotta have some nukes, you’ve gotta have some gas, you’ve gotta keep drilling for oil. Don’t believe it...It’s not true.” Do you agree? Why? Why not?



IN-DEPTH INQUIRY

TOPIC DISCUSSION GUIDE

DISCUSSION GUIDE



CLIMATE CHANGE



Insight Topics

Topics that touch on current issues for discussion that cross academic



Critical Thinking Questions

Questions that encourage students to think beyond the page and the video to address issues and find creative



Conversation & Paper Starters

Topics that could be posed for a class discussion or as a thesis for an individual paper or group report

INSIGHT TOPICS



1. In your own words, define sustainability as it pertains to Earth and climate change.
2. Explain the difference between weather and climate.
3. Briefly describe different ways in which humans contribute to climate change. (You may include both positive and negative actions that impact Earth's climate.)
4. Discuss why and how residents of different regions of the United States (or other countries) might evaluate energy policy proposals differently.
5. Regarding the fight to save the Tar Sands, Brune stated, "This is not just a movement of bay-area do-gooders. This is not just a movement of environmentalists. This is a movement of people, of humans. Full stop." Explain this quote. Do you believe McKibben would concur? Why or why not? Cite examples from both speakers.

CRITICAL THINKING QUESTIONS



1. Identify several actions you, your family, school, or community could take to help in the fight against climate change?
2. Compare and contrast both speakers' respective approaches to their environmental work.
3. If humans lose the fight against climate change, predict what Earth will be like (i.e. geography, meteorology, biology, philosophy, etc.).
4. In what ways do you think the fight against climate change has altered our perspective of and relation to Earth?

CONVERSATION & PAPER STARTERS



- What do you believe is the main culprit of climate change? Give supporting evidence.
- What do you believe is the most important part of Earth to start (or continue) protecting? Why?
- Meteorologist Edward Lorenz posited the question, “Does the flap of a butterfly’s wings in Brazil set off a tornado in Texas?” Apply the Butterfly Effect of Chaos Theory to climate change.
- Choose one (or more) of the following quotes and thoroughly explain what the author meant by it. Give supporting evidence.
 - “The oceans are our metaphor for vastness, for bigness. Twenty-five years ago it did not occur to us that we could do any damage to the oceans.” (McKibben)
 - “If you stick a pH strip out in the Pacific now it comes out a different color than it would have 30 years ago.” (McKibben)
 - “Though we lacked money, we could find other currencies: passion and spirit and creativity.” (McKibben)
 - “None of the things we are asking for are radical here. We’re asking for a world a little bit like the one we were born onto, the one that’s worked for the last 10,000 years. Maybe that’s even an almost conservative request.” (McKibben)
 - “We can’t stop global warming in the time that Physics and Chemistry allow us one pipeline at a time or one coal mine at a time or one anything at a time. We need to go straight at that industry — straight at it as hard as we can.” (McKibben)
 - “These are the villains in the story: these are the CEOs, the lobbyists, the politicians...the PR flacks, the media manipulators. These are the folks who are working relentlessly to make sure we are extending our dependence on fossil fuels, but what I want to say is that these folks and the mindset that they have, that they represent, they’re relics. These folks are hold outs. They represent a mindset that won’t survive in the 21st century.” (Brune)
 - “We should not underestimate these folks. They have a lot of power, but we have more.” (Brune)
 - “We don’t have to be hog-tied to a fossil fuel vision from back in the 19th century. We can accomplish so much.” (Brune)



STANDARDS

ALIGNING STANDARDS FOR COURSE INTEGRATION

ALIGNING STANDARDS



BIONEERS + STANDARDS

Bioneers' Study Guides Align with Standards

All Bioneers' Study Guides are aligned with national educational standards. Every video and corresponding Guide includes a detailed list of the specific standards met in each subject matter.

Given that the Study Guides offer many different avenues of inquiry and teachers can focus on various aspects of the material, not all standards listed may apply to the chosen discussion topics. However, all have been included for reference and convenience.

Included in this Study Guide:

- Next Generation Science Standards
 - National Geographic Standards
-

SCIENCE STANDARDS



Life Sciences

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. [Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.]

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* [Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]

HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.* [Clarification Statement: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.]

Earth's Systems

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 systems. [Clarification Statement: Examples should include climate feedbacks, such as how an increase in greenhouse gases causes a rise in global temperatures that melts glacial ice, which reduces the amount of sunlight reflected from Earth's surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the wetland extent.]

- Weather & Climate

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. [Clarification Statement: Examples of the causes of climate change differ by timescale, over 1-10 years: large volcanic eruption, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition.] [Assessment Boundary: Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.]



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. [Clarification Statement: Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition).] [Assessment Boundary: Assessment is limited to one example of a climate change and its associated impacts.]

- Human Sustainability

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. [Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]

HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.* [Clarification Statement: Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.]

HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. [Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.] [Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.]

HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.* [Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geo-engineering design solutions.]



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. [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.] [Assessment Boundary: Assessment does not include running computational representations but is limited to using the published results of scientific computational models.]

NATIONAL GEOGRAPHIC STANDARDS



Standard 3

How to analyze the spatial organization of people, places, and environments on Earth's surface

- Spatial Patterns and Processes

2. Complex processes change over time and shape patterns in the distribution of human and physical phenomena

Therefore, the student is able to:

A. Analyze and explain changes in spatial patterns as a result of the interactions among human and physical processes through time, as exemplified by being able to

- Analyze and explain the human and physical characteristics of regions that have changed over time because of the interaction among processes (e.g., local economic patterns shift as international trade relationships evolve because of global social events, local populations of particular species rise or fall because changes in climate affect the viability of a region for other species).
- Analyze vegetation maps for an area over different time periods and explain how changing patterns reflect changes in physical processes and human activities (e.g., desertification, deforestation, natural land cover, agricultural land use).
- Explain how changes in the physical environment, political environment, and conflict influence changes in economic activity within a region. (e.g., interruption of economic activities and trade patterns in Africa, migration of people to economic trade zones in China).

Standard 6

How culture and experience influence people's perceptions of places and regions

- Changes in the Perception of Places and Regions

2. Changing perceptions of places and regions have significant economic, political, and cultural consequences in an increasingly globalized and complex world

Therefore, the student is able to:

- A. Explain the possible consequences of people's changing perceptions of places and regions in a globalized and fractured world, as exemplified by being able to
- Explain how international alliance networks are responses to changing views about places and regions (e.g., North Atlantic Treaty Organization [NATO], European Union [EU], Organization of American States [OAS]).
 - Analyze the changes in the US perceptions of increasing consumer demand and consumption in emerging national economies, especially in such Asian nations as China, India, Singapore, and South Korea.
 - Explain the consequences of people's changing perceptions of places due to natural and human disasters (e.g., reevaluating the use of artificial levees in New Orleans after Hurricane Katrina in 2005, decreased tourism after the eruption of Indonesia's Mount Merapi in 2010, responses to terrorist attacks on the World Trade Center in 1993 and 2001).



Standard 7

The physical processes that shape the patterns of Earth's surface

- Components of Earth's Physical Systems

1. The interactions of Earth's physical systems (the atmosphere, biosphere, hydrosphere, and lithosphere) vary across space and time

Therefore, the student is able to:

A. Explain how the effects of physical processes vary across regions of the world and over time, as exemplified by being able to

- Explain the changing relationships among climate, vegetation, and landforms (e.g., desertification and soil degradation, glacial advances and retreats).
- Analyze and explain the differential effects on climate of the relationship between water and wind at different latitudes (e.g., cold currents influence the creation of deserts at 20 and 30 degrees north and south latitudes, the formation of hurricanes and tropical storms).
- Analyze and explain the relationships between physical processes and the location of land features (e.g., river valleys, canyons, deltas, glaciated lakes and moraines, limestone deposits, caves, alluvial fans, canyons).

B. Explain the ways in which Earth's physical processes are dynamic and interactive, as exemplified by being able to:

- Explain how volcanic eruptions and forest fires change atmospheric conditions and disrupt the nitrogen and carbon cycles.
- Explain how increasing surface temperatures result in melting ice sheets and rising sea levels.
- Construct a diagram illustrating how El Niño and La Niña form and how these influence weather in different locations on Earth.



Standard 14

How human actions modify the physical environment

- Modification of the Physical Environment

1. Human modifications of the physical environment can have significant global impacts

Therefore, the student is able to:

A. Explain the global impacts of human changes in the physical environment, as exemplified by being able to

- Explain the spatial consequences, deliberate and inadvertent, of human activities that have global implications (e.g., dispersal of plant and animal species, fungi, and disease worldwide; global petroleum production, transport, and consumption; global climate change).
- Explain how changes in human behavior can result in the introduction of aerosols into the atmosphere that have effects on a global scale (e.g., dust from Chinese agriculture and industry affecting Hawaii's weather, dust from the Saharan Africa affecting weather in Florida).
- Explain the implications of modifying the physical environment in Brazil to grow soybeans for global export (e.g., siltation, desertification, deforestation, global climate change).

- The Use of Technology

2. The use of technology can have both intended and unintended impacts on the physical environment that may be positive or negative

Therefore, the student is able to:

A. Evaluate the intended and unintended impacts of using technology to modify the physical environment, as exemplified by being able to

- Evaluate how the technologies used in petroleum production and transportation have expanded the scale of the industry from local or regional to global over the last century (e.g., offshore oil drilling, oil sands, supertankers, pipelines).
- Evaluate various types of contemporary agricultural techniques (e.g., no-till farming, herbicides, pesticides, center-pivot application of chemicals, crop rotation, irrigation, increased acreage in production), and compare the positive and negative implications of using these techniques.
- Evaluate the environmental impact of road building into remote locations (e.g., rain forests in Brazil, old growth forests in Oregon, agricultural land in China, Alaskan pipeline in the Arctic).



- Consequences for People and Environments

3. People can either mitigate and/or adapt to the consequences of human modifications of the physical environment

Therefore, the student is able to:

A. Describe and evaluate scenarios for mitigating and/or adapting to environmental changes caused by human modifications, as exemplified by being able to:

- Compare the costs and benefits of alternative solutions for a human-caused environmental problem, such as acid rain (e.g., coal with lower sulfur content, scrubbers on smokestacks, nuclear waste disposal, use of alternative energies) or urban heat islands (e.g., green roof construction, increased public transportation, energy efficient buildings).
- Explain and evaluate the policy implications of managing upstream development in relation to downstream impacts (e.g., flooding, dam construction or removal, zoning).
- Evaluate the feasibility, costs, and benefits of green construction techniques (e.g., Leadership in Energy and Environmental Design [LEED] certification) and describe how these efforts may increase sustainability and mitigate human impact on the physical environment.
- Construct a plan for a public-awareness campaign about a hazardous issue including suggestions for mitigation and adaptation (e.g., radon gas, potential flooding, lead paint, water quality, industrial pollutants).

Standard 16

The changes that occur in the meaning, use, distribution, and importance of resources

- Sustainable Resource Use and Management

3. Policies and programs that promote the sustainable use and management of resources impact people and the environment

Therefore, the student is able to:

A. Explain and compare the costs and benefits of using various types of renewable, nonrenewable, and flow resources, as exemplified by being able to:

- Compare the advantages and disadvantages of using alternative energy resources (e.g., electricity generated from coal fire, diesel turbines, hydroelectric dams, nuclear power, wind turbines, solar panels, geothermal heat, methane gas from landfills or animal waste) and then rank them based on criteria such as availability, sustainability, pollution, and expense.
- Describe and explain the costs and benefits of Organization of Petroleum Exporting Countries (OPEC) policies on oil for both the producing and consuming countries.
- Analyze the efforts of countries with emerging global economies (e.g., China, India, Brazil) to develop and use renewable and flow energy resources and evaluate the economic and environmental costs and benefits of these efforts.



B. Evaluate policy decisions regarding the sustainable use of resources in different regions and at different spatial scales in the world, as exemplified by being able to:

- Evaluate the effect of efforts by the United Nations or other supra-national organizations (e.g., World Bank, International Monetary Fund [IMF], Organization of American States [OAS], European Union [EU]) to promote sustainable development.
- Compare government policies and programs to promote sustainability (e.g., reducing fossil-fuel dependency, recycling, conserving water) in developed and developing countries.
- Compare the recycling programs of several local municipalities and evaluate the costs and benefits of each program.

Standard 18

How to apply geography to interpret the present and plan for the future

- Using Geography to Interpret the Present and Plan for the Future

1. Geographic contexts (the human and physical characteristics of places and environments) provide the basis for analyzing current events and making predictions about future issues

Therefore, the student is able to:

A. Explain and evaluate the influences of the geographic context on current events and issues to make informed decisions and predictions about the future, as exemplified by being able to

- Identify different views regarding contemporary social and environmental challenges and analyze the geographic factors influencing the stakeholders and their preferred policies (e.g., visions from local citizens about the relative importance of privacy versus security, viewpoints from around the world about relationships between economic development, resource consumption, population, and environmental alteration).
- Evaluate the current zoning policies for high-crime areas in a metropolitan area and predict changes in zoning and land use that may positively affect the community.
- Analyze the geographic consequences on different continents of strategies for responding to a global health pandemic (e.g., effects of closing international airports, quarantine of ships or cargoes, implementation of immunization plans for susceptible populations).



B. Analyze and evaluate the connections between the geographic contexts of current events and possible future issues, as exemplified by being able to:

- Evaluate the feasibility and long-range impacts in a series of scenarios for dealing with social and environmental issues (e.g., absorbing and dispersing refugees, responding to threats from global warming, managing the future of Antarctica).
- Analyze the geographic implications of storing low-level nuclear material in a given state or region (e.g., suitability of sites, distribution of population, transportation network and routes).
- Analyze the effects of current rates of population growth on long-term sustainability in different regions of the world.

- Perceptions of Geographic Contexts

3. Multiple and diverse perceptions of the world must be taken into account to understand contemporary and future issues

Therefore, the student is able to:

A. Evaluate how perceptions vary and affect people's views of contemporary issues and strategies for addressing them, as exemplified by being able to:

- Explain how and why residents of different regions of the country might evaluate energy policy proposals differently (e.g., Alaska and Arctic National Wildlife Refuge [ANWR] oil drilling, California and off-shore oil production, mid-Atlantic states and the Marcellus Oil Shale Field).
- Explain how perceptions of immigration differ among people depending on their location, socioeconomic status, or occupation.
- Identify and compare different perspectives about international climate change agreements regarding carbon emissions from the points of view of the developed countries and the less-developed countries.



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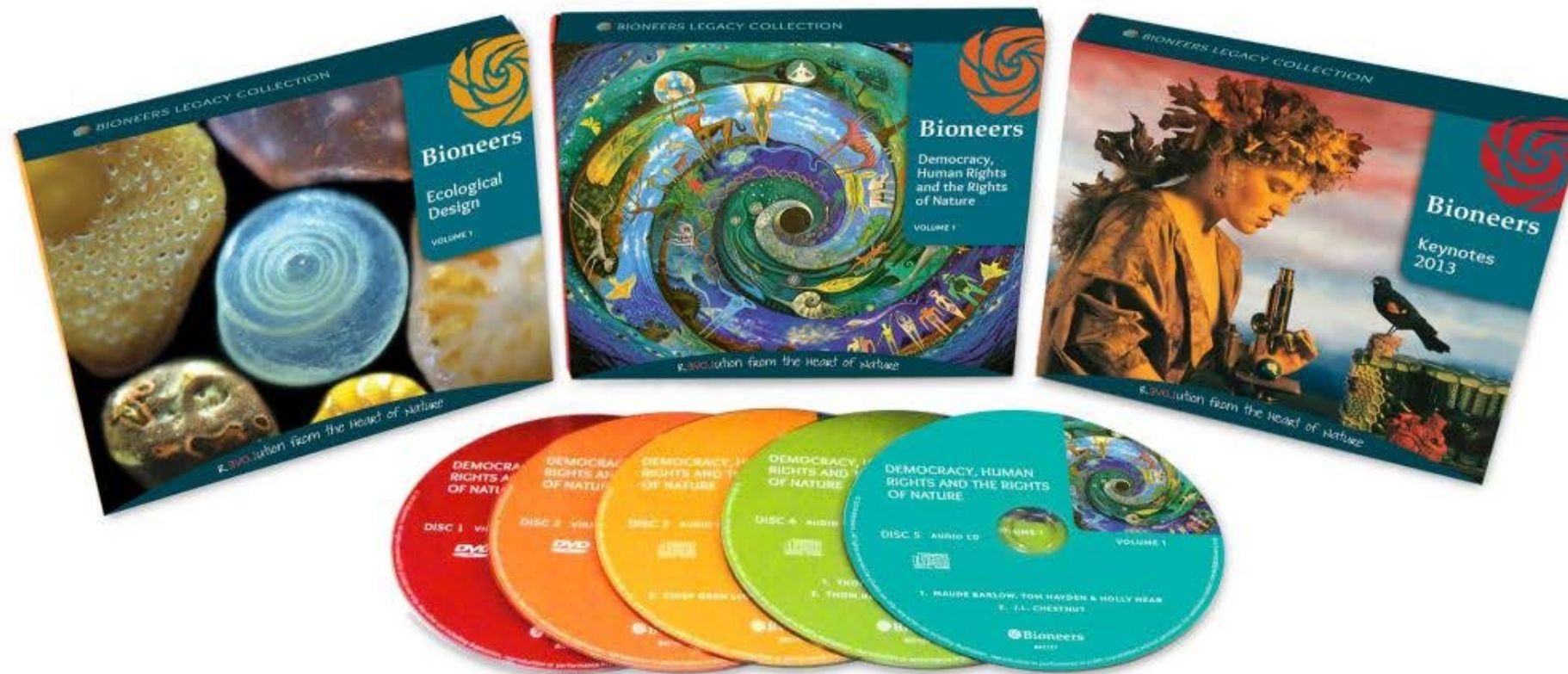
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Apartheid

a former social system in South Africa in which black people and people from other racial groups did not have the same political and economic rights as white people and were forced to live separately from white people

Related Glossary Terms

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Find Term

Barnstorming

v., to conduct a campaign in rural areas by making brief stops in many small town

Related Glossary Terms

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Find Term

Chapter 1 - Introduction

Chapter 3 - Discussion Guide

Canvassing

v., to solicit votes, opinions, or the like

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Carbon Reserves

n., quantities of energy sources that are known to be recoverable under existing economic and operating conditions. The location, quantity, and grade of the energy source are usually considered to be well established in such reserves.

Related Glossary Terms

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Find Term

Clean Energy

n., energy that does not pollute the atmosphere when used

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- Chapter 2 - Bioneer: Bill McKibben
- Chapter 3 - Video: emPOWERed
- Chapter 3 - Discussion Guide
- Chapter 3 - Discussion Guide

Climate Change

n., because the Earth’s climate is never static, the term is properly used to imply a significant change from one climatic condition to another and often used synonymously with “global warming.” Scientists can use “climate change” in the wider sense to also include natural changes in climate.

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Coal Ash

n., generic term referring to several very distinct materials produced when coal is combusted to produce electricity

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Coal Country

Pennsylvania/Appalachia

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Coalition

n., a combination or alliance, especially a temporary one between persons, factions, states, etc.

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Desmond Tutu

South African Archbishop known for his efforts to bring attention to the inequities of apartheid

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FDR Administration

1933-1945

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Fossil Fuels

n., any fuel such as coal or oil that is derived from the remains of once-living organisms that were deeply buried beneath the ground

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Fracking

n., hydraulic fracturing, the injection of fluid into shale beds at high pressure in order to free up petroleum resources such as oil or natural gas

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Chapter 3 - Discussion Guide

George W. Bush Administration

2001-2009

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Governor Cuomo

Governor of New York, 2010 - Present

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Grassroots

adj., local or person-to-person, a typical grassroots effort might include a door-to-door education and survey campaign

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Greenhouse Gas

n., a gas that prevents heat from radiating from Earth or that absorbs infrared radiation in the atmosphere, causing Earth's surface to warm. Greenhouse gases include water vapor, carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), ozone (O3), and perfluorocompounds (PFCs).

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Chapter 5 - Science Standards

Holocene Epoch

n., the name given to the last ~11,700 years of the Earth's history or the time since the end of the last major glacial epoch, or "ice age"

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IPCC

Intergovernmental Panel on Climate Change

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James Hansen

Renowned NASA climate scientist-turned professor at Columbia University

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John Muir

1838-1914, Scottish-American conservationist, Writer, Naturalist, and founder of Sierra Club

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Martin Luther King, Jr.

1929-1968, Baptist minister who led the Civil Rights Movement in the US

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Michael Mann

Professor of Meteorology & Director of Earth System Science Center at Penn State

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Nelson Mandela

1918-2013, former South African President and peace activist

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Pollutant

n., any substance introduced into the environment that may adversely affect the usefulness of a resource or the health of humans, animals, or ecosystems. For most environmental media, this term is commonly understood to refer to substances introduced by human activities

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Chapter 5 - Science Standards

Chapter 5 - National Geographic Standards

Theodore Roosevelt Administration

1901-1909

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Tipping Point

n., the point at which an issue, idea, product, etc. crosses a certain threshold and gains significant momentum, triggered by some minor factor or change

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Truman Administration

1945-1953

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