

# RENCI Weather Web Curriculum



2008

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### **About the RENCi Weather Web Program**

The *RENCi Weather Web* program uses research and operational grade weather stations to enable North Carolina educators to teach required meteorology and atmospheric science classes. RENCi provides the weather stations, along with the MCNC's North Carolina Research Education Network (NCREN), throughout the state in underserved areas that lack the stations needed to provide good quality climate-related data. The weather data retrieved from the stations are used by teachers and their students in the classroom, and provide information to RENCi disaster response researchers, state climatologists, emergency responders, agricultural managers, and citizens.

In collaboration with the State Climate Office of North Carolina and NCREN, RENCi organizes the Weather Web competition each year and sends out a challenge to the schools in the targeted counties to develop curricula that would use a weather station and the data it produces. The area students are also asked to participate in an essay competition by researching and writing a composition about the local benefits of weather stations. Proposals and essays are evaluated on whether they make good use of weather station data in teaching concepts of meteorology and involve as many students, teachers and/or members of the community as possible. Originality and creativity of the proposals are also considered. After the recipients are chosen, the State Climate Office finds suitable locations for the weather stations, and provides installation and maintenance.

### **Eligibility**

Middle and High School science teachers in NC counties that currently lack research and operational grade weather stations are eligible.

### **2008 Weather Web Program Winners**

Yancey, Alexander, Hyde counties

### **Application Process**

Another call for proposals will be issued in 2009. Please check [www.renci.org](http://www.renci.org) for an announcement.

### **Funding**

State of North Carolina

### **Partners**

State Climate Office of North Carolina

MCNC's North Carolina Research Education Network (NCREN)

### **About RENCI**

Founded in 2004, the Renaissance Computing Institute is a major collaborative venture of Duke University, North Carolina State University, the University of North Carolina at Chapel Hill and the state of North Carolina. It combines the strengths of state initiatives and three world-class universities with the social, business and research opportunities of the Research Triangle and the state of North Carolina. The "renaissance" in RENCI evokes both its collaborative atmosphere and the breadth of its intellectual activities.

### **About NCREN**

Since 1985, MCNC has collaborated with the University of North Carolina's 16 campuses to develop and operate the N.C. Research and Education Network (NCREN) – one of the nation's first statewide education and research networks. Today, the NCREN community is expanding in partnership with state government and the N.C. Department of Public Instruction to provide advanced communications and network support for a seamless K-20 education experience for all public education institutions in North Carolina, adding all K-12 schools and community colleges as NCREN customers. For more information, please visit [www.mcnc.org](http://www.mcnc.org).

## **Lesson Plans**

The following lesson plans were submitted by the winners of the 2008 Weather Web Competition and edited by RENCI staff. All North Carolinians have access to weather station data from across the state at <http://www.nc-climate.ncsu.edu/cronos>. Many people are often surprised to find out that they live close to a research grade station!

These plans cover topics in math, physical science, earth and environmental science, horticulture, social studies and language arts. Links for additional plans from the New York Times Learning Network are included at the end of this document. In addition, RENCI is making a challenge to teachers and students to track the validity of TV weather forecasts. Details are on page 29.

# **FOURTH AND FIFTH GRADE LESSON PLANS**

## **Weather Watchers**

Submitted by:  
Tamara Presnell  
Fifth Grade Teacher  
Bald Creek Elementary  
Yancey County

### **Lesson Description**

Students establish pen pals with other students in a school located in a different climatic zone and exchange information about weather and climate using the Internet. Over a four-week period, students correspond about local weather conditions. Students maintain weather logs and compare and contrast differences in weather and climate by analyzing their data that has been collected from the weather station.

### **Subject Area Focus**

Math and Science

### **Objectives**

- Recognize that weather can vary depending on location.
- Begin to build an understanding of the difference between weather and climate.
- Gain experience using technology to collect, analyze and display scientific data.
- Understand that weather and climate influence the types of activities we do.

### **North Carolina Standard Course of Study**

Fifth Grade Science Competency Goal 3: The learner will conduct investigations and use appropriate technology to build an understanding of weather and climate.

### **Classroom Time Required**

10-20 minute segments to collect and record weather data; 15-30 minute segments to analyze data and share information via Internet

### **Teacher Prep Time**

- 15 minutes to register class at <http://www.epals.com>
- 30 minutes to 1 hour to research and select partner class
- 2 hours over duration of 4-week project to select and monitor student activities

### **Materials Needed**

- Flip chart, white board or blackboard
- Student handouts to record weather data
- Access to the Internet

### **Pre-activities**

- This is a long-term project that can be done over several weeks: a quarter, term, semester, or year period. Prior to starting this lesson students should understand the characteristics of the three major climatic zones – polar, temperate and the tropic.

- Students should be familiar with using the Internet to search for information and be able to exchange documents using email.
- Students will also need to be familiar with different weather instruments and what they are used to measure.

### Activities

1. Do a KWL (What I KNOW; What I WANT to know; What I LEARNED) chart with each one of the three major climatic zones.
2. Lead a class discussion on the differences between climatic zones, recording the comments of the students.
3. Tell students that in this project, they will exchange emails with another class of students in a different climatic zone to learn more about worldwide weather.
4. Use a “Daily Weather Observation Data” chart to record weather for your location for Monday through Thursday.
5. On Friday, share weekly observations with your partner class via the Internet.
6. Send “Daily Weather Observation” chart as an attachment to an email.
7. Use local and partner class weather data to create simple charts and graphs that can be used to compare and contrast weather patterns. For example, students may plot on a line graph the average daily temperature for each location over the observation period.
8. Have students examine data for any noticeable trends in weather patterns. For example, over the 4-week period, did the average temperature rise or fall? Was the wind generally from one direction or did it vary each day? Did any severe weather occur such as tornadoes, hurricanes, blizzards, ice storms, heat waves, or flood?
9. Display students’ graphs and written observations on a class or school bulletin board.

### Evaluation

Student success will be determined through informal discussions. At the end of the project students will be asked to present their findings and write an article for our school newsletter. Students will be evaluated on how well they explain what they have learned throughout this unit. Graphs and data analysis will also be used to determine success.

### Extension Activities

- Students may investigate the geography in the different climate zones and discuss how this affects the climate.
- Rather than a 4-week continuous period, modify the project to collect data the first week of four consecutive months. This may provide additional insights into climatic and weather differences over an extended period of time.
- Consider exchanging information in more than one language or measurement system. For example, use metric rather than English units to record weather data.
- On the last week of the project, ask the parents to sponsor a party for the class using the location of your partner class as a theme for a celebration.

### Resources

<http://www.epals.com> – To register class and to look for a partner class.

## Does Temperature Predict Migration Dates?

Submitted by:

Rita Thiel

Fourth Grade Teacher

Ocracoke School

Hyde County

### Lesson Description

There are many migratory species of waterfowl and other birds that seasonally visit the Outer Banks. This lesson is the first in a series of lessons that have students tracking weather data for the northern migratory origins and the final wintering habitat for several species of waterfowl on the Outer Banks area (Ocracoke Island/Hatteras Island). Placement of thermometers, and initial recording and graphing of daily temperatures for Ocracoke Island begins this unit of study. For classes that are not on the Outer Banks, weather station data for this area may be collected on the Internet at [www.nc-climate.ncsu.edu/cronos](http://www.nc-climate.ncsu.edu/cronos) beginning in September 2008.

### Subject Area Focus

Math

### Objectives

- Use technology (Weather Station data or thermometers) to observe and record daily temperature.
- Graph daily temperature data on line graphs.
- Work cooperatively in teams to observe and record data.

### North Carolina Standard Course of Study

Fourth Grade Math Competency Goal 4.0: Collect, organize, analyze and display data (including line and bar graphs) to solve problems

Fourth Grade Math Competency Goal 4.02: Describe the distribution of data using median, range, mean

### Classroom Time Required

45 -60 minutes per day for 6-8 Weeks (for on-going observations and tracking of migratory species)

### Materials Needed

- 6-8 thermometers (or a Weather Station to obtain data)
- Charts for keeping daily temperature data (student generated charts)
- String to fasten or hang thermometers outside
- Graph paper for line graphs

### Pre-activities

- Students should be familiar with calculating mean, median, mode, and range for a set of data.
- Students should also be familiar with making line graphs.
- Skills for how to read a thermometer in degrees Celsius and Fahrenheit will be necessary.
- Students need to have basic measurement skills for cm/m and in/ft.
- Teachers should be familiar with using a thermometer, and where the appropriate placement for the most accurate temperature readings should be, as well as inappropriate placements.

## Activities

1. Choose teams of 2-4 students
2. Teams select or are given a location on the school grounds for placement of their thermometer.
3. Teams place their thermometers at their location, and use a data recording chart to record the physical and environmental conditions around their thermometer: proximity to a building or other structure, the height above ground, shaded or sunny, exposed to wind or protected? Will the thermometer be free-hanging or attached to another object?
4. Follow up: Each day at approximately the same time(s), data readings should be taken from the thermometers, and data recorded on an on-going line graph. \* If temperatures can be taken twice daily during the school day, an average daily temperature could be recorded
5. Students enter data daily on a line graph, and calculate the mean, median, and range of the data.

## Evaluation

Student-generated line graphs will be assessed for accuracy. Student-generated data recording charts will be evaluated for accuracy of daily temperature entries. Success for this lesson is focused on the mathematical graphing and calculations performed, using the weather data. The generation of student interest and enthusiasm for observation and recording of weather data would also be a measure of success.

## Follow-up Activities

- Continual data recording of temperatures, to be used in conjunction with Science lessons for the tracking of migration dates of Outer Banks waterfowl. (Math /Science)
- Temperature data is collected from the northern ranges of several species of migratory waterfowl. This data is taken concurrently with the local data, to track changes in the northern temperatures that signal migrations are beginning. (Math/ Science)
- Line graphs of the different sets of temperature data (northern ranges and Ocracoke) are analyzed in relation to migration dates, and student predictions are made for when certain species will be arriving at the Outer Banks. (Math/ Science)

## Resources

[www.nc-climate.ncsu.edu/cronos](http://www.nc-climate.ncsu.edu/cronos): State Climate Office of NC CRONOS Database

[www.worldclimate.com](http://www.worldclimate.com): Weather data, worldwide

[www.mcadc.noaa.gov/oa/ncdc.html](http://www.mcadc.noaa.gov/oa/ncdc.html) : This site covers surface marine observation data

[www.rap.ucar.edu/weather](http://www.rap.ucar.edu/weather): From the National Center for Atmospheric Research, operated by the University Corporation for Atmospheric Research, includes satellite views, surface weather, radar images, and upper-air conditions

## **They're Coming! Migration Dates of Outer Banks Waterfowl**

Submitted by:

Rita Thiel

Fourth Grade Teacher

Ocracoke School

Hyde County

### **Lesson Description**

This lesson involves the tracking of temperature data to try to predict the migration dates of several species of migratory waterfowl. Students research the northern ranges of several species of waterfowl that are seasonal residents of the Outer Banks. Species included here are the Tundra Swan, Snow Geese, and the Bufflehead duck. Temperature data is then gathered on these northern areas, and graphed on a line graph. This data is taken concurrently with daily local temperature data, which is also graphed. Temperature data is gathered over an extended period of time, so trends can be observed, and predictions made for the birds' arrival dates.

### **Subject Area Focus**

Science

### **Objectives**

- Use technology to track and record temperature data for the northern ranges of a species of migratory waterfowl.
- Research the northern habitat ranges of several species of migratory waterfowl.
- Analyze sets of temperature data, and make predictions for migration dates.
- Gain an understanding of how weather and climate are factors in the survival of living organisms.

### **North Carolina Standard Course of Study**

Fourth Grade Science Competency Goal 1: Make observations and conduct investigations to build an understanding of animal behavior and adaptation

Fourth Grade Science Competency Goal 1.01: Observe and describe how non-living things affect the life of a particular animal, including weather and climate.

### **Classroom Time Required**

- Research of species' northern ranges: 1-2 class periods
- Recording of daily temperature data: 10-15 minutes daily, on-going for 6-8 weeks

### **Materials needed**

- Bird identification guide books with migratory range maps
- Background information on the species being tracked
- Internet resources to track northern range temperatures (resource list follows)
- Data charts (student generated or graph paper) to record temperatures

### **Pre-activities**

- Students should know how to record high and low temperature data, read a species range map, and have a general understanding of the terms *migration/migratory*.
- Teachers should familiarize themselves with the website resources for recording northern range temperatures.
- Teachers should also be familiar with several species of migratory waterfowl for their area.

### Activities

1. Students work in teams of 2-4 to research the northern and southern range of a particular species of migratory waterfowl. Research continues to find how long it generally takes for the bird to follow its migration route, and what kinds of hazards or challenges it faces along the way.
2. Once the northern range has been located, students should begin to record the temperature data from that area. Daily readings should be recorded, using a weather data website. Temperatures are then graphed on line graphs.
3. Students also record the daily local temperature, and add to a separate line graph.
4. As temperature data is collected each day, have students *look for trends* in the northern ranges that might signal migration times beginning.
5. Students begin to make predictions of when their species will arrive in the Outer Banks, given the temperature conditions up north.
6. Student teams make a timeline of activities their bird might be involved in, in preparation for its migration (extra feeding, gathering in groups, distance flown each day).
7. Student teams design a visual representation of their species along with the migration data. Student teams can present this data, explaining the factors influencing their species' migration.
8. Contact Pea Island National Wildlife Refuge for a fieldtrip to observe some of the birds as they arrive. (Follow-up activity)

### Evaluation

Student assessment involves evaluation of the research completed on the species of waterfowl, and the accuracy of the information. Teams will be assessed on the continuity of data collection, reasonable predicting of migration dates, generation of a “pre-migration” timeline, and a visual representation of their species and its migration data. Temperature data and the line graphs will be assessed for accuracy and neatness.

### Follow-up Activities

Take a fieldtrip to Pea Island National Wildlife Refuge to observe the species of waterfowl as they arrive in the fall.

### Resources

The Sibley Field Guide to Birds of Eastern North America

[http://en.wikipedia.org/wiki/Bird\\_migration](http://en.wikipedia.org/wiki/Bird_migration) : Gives information on species' migration routes

[www.nc-climate.ncsu.edu/cronos](http://www.nc-climate.ncsu.edu/cronos): State Climate Office of NC CRONOS Database

[www.worldclimate.com](http://www.worldclimate.com): Weather data, worldwide

[www.mcdc.noaa.gov/oa/ncdc.html](http://www.mcdc.noaa.gov/oa/ncdc.html) : This site covers surface marine observation data

[www.rap.ucar.edu/weather](http://www.rap.ucar.edu/weather): From the National Center for Atmospheric Research, operated by the University Corporation for Atmospheric Research, includes satellite views, surface weather, radar images, and upper-air conditions

## **Tracking Hurricanes**

Submitted by:  
Rachel Murphy  
Fifth Grade Teacher  
Micaville Elementary School  
Yancey County Schools

### **Lesson Description**

Students track tropical storms and hurricanes as they develop in the Atlantic and move toward the United States. The data is collected from the weather channel and plotted on a map using absolute and relative location. Colored pencils indicate whether a storm is a tropical storm or a hurricane. If a tropical storm changes into a hurricane, then the color on the map changes. The same is true if a hurricane becomes a tropical storm. Once the map is complete, students can identify each storm and the path it has taken. The librarian assists students in researching the causes of tropical storms and hurricanes, and students produce a research paper from the data collected.

### **Subject Area Focus**

Earth Science, Math, Social Studies and Language Arts

### **North Carolina Standard Course of Study**

Fifth Grade Science Competency Goal 3: The learner will conduct investigations and use appropriate technology to build an understanding of weather and climate.

Fifth Grade Math Competency Goal 4.01: The learner will collect, organize, analyze, and display data to solve problems.

Fifth Grade Social Studies Competency Goal 1: The learner will apply key geographic concepts to the United States and other countries of North America, including absolute and relative location

Fifth Grade Language Arts Competency Goal 3.06: The learner will conduct research (with assistance) from a variety of sources for assigned or self-selected projects.

Fifth Grade Information Skills Competency Goal 4: The learner will EXPLORE and USE research processes to meet information needs.

### **Classroom Time Required**

45 minute classes, as needed for the duration of the unit, with additional 5-10 minutes sections needed to watch the weather station for storm tracking.

### **Materials Needed**

- Hurricane maps
- Data from the hurricane center (coordinates)
- Colored pencils
- Index cards
- Access to Internet

**Activities**

Students will watch weather updates on the weather channel to stay informed of the progress of storms in the making. They will plot the points for the track of the storm using colored pencils to indicate the status of the storm (tropical or hurricane). An index card is labeled with the name and type of storm. Each storm is given a different color creating a map key. When the map is completed, students will have a color-coded map with a key to enable others to “see” the storm tracks and the severity as progression is made toward land. A completed research paper will also be done by each student as a writing and language arts activity.

**Evaluation:**

- Completed Map
- Research paper

**Follow-up Activity**

With a research-grade weather station, students could track more local severe weather such as thunderstorms, tornadoes, and snow storms.

**Resources**

[www.nc-climate.ncsu.edu/cronos](http://www.nc-climate.ncsu.edu/cronos): State Climate Office of NC CRONOS Database

<http://weather.unisys.com/hurricane/atlantic/2008>: Unisys Weather: 2008 Hurricane/Tropical Data for Atlantic

[http://www.nhc.noaa.gov/AT\\_Track\\_chart.pdf](http://www.nhc.noaa.gov/AT_Track_chart.pdf): Atlantic Basin Hurricane Tracking Chart

Access to weather channel

# **SIXTH AND SEVENTH GRADE LESSON PLANS**

## **Inquiry Weather and Local Weather Lore**

Submitted by:

Jane C. Miller

Seventh Grade Science Teacher

Cane River Middle School

Yancey County Schools

### **Lesson Description**

The weather unit is inquiry based. The unit engagement involves student interviews of grandparents or other community elders in order to learn local weather lore. Students share information and consider the application, feasibility, and practicality of such weather forecasting. In exploration, students collect daily weather data to make comparisons and connections as they view current weather maps, radar, and satellite pictures. Other exploration occurs as students graph 24 hr cycles of data for the specific weather element about to be covered. The explanation portion of the unit includes daily discussions, video clips, written texts, and the instructed use of classroom weather instruments. Extensions of the unit include computer simulations and connections to local weather phenomenon.

### **Subject Area Focus**

Science, Language Arts

### **North Carolina Standard Course of Study**

Seventh Grade Science Competency Goal 1.04: Analyze variables in scientific investigations

Seventh Grade Science Competency Goal 1.05: Analyze evidence to explain observations, make inferences and predictions, and develop the relationship between evidence and explanation.

Seventh Grade Science Competency Goal 1.06: Use mathematics to gather, organize, and present quantitative data resulting from scientific investigations

Seventh Grade Science Competency Goal 2.01: Explore evidence that "technology" has many definitions.

Seventh Grade Science Competency Goal 2.02: Use information systems to identify scientific needs, human needs, or problems that are subject to technological solution.

Seventh Grade Science Competency Goal 3.05: Examine evidence that atmospheric properties can be studied to predict atmospheric conditions and weather hazards

Seventh Grade Science Competency Goal 3.06: Assess the use of technology in studying atmospheric phenomena and weather hazards

Seventh Grade Language Arts Competency Goal 1: The learner will use language to express individual perspectives in response to personal, social, cultural, and historical issues.

Seventh Grade Language Arts Competency Goal 2: The learner will synthesize and use information from a variety of sources.

**Class Time**

60 minute classes; four to five weeks

**Materials Needed**

- Internet access and various websites
- LCD projector
- Access to computer lab
- Weather data collection instruments such as thermometers, psychrometers, barometers, anemometer, and wind vane
- Simple lab supplies such as beakers, stirring rods, etc.
- Various charts and maps for classroom use

**Pre-Activities**

Students will have just completed a unit on atmosphere structure and composition as well as a unit on air quality.

**Activities**

The exploration and extension activities of this unit employ students in hands on data collecting and analysis. The exploration segment has three parts, all spanning the entire unit.

For one, students collect daily weather data for their specific class time. Using an LCD projector and Internet access this data is on the screen when they enter the classroom. This data collection allows students to see day to day changes in specific weather data and make daily comparisons and connections as they view current weather maps, radar, and satellite pictures. The students keep individual weather logs but a different student each day enters the data into an excel spread sheet as a class record to be shared by other classes.

The second part of the exploration occurs as students graph hourly data, for a specific day, of the weather element they are about to cover. Select a typical day that will allow students to see the usual 24 hour pattern and identify relationships between the different weather elements. Do the same graphing on acetate overlays that make it easy for students to see changes in several elements at one time. Although the students use the same day's meteorological data for each of these explorations, they also graph atypical days when there is unusual weather which serves as extensions, broadening their understanding of forecasting. More literal hands-on data collection occurs when students use classroom instruments for data collection. They learn to read and calibrate thermometers for determining air temperatures of various locations on campus, use hygrometers and sling psychrometers to compare relative humidity inside and outside of the building, read aneroid barometers, and use an anemometer and wind wane to measure wind speed and direction.

Finally, students will interview grandparents or other community elders in order to learn local weather lore. Students share information and consider the application, feasibility, and practicality of such weather forecasting by applying the "local weather lore" and comparing it to the scientific data gathered.

To reinforce vocabulary, students complete a flash card project which includes illustrations and operational definitions geared to a fifth grade level. These cards can be boxed and passed to other fifth grade classes.

### **Evaluation**

Formative and summative assessments will be used to evaluate student learning. These evaluations include graphs and other data analysis, worksheets, journal entries, quizzes, a project rubric, their science notebook, and a comprehensive test. Daily informal discussions and questions are part of the on-going assessment.

### **Follow-up activities**

As an interdisciplinary component, students may wish to write and describe the local weather lore in their community, produce a documentary featuring the elders they interview, or write a short story featuring the lore.

## **Weather Data Collection**

Submitted by:

Mary Sapp

Sixth/Seventh Grade Science Teacher

East Yancey Middle School

Yancey County Schools

## **Lesson Description**

Students collect weather data (precipitation, cloud cover, temperature, and wind speed) from home observations twice weekly to compare with data collected with weather station and data observations from the regional newspaper. Based on daily collected observations predict upcoming local weather.

## **Subject Area**

Science

## **Objectives**

- Collect local weather data (precipitation, cloud cover, temperature, rainfall)
- Compare micro-climates in county
- Compare local data with regional and national data (similar latitudes)

## **North Carolina Standard Course of Study**

Seventh Grade Science Competency Goal 1.05: Analyze evidence to explain observations, make inferences and predictions, and develop the relationship between evidence and explanation.

Seventh Grade Science Competency Goal 1.06: Use mathematics to gather, organize, and present quantitative data resulting from scientific investigations.

Seventh Grade Science Competency Goal 1.08: Use oral and written language to communicate finding, defend conclusions

Seventh Grade Science Competency Goal 2.01: Explore evidence that "technology" has many definitions.

Seventh Grade Science Competency Goal 3.05: Examine evidence that atmospheric properties can be studied to predict atmospheric conditions and weather hazards.

Seventh Grade Science Competency Goal 3.06: Assess the use of technology in studying atmospheric phenomena and weather hazards.

## **Classroom Time Required**

Two class periods per week for nine weeks

## **Materials**

- Outdoor thermometers
- Plastic rain gauges
- Anemometers

- Journals
- Regional newspapers
- Yancey County map
- North Carolina map

**Pre-activities**

Students will be introduced to the concept of weather and data collection. They will gain knowledge of how to interpret data for precipitation collection, wind speed, cloud cover, and temperature.

**Activities**

1. Students will be in groups of four that have been chosen according to their home location in the county.
2. On Monday and Wednesday of each week for nine weeks students will collect data at home to share at school on the following days.
3. Each day that students meet they will compare and record weather data for their area.
4. All data will be added in a class chart that will be shared with a total of five seventh grade classes (approximately 105 students).
5. Students will be responsible for detecting weather patterns depending on their location in relation to elevation of their home compared with that of the school and other students.
6. Student data will be compared to that of the NC CRONOS Database (<http://www.nc-climate.ncsu.edu/cronos>) collected throughout North Carolina and expanded to the nation through the use of newspapers and available weather websites.

**Evaluation**

Students will be responsible for completing and keeping collected data in their science notebooks, and completing analytical tables comparing local data to state and nation data. Additionally, a written assessment will be devised to measure students' ability to analyze the collected data.

# High School Lesson Plans

## **The Effect of Environment Factors on Plant Growth**

Submitted by:

Chad Ayers

Agriscience Applications, Horticulture I & II, Animal Science I & II

Mountain Heritage High School

Yancey County Schools

### **Lesson Description**

Plants require a good environment to grow and be productive. Climate and weather are important to plant growth. Understanding climate and the characteristics of plants helps in making choices about what to plant. Edaphic environment of a plant is the soil, including mulches on the soil.

Pollution threatens plants. Air, water, and soil pollution are major concerns. Depletion of the ozone layer, increasing carbon dioxide, and acid rain are major air pollution concerns. Water and soil quality depend on preventing degradation of these natural resources. Through the activities in this lesson students will identify and explain the meaning of the plant environment, research the role of climate and weather, explain growing season and related concepts, describe the edaphic environment, describe the effect of pollution on plants, and use data information from the weather station and data gathered from plant measurements to write a lab report.

### **Subject Area**

Horticulture I and II

### **Objectives**

- Explain the meaning of plant environment.
- Research the role of climate and weather.
- Explain growing season and related concepts.
- Describe the edaphic environment.
- Describe the effect of pollution on plants.

### **North Carolina Standard Course of Study**

Horticulture I Competency Goal 016.00 Analyze the process of growth in horticultural plants.

Horticulture I Competency Goal 016.01 Compare and contrast the process and stages of growth in horticulture plants.

Horticulture I Competency Goal 016.02 Explain how the phases of plant cell growth relate to total plant growth

Horticulture I Competency Goal 016.03 Investigate how light, moisture, temperature, and nutrients affect a plant.

### **Class Time Required**

3 – 90 minute periods

### **Materials Needed**

- Laptop Computer

- LCD Projector
- Projector Screen
- Printed Handouts
- Printed Information from Weather Station
- Plants
- Measurement Tools

### Pre-activities

Research and discuss past environmental/weather disasters and their effect on horticultural/agricultural crops.

### Activities

- **Introduction and Mental Set**

Have students read the introduction on page 305 in *Introduction to Plant Soil Science and Technology*. Ask one or more students to summarize the content for the class. Ask students if they have plants in their homes and what they do to keep it growing well.

- **Discussion**

1. **What is plant environment?**

The surroundings in which a plant grows.

2. **What environmental factors must be met for plants to grow?**

- A. Light
- B. Temperature
- C. Water
- D. Air
- E. Nutrients

See page 307 in *Introduction to Plant Soil Science and Technology*.

3. **What is an ecosystem? What is it composed of?**

- A. An ecosystem is all the area of the environment where a particular plant is living.
- B. It is composed of biotic factors (living things that affect growth) and abiotic factors (non-living elements in a plant's environment).

4. **Why is climate important to plant growth?**

- A. Climate and weather determine the crops that can be grown and the cultural practices needed to have good production.
- B. Climate is the average of the weather conditions that are found in a particular location.
- C. Weather is current conditions of the atmosphere.

5. **What weather factors affect plant growth?**

- A. Temperature
- B. Moisture
- C. Wind

D. Atmospheric pressure

**6. What is growing season?**

The number of days from the average date of the last freeze in the spring to the average date of the first freeze in the fall.

**7. What is an edaphic environment and what are the important factors?**

- A. An edaphic environment is the soil and the area where the roots are located. Includes erecting a good soil or media environment.
- B. Some important factors are soil moisture, temperature, aeration, pH, and salinity.

**8. How does pollution affect plants?**

- A. Air quality: suitability of the air for use by living organisms
- B. Water quality: suitability of water for plants and animals
- C. Soil quality: plants must have certain nutrients from the soil to grow and be productive. Soil can also be degraded.
- D. Soil degradation: contamination, erosion, construction activities

**9. Using the weather station, have students research the average date of the last freeze in the spring and the first freeze in the fall.**

**10. Develop a list of plants that will grow in this growing season.**

Begin with plants that are currently grown in the area.

**11. Have students study the climate, weather, and growing season information for the local area.**

- A. Use the weather station data sheets to allow students to gather both long term and short term weather information.
- B. Record plant growth measurements on a daily basis, throughout the semester, from available plants from the list of plants in number 10.
- C. Combine data and research to write a lab report, complete with research, data charts and explanations

**Evaluation**

Written Test

Lab Report/Activity

**RESOURCES**

Biondo, Ronald J. & Jasper S. Lee. *Introduction to Plant and Soil Science and Technology*. Interstate Publishers, Inc. Danville, IL 1997.

Biondo, Ronald J. *Activity Manual Introduction to Plant and Soil Science and Technology*. Interstate Publishers, Inc. Danville, IL 1998.

Georgia Agriculture Education. <http://aged.ces.uga.edu/index.htm>

## Average and Instantaneous Speed

Submitted by:

Mary Dougherty

Earth/Environmental Science, Physical Science, Biology; Anatomy and Physiology, AP Biology

Alexander Central High School

Alexander County Schools

### Lesson Description

In this lesson students differentiate between instantaneous speed and average speed using data from a local weather station. Students plot a line graph using local weather data (wind speed at the beginning of each hour for the last 7 days). Next, they calculate average wind speed each day for the past seven days. They produce a bar graph using this data. Last, students mark wind speed at the instant they complete their graph. This lesson illustrates the difference between average and instantaneous speed. Students also have the opportunity to make several types of graphs and compare a bar versus a line graph.

### Subject Area

Physical Science

### Objectives

- Describe the difference between speed, velocity, and acceleration.
- List examples of constant speed, average speed, and instantaneous speed using wind speed data.
- Explain when it is appropriate to use a bar graph and a line graph.
- Produce accurate line and bar graphs showing wind speed.
- Calculate average speed after collecting data from a chart. Calculate speed using a line graph (rise over run).

### North Carolina Standard Course of Study

Physical Science Competency Goal 1.02: Design and conduct scientific investigations to answer questions about the physical world.

Physical Science Competency Goal 2.01: Measure and mathematically/graphically analyze motion.

### Classroom time required

This project should take about one class period (block schedule).

### Materials needed

- Wind speed data
- Calculator
- Ruler
- Colored pencils
- Graph paper

### Pre-activities

Students should have been introduced to the definitions, equations, and examples for speed, acceleration, and velocity. Students should be able to set up and produce a scientific graph. They should also have practiced calculating average speed and acceleration.

### **Activities**

Students make two graphs using wind speed data collected hourly for the past seven days.

1. First, students make a line graph plotting the wind speed each hour for seven days. They answer a series of questions about changes in wind speed.
2. Second, students calculate the average wind speed for the past seven days. They then plot their data on a bar graph. Again, they answer a series of questions about the changes they see.
3. Last, students plot the wind speed at a specific time as a point on the line graph. This allows them to differentiate between average speed and instantaneous speed. Students answer some questions about speed at specific times on the line graph (using rise over run).

### **Evaluation**

Students' products will be their graphs and the answers to their questions. These will be graded for accuracy. Students will be tested on the concept of average speed and instantaneous speed on the unit test.

### **Follow-up activities**

Put student graphs on the Internet and use them to track wind speed data from year to year. These graphs will be available to any classes interested in analyzing wind data.

### **Resources**

Students need access to the computer and weather station data (<http://www.nc-climate.ncsu.edu/cronos>).

## **What are Clouds?**

Submitted by:

Leslie Barger

Earth/Environmental Science, Physical Science

Alexander Central High School

Alexander County Schools

### **Lesson Description**

In this lesson students learn the three basic cloud forms: cirrus, stratus, and cumulus. Students also observe how clouds are classified by their height above the ground. Each day for two weeks, students go outside and record cloud cover, cloud types, and weather conditions. Students may take pictures of the clouds each day or draw a picture of what they see. Students gather “real time” weather data from the weather station. During the two weeks, students record their data on a chart. At the end of the assigned time they analyze the pattern of clouds, precipitation, and weather conditions they have seen.

### **Subject area focus**

Earth/Environmental Science

### **Lesson Objectives**

- Describe how clouds are classified.
- Compare and contrast clouds and fog.
- Explain what must happen for precipitation to form.
- Identify what controls the type of precipitation that reaches Earth’s surface.

### **North Carolina Standard Course of Study**

Earth/Environmental Science Competency Goal 1.05: Analyze reports of scientific investigations and environmental issues from an informed scientifically literate viewpoint including considerations of: Appropriate sample, Adequacy of experimental controls, Replication of findings, Alternative interpretations of the data.

Earth/Environmental Science Competency Goal 5.01: Analyze air masses and the life cycle of weather systems: Planetary wind belts, Air masses, Frontal systems, Cyclonic systems.

Earth/Environmental Science Competency Goal 5.02: Evaluate meteorological observing, analysis, and prediction: Worldwide observing systems, Meteorological data depiction.

Earth/Environmental Science Competency Goal 5.03: Analyze global atmospheric changes including changes in CO<sub>2</sub>, CH<sub>4</sub>, and stratospheric O<sub>3</sub> and the consequences of these changes: Climate change, Changes in weather patterns, Increasing ultraviolet radiation, Sea level changes.

### **Classroom Time Required**

About 20 minutes per day for a two-week period.

### **Materials Needed**

No special material is required. Students may use a camera to record the clouds they see. They may also put the information on the Internet (optional).

### **Pre-activities**

The class will go over the phases of the hydrologic cycle and list factors that lead to the formation of clouds. The class will also draw and define the different types of precipitation, and investigate factors that lead to the formation of different cloud patterns and precipitation.

### **Activities**

1. Record exact data from the NC Climate Office CRONOS Database ([www.nc-climate.ncsu.edu/cronos](http://www.nc-climate.ncsu.edu/cronos)) or use data from The Weather Channel or local news websites.
2. Students keep an ongoing log of cloud types and weather conditions.
3. Results are shared and analyzed at the end of the unit. Students look at data from previous semesters and analyze weather and cloud patterns.

### **Evaluation**

Students submit their log and cloud pictures. A grade is given for the student's log and another grade is given for the cloud pictures submitted.

### **Resources**

Students identify all the clouds they see and can use the Internet for a "cloud" reference (they must cite the sources they use). Students must also look up the weather information for the day on the Internet ([www.nc-climate.ncsu.edu/cronos](http://www.nc-climate.ncsu.edu/cronos)).

## **Analyze Changes in Weather Patterns and Become a Weather Forecaster**

Submitted by:

Jennifer Garrish

Earth/Environmental Science, Chemistry, Biology, Physical Science, Marine Science

Ocracoke School

Hyde County Schools

### **Lesson Description**

Students are to keep track of weather data during the course of Earth/Environmental Science as we study the various attributes that give us our weather. Students will document data on a daily basis using weather instruments. This data will be assessed and evaluated and compared to weather data from news programs and newspapers. Students will develop a greater appreciation of weather forecasting and how to infer and predict our own weather on a daily/weekly basis.

### **Subject Area Focus**

Earth/Environmental Science

### **Objectives**

- Investigate technological resources for observing, analyzing and predicting weather
- Interpret and analyze weather maps and relative humidity charts.
- Identify the importance of water vapor and its influence on weather (clouds, relative humidity, dew point, precipitation).

### **North Carolina Standard Course of Study**

Earth/Environmental Science Competency Goal 5.01: Analyze air masses and the life cycle of weather systems: Air masses, Frontal systems.

Earth/Environmental Science Competency Goal 5.02: Evaluate meteorological observing, analysis, and prediction: Worldwide observing systems, Meteorological data depiction, Changes in weather patterns.

### **Classroom time required**

10-15 minutes/day for three to four weeks. Final day about 45 minutes

### **Materials Needed**

- Thermometers-wet and dry bulb
- Anemometer
- Barometers
- Rain gauge
- Wind vane
- US maps of the weather (Daily) from Internet or newspapers.

### **Pre-activities**

Students should be familiar with these instruments and how to use them from elementary and middle school days. They should also be familiar with basic graphing techniques for line graphs. Basic measurement skills for metric and English units are also useful. Use of maps should also be basic.

Teacher will establish appropriate set up for ‘weather station’ or could allow students to develop and compare microclimates around the school campus.

### Activities

1. Students will be divided into groups of 2-4.
2. Students will review how to read the instruments and record data in their notebooks. Students can also rotate among themselves reading of various data instruments and share daily data with peers. This could save class time for the teacher.
3. The first day will take longer in establishing charts in journals.
4. At the beginning of class daily, (this should be the same time every day) throughout the unit. Students will continue throughout the next several days recording their data. At the end of the required time, students will make graphs of their data showing the different trends for each of the instruments.
5. Students will apply weather data in weather station format applying all the various symbols relevant to the day’s weather.
6. Students will use daily weather maps from local newspapers or the Internet to compare and contrast weather data from those maps to what we are currently having.
7. The goal will be to see how weather changes from one day to the next, read the various maps to see if we experience the same weather patterns from places further to the west, just a few days/hours removed.

### Evaluation

The daily log will be assessed, how well they keep the data, and how well they assist within the group and graphing of their data. Students could also be asked to “predict” the weather for a particular day, based on previous data or by reading a weather map. They will also look at various weather maps and interpret the data that is presented.

### Resources

<http://www.weather.com/weather/local/27960>

[www.nc-climate.ncsu.edu/cronos](http://www.nc-climate.ncsu.edu/cronos)

Local Newspaper

### **RENCI Challenge- How Valid are TV Weather Forecasts?**

On April 21, 2008, The NY Times online posted the Freakonomics blog, “How Valid are TV Weather Forecasts.” The blog details the efforts of a father and his fifth grade daughter to document the temperature and rainfall predications of four different local news stations, and compare them with the actual measurements taken at their home. The RENCi challenge is for your class to do that same thing but compare them with the data from the research grade weather station closest to your school (data found at <http://www.nc-climate.ncsu.edu/cronos>). If you, or a class at your school, decides to accept this challenge, please notify Jennifer Shelton at [jshelton@renci.org](mailto:jshelton@renci.org). RENCi hopes to collect data from several different schools and post it on the RENCi website ([www.renci.org](http://www.renci.org)).

For details on how the bloggers collected and documented their data, please refer to [freakonomics.blogs.nytimes.com/2008/04/21/](http://freakonomics.blogs.nytimes.com/2008/04/21/)

**Additional Lesson Plans from the NY Times Learning Network** The New York Times Learning Network has a wide variety of lesson plans using weather data. The most relevant plans, as of publication, are presented below. Teachers may search for additional plans at <http://www.nytimes.com/learning/index.html>.

### **And Now for the Weather (and Climate) Report ...**

*Analyzing Data Related to Weather and Climate*

**Author(s)**

[Catherine Hutchings, The New York Times Learning Network](#)

[Bridget Anderson, The Bank Street College of Education in New York City](#)

**Grades:** 6-8, 9-12

**Subjects:** Current Events, Media Studies, Science

**Overview of Lesson Plan:** In this lesson, students make basic weather predictions and investigate a weather cable channel and its response to climate change. They then interpret and compare charts and graphs about weather and climate and reflect on how climate changes impact their own life and the business community.

[http://www.nytimes.com/learning/teachers/lessons/20070605tuesday.html?searchpv=learning\\_lessons](http://www.nytimes.com/learning/teachers/lessons/20070605tuesday.html?searchpv=learning_lessons)

### **In the Eye of the Storm**

*Creating News Reports on Major Storms*

**Author(s)**

[Jennifer Rittner, The New York Times Learning Network](#)

[Bridget Anderson, The Bank Street College of Education in New York City](#)

**Grades:** 6-8, 9-12

**Subjects:** Geography, Media Studies, Science

**Overview of Lesson Plan:** In this lesson, students share opinions about what information the public needs about an impending hurricane. They then research and report on a major U.S. hurricane and synthesize their learning by comparing different news sources' reports about Hurricane Katrina.

[http://www.nytimes.com/learning/teachers/lessons/20050830tuesday.html?searchpv=learning\\_lessons](http://www.nytimes.com/learning/teachers/lessons/20050830tuesday.html?searchpv=learning_lessons)

## **What Weather When and Where?**

*Writing Gripping News about Seemingly Ordinary Topics*

**Author(s)**

[Clayton DeKorne, The New York Times Learning Network](#)

[Tanya Yasmin Chin, The Bank Street College of Education in New York City](#)

**Grades:** 6-8, 9-12

**Subjects:** Geography, Journalism, Language Arts, Science

**Overview of Lesson Plan:** In this lesson, students learn the difference between hard news and feature writing. They then choose one of these news styles to write a compelling weather-related article based on interviews with local sources.

[http://www.nytimes.com/learning/teachers/lessons/20030717thursday.html?searchpv=learning\\_lessons](http://www.nytimes.com/learning/teachers/lessons/20030717thursday.html?searchpv=learning_lessons)

## **Variable Skies**

*Utilizing the Scientific Method to Investigate Tornado Models*

**Author(s)**

[Priscilla Chan, The New York Times Learning Network](#)

[Bridget Anderson, The Bank Street College of Education in New York City](#)

**Grades:** 6-8, 9-12

**Subjects:** Geography, Language Arts, Science

**Overview of Lesson Plan:** In this lesson, students examine factors which affect a vortex and create model tornadoes. They then identify variables, pose a testable question, and perform an experiment using the scientific method. After they collect their data, students write a complete lab report.

[http://www.nytimes.com/learning/teachers/lessons/20030506tuesday.html?searchpv=learning\\_lessons](http://www.nytimes.com/learning/teachers/lessons/20030506tuesday.html?searchpv=learning_lessons)

## **In the Forecast, a Flurry of Concerns about Snow**

*Exploring Implications of the Lack of Snowfall Data on Various Stakeholders*

**Author(s)**

[Priscilla Chan, The New York Times Learning Network](#)

[Bridget Anderson, The Bank Street College of Education in New York City](#)

**Grades:** 6-8, 9-12

**Subjects:** Civics, Geography, Language Arts, Science

**Overview of Lesson Plan:** In this lesson, students consider the effects of climate change on snowfall and how a lack of data in snowfall collection will impair climate change research. In groups, students investigate different effects of snowfall and make recommendations to lobbyists about effective means to persuade policymakers to increase funding for better snowfall monitoring systems.

[http://www.nytimes.com/learning/teachers/lessons/20030211tuesday.html?searchpv=learning\\_lessons](http://www.nytimes.com/learning/teachers/lessons/20030211tuesday.html?searchpv=learning_lessons)

## **Storming the Web**

*Exploring How the Internet Has Changed the Way We Learn About Weather*

**Author(s)**

[Rachel McClain, The New York Times Learning Network](#)

**Grades:** 6-8, 9-12

**Subjects:** Geography, Language Arts, Science, Technology

**Overview of Lesson Plan:** In this lesson, students explore the importance of weather prediction and the Internet's role in changing the way weather is reported. By participating in an Internet scavenger hunt, students will come to a greater appreciation of the role weather prediction through the Internet plays in their own lives as well as the lives of people all over the world.

[http://www.nytimes.com/learning/teachers/lessons/20000601thursday.html?searchpv=learning\\_lessons](http://www.nytimes.com/learning/teachers/lessons/20000601thursday.html?searchpv=learning_lessons)

## **Warning Signs for Dangerous Times**

*Exploring the Use of Storm-Tracking Technologies*

**Author(s)**

[Catherine Wilson Bazant, The New York Times Learning Network](#)

**Grades:** 6-8, 9-12

**Subjects:** Geography, Language Arts, Technology

**Overview of Lesson Plan:** In this lesson, students explore the use of storm-tracking technologies, research and present how they forecast natural disasters, and assess the importance of these technologies.

[http://www.nytimes.com/learning/teachers/lessons/20000127thursday.html?searchpv=learning\\_lessons](http://www.nytimes.com/learning/teachers/lessons/20000127thursday.html?searchpv=learning_lessons)