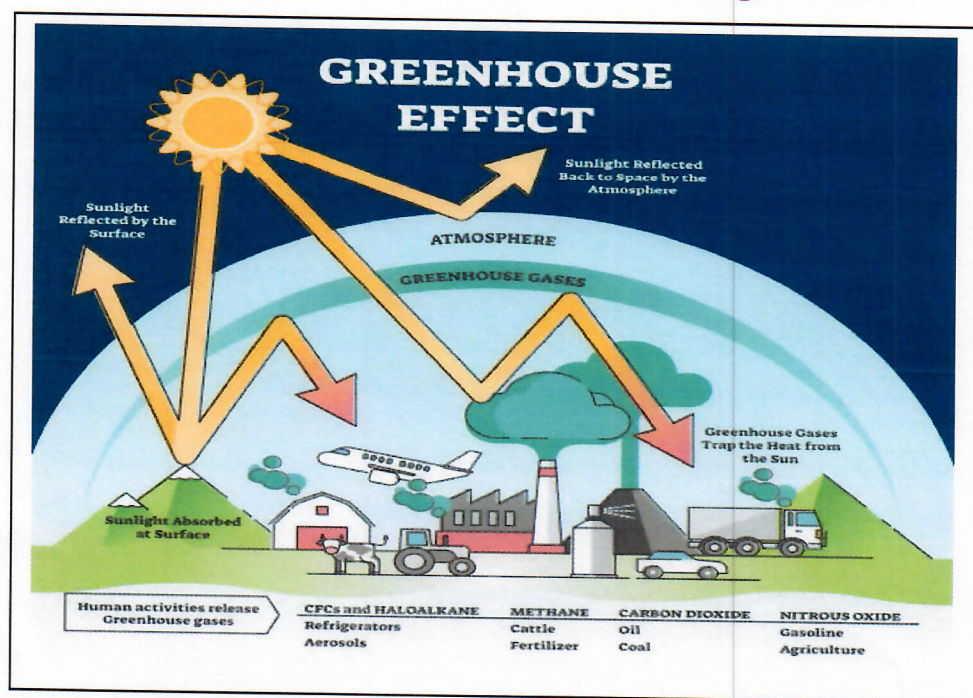


Welcome to:

“Modeling the Greenhouse Effect and the Global Warming Game”



Presented
by: Dr. Ed
Donovan
Adjunct
Professor
of Science
Education
at USC
Upstate

The 2024 EEASC (Environmental Education Association of South Carolina) Conference

CLIMATE RESILIENCE **How to Save the Planet 2024?**

Please enter to learn about Global Warming
and the Greenhouse Effect

USC Upstate Campus Life Center – Room 317
Friday, 06.21.2024 from 11:00 AM – 11:50 AM

(scieddie4@aol.com or donovane@uscupstate.edu)

EXTRA ACTIVITIES

Name _____

Date _____

Carbon Dioxide In the Atmosphere: Who Contributes and How Much?

The top graph on the next page shows how much carbon dioxide different regions of the world contribute to the atmosphere each year. The amount is given in millions of tons of carbon contained in the carbon dioxide, and in percentage of the total carbon dioxide produced worldwide. The bottom graph shows how many people live in each region and what percentage they are of the world population.

A. Which region produces most of the world's carbon dioxide? _____

B. What percentage of the world's population lives in that region? _____

C. Which other regions with low populations produce a lot of carbon dioxide? _____

D. Why do you think these regions produce so much carbon dioxide? _____

E. To find the average amount of carbon (as carbon dioxide) that each person adds to the atmosphere, divide the number of tons of carbon by the population. Complete the table:

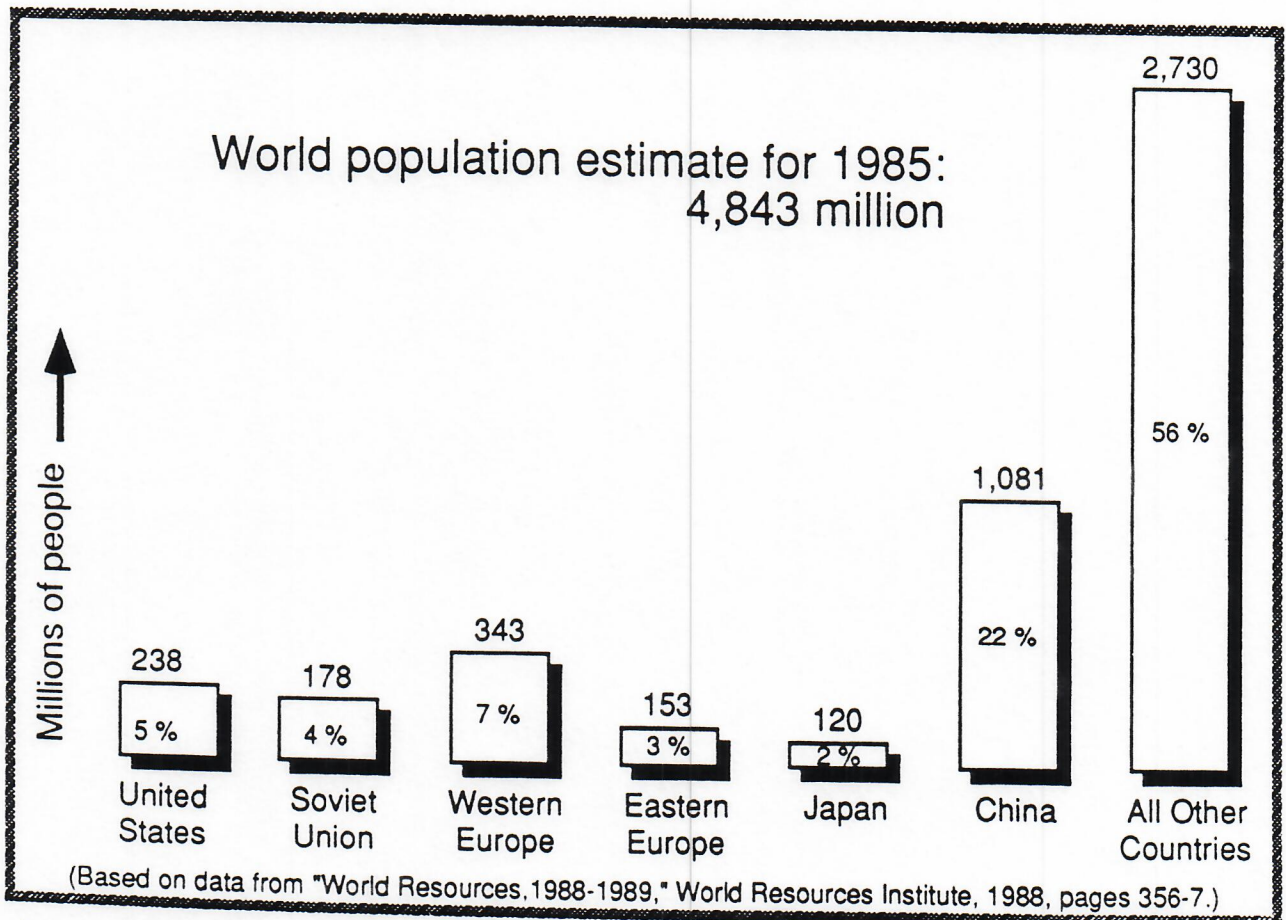
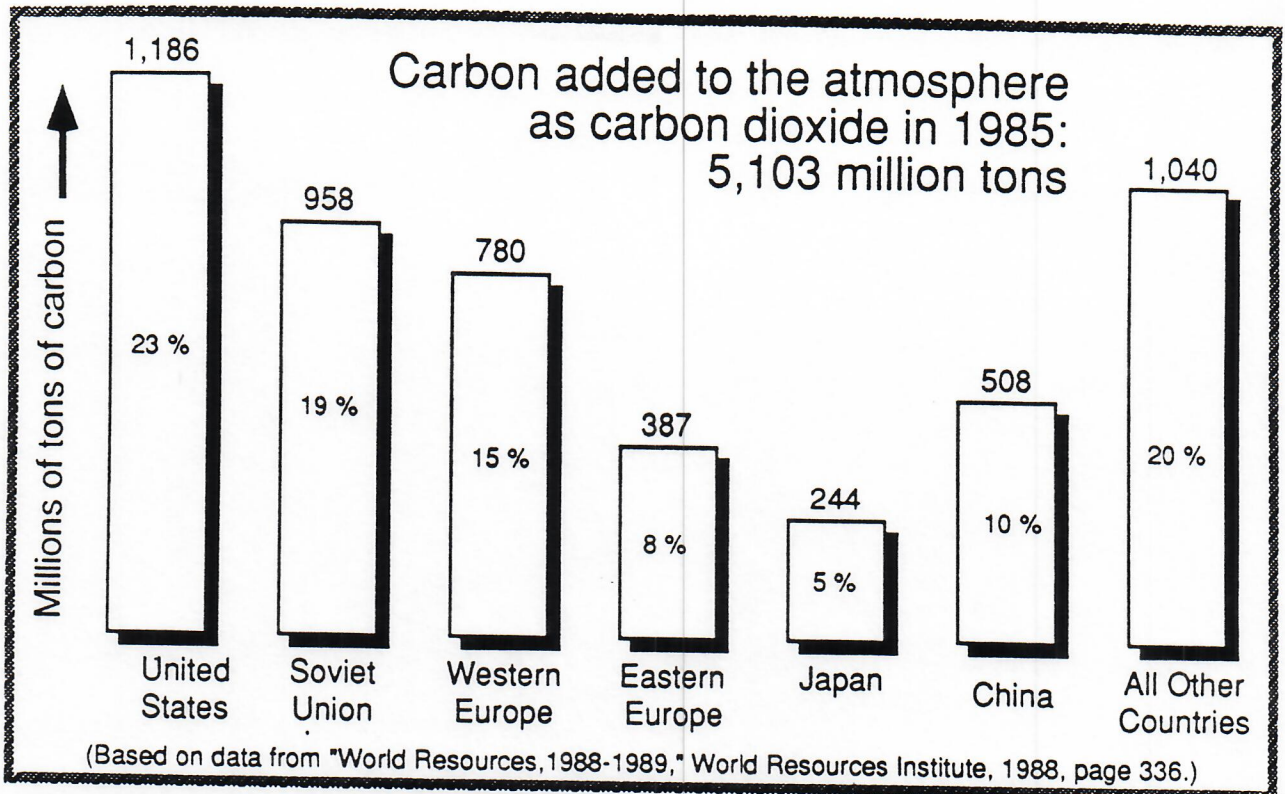
United States	$1,186 \div 238 =$	<u>4.98</u> tons/person
Soviet Union	$=$	_____ tons/person
Western Europe	$=$	_____ tons/person
Eastern Europe	$=$	_____ tons/person
Japan	$=$	_____ tons/person
China	$=$	_____ tons/person
All Other Countries	$=$	_____ tons/person

F. Which region produces the least carbon dioxide per person? Why do you think they produce so little carbon dioxide per person?

G. What do you think are the differences in how people live in countries that produce little carbon dioxide compared with countries that produce a lot of carbon dioxide?

H. In what ways do you think the people who produce a lot of carbon dioxide can reduce the amount they add to the atmosphere?

Carbon Dioxide in The Atmosphere: Who Contributes and How Much?



Session 6: Changes On Noua's Island

Overview

So far in this guide, emphasis has been on understanding how the greenhouse effect works, and its consequences for global warming. Now the focus shifts to the large-scale effects of global warming, and some of the issues and dilemmas our global society faces in dealing with these effects.

Session 6 consists of two parts. First, the students meet in small groups to plan how they will represent specific points of view at a mock "World Conference on Global Warming" (to be conducted in Session 8). Summaries of these plans allow the teacher to provide feedback to the groups when they refine their plans during the next session. In part two, the students hear an imaginative story ("Noua's Island"), which helps them visualize the possible effects global warming will have on the lives of people in a distant place on the Earth.

The purposes of Session 6 are to:

- (1) introduce the concept of an international forum for discussing environmental problems and possible solutions;
- (2) provide students with insights into the effects of global warming on a society and culture very different from their own;
- (3) provide the experience of looking at an environmental issue from viewpoints that may be different from their own.

What You Need

For each student interest group

- ☐ One copy (for each student in the group) of a specific interest group's description and list of questions. Include one additional copy for the group (see pages 101-105)

For each student

- ☐ Homework article on global climate change (select the article most appropriate for your students—see pages 106-107)

You may find your class needs more time to discuss the homework, "Noua's Story," and other ideas covered so far in the unit. If so, it is probably best to add another session rather than rushing your students to stay on schedule. Most of Session 6 could then be taken up by discussion of the homework and Noua's Story, with the World Conference introduced at the end. This arrangement would also give students time to think about their preferred group until the next class period. Then, the students would form their interest groups and start planning for the World Conference.

Getting Ready

1. Photocopy pages 101-107 for in-class and homework reading. Depending on your students, you may wish to use one or both of the articles.
2. In this session, students form interest groups to prepare for a "World Conference on Global Warming." Decide in advance if it is best for you to assign students to the five groups on the basis of which students work productively together, or if you want them to choose which of the groups they wish to represent.
3. Plan how you will organize tables or desks so small groups can meet together halfway through the session.



Where Does the World's CO₂ Come From?

1. Discuss the homework questions from Session 5 (see page 90).
- A. [The United States produces most of the world's carbon dioxide.]
- B. [Five percent of the world's population lives in the United States.]
- C. [The Russian Federation, Japan, and Germany have low populations and produce a lot of carbon dioxide.]
- D. [Some countries produce more carbon dioxide per person because they have more industry and more automobiles than other countries.]
- E. [United States 19.06 tons/person
China 2.28 tons/person
Russian Federation 14.02 tons/person
Japan 8.81 tons/person
Germany 10.97 tons/person
India86 tons/person
All Other Countries 3.61 tons/person]

F. [India. A lower level of industrialization, fewer automobiles, and large populations in many developing nations probably account for the lower production of carbon dioxide per person.]

G. Allow individuals to express their opinions and discuss their different points of view on this question.

H. Allow individuals to express their opinions and discuss their different points of view on this question.

The Story of Noua's Island

1. Ask students to imagine themselves in a developing country that may be affected by increased sea levels. Although people in that country contributed very little to the cause of global warming—increased carbon dioxide—they will be affected by it as much as any of the industrialized nations, and in some cases the effects will be even greater.

2. Tell the class you are about to read a story to help them imagine what it is like to live in a developing country, and how people in that country may be directly affected by global warming. Explain that the story is not about an actual person, but it does describe a real situation for millions of people who live on islands or low coastal areas around the world. The story portrays predictions by researchers concerning how people in these areas are likely to be affected by rising sea levels if global temperatures increase by just a few degrees Fahrenheit.

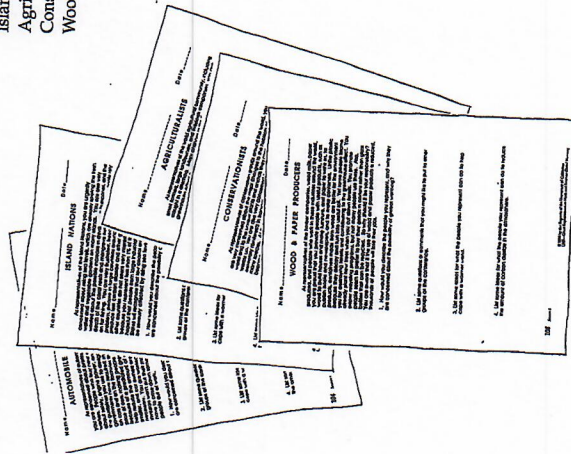
3. Ask the class to put aside any distractions, sit back, relax, and imagine what is happening in the story.

4. Begin to read the story **slowly and carefully**—it is meant to transport the students into the world of an ocean island faced with the problem of rising sea levels. (Your reading copy of the story is on pages 98–100.) Where it is indicated in the story, stop and ask questions.

5. After reading the story, ask the students: What would you do if you were in Noua's situation? Do you think other countries are going to respond to this dilemma of the low-lying ocean islands? Why or why not? Allow the students to discuss their opinions, and explain they will have a greater opportunity to plan what might be done during an upcoming conference on global warming.

Planning the International Conference

1. Tell the students they will conduct an imaginary **World Conference** to discuss how people might cooperate to decrease the greenhouse effect, or cope with the changes it causes. In the conference, groups of students will represent people from various countries and other interests.
2. Divide the class into five groups (or allow the students to choose the interest group they will represent) as follows:
Automobile Manufacturers
Island Nations
Agriculturists
Conservationists
Wood and Paper Producers
3. Organize tables or desks so students can meet in the five small groups. Give each student a copy of the description of her interest group, and leave one extra copy with each small group.
4. Briefly describe each of the interest groups for the entire class.
5. Explain that the World Conference has been called to allow each of the interest groups involved to present their point of view, and to look for possible solutions that are acceptable to some or all of the other interest groups.
6. Emphasize that it will not be a debate—everyone is affected by global warming, so no one is really for or against it. Instead, the task is to find out who is affected, how, and what, if anything, can be done about it.



7. Tell the groups to appoint a Reader, who will read the interest group description and questions aloud to the group, and a Recorder to write down everyone's ideas in response to the four questions on the page. Allow the groups 10–20 minutes to read the handouts, and to discuss and record their ideas.

8. Five minutes before the end of the session, ask if there are any questions about the conference. Tell the class they will have some more time in the next session to plan what they are going to say at the conference.

9. Collect the writing from each of the groups so you can provide feedback during the next planning period in Session 7.

10. Hand out the reading assignment (pages 106–107). Instruct the class to read these before the next session, because they will find the information helpful in their planning for the “World Conference on Global Warming.”

Going Further

1. Have students draw pictures of what they imagine Nouna's Island to be like—an island nation threatened by rising sea levels due to global warming.
2. Students could write a letter to Nouna, either for homework, or as a summary at the end of the unit, explaining to the island people what is currently known about global warming, and what solutions there might be to the problems that it may cause.
3. The class could write a play about Nouna and the issue of global warming, to present to other classes, or dramatize an imaginary interview with Nouna, asking what effects global warming may have on the life-style of the island nations. (Some helpful references are listed in the Resources, starting on page 146.) You may have other ideas about a play or other literary extension focusing on the topic of global warming.

Nouna's Island

Imagine you live on one of a cluster of tropical islands, in the middle of the Pacific Ocean. Your name is Nouna, and for as long as your elders can remember, the spirits of your people have lived on these islands.

You live in a village of wooden, thatch-roofed houses, at one end of a long white beach. Beyond the beach is a beautiful coral reef, enclosing a small lagoon of bright blue water. The weather is almost always hot and balmy—there is no real winter. But at a certain time in the year the hurricanes come. The hurricanes are frightening, but over many generations your people have learned how to live with them—how to construct safe shelters to protect you from the high winds, giant waves and floods, and how to quickly repair the damage.

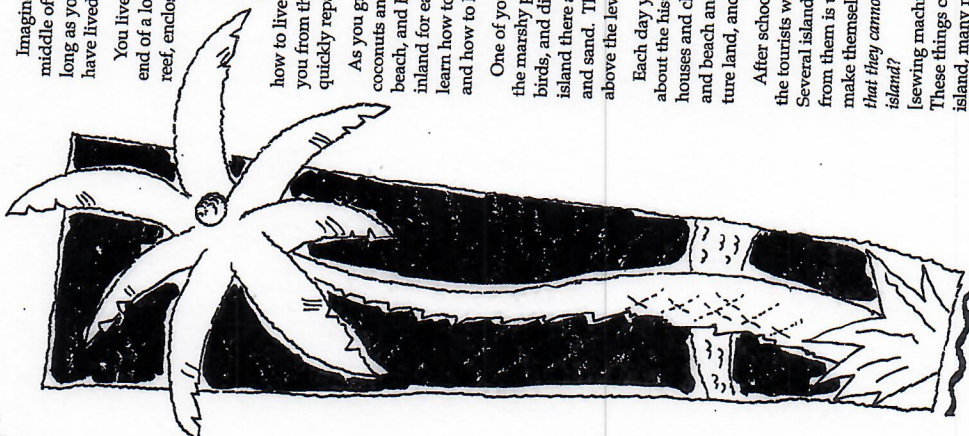
As you grow up on your island, you learn how to collect coconuts and bananas from the trees along the back of the beach, and how to gather special plants from the forest further inland for eating and for making clothes and medicines. You learn how to grow vegetables on the fields next to the village, and how to hunt for fish in the lagoon and around the reef.

One of your daily tasks is to collect fresh water in tins from the marshy pool near the village. Here you find many water birds, and different sorts of fish, frogs, and tortoises. On the island there are no mountains to speak of, only tropical forest and sand. The highest point of the island is only a few feet above the level of the sea.

Each day you go to school in the village, but you also learn about the history of your island, and how to get food and make houses and clothes, from the old people. The lagoon and reef and beach and tropical forest are your playground, your adventure land, and your classroom.

After school, you earn some money by running errands for the tourists who stay in huts at the other end of the beach. Several island families own these tourist huts, and the cash from them is used by your village to buy the things they cannot make themselves. *What do you think people on your island need that they cannot make themselves from the natural resources on the island?*

[sewing machines, steel axes, medicines, refrigerators]
These things come from the stores in the big city, on a main island, many miles to the north.

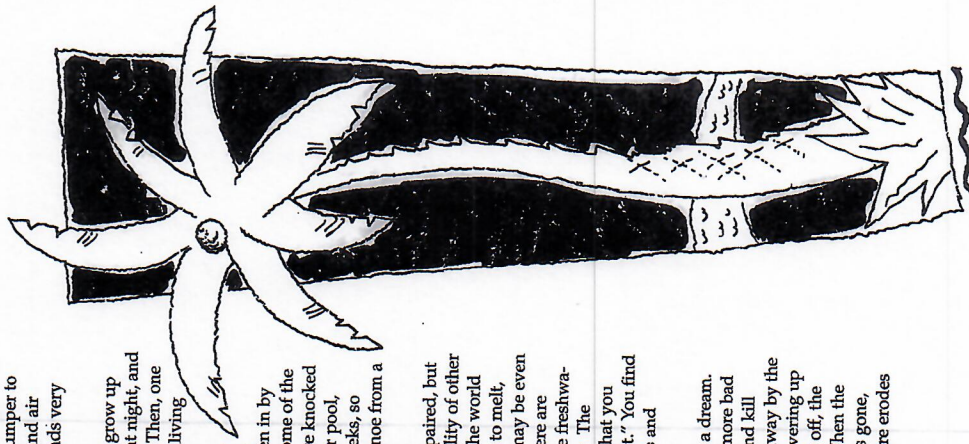


You also learn many things from the tourists, and from the one TV in the village—about places where there are high mountains and huge buildings, and freeways with cars bumper to bumper, and bright lights, and hamburger stands, and air pollution. *How do you feel about these things?* It sounds very exciting, but also somehow scary and very big.

You are mostly happy with your life here, as you grow up among friends and sunshine and laughter, singing at night, and sharing grilled fish and coconut milk on the beach. Then, one night, there is a terrible hurricane, worse than in all living memory. Huge waves crash over the reef and sand bank, and sweep away the lower part of the village. Three people are killed, and many more are injured. Many families are left homeless, and have to be taken in by neighbors. The season's crops are destroyed, and some of the biggest coconut and banana trees along the beach are knocked down. Seawater has even swept into the fresh water pool, making the drinking water too salty to drink for weeks, so barrels of water have to be carried laboriously by canoe from a nearby island.

Over several months, the devastation is slowly repaired, but your people are now very worried about the possibility of other storms. There are reports on the TV about the way the world temperature is increasing, causing the polar ice caps to melt, and sea levels to rise. Some scientists predict there may be even more intense hurricanes in the coming years, and there are likely to be other effects on ocean islands, such as the freshwater pools being contaminated by the rising saltwater. The reports blame these changes on some strange thing that you haven't heard of before, called the "greenhouse effect." You find out that it is somehow caused by people driving cars and burning coal and oil, in strange countries far away.

One night after watching the TV reports you have a dream. In your dream the predictions come true—there are more bad hurricanes that destroy more of the village houses, and kill more people. The beautiful sandy beach is washed away by the huge waves and redeposited over part of the reef, covering up food for the fish. As the trees along the shoreline die off, the sand dunes at the top of the beach begin to erode. When the protection they gave to the plants behind the beach is gone, most of these plants turn brown and die, and the shore erodes even further.



In your dream, the lower part of the vegetable gardens is now covered by saltwater at the highest tides, killing all the plants. And the beautiful clear water that you used to drink becomes saltier, whether there are storms or not. Many of the plants that you used to collect for food, clothing, and medicine disappear. Even some of the beautiful birds you used to see frequently do not appear on the island any more. *Why would plants and animals be disappearing?*

[Plants and animals are adapted to survive under a certain range of temperatures, but temperatures are beginning to change. Other changes in habitat are also occurring. For example, if there is less fresh water for humans, there is less fresh water for animals, too.]

Tourists have stopped coming to stay, and there is no money to buy spare parts for the sewing machine and refrigerator, or even to buy new axes. In the dream, a number of your friends have now grown older, and there is no work, or even food, to support them. One by one they are forced to leave the island, moving to the big city on the island to the north, along with young couples with children, who are no longer able to feed and clothe them on your island. When people leave, you hear very little about them, because communication with the big island isn't very good, and it seems that people easily get lost in the hugeness of the city. In the village people argue about why things are changing. Some of the old people say the spirits are angry with humans for something bad they have done.

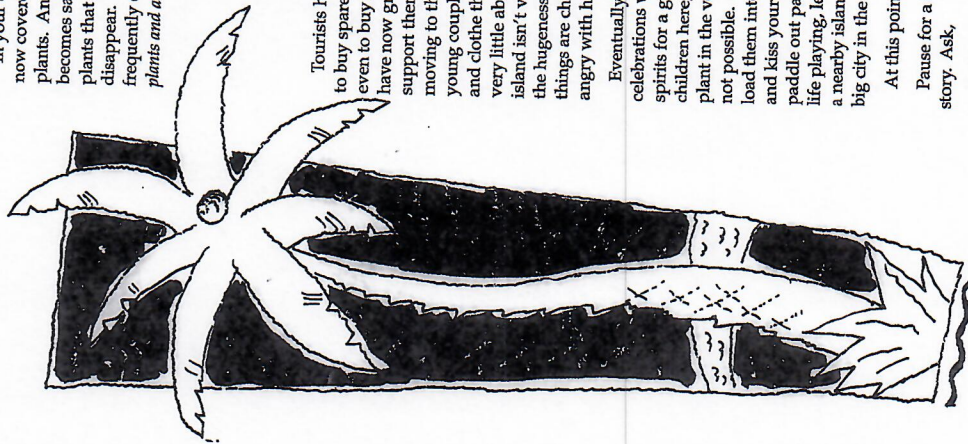
Eventually, it is also time for you to leave. You will miss the celebrations when all the islanders got together to thank the spirits for a good season. You would have married and had children here, taught them how to catch fish on the reef, and plant in the vegetable patch next to the village. But now, that is not possible. So one sad day, you pack your few belongings, load them into a canoe on the beach you have always known, and kiss your parents and brothers and sisters good-bye. You paddle out past the lagoon and reef where you have spent your life playing, learning, and gathering your food, on your way to a nearby island, which has a plane to take you far away to the big city in the north.

At this point, Noua wakes up.

Pause for a few seconds so the students can reflect on the story. Ask,

If you were Noua, how would you be feeling?

What did you think about the story?



Name _____

Date _____

AUTOMOBILE MANUFACTURERS

As representatives of automobile manufacturers around the world, you are concerned about profits for owners and investors, and jobs for workers. People who buy new cars seem to be mostly concerned about safety, engine power, and the cost of a new car. So, these are the guidelines you use to design them. In the past 10 years, many governments have required more effective pollution control equipment on cars and on the factories that produce them—all of which adds to the price of cars, making people think twice about buying a new one. Now, because of a predicted greenhouse effect, you are being asked to help reduce the amount of carbon dioxide by producing cars that are smaller, and car owners are being encouraged to use them only when necessary. You are worried about reducing profits. If this happens investors won't put their money into your companies, and you would have to close down some of your factories, which would put thousands of people out of work.



1. How would you describe the people you represent, and why they are concerned about the possibility of global warming?

2. List some questions or comments you might like to put to other groups at the conference.

3. List some ideas for what the people you represent can do to help cope with a warmer world.

4. List some ideas for what the people you represent can do to reduce the amount of carbon dioxide in the atmosphere.

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LHS GEN5—Global Warming & the Greenhouse Effect

Session 6 101

Name _____

Date _____

ISLAND NATIONS

As representatives of the island nations, you are urgently concerned about rising sea levels, which are spoiling the freshwater and vegetable gardens on many islands. You are also very worried about the possible increase in devastating hurricanes, and the death of the coral reefs and mangrove swamps that your people rely on for fishing. You are very frustrated, because in order to solve your problem, people in large countries around the world must decide to produce less carbon dioxide and other gases. Most people in these other countries do not seem very interested in helping you, possibly because you represent less than 1% of the world's population. You are hopeful that people from large industrialized countries such as the United States will recognize that low coastal areas in their own countries also will be seriously affected by rising sea levels.



1. How would you describe the people you represent, and why they are concerned about the possibility of global warming?

2. List some questions or comments you might like to put to other groups at the conference.

3. List some ideas for what the people you represent can do to help cope with a warmer world.

4. List some ideas for what the people you represent can do to reduce the amount of carbon dioxide in the atmosphere.

102 Session 6

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LHS GEN5—Global Warming & the Greenhouse Effect

Name _____

Date _____

AGRICULTURISTS

As representatives of the world agricultural community, including small farmers, large landowners, and livestock companies, you are caught in a dilemma. Major changes in the Earth's climate due to the greenhouse effect and global warming will affect which crops and animals are able to be raised in different regions. Thus, some farmers will be helped, and others may be devastated. You also know that animals such as cows, sheep, and horses contribute significantly to the greenhouse effect, through their production of methane. (Like carbon dioxide, methane is a greenhouse gas and it is estimated that it may account for about 25% of the global warming that is predicted to occur in the next century.) In addition, cutting down forests to make room for crop and pasture land also increases the amount of carbon dioxide in the atmosphere. While you worry about the consequences of these activities, you know that you must increase food production to feed the world's growing population.



1. How would you describe the people you represent, and why they are concerned about the possibility of global warming?

2. List some questions or comments you might like to put to other groups at the conference.

3. List some ideas for what the people you represent can do to help cope with a warmer world.

4. List some ideas for what the people you represent can do to reduce the amount of carbon dioxide and methane in the atmosphere.

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LHS GRMS—Global Warming & the Greenhouse Effect

Session 6 103

Name _____

Date _____

CONSERVATIONISTS

As representatives of conservation groups around the world, you are very concerned about the major changes to the habitats of the world and to the unique plants and animals they contain, if the Earth warms up. You are also very concerned about the destruction of forests, especially rain forests in tropical and temperate areas that contain so many species. As many as 300–400 species of plants and animals become extinct each year due to the removal of forests. This "extinction crisis" is likely to increase with global warming. You would like to find ways of convincing people that the things each individual person does, such as driving cars, using plastic and paper packaging, even using too much electricity (which is made by burning fossil fuels) can have a detrimental effect on our global environment. You want people to realize that it makes good economic sense to conserve natural resources, whether or not the predictions about global warming turn out to be accurate.



1. How would you describe the people you represent, and why they are concerned about the possibility of global warming?

2. List some questions or comments you might like to put to other groups at the conference.

3. List some ideas for what the people you represent can do to help cope with a warmer world.

4. List some ideas for what the people you represent can do to reduce the amount of carbon dioxide in the atmosphere.

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Session 6 104

Name _____

Date _____

WOOD & PAPER PRODUCERS

As representatives of the timber companies, wood mills, paper producers, and people who work in these industries around the world, you are proud that you provide people with useful products, such as wood to build houses and make furniture, and paper to write on, to publish books and newspapers, and to make containers. Unlike plastic products, containers made from wood are better for the environment because they decay and turn into useful soil. Yet some people blame you for destroying forests and contributing to the greenhouse effect. You already plant new trees when you cut down these. Also, people seem to prefer to buy their goods in cartons rather than glass bottles that can be recycled. So why should it be your responsibility? You are aware that if the use of wood and paper products is reduced, thousands of people will lose their jobs.



1. How would you describe the people you represent, and why they are concerned about the possibility of global warming?
2. List some questions or comments you might like to put to other groups at the conference.
3. List some ideas for what the people you represent can do to help cope with a warmer world.
4. List some ideas for what the people you represent can do to reduce the amount of carbon dioxide in the atmosphere.

Following is an article about global climate change. Underline predictions about the effects that global climate change may have on the Earth's environment.
(Excerpted with permission from the San Francisco Chronicle, April 17, 1995.)

Name _____

Date _____

New Hints Of Global Warming

World temperatures
are climbing again

by Charles Petit
Chronicle Science Writer

Seven years after a sweltering heat wave helped make the "greenhouse effect" front-page news, scientists see new evidence suggesting that global warming is no far-off theory, but a real phenomenon that is already reshaping climate worldwide.

At the same time, they voice growing pessimism that the nations of the world will move anytime soon to reduce dramatically the human activities that are altering the chemistry of the protective atmosphere enveloping planet Earth.

After a brief cooling under the shade of volcanic dust spewed by Mount Pinatubo in 1991, world temperatures are again climbing to near-record levels. And even if it were possible to immediately freeze emissions of carbon dioxide—the chief "greenhouse" gas—levels high in the atmosphere would continue rising well into the next century.

"Is there global warming? I'm not 99 percent sure, but I am 90 percent sure," said Stephen Schneider, a climatologist at Stanford's Institute for International Studies.

Nobody can predict just what the long-term consequences of global warming might be. There could be good news—for instance, improved farm production at high latitudes as growing seasons lengthen. And there could be disaster: flooded coasts, droughts, outbreaks of disease, and mass extinctions as plants and animals expire before they can adapt or move.

On average, temperatures around the world are now about 1.2 degrees Fahrenheit warmer than in the 1860's when reliable record keeping began, and the change

WHAT WE MIGHT EXPECT ON A WARMER EARTH

Here are possible consequences if the Earth's average temperature increases by several degrees in the next century, as many computer climate models predict.

SEA LEVEL

Warming expands ocean water and may melt some glaciers. Could go up one foot in next 35 years and two in next 100.

EXTREME STORMS

Hurricanes and other storms may become worse, but no clear sign of that yet.

DROUGHTS AND HEAT WAVES

Centers of large continents, such as the U.S. Great Plains, may be drier even if overall world rainfall increases somewhat. Heat waves may be more common.

REFUGEES

Movement of just 1 percent of a future population of 6 billion people due to higher sea level, drought, or other climate changes would produce 60 million migrants, many times the number of all refugees today.

AGRICULTURE

Impact mixed. Carbon dioxide stimulates plant growth. However, heat increases demand for water. Growing zones will shift if weather patterns change.

DISEASES

Warming that expands the tropics will also expand the range of tropical diseases such as malaria and other insect-borne maladies.

WILDLIFE

Possible mass extinctions may occur as conditions change faster than species can move or adapt. Urban agriculture development leaves few wilderness corridors for migration.

ing patterns look increasingly like what the computers predict.

The best-known of greenhouse Cassandras is James Hansen of the Goddard Institute for Space Studies in New York. During the heat waves of 1988, Hansen caught the nation's attention when he told Congress he was convinced that global warming was under way.

The year 1990 brought a new record for annual average global temperature—59.84 degrees Fahrenheit, compared with a 1951–1980 average of 59—and the next year was the second-hottest on record.

In 1992, haze from Pinatubo spread through the atmosphere, dimming sunlight at the surface slightly, and cooling the planet a bit, just as Hansen's computer models predicted. And, as he predicted, the cooling kicked global warming out of the news.

But Hansen's models also predicted the long-term warming would quickly resume. And, indeed, 1993 was the 10th-hottest on record (all 10 have been since 1973). Last

year was the fifth-hottest, and so far, 1995 has been warm, too.

If there is one leading authority on global warming, it is probably the Intergovernmental Panel on Climate Change, a team of hundreds of the world's top climate experts appointed by the United Nations and World Meteorological Organization to weigh the evidence and forge a scientific consensus.

In 1990, and again in 1992, the panel projected that a doubling of carbon dioxide and other "greenhouse gases" will probably raise the average world temperatures 3 to 8 degrees Fahrenheit by late next century—a far faster increase than any seen in the geologic record going back tens of millions of years. One result, the group said, would be a two-foot rise in sea level.

Like most climate experts, Michael MacCracken, an atmospheric scientist at the federal government's \$1.8 billion Global Change Research Program, cautions that the jury is still out.

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LHS GEMS—Global Warming & the Greenhouse Effect

Name _____

Date _____

Human Activity and Climate Change

The "greenhouse effect" is so named because certain gases in the atmosphere trap heat and keep the earth warm, much as the glass of a greenhouse keeps the air inside warm. This atmospheric blanket is essential to life; without it, the earth would be much colder and uninhabitable. But civilization is now adding to the concentrations of "greenhouse gases" in the atmosphere, apparently causing the Earth's temperature to rise beyond its natural level. Several gases are responsible, the most important being carbon dioxide (CO₂), which is released by the burning of coal, oil, natural gas, and by the destruction of forests. Scientists have little doubt that the increase in these gases will cause the earth to get warmer in the future, but exactly how much and how fast the temperature will rise is uncertain, as are the precise consequences of the rise.

One almost certain change is that the oceans will rise, because warmer water will expand and Arctic ice sheets and alpine glaciers will partially melt. Analyses suggest the sea level rise will be between one and three feet by the mid-21st century, enough to cause severe coastal erosion, destroy irreplaceable wetlands, and contaminate water supplies and drainage systems with sea water. Major changes in weather patterns are also expected. Overall, average precipitation around the world should rise—but not necessarily where and when it is most needed. In the interiors of continents, the weather may actually become drier in the summer, causing more frequent droughts. And, as the oceans warm, the severity and frequency of tropical storms and hurricanes are likely to increase. Changes like these could have a serious impact on agriculture. In the United States, decreased rainfall and hotter summers in the Midwest and West could be devastating. Forests and wildlife could be destroyed, since many species may not be able to adapt quickly enough to changing conditions.

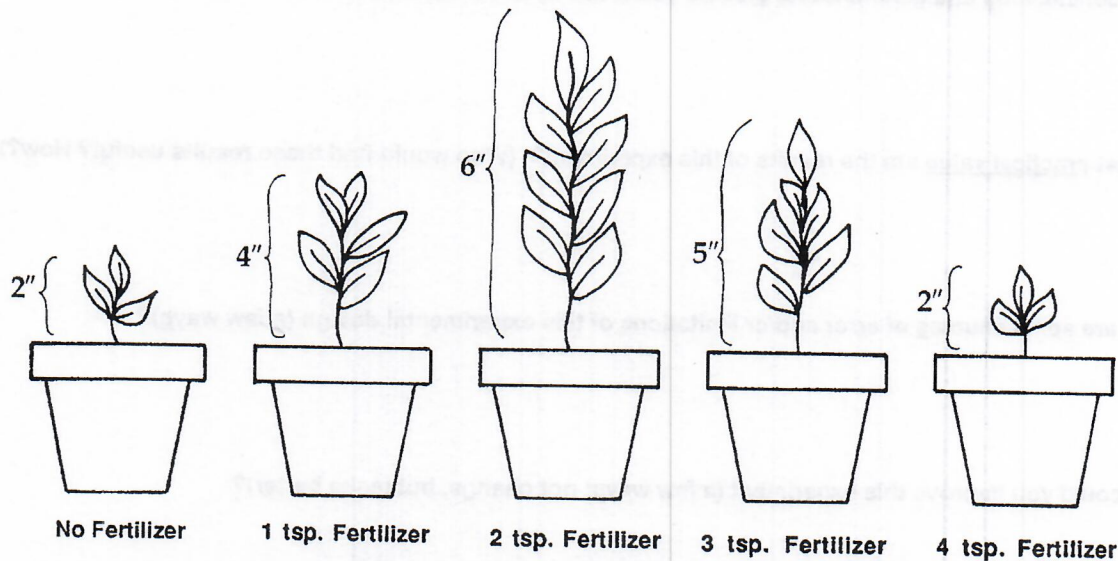
Excerpted from a pamphlet issued by the Union of Concerned Scientists, "The Heat Is On: Global Warming, The Greenhouse Effect & Energy Solutions." 1990.

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LHS GEMS—Global Warming & the Greenhouse Effect

Name _____ Date _____
Class _____ Table # _____

AN INTRODUCTION TO CONTROLLED EXPERIMENTS:

Growing Plants Experiment



File: growingplantsexp.07.17.18 [Modified by Dr. Ed Donovan from a GEMS Activity Guide]

[PLEASE USE COMPLETE THOUGHTS WHEN ANSWERING THE FOLLOWING QUESTIONS!]

1. More than likely, what was the purpose of this experiment? (The problem or the question?)
2. What was the independent (MIX; manipulating) variable? _____
3. What was the dependent (DRY; responding) variable? _____
4. Name at least three standardized variables (conditions) that were probably or should have been held constant in the experiment:
5. What was the control in this experiment? _____
6. What would be a well-stated Hypothesis for the above "growing plants experiment."
7. What would be a reasonable null hypothesis (H_0) for the "growing plants experiment" above?

8. What are the 2 *important materials* and 2 *important methods* (procedures) that were used in this experiment?

9. What were the observed results?

10. What conclusions and generalizations could you make about the results?

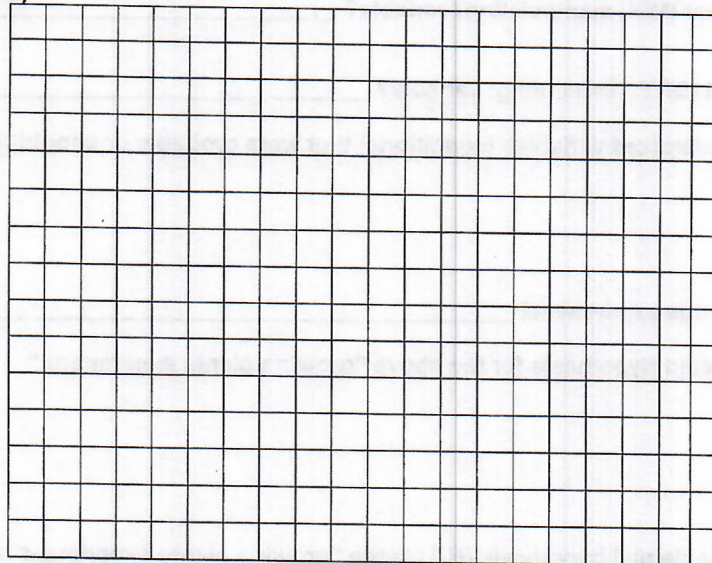
11. Of what practical value are the results of this experiment? (Who would find these results useful? How?)

12. What are some sources of error and/or limitations of this experimental design (a few ways)?

13. How could you improve this experiment (a few ways; not change, but make better)?

14. What areas of future research should be pursued after completing this experiment (a few ways)?

15. In the space below, draw a scientifically accurate graph for the experimental results (Please make sure you use a ruler and a *Figure Title*):



Name _____ Date _____

USCS/Spartanburg County

SCIENCE
EDUCATION
CENTER



The Scientific Method

Class _____

Table #: _____

STUDENT RECORD SHEET FOR AN EXPERIMENT/SCIENCE PROJECT

1994 (EPD)

1. What do you want to find out? (purpose)

2. What is already known about this? (related information)



3. What do you think will happen? (hypothesis)



4. What do you need to use? (materials)



5. What will you do to find out?
(procedures; list steps)



Continued
on
other side.



6. What happened? (results: qualitative and quantitative observations on tables and graphs)

7. What did you learn? (conclusions: status of hypothesis after research; sources of error; what did you learn?; practical applications; things you would do differently; areas of future research)

Supported or not supported

(EPD)

The Scientific Method

STUDENT RECORD SHEET FOR AN EXPERIMENT/SCIENCE PROJECT

1. What do you want to find out? (purpose)

The purpose of my project was to find out if people when asked to choose the name of an animal for an activity would generally choose a mammal. The activity is "Animal Charades" from Project Wild.

2. What is already known about this? (related information)

Animal Charades is a Project Wild activity found in the Elementary Project Wild Activity Guide on pages 3-4.

In Connecticut, they have a state animal and a state bird, but a bird is an animal. Mixing up the word "animal" and "mammal" is a common mistake.

An animal is a living organism that is not a plant (except some one-celled animals which can also be grouped as a plant or as a Protist).

An animal is usually described as an organism which moves (not in all cases) and gets its own food. Examples of animals are: sponges, jellyfish, starfish, insects, birds, mammals, fish, reptiles, amphibians, worms, etc.

A mammal is a special kind of animal that is a vertebrate (has a backbone), has hair or fur, has mammary or milk glands, and its young are typically born live.

The objective of the "Animal Charades" is: students will be able to define wildlife, as well as to distinguish between domesticated and non-domesticated animals. Wildlife is any animal that lives in a basically free condition, providing for its own food, shelter and other needs.

3. What do you think will happen? (hypothesis)

My hypothesis for this project is that people will generally choose a mammal when asked to choose an animal for the Project Wild activity called "Animal Charades". I thought that people would choose a mammal because they get confused between the terms "animal" and "mammal."

4. What do you need to use? (materials)

- Paper
- Pencils
- Markers
- Apple IIe computer
- Wooden backboard
- Print Shop Computer Program
- Names of animals chosen by people for a Project Wild activity "Animal Charades"
- The 214 people surveyed were USCS undergraduates participating in Project Wild workshops between 1986 and 1990. These are education majors.

5. What will you do to find out? (procedures; list steps)

1. Take the sheets containing the names of animals from 12 Project Wild workshops and separate them into groups by animal names.
2. Count the number of animals of each type.
3. Separate the animal types into categories such as mammal, non-mammal, vertebrate, invertebrate, wild, domesticated, etc. Count the number in each group and calculate percents.
4. Record all data on a table and create a graph of the percents.

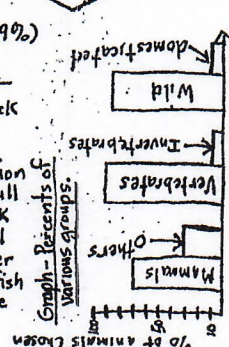
6. What happened? (results: qualitative and quantitative observations on tables and graphs)

Table - Number of times each animal was chosen to be used in "Animal Charades" from greatest to least.

Animal Name	Times Chosen	Animal Name	Times Chosen
Elephant	19	Grasshopper	4
Kangaroo	18	Turtle	4
Monkey	18	Bird	3
Bear	12	Cow	3
Earthworm	7	Gorilla	3
Cat	7	Lion	3
Owl	7	Shark	3
Rabbit	7	Squirrel	3
Raccoon	7	Beaver	2
Giraffe	6	Butterfly	2
Tiger	6	Camel	2
Snake	5	Caterpillar	2

Total Animals - 214 Number of mammals - 148 (69%)

Animals Chosen Twice	Animals Chosen Once
Chicken	Alligator
Deer	Amoeba
Dog	Hippo
Duck	Anteater
Eagle	Iguana
Fox	Ape
Hamster	Koala bear
Horse	Bull
Hyena	Llama
Mouse	Moose
Penguin	Centipede
	Chimpanzee
	Crocodile
	Dolphin
	Flamingo
	Fly
	Gazelle
	Gerbil
	Peacock
	Pig
	Rat
	Scorpion
	Sea Gull
	Skunk
	Snake
	Spider
	Sturfish
	Whale
	Parakeet
	Parrot



7. What did you learn? (conclusions: status of hypothesis after research; sources of error; what did you learn?; practical applications; things you would do differently; areas of future research)

The results of my project were that 69% of the animals chosen for "Animal Charades" were mammals. I discovered that 89% of the animals chosen were wild animals and that 89% were vertebrates.

I supported my hypothesis. Most people when asked to choose an animal will choose a mammal.

I believe this happens because people generally confuse the words "animal" and "mammal." Most people think of a "mammal" when asked for the name of an animal. Since these results came from undergraduate education majors, these conclusions may not apply to all people. Also, only 214 people were surveyed which is a small number. Since I was not there when the people did the activity, I can not be sure whether the workshop leader did or did not influence the results. To improve on this project in the future, I would make my own survey, asking people what the difference there is between a mammal and animal. I would also survey people of all ages. It would also be useful to explore people's knowledge of wild and domesticated animals.

Famous and/or Notable Environmental Scientists, Environmentalists, Conservationists and/or Ecologists

1. Adams, Ansel (1902 – 1984)
2. Attenborough, David (1926 -)
3. Audubon, John (1785 – 1851)
4. Begley, Ed Jr. (1949 -)
5. Brockovich, Erin (1960 -)
6. Brower, David (1912 – 2000)
7. Caldeira, Ken (1960 -)
8. Carson, Rachel (1907 – 1964)
9. Carter, Jimmy (1924 -)
10. Clements, Frederic (1874 – 1945)
11. Corwin, Jeff (1967 -)
12. Cousteau, Jacques (1910 – 1997)
13. Cowles, Henry Chandler (1869 – 1939)
14. Darwin, Charles (1809 – 1882)
15. Denes, Agnes (1931 -)
16. Douglas, Marjory Stoneman (1890 – 1998)
17. Douglas, William O. (1939 – 1975)
18. Ehrlich, Paul Ralph (1932 -) & Anne Ehrlich (1933 -)
19. Emerson, Ralph Waldo (1803 – 1882)
20. Fossey, Dian (1932 – 1985)
21. Goodall, Dame Jane Morris (1938 -)
22. Gore, Al (1948 -)
23. Haeckel, Ernst Heinrich (1834 – 1919)
24. Hansen, Dr. James (1941 -)
25. Hemmingway, Ernest (1899 – 1961)
26. Hensen, Victor (1835 – 1924)
27. Hill, Julia (1974 -)
28. Hutchinson, G. Evelyn (1903 – 1991)
29. Irwin, Steve (1962 – 2006)
30. Janzen, Daniel H. (1939 -)
31. Joughin, Ian (1965? -)
32. Lamarck, Jean-Baptiste (1744 – 1829)
33. Leopold, Aldo (1887 – 1949)
34. Lovelock, James (1920 -)
35. Maathal, Wangari (1940 – 2011)
36. MacKaye, Benton (1879 -1975)
37. Malthus, Thomas (1766 – 1834)
38. Mancke, Rudy (1949 -)
39. Mann, Michael E. (1965 -)
40. Mill, John Stuart (1805 -1873)
41. Mobius, Karl (1825 – 1908)
42. Muir, John (1838 – 1914)
43. Murie, Margaret (1902 – 2003)
44. Obama, Barack (1961 -)
45. Odom, Eugene (1924 – 2003)
46. Olmstead, Frederick Law (1822 – 1903)
47. Olmstead, John (1852 - 1920)
48. Patrick, Ruth (1907 – 2013)
49. Pimentel, David (1928 -)
50. Pinchot, Gifford (1865 – 1946)
51. Reagan, Ronald (1911 – 2004)
52. Rignot, Eric (1965 -)
53. Roosevelt, Theodore (1858 – 1919)
54. Ruckelshaus, William Doyle (1932 -)
55. Schmidt, Gavin A. (1967? -)
56. Schulte, David (?)
57. Shiva, Vandana (1952 -)
58. Simon, Seymour (1931 -)
59. Smithson, Robert (1938 – 1973)
60. Theophrastus (370 BC – 286 BC)
61. Thoreau, Henry David (1817 -1862)
62. Twain, Mark (1835 – 1910)
63. Udall, Stewart (1920 – 2010)
64. Van Humboldt, Alexander (1769 – 1859)
65. Van Leeuwenhoek, Anton (1632 – 1723)
66. Vernadsky, Vladimir (1863 – 1945)
67. Von Linne (Linnaeus), Karl (1707 – 1778)
68. Wallace, Alfred Russel (1823 - 1913)
69. Warming, Eugenius (1841 – 1924)
70. Watson, Adam (1931 -)
71. Weyler, Rex (1948 -)
72. Wilson, Edward O. (1929 -)
73. Wyeth, Andrew (1917 – 2009)
74. Yard, Robert Sterling (1861 – 1945)

Compiled and Updated by Dr. Ed Donovan, Adjunct Professor of Science at USC Upstate,
edonovan@uscupstate.edu on 09.09.18.

File: DeadSTEMEnvironmentalScientists.F.18.6

Environmental Science STEM Dude Project

Possible Project Ideas & Bonus Ideas

Project Required by All (Worth 100 points). You are required to do this (This is the minimum requirement):

- Create a Power Point or Prezi Slide Presentation and present it to the class (All information asked for in my report form is required. You will be expected to present this to the class, give me a copy of the actual slide presentation to view, and a printout of the slides. The Power Point/Prezi is worth 50-points and the actual presentation is worth 50 points.
- IF YOU DO A BONUS, MAKE SURE TO IDENTIFY WHICH PART OF YOUR PROJECT IS THE 20 POINT BONUS!

Additional Project Ideas done in addition to above (+20 Bonus Points). If one of these is done for Bonus Points, not all the information listed on my report form must be used on these projects. Check with me if you have a question about this. The projects are:

- Completing my project form
- A paragraph paper with a title page
- Poster presentation
- RIP Poster with a photo, epitaph + Year of Birth & Year of Death, and contribution(s) to science
- Rap
- Poem
- Oral Presentation (5 minutes)
- Song
- Skit
- Tombstone with a photo, epitaph + Year of Birth & Year of Death, and contribution(s) to science
- Video
- Mobile
- Diorama
- Letter
- Picture Booklet
- T-shirt design
- Timeline
- Cube
- Sent Letter
- Sent Email
- Received Response to Sent Letter/Email
- Picture Book
- Scrapbook
- Piñata
- Calendar
- Sculpture
- Painting
- Brochure
- Tie
- Commercial
- Comic book
- Birthday card
- Wanted poster with a photo, reason for being wanted, and contribution(s) to science if appropriate
- Decorated Tissue Box
- Postcard
- Puppet Show
- Christmas Ornament
- Other: _____

Created by Dr. Ed Donovan, Adjunct Professor of Science, edonovan@uscupstate.edu on 10.16.18)

File: FamousEnvironmentalScientistsProjectIdeas.2018.10.16



Theodore Roosevelt [1858-1919]



Rachel Carson [1907-1964]

Name _____ Date _____ Class _____

FAMOUS ENVIRONMENTAL SCIENTIST REPORT
("Dead or Alive ENVIRONMENTAL STEM Dude Project")

SCIENTIST FULL NAME: _____

DATE OF BIRTH: _____ DATE OF DEATH: _____

NATIONALITY: _____

PLACE OF BIRTH: _____

MAJOR FIELD(S) OF SCIENCE: ___ Chemistry ___ Physics ___ Biology ___ Geology/Earth Science

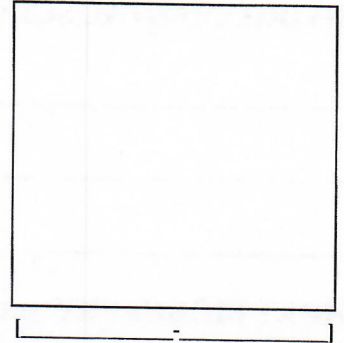
Other Fields/Specialties: _____

EDUCATION/TRAINING BACKGROUND: _____

MAIN STEM-RELATED CONTRIBUTION(S) TO ENVIRONMENTAL SCIENCE: _____

DATE(S) OF MAIN CONTRIBUTIONS: _____

OTHER CONTRIBUTIONS: _____



ENVIRONMENTAL SCIENCE AWARDS, HONORS AND RECOGNITIONS RECEIVED: _____

SHORT BIOGRAPHY (HISTORY OF HIS/HER LIFE, Parents, Spouse, Children): _____

Glossary of Key Terms:

WORK CITED & CONSULTED: