An Action Plan for a Sustainable Future

Andrea Wise

Introduction

A teacher from my district teacher proclaimed at a workshop, "I am so done with this GREEN thing… my students tell me to recycle, but I can't waste my time." I had no response. I was in a bit of a shock. Although I also have trouble with Green as a fad, it is for quite different reasons. Soon, this teacher's students will be mine. The misconception that resources will be infinitely available is common. I once had a student who believed that we couldn't possibly run out of clean drinking water; water always comes out of the faucet at home. Clearly, I have a great responsibility. Some students have been confused into believing global climate change isn't real, and that somehow this means that all custodial responsibility is pointless. There is a lot of funding for propaganda meant to convolute these issues. Even I was becoming less confident about teaching this subject.

I am also concerned that "Green," like another hot color of the season, is a trend. If it's cool to be GREEN today, then it may not be so cool tomorrow. To combat this, I want to make sure that my students are presented solid information in a clear fashion so that they can make responsible societal decisions in an ever-changing world. This curriculum unit is my response to the teacher who cannot be bothered, and to industry that does not plan for a future beyond quarterly reports. I will teach this unit to Advanced Placement (AP) Biology students, and include several of the sections in my Biology 1 class. This curriculum unit will be setup in the first weeks of school, which is the goal setting component. It will then be taught over a three week period in AP Biology, after the AP test. Many teens have a great drive to bring their learning out of the classroom and apply it to the community. Young people have a fresh understanding of environmental concerns, and have the idealism to want to get to work. They are still certain that they can make a difference, as indeed they can.

Humans are impacting the climate in both clearly apparent and unforeseen ways. As part of this curriculum unit, students will become empowered to take action in creating an environmentally sustainable world, and they will educate others to increase their impact. Students will show connections between the living and non-living parts of the biosphere, and will display an awareness of unexpected connections and unintended consequences. They will use math skills to analyze data about the impact of climate change on populations. My ultimate goal is for my students to become engaged in processes that will reverse the current trend of unsustainable use of limited resources.

As mentioned above, there is a debate about climate change, but corporations fabricate much of that debate and the popular press propagates it. There is general consensus in scientific journals that climate change is real and is at least partly attributed to human activity. However, it is important to spend limited class time teaching about conservation of limited resources rather than to engage in a debate about whether humans cause climate change. Well presented lessons about the science of climate change can help to minimize the impact of the fabricated debate.

Conservation is an ancient concept. Of course it is, for no society can remain bountiful if it uses all of its resources in only a few generations. Fallen civilizations can often be traced back to unchecked resource use. David Suzuki in 11th Hour, says of honoring the natural world, "we've forgotten these ancient truths …that have kept us plugged into nature." In *Earth Democracy,* Vandana Shiva describes the Native American philosophy of considering the 7th Generation. It is the responsibility of each generation to think forward so that resources will be available not only for one's own children and grandchildren, but for 7 generations of descendents. My grandparents had never heard of Climate Change, but no one in my life was more convincing about conserving resources than they were. When I was small, on a walk with my grandfather, I reached for a budding flower, and he reminded me to consider the tree and the animals that would depend on that flower, before I tore it away. At my grandparent's house ribbon and paper and aluminum were always neatly stored for later use. They had a clear recollection of the Great Depression, an indelible manifestation of limited resources. Similarly, thoughtful Huy, the main character of Richard Llewellyn's poignant novel *How Green was My Valley*, reflected, "There is pity that we cannot dig all around the flowers and take the earth and all with us. It is hurting to have to break the stems of blossoms and see them lose their rich white blood only for the pleasure of putting them in a pot of water". Frugality was once a desirable trait. This had nothing to do with Global Warming. There is nothing GREEN or modern or political about our connection to the earth, it is ageless.

Regardless of whether human activity is influencing global climate, human activity is impacting habitat the world over. For example, the coral reef is home to the earth's greatest ocean diversity. In 1957, Alfred Russel Wallace described the reef off of what is now Indonesia as, "…one of the most astonishing and beautiful sights I have ever beheld. The bottom was absolutely hidden by a continuous series of corals, sponges, actiniae, and other marine productions, of magnificent dimensions, varied forms, and brilliant colors." He was truly awed. On a recent visit, biologist Tim Flannery saw not an ocean wonderland, but a cesspool, devoid of coral and fish, opaque, and stinky. Coral reefs are extremely fragile, and even remote reefs, far from human habitation, are affected. Reef destruction is attributed to overfishing, acidification of the ocean and temperature increases.

Loss of trees presents a visual demonstration of the impact of resource destruction. In recent history, trees have been valued as lumber, as firewood, and have been removed to make room for human habitation. The ecological services that trees provide have not been properly considered. An ecological service is an economic advantage that a species provides for humans. Trees provide an abundance of services; one of them is flood control. As trees were removed in the Smokey Mountains of Western Carolina, the valleys below flooded. The roots of trees help to keep the soil intact; the foliage retains some water during a heavy rain and reduces impact. What I didn't realize, and it was an unexpected find for hydrologists as well, is how much water a tree can absorb. Trees act as a reservoir. During heavy rains, water is drawn into trees like a sponge, and is released over time, when the ground has a higher capacity for water. One unintended consequence of deforestation is thus increased flooding. Trees provide the oxygen that much of life requires. They help reduce CO_2 levels by fixing carbon. They help moderate temperatures, at least locally. Trees provide habitat for many organisms, and food for even more. This is an illustration that consumption has a broad spectrum of effects, not the least of which is climate

change.

We are experiencing the highest average temperatures in recorded history, and we live with the effects. Human activity is correlated to climate change with a high degree of confidence. Impacts include changes in water cycles, an earlier onset of spring, and a rising sea level, and these are just three of a larger list. Environmental scientists and climatologists generally agree that there is still time before we reach a "tipping point" at which point global warming itself becomes self-perpetuating and irreversible. It appears that decisions that are made within the next 30 to 40 years will be crucial to the long term well being of the earth.

The sustainability of resources is being threatened. In Lester Brown's *Plan B 4.0, Mobilizing to Save Civilization*, the problem of limited resources, especially land and water is clearly laid out. He states that if we continue "Business as Usual," environmental systems will break down. Most of the text, however, is devoted to seeking solutions. In many cases, solutions that are already in place have proven effective. Burning fossil fuels is one way to power the many technologies on which we have become dependent. This increases atmospheric CO2 and other fossil fuels. There are alternatives. Wind energy has become an important supplement to fossil fuel power. In Denmark, 21% of the country's energy comes from wind energy. Here in North Carolina, wind energy is a promising alternative. Because of the large wind- generating potential in the off-shore area, it is thought that wind power alone can exceed the energy demands of the state.

Population growth is creating pressures on available resources. Human populations are in an exponential growth phase, a phase that cannot be maintained indefinitely. The world population is now nearly seven billion. Some countries bear a disproportionate burden from this pressure. In areas of China and India, for example, where access to clean water and food is limited, infanticide and feticide, the abortion of the fetus, are accepted practices. But, population size alone does not determine the environmental impact. Environmental impact (I) is the product of three factors: population size (P), affluence (A) which is per capita consumption, and technological impact per unit of consumption (T)

$$I = P \times A \times T$$

This formula accounts for heavy resource use in developed countries. In fact, 20% of the population uses 80% of the earth's resources. The average citizen from a developed society uses many times more resources than a citizen from an undeveloped country. For example, a family in India would need to have up to 200 children to use the same amount of resources that one average U.S. family consumes. The Affluence component of this formula is the one in which my students can make the biggest changes. One change is to eliminate plastic water bottles. Plastic water bottles are almost ubiquitous at my school and are completely unnecessary. Corporations such as Nestle and Coca-Cola bottle municipal water and sell it back to the community at large profits. Once it is bottled, this water is far less regulated than the municipal water, which is monitored many times daily. About 22% of bottled water contains contaminants at levels higher than acceptable in municipal water supplies. The production and shipping of a regular sized water bottle consumes about 1/3 of the volume of that bottle in petroleum. The bottle is responsible for industrial and landfill waste, and may itself pose health risks. My dentist has seen

an increase in the number of cavities in children, which he attributes to the lack of fluoride in some bottled water. The only time that bottled water needs to be used is when there is a problem with the municipal water.

The graphic news media has helped to make teaching Environmental Sustainability urgent and immediate. My students remember seeing the levees break and people awaiting rescue on their roofs in Louisiana as a result of Hurricane Katrina. They have seen clean-up efforts in the Gulf after the BP oil leak, which seemed to go on forever.

Strategies

Goal Setting

This unit focuses on empowerment, so it is important for students to be able to set goals. This lesson will begin with a goal setting activity that my students will do during the second week of class. I present John Goddard's "Life List of Goals". Goddard is the preeminent goal achiever. At age 15, he wrote a list of 127 challenging goals, and has accomplished almost all of them. Students can relate to this and it sets a mood for my class. They are empowered, for some this is the start of the realization that their choices are in their own hands. I tell them from the beginning that some of the topics we discuss may seem to contrast with their beliefs. I will not ask them to make permanent decisions or turn aside any beliefs. Instead, I give them the examples of C.S. Lewis and Louis Pasteur, both famous for their stance on religion, and both who reconsidered their opinions later in life. I tell students that they will be able to form their own opinions, during the course of our time together, and over their entire lifetimes. A teenager cannot hear this enough. Throughout the class, students may argue points, but they will never argue their right to autonomous thought. This creates an attitude that will help foster deep thought and discussion throughout my class.

General Ecology and Population Studies

Exponential Growth, "The Penny Scenario": It is difficult for students to understand the explosion of the human population. As an introduction to human population growth and the concept of exponential growth, I will pose the question, "If given a choice, which would you prefer to get for your monthly allowance, one million dollars outright or 1 penny on the first day, doubled every day for the entire month. Students who have not done this will often choose the one million dollars. Then students will calculate the amount of money they will have after 30 days. They find that they will get far more money if they choose the penny option, due to exponential growth. Then I will relate this to the growth of the human population. I will give an overview of Ecology and Population studies through interactive Power Point presentations. They will be interactive because throughout the presentation, students will be asked to answer questions individually or discuss answers. To delve deep into topics such as food webs, and population growth models, I will use Pair & Share strategies. In Pair & Share, I will ask such questions as, "How can we decrease our carbon footprint?" and, "The frequency of flooding has increased worldwide. What factors have led to increased flooding in recent years?" Students will

discuss ecological services, and I predict that they will think of services that haven't often been considered. I have included a list of questions that may be useful in the Appendix. Students will discuss the answer in pairs, before sharing their answer with a larger group or the class. This enables students to anchor their new learning to what they already know. Since all of my students have already taken an Earth and Environmental Science class, they have a lot to contribute to these discussions.

An activity specifically for Biology 1 students that will incorporate math skills will be a calculation of the amount of biomass at every level of a food chain with real-life estimates. Students will graph the amount of biomass that is found at each level. From that, students calculate that approximately 10 percent of the energy from each level is transferred to the next level. Most of the energy is lost as heat. Three-dimensional ecological pyramids will be created on folded paper. On three sides of the pyramid three types of ecological pyramids will be drawn: pyramid of biomass, pyramid of energy, and pyramid of numbers. This helps students discern the three types of ecological pyramid that will be discussed. To understand that unexpected consequences can arise from interfering with a food chain, we read a short story called "Operation Cat Drop," about the unexpected increase in disease in Borneo when cats were accidentally removed. The reduction of cats was not caused by biological magnification as the story was originally told, but rather from direct contact of poison by cats. Ultimately cats were dropped by parachute to remedy the rat problem. Students enjoy illustrating a food web of this bizarre true incident.

Ecology shows us that organisms depend upon one another. One of the outcomes of climate change is that the timing of reproductive cycles has changed, but not in the same way for all species. This has led to mismatch in the timing of the life cycle of organisms. If the food supply for insect larva is spring buds, then if budding does not coincide with emergence of larvae, then food resources are not available for young animals when they need it the most. The article "Spring Forward" has a clear explanation of the outcomes of this mismatch for several species. One instance of this appears to be the case of a bird called the pied flycatcher. While it uses day length as a cue to migrate from Africa to the Netherlands, the caterpillars that it eats uses temperature to signal reproduction. Day length does not change because of climate change, only temperature does. So the pied flycatcher is arriving too late, and many of the offspring are not strong enough to return to breed the following year.

I will use Grossman's article to prompt discussion about the impact of climate change on temporal biological relationships. Discussion prompts will include, "Give examples of pairings that have become mismatched." "What are some causes of mismatch between the emergence of food resources and the birth of consumers?" "What types of evidence reveal that the timing of reproductive cycles has changed over the past 100 years?" Many of my students have read excerpts from Rachel Carson's "Silent Spring" in previous Earth and Environmental classes. The discussion will also connect with how Carson unearthed unexpected consequences of human behaviors.

As an extension for Honors Biology, I will give an outside reading about Easter Island. The article, called "Easter's End" asks the reader to compare our world's resource use today with that of Easter Island's inhabitants. The article is available online. Such evidence as the enormous

stone monoliths that have been found, in addition to pollen samples and archeological evidence indicates that Easter Island once hosted a prosperous human population. It is thought that the monoliths were a display of wealth. Pollen analysis reveals that the island was once a subtropical forest with a large variety of plant life and crops. The island is now a "wasteland." It appears that the early islanders consumed their resources until there were simply no more. The author, Jared Diamond asks, "Why didn't they look around, realize what they were doing, and stop before it was too late? What were they thinking when they cut down the last palm tree?" Then he discusses the plausible answer - they couldn't see what was happening right before their eyes.

Ecological Footprint and Carbon Footprint

Students will then watch segments from the video, "An Inconvenient Truth." Narrated by Al Gore, who won a Nobel Peace Prize for this work, this documentary uses video and a clear lecture format to explain the human influence upon climate change. Among many important points that are made is that economic decisions cannot be made at the expense of Earth, because as Gore poignantly points out, "Without earth…" and he says no more about that. Nothing more needs to be said. My colleague and I wrote a list of questions that generate lively discussion for this video. I have included these questions in Appendix 2. I will also include segments from the exciting documentary "The 11th Hour." This video is narrated by Leonardo DiCaprio, and is a fast- paced and highly visual representation of the impact of climate change. The presentation uses an excellent scope of biological sciences. It ties together evolution, genetics, and ecology, and provides explanations by top experts from many scientific areas. "The 11th Hour" might be thought of as the teen version of "An Inconvenient Truth."

All of my students calculate their carbon footprint and their ecological footprint. They use the websites HYPERLINK http://www.climatecrisis.net http://www.climatecrisis.net and http://www.footprintcalculator.org to analyze their impact and to make comparisons with average US citizens. They also explore the website to find suggestions for decreasing their carbon footprint. We share these suggestions during a class discussion. This has expanded and for the fourth year Carbon Footprint is also on the Environmental Club member information sheet. For the past two years, the Environmental Club officers have made this a mandatory part of membership. Suggestions question for discussion are found in the Student Activities section.

Reducing Plastic Water Bottle Use

After giving an overview of ecology, I will ask my students to consider the amount of water that they use. I will show my students a picture of me hauling water in buckets in a wheelbarrow to my home in an African village. I ask them to consider this question, "How would your water use be different if you lived like I did, and had to fetch every drop of water that you used to your home?" After a few minutes of writing down ideas, I begin a class discussion. Having done this before, I expect that my students will come up with ideas like: "Take shorter showers," and "Turn off the faucet while brushing your teeth." Once I get many responses, I challenge them further. "How much water does even a short shower use?" Then I ask them to write down a realistic plan for how they can save water in their own homes. They are to be specific. They will estimate the amount of water that they currently use per day, and how much could be saved with conservation practice. To do this, students will be supplied information about the amount of

water that is commonly used for daily activities, both the average and the savings using conservation practices. Knowing that each vessel that I wheeled contained 5 gallons of water, they will calculate the number of trips it would take to maintain their lifestyle if they maintain their current lifestyle. I then will ask student to write a two to four paragraph description of how they can limit their water use in their own home. They will share this with their classmates. In order to try to generate original thought, I will only giving the highest grade to those who think of at least two original ideas.

As mentioned in the Introduction, plastic water bottles are very common in my school. They are even sold in the vending machines and in the cafeteria. They are unnecessary, and are harmful to the environment. I will incorporate Discovery Streaming Video. A video segment featuring Bill Nye demonstrates how much plastic trash is in the oceans, and how far it can travel. The segment shows the North Pacific Gyre, a whirlpool of human-made debris that is swirling around the Pacific just north of Hawaii. After describing the enormous amount of plastic water bottles and plastic bags used worldwide, especially in the U.S., he offers suggestions for cutting back . Our school purchased the documentary Tapped and the site license. I have included a detailed lesson about reducing plastic water bottle use in the Appendix, called "Getting off the Bottle".

Real-life Experiences

There are some specific real-life experiences that will be included. I currently host occasional Café Days, during which students who bring their own mugs have the option of coffee or tea (organic fair trade coffee, and organic tea), or hot cocoa. This discourages disposable cups. Some of my students and I now bring our own mugs, plates and silverware to school events--sometimes. An extension of this will be an environmental class picnic, before which students will list their ideas for natural foods that do not require packaging. I think that this discussion will help students to take a critical look at packaging and waste. They will understand that on the day of the picnic, students will rate the offerings, based on characteristics such as amount of waste generated, health benefits, value, and taste.

Students will get a visual of the amount of waste they generate by carrying all the trash that they accumulate over the course of five days. They must carry this trash to each class from Monday through Friday. At the end of 5 days, we will weigh the trash bags. This will generate a discussion about how one can reduce waste, and these ideas may be incorporated in the student's personal action plan.

Book Club Activity: "Sustainability Read and Share"

The objective of this assignment is for students to read a range of current books relating to Environmental Sustainability and fact-check points that they find. This lesson is set up like a Book Club, except they will each read different books or different parts of the same book and share. They write about what they learned, what they found interesting, what they didn't like, and how the book supports specific topics that we learned about in class. Then they share they what they found during a "Book Club" meeting. (See Appendix for full description,

"Sustainability Read and Share.")
Campus and Local Recycling

The Environmental Club students will join our Exceptional Children's department students in a field trip to our local recycling facility. Our school and community curbside recycling programs have recently been expanded. The students will gain the knowledge to share the details about the new recycling program with their classmates and their families. After our visit, students will make a short video about the changes in the recycling program that will be used on the school wide announcements. The club will continue to foster awareness about how the recycling program works, including creating posters and power point slides to use on the video public address system.

The Action Plan

The two-part Action Plan is the culminating piece of this curriculum. Students will make a commitment to change a practice in a way that will have a positive influence on sustaining resources. Students will also share the knowledge that led them to this change in behavior with at least 20 people, in an effort to persuade others to change as well. The 20 people may include family members. The parameters of this activity are broad. One student may choose to simply turn off their computer when not in use, and try to convince their family members to do the same. Another student may choose to install rain barrels to reuse rainwater for gardening and lawn maintenance. The Action Plan will make this lesson more meaningful than a typical lesson or even a project, for the goal is for students to permanently change a behavior. This will have lasting effects. This idea came from a student, who, after writing her statement about how she could save water in her own home, ended with a pledge that she would make these changes from that point forward.

The class will have an opportunity to share ideas when the assignment is given. Ideas for the sharing part of the assignment may include a 30-60 second public service announcement (PSA) or a poster with contact information that readers could report back to and commenting on whether they heeded the advice. Since many students are involved in school activities, I am hopeful that it will not be a particular challenge to find an audience of 20. They also have opportunities to make video announcements that can be shown on the school-wide announcements. Each student will turn in a report including a description of the practice that they are changing and why they made this decision. They will describe the information that they shared and how they have shared this information with at least 20 other people. They must also demonstrate how they know that 20 people got the message.

The final component will be to have my students keep a journal of their own practices as they learn to implement their new behaviors. The journal will be a daily record documenting what they have changed, how well the change is going, and what obstacles they are facing. I envision a 10-day journal.

Classroom Activities

What is Your Impact on Our World?
Objectives:

Calculate your carbon footprint.
Determine how your carbon footprint compares with other US Cititzens.
Determine how many Earth's it would take to support a world of people who live like you do.
Describe three things that you can do to lower any negative impact.

Part 1. Calculate your Carbon Footprint

Go to my homepage. HYPERLINK http://pages.cms.k12.nc.us/andreawise/ http://pages.cms.k12.nc.us/andreawise/
Click on: Carbon Footprint Calculator". HYPERLINK "http://www.climatecrisis.net/calculate-your-impact.php" http://www.climatecrisis.net/calculate-your-impact.php

Answer the questions as accurately as possible. You may need help to get the information about electric bills, etc.
1. What is your Carbon Footprint, in tons per year? _____
2. How does this compare with the average of 7.5 tons per year? _____
On the bar across the top, click on Take Action. Then click on Reduce Your Impact at Home.
3. Read over the suggestions.
a. List two of these that you already do.
_____
b. List two of these that you think you *could* do, although you are not currently doing.

c. Click on these two . What is the reduction in carbon dioxide production if you implement each tip?

_____
_____
_____

Part 2. How many Planet Earths would it take to support a world of people who live like you? Let's find out.

Go to my home page.
Click on "Ecological Footprint" HYPERLINK "http://www.footprintcalculator.org/" http://www.footprintcalculator.org/
After selecting your character, answer the questions as they apply to you. You may answer each question either generally or specifically.
After answering the questions, you will get a chart showing information about your ecological footprint.
4. How many Planet Earth's would it take to provide enough resources for everyone if we all used as many resources as you? _____

5. How many Global acres support your lifestyle? _____

6. From the pie chart, what is the largest part of your Ecological Footprint? _____

7. Under explore scenarios, choose one change that you could make, and describe the impact that that change would have on the number of global acres that are used.

Getting off the Bottle. A lesson plan for High School Students

Objectives:
Students will consider the cause of the rise in bottled water consumption.
Students will consider the impact of water bottle use to the environment.
Students will analyze the long-term effects of personal behaviors related to purchasing and using plastic water bottles verses reusable containers.
Students will analyze advertising claims.

Activity 1
Blind Taste Test- Water
Complete a blind taste test of two bottled water brands and tap water.
In this controlled experiment, students will sample three water specimens labeled only Unknown to the students, "A", "B" and "C". A will contain Dasani water, B will contain bottled water from the cafeteria, and C will contain tap water. Students will report a preference and their choices will be tallied. If possible, the results can be expressed as a cell phone poll, such as PollEverywhere.com
Results will be graphed.

Activity 2
View the movie "Tapped". This documentary describes how large corporations take water from municipal water sources, bottle it in plastic bottles that cause pollution at nearly every point in their life cycle, put a large price tag on the product, and sell a possibly less safe product for an unbelievable mark up.

Activity 3
Evaluate Home Water Use
View photos of people who fetch water instead of having water piped into their home. Describe how you can reduce your home water use.

Activity 4
Synthesis Report
Do the following after completing the above class activities:

Report about 7 reasons why people should reduce or eliminate water bottle use. Develop each reason by explaining in depth the impact of each point that you list.

Describe how you can reduce your water bottle use at home and in the community.

Create a PSA to make others aware of the problem.

Questions related to the documentary "Tapped".

1. If a 17 oz bottle of water costs _____, how much does a gallon of this water cost? _____
(1 gallon = 128 oz)

Which costs more, 1 gallon of gasoline or 1 gallon of bottled water? _____ The higher priced item costs how many times more?
Which of these products can also be obtained for free?

2. a. Water bottles are made with PET (or PETE) plastics. These require petroleum for manufacture. You know that petroleum is a non-renewable resource. How much oil is used each year for producing bottled water? _____
b. Oil and gas are used in other ways besides manufacturing. List two other uses of petroleum products related to the selling of bottled water.
c. The amount of oil used for each bottle of water is roughly how much of the volume of one bottle? _____

3. a. List three contaminants that have been found in bottled water that would be regulated in municipal tap water.
b. Describe the possible health concerns related to each of the above contaminants.

4. Some people believe that they suffer from specific health problems because they live near plastic bottle manufacturing plants. What specific health problems do they cite?

5. What is the North Pacific Gyre? How large is it relative to US states?

Sustainability Read and Share

Read at least 2 chapters (not necessarily the first 2) of one of the following books related to sustainability.
Avoid Buying! Go to library or online to request books from other branches. Plan Ahead!

Title of book _____ Due Date _____
Author_____
Year of publication___

Must use separate paper

Assignment Report and Share
Title and Author of Book
Chapter titles and main idea.
10 interesting facts.
Confirmation of 5 of the facts with corroborating evidence (another source).
Which themes of Biology were discussed? –Give specifics from reading.
Which chapters of the Biology book does this correlate with? Give specifics from reading.
These books are intended to instruct us about how we can reduce our impact on the Earth.
Describe at least 5 behaviors that you could change that are based on your reading.
Would you read more/ recommend this book based on what you read? Why or why not?
Fact checking
Choose 5 points from the book. Corroborate each point using a source other than your

book, and write the <u>statement</u> that you find and its <u>source.</u> (You are encouraged to use references provided in your book for verification).

Information from book Include statements from the book	Verification/ Refutation 1. Source 2. What does the source say? Can't use "No information found" to support or discredit a fact.

The above information will be shared with a small group, and turned in.
The only way to receive full credit for this assignment is to share.
For credit in AP Biology you must read from outside sources. This assignment fulfills that requirement.
You are expected to read a book that you have not read before. This is on your honor.

An Inconvenient Truth
Documentary --96 minutes

***Name*_____**
Date _____Per_____

Questions Provided by Mrs. Ratliff and Miss Wise, Providence High School

1. The thickness of earth's atmosphere is compared to _____.
2. Roger Revelle began studying CO_2 levels in the atmosphere in 1958. What have his studies revealed?
3. Why do CO_2 emissions increase in the winter?
4. According to ice cores, as CO_2 levels rise, what happens to the earth's temperature? _____ How many ice ages has the earth experienced according to these cores? _____
5. Our CO_2 emissions are now above _____ ppm (parts per million). Is this amount within the parameters of earth's natural cycle? _____
6. The video states that the 10 hottest temperatures on record have happened in the last _____ years.
7. Describe the recent activity of hurricanes and tornadoes.
8. Why does ocean temperature affect the velocity of a hurricane?
9. In what countries has flooding recently become a major concern?
10. In what countries has drought become a major concern?
11. How does global warming affect the frequency and location of flood and drought?
12. Where are "drunken trees" located and how does global warming contribute?
13. According to the data from nuclear submarines, the arctic ice has diminished by _____ in the last 40 years.
14. Ice reflects _____ of the sun's rays, however water in the ocean absorbs _____ of the sun's rays.
15. Describe the plight of the polar bears.
16. The ocean conveyor is the system of the earth's major ocean currents that is _____ together. The blue arrows represent the _____, dense currents that we don't see that are _____ the ocean surface.

17. How would the melting of ice sheets cause an ice age?
18. Why would global warming increase the spread of disease?
19. Why is it a more serious problem if land-based ice melts compared to sea-based ice?
20. If Greenland should melt, what would happen to the World Trade Center Memorial?
21. American car companies say that in 10 years they will not be able to meet the reduced CO_2 emissions that _____companies have already reached.
22. What is the relationship between increased population and climate change?
23. Reflect on this quote: "It is difficult to get a man to understand something when his salary depends on him **not** understanding it."
24. Name 3 things we can do to reduce global warming.
25. What 2 major countries have not ratified the Kyoto Treaty? Which US states are abiding by the Kyoto Treaty?
26. Is there a precedent for slowing down environmental damage? Describe.
27. Do you think that the film is politically biased? Explain. Give examples.
28. Reflect on the quote: "When you pray, move your feet".
29. Will you change any behaviors? Explain.

An Inconvenient Truth
TEACHER NOTES with answers

1. The thickness of earth's atmosphere is compared to *VARNISH ON A GLOBE*
2. Roger Revelle began studying CO_2 levels in the atmosphere in 1958. What have his studies revealed? *INCREASED LEVELS*
3. Why do CO_2 emissions increase in the winter? *NORTHERN HEMISPHERE HAS MORE PLANTS, SO MORE CO2 DURING THEIR WINTER*
4. According to ice cores, as CO_2 levels rise, what happens to the earth's temperature? *CORRELATES* How many ice ages has the earth experienced according to these cores? *7 ICE AGES*
5. Our CO_2 emissions are now above *330* ppm (parts per million). Is this amount within the parameters of earth's natural cycle? *NOT WITHIN NORMAL*
6. The film states that the 10 hottest temperatures on record have happened in the last *14_* years.
7. Describe the recent activity of hurricanes and tornadoes.
FAR INCREASES ACTIVITY, RECORDS BEING SET, FIRST HURRICANE IN SOUTH AM. (BRAZIL)
8. Why does ocean temperature affect the velocity of a hurricane?
AS TEMP INCREASES, ENERGY IS HIGHER, WIND VELOCITY AND HUMIDITY INCREASE.
9. In what countries has flooding recently become a major concern?
INDIA, CHINA
10. In what countries has drought become a major concern?
11. How does global warming affect the frequency and location of floods and droughts?
MORE WATER EVAPORATES, STORED IN ATMOSPHERE (AND MORE PRECIPITAION DURING A DROUGHT)
12. Where are "drunken trees" located and how does global warming contribute?
GREENLAND
13. According to the data from nuclear submarines, the arctic ice has diminished by *40%* in the last 40 years.

14. Ice reflects *90%* of the sun's rays, however water in the ocean absorbs *90%* of the sun's rays.
15. Describe the plight of the polar bears. *DROWNING BECAUSE THEY CAN'T FIND ICEBURGS TO REST ON*
16. The ocean conveyor is the system of the earth's major ocean currents that is *LINKED* together. The blue arrows represent the *COLD*, dense currents that we don't see that are *BELOW*_ the ocean surface.
17. How would the melting of ice sheets cause an ice age? *IT WOULD STOP THE OCEAN CONVEYOR BELT*
18. Why would global warming increase the spread of disease? *FLOOD CAN CAUSE CONTAMINATED WATER*
19. Why is it a more serious problem if land-based ice melts compared to sea-based ice? *LAND-BASED ICE INCREASES SEA LEVEL BUT SEA BASED-ICE DOES NOT.*
20. If Greenland should melt, what would happen to the World Trade Center Memorial?
IT IS FLOODED IN THE SIMULATION
21. American car companies say that in 10 years they will not be able to meet the reduced CO_2 emissions that *JAPANESE* companies have already reached.
22. What is the relationship between increased population and this issue?
CONTRIBUTES TO MORE FORESTS BURNED, MORE TECHNOLOGY, MORE DIVERTED RIVERS (WHERE IS EROL SEA?)U.S. IS WAY OUT OF PROPORTION
23. Reflect on this quote: "It is difficult to get a man to understand something when his salary depends on him **not** understanding it."
24. Name 3 things we can do to reduce global warming. *Answers will vary and may include: Reduce/ combine car trips. Wait until afternoon to drive or mow lawn. Use fuel efficient cars and appliances. "Green" your home. Don't buy items with unnecessary packaging. Don't buy bottled water.*
25. What 2 major countries have not ratified the Kyoto Treaty? *USA AND AUSTRALIA* Which US states are abiding by the Kyoto Treaty?
CA, OREGON, PENN, 9 NORTHEASTERN STATES
26. Is there a precedent for slowing down environmental damage? Describe.
YES, SUCH AS LAKE ERIE OR OZONE LAYER
27. Do you think that the film is politically biased? Explain. Give examples.
28. Reflect on the quote: "When you pray, move your feet". *Do something!!*
29. Will you change any behaviors? Explain

Appendix
Implementing District Standards

Objective 5.01 Investigate and analyze the interrelationships among organisms, populations, communities and ecosystems. Students will repeatedly describe examples in which relationships occur between populations, especially the relationship between humans in developed and developing countries, and the human impact on the resource availability of all species.

Objective 5.02 Analyze the flow of energy and the cycling of matter in the ecosystem. With a focus on carbon dioxide cycling, students will explain how carbon dioxide is produced and removed from the ecosystem, and then will calculate their own carbon footprint.

Objective 5.03 Assess human population and its impact on local ecosystems and global environments. This objective is the heart of this curriculum, and each of the activities in the curriculum are meant to go beyond this assessment and to empower students to make changes that have a more positive impact on local ecosystems.

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