

## Introduction

Globally, we face many challenges from the effects of global warming. Consensus of scientific opinion is that the Earth's climate is being affected by human activities. Human activities are modifying the concentration of atmospheric constituents that upset the balance of absorbance or scattering of radiant energy from the sun.

To facilitate students to reach a level of understanding of this complex environmental problem, one must teach the science behind the greenhouse effect. This unit will explore the atmosphere and all its components, properties, and processes. This unit will give the students a better understanding of the atmosphere and how the human experience affects atmospheric processes. Students will also gain a better understanding of the chemistry involved with the major air pollutants and the atmosphere.

The intended audience for this curriculum unit is tenth grade vocational students enrolled in the Environmental Landscape Technology Program. For this reason the types of hands-on activities that are incorporated into this unit are task oriented and mimic the actual tasks that a research scientist or environmental field technician would do as part of their job. This makes the data that is collected from many on-line sources more authentic since students will be collecting some of the same data locally.

By using the issue of global climate change, the students can see how the delicate balance of the Earth's biogeochemical cycles is important to all biota. We will discuss the burning of our fossil fuels, which formed over a 300 million year period, in a blink of geologic time. The input of sulfur, nitrogen, and carbon rivals the overall flow of nature. This human-induced global warming is currently happening and has strong momentum to continue this warming trend in the foreseeable future. Our global society and ecosystems are currently affected by this warming and the impacts are felt at all trophic levels.

There is less consensus of the scientific community as to the conclusion or outcomes of global warming. There is however, ample research and evaluation as to the extent of greenhouse warming and its potential impacts in peer-reviewed and published scientific literature. Students will be exposed to the potential impacts derived in this literature and engage in critical thinking exercises to tie these potential impacts to their local environment. Students will evaluate findings of relationships between current observed biological changes and human activities.

Students must evaluate the landscape as part of the Environmental Landscape Technology curriculum. Students evaluate the local area through historical aerial photos, on-line chemical contamination data, various annually collected biological data sets, and ground measurements of land cover types. With this information, the students determine the human-induced stressors in their local area such as habitat destruction or fragmentation, introduction of invasive species, and contamination. Once this information is compiled, the students will infer how the altering of the local climate may impact the remaining valuable habitats and the types of challenges future conservationists will have to protect these resources.

### Content Objectives

With the completion of this unit, students will be able to:

- Explain the formation of the atmosphere and the changes in composition that have taken place over time
- Diagram the structure of the atmosphere
- Describe the relationship between water content and density
- Describe the relationships between air pressure, density, and temperature
- Explain the production of wind in the atmosphere
- Diagram and explain the convection cells that drive our climate
- Contrast and compare both weather and climate
- Explain the biogeochemical cycles for carbon, nitrogen, phosphorous, and sulfur
- Name the chemicals involved in the global warming process and describe their effect on the climate system
- Explain and support with evidence, potential forecasted ecological effects of greenhouse warming

### Vocational Tasks

#### Sampling Protocols

- Soil Sampling and Analysis
- Aquatic Sampling and Analysis

#### Habitat Evaluation

- Collect qualitative and quantitative information in the field
- Analyze maps and aerial photographs
- Analyze data and prepare a technical report

### Strategies

This unit will be taught in a constructivist manner. Students will be encouraged to think independently and make sense of the atmospheric phenomenon talked about in class or observed in a laboratory setting. Working in collaborative groups will be the norm throughout the unit. Because not all concepts fit well into a lab format, direct instruction will also be used throughout. Videos as well as video clips and web based instruction will also be a big portion of the classes.

Students will be placed into research groups that will research and present a “line of evidence” of global warming to the class. The student groups will be given a binder that includes journal articles, Internet resources, and other information on the specific topic. Student groups will read through and decipher the information in the binder as well as “researching the research” on the web to develop a multimedia presentation to kick off each weekly section of this unit.

Content related lectures, labs and hands-on activities tied to the information presented by the students each week will clear up any misconceptions about the weekly topic and facilitate a better understanding the content. Having the students introduce the topic each week will help heighten the interest of the students in the subject matter and may facilitate better questioning by the students.

Field work will also be the norm in the unit. Students will be gathering atmospheric data on a daily basis throughout the unit from our instrument shelter as well as collecting cloud data. This data will be uploaded to NASA G.L.O.B.E. website via the internet. Each week of the unit will involve related field work and environmental data collection.

### Classroom Activities

Format of lessons will include, as appropriate:

#### Teacher-centered activities

- direct instruction of specific content knowledge
- teacher modeling of specific practical skills for students
- research guidance and troubleshooting
- modeling how to conduct a presentation of research to model “researching the research” portion of curriculum

#### Student-centered activities

- class discussion
- hands-on and inquiry based lab activities
- practical skills practice and evaluation
- formative and summative assessment of content knowledge
- research opportunities
- collaborative group work on research portion of curriculum
- development and execution of multimedia presentation

## Resources

### Teacher

I have compiled a large amount of journal articles on the various topics addressed in the unit. This bibliography will be included in the final document.

### On-Line Resources

- UN Framework Convention on Climate Change Site  
[http://unfccc.int/essential\\_background/feeling\\_the\\_heat/items/2918.php](http://unfccc.int/essential_background/feeling_the_heat/items/2918.php)
- Intergovernmental Panel on Climate Change  
Climate Change 2001: The Scientific Basis  
[http://www.grida.no/climate/ipcc\\_tar/wg1/index.htm](http://www.grida.no/climate/ipcc_tar/wg1/index.htm)
- Global Warming In depth  
<http://www.pewclimate.org/global-warming-in-depth/>  
[Teacher gathers information to teach students a more close examination of the global warming]

### Student

Resource binders for “researching the research” portion of curriculum on the following ‘lines of evidence’:

- Animals / Birds
- Aquatics
- Land Cover
- Plants / Trees
- Sea Level Rise
- Soils
- Weather

### On-Line Resources

- Hodgson Technical High School  
Environmental Landscape Technology’s  
Global Change Blackboard Site [Under Construction!]  
<http://blackboard.nccvt.k12.de.us/>  
[Lecture Notes, links to on-line content used for research, on-line assessments, discussion board on global warming topics.]
- Global Warming Basics  
<http://www.pewclimate.org/global-warming-basics/>  
[students answer questions based on the reading they do at this website and type up answers and submit them through Blackboard]