

# **JOURNEY TO PLANET EARTH**

## **Plan B: *Mobilizing to Save Civilization***

**Educators Guide**

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# NATIONAL EDUCATION STANDARDS

This video and associated lessons correlate to the following content standards:  
<http://www.educationworld.com/standards/>

## **National Science Standards: Grades 9-12**

### NS.9-12.6 Personal and Social Perspectives

As a result of activities in grades 9-12, all students should develop understanding of:

- Personal and community health
- Population growth
- Natural resources
- Environmental quality
- Natural and human-induced hazards
- Science and technology in local, national, and global challenges

## **National Social Studies Standards: Grades 5-12**

### NSS.WH.5-12.9 The 20th Century Since 1945: Promises and Paradoxes

The student in grades 5-12 should understand:

- Major global trends since World War II

### NSS-G.K.-12.4 Human Systems

The student in grades 5-12 should:

- Understand the characteristics, distribution, and migration of human populations on Earth's surface.
- Understand the characteristics, distribution, and complexity of Earth's cultural mosaics.
- Understand the patterns and networks of economic interdependence on Earth's surface.
- Understand the processes, patterns, and functions of human settlement.
- Understand how the forces of cooperation and conflict among people influence the division and control of Earth's surface.

### NSS-G.K.-12.5 Environment and Society

The student in grades 5-12 should:

- Understand how human actions modify the physical environment.
- Understand how physical systems affect human systems.
- Understand the changes that occur in the meaning, use, distribution, and importance of resources.

### NSS-G.K.-12.6 The Uses of Geography

The student in grades 5-12 should:

- Understand how to apply geography to interpret the past.
- Understand how to apply geography to interpret the present and plan for the future.

## OVERVIEW

“Plan B: Mobilizing to Save Civilization” focuses on environmental visionary Lester Brown and his sobering concerns about what humans are doing to Earth’s environment.

Brown makes it clear that continued human population rise coupled with the burning of massive quantities of fossil fuels are leading to an environmental catastrophe that threatens our future and the future of other living things that also call Earth their home.

The time has come, Brown argues, for a dramatic shift in how we provide energy for our use and otherwise exploit the planet’s natural resources. Everyone needs to take stock of what he or she is doing and contribute toward finding new, sustainable ways of inhabiting Planet Earth.

Brown is convinced that the time we have to make significant and necessary changes in our lifestyles is short. If we delay, we confront the real danger that we will soon witness environmental changes that will severely impact our planet, its living creatures, and even civilization as we know it today.

## **LEARNING OBJECTIVES**

Students will be able to:

1. Connect human-caused global climate change with food availability, environmental deterioration, poverty, and social and political instability around the world.
2. Explain the relationship between human population growth and carbon emissions leading to global climate change.
3. Understand why improving education, especially for women and girls, effectively reduces poverty, human population growth, and, indirectly, global climate change.
4. Understand the urgency of acting swiftly and decisively to confront global climate change and the importance of every citizen doing what he or she can to contribute to address the problem.

## PRE-VIEWING ACTIVITIES

If students do not know the following locations, use a wall map, desk map, or atlas to familiarize them with the geographical areas profiled in the video:

- A. North America
  - Washington, DC
  - Utah
  - Arizona
  
- B. Caribbean
  - Haiti
  
- C. Asia
  - The following countries: China, India, South Korea, Afghanistan, Pakistan, Bangladesh, Turkey, Philippines
  - Beijing, China
  - Seoul, South Korea
  - Istanbul, Turkey
  - Esenyurt, Turkey
  - Himalayas
  - Tibetan Plateau
  - The following rivers : Indus, Ganges, Yangtze, Yellow
  - Indian Ocean
  - Suez Canal
  
- D. Arctic
  - Arctic Sea
  - Greenland
  
- E. Europe
  - United Kingdom
  - Copenhagen, Denmark
  - Scotland
  - Iceland
  
- F. South America
  - Peruvian Andes
  - Amazon river and surrounding rain forest
  
- G. Africa
  - The following countries: Somalia, the Sudan, the Democratic Republic of the Congo, Chad, Algeria, Zambia
  - Zambia's Luangwa Valley

The following terms are used in the video and may need to be introduced to students:

- Agronomy: the study of soil and plants, soil management, crop production, and land cultivation
- Biodiversity: the variety of all life forms on Earth
- Bush meat: the meat of wild animals used for food, especially in Africa
- Coal-fired power plant: an electricity-generating plant that burns coal to generate electricity
- CO<sub>2</sub> Emissions: the release of carbon dioxide into the atmosphere from substances that contain carbon, for example from the burning of gasoline and oil
- Ethanol: a form of fuel known as a “bio-fuel” that comes from common agricultural plants such as sugar cane and corn; it is used as an additive to gasoline
- Fossil fuel: fuels such as coal, natural gas, and petroleum that formed from ancient decomposed remains of plants and animals
- Glacier: a large mass of ice and compacted snow that forms over land masses and moves slowly, shaping the land around it
- Katrina: A devastating hurricane that hit the Gulf Coast in 2005, especially wreaking havoc on New Orleans, LA and surrounding areas
- Maya: A tribe of Mesoamerican Indian people primarily inhabiting southeastern Mexico, Guatemala, and Belize. Mayan ancestors created a great civilization that was known for its written language, art, architecture and mathematics and that reached its zenith from 300 - 900 A.D.
- Micro-credit: the extension of small loans to poor people who otherwise would not qualify for traditional loans to start entrepreneurial ventures and small businesses. Such loans have an impressive record of helping people generate income to be self-sufficient and even lift themselves out of poverty
- Pearl Harbor: an inlet on the island of Oahu in Hawaii and the site of a U.S. naval base, which was attacked by the Japanese on December 7, 1941, spurring the United States to enter World War II
- Poaching: the illegal catching of wildlife and fish
- Shona Tribe: a member of a Bantu tribe living in present day Zimbabwe, in southern Africa
- Sumerians: one of the world’s oldest known civilizations established in the fourth millennium B.C. in Mesopotamia (present-day Iraq)

To help students put the video in perspective, ask them the following questions:

- What have you heard about global climate change? Do you know what human activities are thought to be causing it? Do you think it is actually happening? Why or why not? Do you think it's important to find out?
- What are some of the consequences of global climate change on the planet? How do you think each consequence could affect populations of people and civilizations in general?
- What civilizations have you heard about that disappeared? If you were to choose one or two of the most important factors that you think help sustain civilizations, what would they be? Could these factors be affected by global warming? In what ways?
- In what parts of the world is human population rising the fastest? In what parts of the world is development the fastest? What are the possible consequences of these trends?
- What threats do you see confronting your future?

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## VIEWING ACTIVITIES

### **Distress Signals from 35,000 Feet**

*(Minute 00:04; Length: 4 minutes)*

Plan B begins with Lester Brown flying over the Arctic Sea from Washington, D.C. to Beijing, China. He notes the ice below fracturing, and he then notes that the Arctic Sea Ice, as well as ice in the Himalayas and other places, is melting at a rapid pace, due to human-caused climate change. Himalayan glaciers feed major Asian rivers, which hundreds of millions of people depend upon for their agricultural, domestic, and industrial needs. What would happen, Brown wonders, if these rivers were to dramatically diminish because of climate change?

#### **Post-viewing Discussion**

1. What is the connection between glaciers high in the Himalayan Mountains and hundreds of millions of people living in the lowlands of India, China, and Bangladesh? (Answer: The glaciers feed great Asian rivers that supply people with water for drinking and bathing, irrigating crops, and other essential needs. Without the glaciers, the rivers would shrink dramatically.)

### **Who Will Feed China?**

*(Minute 00:08; Length: 9 minutes)*

Lester Brown is in Beijing, China to share his concerns about climate change with government officials and the general public. His message: China's incredibly rapid industrialization is endangering the country's water supply and therefore its food supply. This could have major global repercussions: While China may be able to avert widespread famine by paying for massive food imported from other countries, it will, in doing so, drive food prices higher around the world, making it vastly more difficult for the planet's poorer countries to feed their own populations. In an interview on English-language television, he encounters resistance to his point of view. The program host insists on focusing on the responsibility of the United States to address climate change first and foremost. Lester Brown considers this issue a distraction; the point he is trying to make is that all countries will be impacted by climate change, so all must contribute to solving this looming menace.

## **Post-viewing Discussion**

1. How will China's rapid industrialization threaten its food supply? (Answer: China's industrialization is contributing to the global climate change that is melting the Himalayan glaciers that feed the country's major rivers. If the rivers dwindle, China's agricultural production will suffer. Exactly how this industrial development is affecting the world's climate is explored later in the film.)
2. What global impact will occur if China is forced to import massive amounts of food to feed its people? (Answer: Demand for food will rise, driving up prices around the world. Food in the United States will become more expensive, but the world's poorer countries will suffer the most, because they will find it difficult to pay for the food they need to feed their populations.)

## **A Road Trip**

***(Minute 00:17; Length: 4 minutes)***

Lester Brown continues on his journey to Japan, Korea, India, Turkey, and Italy. In India, he learns that the Indian prime minister knows how important the Himalayan glaciers are to the country's people, but that he is perplexed as to how to address the problem. In Korea, he witnesses a massive public protest over environmental policies, which suddenly turns violent. Brown considers this a portent: a glimpse of what might very well happen if human-caused climate change continues unchecked.

## **Post-viewing Discussion**

1. Why does Lester Brown think climate change will lead to increased violence? (Answer: Climate change will, among other things, endanger people's water and food supplies. This will make their lives more desperate, and they may feel they have to resort to violence, either internally or with neighboring countries, to obtain the food and water that they need. Unstable governments that can't meet people's basic needs may be vulnerable to being toppled by violent uprisings.)

## **Ancient Civilizations**

***(Minute 00:21; Length: 5 minutes)***

During Lester Brown's world tour, he often had time to think, and what crystallized in his mind at this time was that food shortages have led to most of the examples of civilization collapse throughout human history. The Sumerians in the ancient Middle East, the Classic Mayan civilization in Middle America, and the Great Zimbabwe culture in Africa are all examples of societies that came undone because of environmental abuse leading to famines. Brown sees the fates of these ancient civilizations as warning signs, showing us what might happen today if we likewise damage our environment so that food becomes scarce and great numbers of people go hungry.

## Post-viewing Discussion

1. What types of environmental damage might lead to widespread famines? (Answer: Examples might include soil erosion caused by, among other things, deforestation; depletion of soil nutrients through over-intensive farming, soil salinization caused by poor irrigation practices, disappearance of water supplies, and climate change.)
2. People have always gazed at the ruins of ancient civilizations and wondered why they disappeared. Do you think we could ever inflict environmental damage so severe that future generations will wonder the same thing about the remains of our civilizations? Why or why not? (Answers will vary.)

## Meat... Milk... And Eggs...

*(Minute 00:26; Length: 7 minutes)*

This segment describes three recent global trends that, taken together, are making the challenge of feeding the world's people even more daunting. First, billions of people are becoming more affluent and are aspiring to attain the living standards we enjoy in the United States. This means that they want to eat more protein: meat, milk, and eggs. Animal products require much more land to produce than grains and vegetables, so to increase animal production people will put more pressure on agricultural land and appropriate more forests and other natural habitats for crops. Second, the world's population is continuing to rise, with today's 6.7 billion people expected to increase to over *9 billion* by the middle of this century. These added billions will want to eat. Third, we are now mixing ethanol, which is made from grain, with gasoline. Huge amounts of grain are going toward filling the gas tanks of our vehicles, leaving less for people to eat. Combined, these three factors reinforce the necessity of addressing human-caused climate change so that food production does not plummet.

## Post-viewing Discussion

1. What three factors are making it increasingly difficult to feed the world's people? (Answer: 1) Rising affluence and, with it, increased consumption of meat, milk, and eggs; 2) Significant human population growth; 3) Increased use of grain to make ethanol instead of food.)

## **Failing States**

***(Minute 00:33; Length: 8 minutes)***

Today, as in the past, environmental abuse is contributing to the demise of nations. Haiti is a case in point. Years of deforestation and associated soil erosion have left Haiti the most impoverished nation in the Western Hemisphere. Many people consider it a “Failed State”, a country unable to ensure that its people obtain adequate food, shelter, education, and security. Lester Brown believes that unchecked climate change will make it increasingly difficult for poor countries to provide for their populations so, in the future, we will likely see more failed states resembling Haiti. How many failed states, Brown wonders, will it take before we can say that we have a failing global civilization?

### **Post-viewing Discussion**

1. How has environmental degradation led to poverty in Haiti? (Answer: Rampant deforestation has led to the disappearance of trees, which, in turn, has caused massive soil erosion. Soil washing into the sea has smothered coral reefs, so the fish depending upon the reefs for food and shelter have also vanished. Haitians cannot earn a living from farming, fishing, or forestry without soil, fish, or trees. And, since the country is so poor it cannot pay for adequate education, health care, and security. When the earthquake hit in 2009, Haiti had no financial resources to cope with the disaster.)
2. Do you think other countries, especially in the developing world, are also witnessing similar environmental degradation? Do you think some might become “Failed States”? What might happen if a lot of countries ended up like Haiti? (Answers will vary. Many, if not most, of the world’s developing countries are going down Haiti’s path. They are seeing uncontrolled deforestation, depletion of wildlife, soil erosion, water pollution and overfishing. Most are also seeing significant population growth. Left unchecked, this set of factors will lead to increased poverty and associated civil disorder. )
3. How might climate change make it more difficult for poor countries to provide for their citizens? (Answer: Climate change is affecting water supplies and rainfall patterns around the world, thus threatening agriculture. It is also killing forests and coral reefs.)

## **The Economic Truth**

***(Minute 00:42; Length: 6 minutes)***

The damage created by Human-caused climate change costs us money! We have to pay to clean up the aftermaths of deadly storms, heat waves, drought, and flooding, and we have to pay for the loss of biodiversity that climate change is bringing about. Businesses incur costs in manufacturing for, among other things, raw materials, labor, and energy. For the most part, however, they do not have to pay for the environmental damage that they indirectly help create. Those costs typically fall on the rest of us. In this segment, Lester Brown and noted economist Paul Krugman argue that this needs to change. They maintain that corporations need to take into account the environmental damage they are bringing about and put it onto their balance sheets. Primarily through their use of fossil fuels to generate energy, corporations are significant factors in global climate change, and they need to consider the resulting damage as an expense for which they are responsible. If they do, the true cost of producing the items that they manufacture will become apparent. Hopefully, this will serve as an incentive for corporations to find alternative cleaner and less expensive ways of obtaining energy.

### **Post-viewing Discussion**

1. Why do standard business accounting procedures fail to accurately reflect the true costs of manufacturing? (Answer: They do not typically take into the account the costs associated with the environmental damage that they create. If their practices pollute the air, water, and soil, hurt agriculture and fisheries, and even make us sick; we generally incur the costs, not the corporations.)
2. How do these standard accounting practices contribute to global climate change? (Answer: The primary cause of global climate change is the addition of gigantic amounts of greenhouse gases, notably carbon dioxide, to the atmosphere. A significant source of these gases is the burning of the fossil fuels coal and petroleum. Businesses often prefer to meet their energy needs with coal and petroleum because they are convenient and cheap. The environmental damage caused by climate change, largely created by fossil fuels, is not considered. If it were, the true costs of burning coal and petroleum would be significantly higher. As it is, we all are covering the costs of addressing climate change.)

## **The 29<sup>th</sup> Day**

***(Minute 00:48; Length: 3 minutes)***

In this segment, Lester Brown introduces the parable, The 29<sup>th</sup> Day. The parable illustrates exponential growth, the point being that environmental crises can suddenly and dramatically surface where no impending crisis had been apparent before. Environmental crises, in other words, can sneak up on us unless we pay attention to what we are doing and take timely steps to address them before they become catastrophic.

## **Post-viewing Discussion**

1. What is the connection between the 29<sup>th</sup> Day parable and global climate change? (Answer: The parable describes a situation in which a small crisis – the pond becoming choked with lily pads – does not become apparent until the day it happens, and people are worried that a huge crisis – the environmental impact of global climate change – will likewise not show itself until the last minute. Nobody knows at which point the tipping point of the global climate change crisis will become so huge that we won't be able to solve it.)

## **Plan B**

***(Minute 00:52)***

At this point, the film presents the four components of Lester Brown's plan to protect Earth's environment:

- 1) Cutting carbon emissions,
- 2) Stabilizing human population growth,
- 3) Eliminating poverty, and
- 4) Restoring the planet's natural systems.

## **Poverty, Population, and the Diversity of Life**

***(Minute 00:52; Length 9 minutes)***

This segment discusses why eradicating global poverty is a key step in the struggle to preserve Earth's environment. One way to do this is to educate and empower women. It has been established that when we do this, women have fewer children and educate them better, and their families become more prosperous as well. Another measure that has proven effective is the providing of small grants, so-called micro-credit, to people wishing to establish small businesses. And still another is the training of people to adopt alternative lines of work that are both more productive and less environmentally destructive. Reducing poverty, then, lowers population growth and reduces environmental abuse, in addition to improving people's lives.

## **Post-viewing Discussion**

1. Why might educating women lower population growth? (Answer: Educated women feel more empowered to decide for themselves how many children they will have, rather than ceding that authority to their husbands. And, women with jobs outside the home often choose to have fewer children, thereby allowing them to devote more finances and attention to the children that they do have. In addition, people in some parts of the world want to have lots of children to help with family farms and other enterprises, but educated women often do not need such help.)

2. What is the difference between micro-credit and regular credit? (Answer: The quantity of the money being lent and the people whom the money is being lent to. Often, impoverished people cannot receive conventional loans because lenders do not think these people will ever be able to pay them back. To us, the amount of money in micro-credit loans often seems amazingly small, but in many societies a little money can make a huge difference in people's lives.)
3. How did assisting farmers in Zambia's Luangwa Valley reduce the poaching of elephants and other animals? (Answer: When Zambian farmers learned modern farming techniques and help marketing their products, they became more prosperous and consequently did not need to poach animals for income. In addition, the Wildlife Conservation Society made turning in guns and snares a precondition to receiving aid.)

## **Reducing CO<sub>2</sub> Emissions**

***(Minute 1:01; Length: 6 minutes)***

The number one cause of global climate change is the burning of fossil fuels for energy. When we burn coal, petroleum, and natural gas, we send millions of tons of carbon dioxide (CO<sub>2</sub>) into the atmosphere. CO<sub>2</sub> is a greenhouse gas; it absorbs heat. When sunlight travels through our atmosphere and strikes the Earth, much of it converts to heat and radiates back into space. CO<sub>2</sub>, however, absorbs the heat and keeps it from escaping. Other human activities cause huge amounts of other greenhouse gases, like methane, to enter the atmosphere, as well. This, in a nutshell, is why global climate is occurring.

This segment makes the point that people around the world are concerned about atmospheric CO<sub>2</sub> rise and are taking steps to stop it. Unfortunately, world leaders seem to be lagging behind public sentiment; in 2010, at a United Nations conference on climate change in Copenhagen, Denmark, they failed to come to an agreement on how to combat climate change. The film takes the view that any solution to this crisis will have to include measures that make burning fossil fuels more expensive, so that people have the incentive to find alternative energy sources.

### **Post-viewing Discussion**

1. What is the best strategy we could adopt, according to the film, to reduce the burning of fossil fuels? (Answer: Tax the emission of greenhouse gases, making the burning of coal, petroleum, and natural gas more expensive. With the additional revenues from such a tax, the government could lower income taxes or other taxes. More importantly, greenhouse gas taxes would motivate people to use alternative sources of energy.)

- World leaders met in Copenhagen, Denmark, in December, 2009, to try to come up with an agreement that would lead to reducing greenhouse gas emissions. They failed to come up with any legally-binding treaty, but they did agree that global climate change was a serious menace that needs to be addressed, and they agreed that we need to reduce carbon dioxide emissions 80 percent by the year 2050. How does Lester Brown feel about that? (Answer: It is not fast enough. Brown is convinced we need to meet this goal by 2020, which means we have no time to waste.)

## **The New Energy Economy**

***(Minute 1:07; Length: 5 minutes)***

Massive, human-caused, climate change around the globe is as daunting a challenge as there is today. Yet, Lester Brown is convinced that we have the solution at hand. He maintains that we have enough practical and effective alternative sources of energy, such as geothermal heat, the wind, and the sun, to make the burning of fossil fuels obsolete. He believes that we can make the switch from non-renewable, polluting fossil fuels to clean energy sources that will never run out. The film describes several examples in which renewable and non-polluting sources of energy are already being put to good use. But, we still need the incentives in place to create an entirely new energy system that relies totally on clean energy sources.

### **Post-viewing Discussion**

- What are some examples of clean and renewable energy sources? Why are they called “clean” and “renewable”? (Answer: Examples include geothermal heat, the wind, the sun, and oceanic tides. These sources of energy are “clean” because they create little or no pollution. They are “renewable” because they will never run out.)
- What will happen if we do not stop burning fossil fuels? (Answer: We will eventually run out of them, especially petroleum, and we will create global havoc because of significant climate change. We do not know enough about the global climate to predict precisely when major, irreparable environmental damage will happen, so we need to take swift action.)

## **Can We Change Fast Enough?**

***(Minute 1:12; Length: 6 minutes)***

Are we capable of confronting global climate change before it's too late? The crisis demands immediate action on a scale that we have not yet achieved. Yet, Lester Brown believes that we can rise to the challenge. He looks at how quickly the United States mobilized to produce the vehicles, ships, and armaments needed to achieve victory in World War II and concludes that we can put forth a similar effort today. We have the tools at our disposal to make this happen. We just need the will.

## **Post-viewing Discussion**

1. The United States pulled together and achieved victory in World War II against formidable opponents. Do you think we have the leadership, determination, confidence, and public spirit to tackle the colossal challenge of global climate change in similar fashion? Why or why not? (Answers will vary.)

## **Saving Civilization is Not a Spectator Sport / Final Thoughts / Epilogue**

*(Minute 1:18; Length: 6 minutes)*

Lester Brown's final point in Plan B is that ordinary citizens cannot leave the climate change crisis to other people to solve. We must all adjust our own lifestyles so that we use less energy and create less individual pollution; we must also band together, become politically active, and ensure that we get political leaders who understand the critical necessity of acting swiftly and decisively to meet this looming threat head-on. Lester Brown is convinced that our planet and even our civilization is at stake.

## **Post-viewing Discussion**

1. Do you think global climate change warrants an effort as intensive as the one we needed to win World War II or to pass civil rights legislation? Do you agree with Lester Brown that civilization is at risk if we do not address climate change? Why or why not? (Answers will vary.)
2. Where do you stand on this issue? Choose the response that best matches your opinion.
  - I don't think global climate change is serious enough to warrant a massive effort on our part to address.
  - I am not sure if global climate change is a serious crisis, and I think I need to learn more about it to make a decision.
  - I think it is likely that global climate change is a serious threat to our planet and our way of life, but I don't think we have the will or the ability to solve the problem.
  - I think global climate change is a very serious problem and we have to get serious about solving it right away.

Please explain your answer.

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## SPECIAL PROJECTS

1. Have your students conduct a school energy audit. Contact the following website: <http://www.earthday.net/ccscsite/SchoolEnergyAuditEditedFinal.pdf> for an example of an audit that they can use. Once your students conduct the audit, they can recommend steps to take in reducing the school's energy consumption.
2. To help your students understand how environmental degradation can lead to civil unrest and the destabilization of societies, have your class design a consequence wheel. On the board, draw a circle and write inside it "Deforestation". Ask the students what this might do. They might say, for example, "Soil Erosion". Write "soil erosion" on the board next to the deforestation circle, surround it with a circle, and draw a line connecting the two words. Next, ask the students to think of an impact of soil erosion. They might say "ruined farming". Put a circle around this phrase and connect it to "soil erosion". The students might then think that "ruined farming" would lead to abandonment of the farm and migration to the capital city, and so on.

A possible line of thought might include: Deforestation --- Soil Erosion --- Ruined Farming --- Migration to Urban Centers --- Housing Shortages --- Poor Sanitation --- Lack of Employment --- Poverty --- Urban Unrest --- Political Instability --- Immigration to the United States. Other lines of thought are also possible.

Deforestation can also lead to loss of timber, which leads to charcoal shortages, loss of plant and animal species, loss of habitat for migratory birds from the United States, and loss of natural medicines. Soil erosion can cause coral reefs to become covered with sediment, thereby damaging fisheries. These can all lead to poverty and political instability.

3. Students can be assigned to research the following cultures, noting how the degradation of natural resources, particularly soils, helped lead to their downfalls. They can record their findings in collages (posters), which can then be put up in the classroom or hallway. Cultures to consider: Northern China, ancient Sumer or Akkad in Mesopotamia, northern Africa during the Roman Empire, ancient Greece, ancient Palestine, the Mayan classic culture in Mexico and Central America, the ancestral pueblo cultures of the American southwest and even Easter Island.

4. To understand the dramatic truth of where the carbon released in carbon emissions comes from, have your students diagram this incredible journey on paper. (Large paper would work best.) Here are the steps to diagram:

- Sunlight travels 93 million miles from the sun's surface to planet Earth.
- 350 million years ago, a primitive tree (that looks like a giant fern) absorbs that sunlight when it reaches the leaves
- The ancient tree also absorbs water through its roots and CO<sub>2</sub> through its leaves. In the presence of sunlight, a chemical reaction happens resulting in the production of food for the plant (glucose or C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>) and oxygen (which is simply a by-product of photosynthesis). So, the carbon originated in the molecule CO<sub>2</sub>, and then became part of the glucose molecule, which is stored in the plants' tissues.
- The tree dies and is buried in a swamp (there were a lot of swamps on Earth 300 million years ago!). Over time, it turns into coal. The carbon that was stored in the tree's tissues is now stored in the coal.
- 350 million years later, we humans come along and dig up the coal.
- We burn the coal in huge power plants to generate electricity.
- The electricity travels through power lines to your house, which you use to light your house, charge your cell phone, run a computer, and countless other things!

Can you see why coal is called a fossil fuel? Remember, the carbon within coal came from the atmosphere 250-350 million years ago. There is a lot of coal stored underground that "locks up" a lot of carbon. When we dig up that coal and burn it, we don't destroy a single carbon atom. (Matter cannot be created or destroyed.) So, we simply move all of that "locked up" carbon from the ground to the atmosphere, where it becomes carbon dioxide.

Carbon dioxide is a greenhouse gas; the more CO<sub>2</sub> there is, the warmer the atmosphere becomes. It is abundantly clear that 1) CO<sub>2</sub> levels in the atmosphere are rising dramatically; 2) the CO<sub>2</sub> is coming from the burning of fossil fuels, and 3) The CO<sub>2</sub> is warming up the planet. The science explaining the reality of human-caused climate change is rock-solid.

5. Today, around 6.8 billion people live on Planet Earth. We expect the world's population to grow to over 9 billion by the middle of the 21<sup>st</sup> Century before leveling off. This will create enormous pressures on the world's natural resources and on the living things that share the planet with us.

If we want to reduce the rate at which human numbers are increasing, we first need to know why and where this is happening. Not every country or region in the world is experiencing population growth. To find the answers, have your students consult the web site of the Population Reference Bureau, [www.prb.org](http://www.prb.org). Once at the site, click Data Finder at the top of the page, and you should see two columns, one labeled U.S. Topics and one labeled World Topics. These contain a wealth of demographic information, in both graph and map formats.

Ask your students to correlate population growth rates with the following demographic factors:

- Per capita income
- Infant mortality
- Life expectancy at birth
- Birth rate
- Death rate
- Ever-married females (ages 15-19)
- Literate Women as % of Literate Men.

After they have finished, ask the students to summarize. They should have discovered that population growth is high when:

- Per Capita income is low
- Infant mortality is high
- Life expectancy is low
- Birth rate is high
- Death rate is high
- Number of married females ages 15-19 is high
- Women's literacy is comparatively low

Where are the countries where these conditions exist? Are they developing countries or developed? Are they industrialized or are their economies mainly based on agriculture?

To see what the world will be like in 2050, ask your students to click Population Mid 2009 and Population 2050 (projected). Ask them to list the five most populous countries in each category. What country will be new on the list in 2050? What two countries together will account for more than three *billion* people?

Follow up this activity with a discussion. Why should population growth be high in these countries? Answers would include:

- Women often are not empowered to decide for themselves how many children they will be responsible caring for. They often do not have the financial means or the education necessary to be independent. Without employment outside the home, their responsibilities are seen as being strictly home and children-centered.
- Children are often needed to help work on family farms
- Children are often needed to take care of aged parents in countries with no social security.
- High birth rates compensate for high infant and childhood mortality.

To wrap up this activity, your students can consider whether it is in *their* interest to help poor countries improve their education systems, particularly of women and girls. Ask your students, either in small groups or as a class, to brainstorm how population growth and environmental deterioration in developing countries problems affect the United States? They can consider:

- Economically (Possible answers: Poor countries cannot purchase U.S. exports. They require foreign aid. If desperate people destroy their environment, we cannot obtain the products, like food, timber, fish, and medicines that the environment used to provide.)
- Security (Possible answers: Extreme poverty and environmental deterioration can lead to unstable governments and political unrest, which are often breeding grounds for governments hostile to the United States and even terrorism. Desperate people have been immigrating illegally into the United States, which has become an emotional issue across the country. Periodically in the past, the United States has felt it necessary to send the military into countries, particularly in the Western Hemisphere, to stabilize political and social unrest, because it was considered a security threat to the United States.
- Environment (Possible answers: Growing human populations will make global climate change worse. They can lead to the extinction of plant and animal species as they destroy their environment trying to provide for their needs. Natural habitats in the Western Hemisphere are vital homes for migratory birds that nest in the United States.
- Health (Possible answer: Poverty breeds infectious diseases that, today, can easily spread around the world. Witness the recent concern over H1Ni virus (swine flu).
- Peace of Mind (Possible answers: Scenes of human suffering and environmental deterioration can cause us to be worried, concerned, and even guilty.

Your students can now debate whether United States tax dollars should be spent helping developing countries educate their women and girls and adopting other measures to lower their population growth and pull their people out of poverty.

## RESOURCES

### **CARE**

[www.care.org](http://www.care.org)

This organization works on issues of poverty and the empowerment of poor and marginalized people, especially women and children. Visit their “Campaign” section, especially the sub-sections “Face of Climate Change” and “Power Within” to read articles about the ways in which poor people are especially affected by climate change and the importance of educating girls to alleviate poverty.

### **Earth Day Network**

[www.earthday.org/education](http://www.earthday.org/education)

The Earth Day Network website provides a wide variety of lesson plans for teachers on the topics covered in Plan B.

### **Earth Policy Institute**

[www.earthpolicy.org](http://www.earthpolicy.org)

The Earth Policy Institute website provides downloadable publications and data sets that deal with:

- Population, Health, and Society,
- Natural Systems
- Climate, Energy, and Transportation
- Food and Agriculture
- Economy and Policy

### **Environmental Defense Fund (EDF)**

[www.edf.org](http://www.edf.org)

The EDF website section on global warming presents their strategy for addressing global warming, information on the science of global warming, and ideas for what you can do. The last section includes a method of calculating your own personal pollution impact, which you can calculate as an individual or as a family.

### **Environmental Protection Agency (EPA)**

[www.epa.gov](http://www.epa.gov)

Go to the “Learn the Issues” section and visit “Climate” to obtain information and articles about climate change and global warming and to calculate your emissions using a household emissions calculator.

### **Intergovernmental Panel on Climate Change (IPCC)**

[www.ipcc.ch](http://www.ipcc.ch)

Established by the United Nations Environment Program, the IPCC is the leading body for the assessment of scientific data related to climate change and its potential environmental and socio-economic impacts. Several working groups of scientists have written detailed reports with their findings. For a condensed summary of highlights from the reports, please see the Union of Concerned Scientists resource information.

## **NEED**

[www.need.org](http://www.need.org)

The National Energy Education Development Project (NEED) site contains a wealth of information and educational resources for teaching about energy.

## **National Environmental Education Foundation (NEEF)**

[www.neefusa.org](http://www.neefusa.org)

NEEF works with a network of professions (teachers, weathercasters, health professionals, and land managers) to provide information, resources, and programs to thousands of households around the country. Sign up for their e-newsletter to receive updates on their programs, Environmental Education Week lessons, and more.

## **Population Reference Bureau**

[www.prb.org](http://www.prb.org)

Visit the data finder on this website to access excellent population data for all regions of the world. Data about population trends, health, education, and other topics can be displayed as rankings, maps, or bar graphs.

## **350.org**

[www.350.org](http://www.350.org)

350.org is an international campaign that's building a movement to unite the world around solutions to the climate crisis. In addition to downloadable information explaining the science of carbon emissions, 350.org has guidelines on how to create a community Climate Action Plan and get community and local government involved in creating solutions to help reverse global warming.

## **Union of Concerned Scientists**

[http://www.ucsusa.org/global\\_warming/science\\_and\\_impacts/science/findings-of-the-ipcc-fourth.html](http://www.ucsusa.org/global_warming/science_and_impacts/science/findings-of-the-ipcc-fourth.html)

The Union of Concerned Scientists provides an excellent summary of the highlights of the 2007 Intergovernmental Panel on Climate Change (IPCC) report. These include the affects of climate change on water supplies and people, threats to species, and changes to food production.

## **Woods Hole Oceanographic Institute**

[www.whoi.edu](http://www.whoi.edu)

Go to this website and visit the Climate and Oceans Section to view informative articles about a host of climate change research and data, especially as it relates to oceans.

### **World Resources Institute**

<http://www.wri.org>

The World Resources Institute offers much demographic and environmental information on countries around the world, including charts and maps. Its Earth Trends section presents individual country profiles. Sections that particularly relate to Plan B include Water Resources and Freshwater Ecosystems; Population, Health, and Human Well-being; Economics, Resources, and the Environment; Climate and Atmosphere; Energy and Resources; and Agriculture and Food.

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### **Worldwatch Institute**

[www.worldwatch.org](http://www.worldwatch.org)

Worldwatch Institute is an independent research organization recognized for their fact-based analysis of critical global issues. Their website section on Vital Signs includes short summaries of global trends they are watching.

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