

# Dragonfly Gazette

## A LONG DRY SPELL:

### 4 perspectives on drought in Georgia

Imagine a farmer maintaining his crops, a water manager supplying a community with water, and scientists monitoring precipitation amounts or the distribution of water. How does drought affect them?

Drought is a natural phenomenon that has occurred regularly in Georgia in recent years. It has severely affected water supplies, agriculture, stream water quality, lake recreation, hydropower generation, watercraft navigation, forest resources, and wildlife habitat (<http://ga.water.usgs.gov/edu/qadroughts.html#drought>).

Last April, the director of the Georgia Environmental Protection Division (EPD) declared a level two drought response across the state that has required all Georgians to follow a more stringent outdoor water use schedule. Research indicates that outdoor water use can increase by up to 60% in the summer when conditions are drier than normal. The outdoor water use schedule was established to conserve water.

Georgia Project WET helped develop a new resource for 6th grade Earth Science teachers that will make it easier for them to bring the timely issue of drought and water conservation into the classroom. **The Drought in Georgia unit for 6th grade Earth Science teachers** features four lessons written in the *Understanding by design* framework. The unit addresses nine content and characteristics of science standards, plus language arts and social studies standards. Each lesson includes background information, a list of desired outcomes, a recommended assessment strategy, and a detailed plan of action. **See a sample on pages 5-8.**

The Drought in Georgia unit was developed for the *waterSmart* program by the Education Roundtable, a partnership of organizations working together to deliver coordinated environmental messages to Georgians. *waterSmart*



seeks to conserve water in Georgia by encouraging reductions in outdoor water use. It offers simple tips for maintaining healthy lawns and gardens while using less water (**see the back page of this newsletter for more information**).

One of the lessons in the Drought in Georgia unit invites students to define drought through the experiences of a meteorologist, a water manager, a hydrologist and a farmer. For this article, the Dragonfly Gazette built on that idea and interviewed meteorologist Gene Norman, water manager Max Hicks, hydrologist Wei Zing and farmer John Bridges, Jr.

DG asked them: **“How does drought affect your work?”**

#### Gene Norman, Chief Meteorologist, CBS 46 News, Atlanta

The lack of rain becomes a major focus in the weathercast because we need to stay up on the water restrictions and pass those on to viewers. Also, if there is ever the slightest chance that rain could be in the forecast, we do our best to pin point the duration and location of expected rain. Finally, we examine the weather patterns that are causing the drought as well as projections of when those patterns could change. For example, we pay close attention to the hurricane projections because a land-falling Florida hurricane could bring drenching rains into the state.



Gene Norman

**NOTE:** A meteorologist is an individual with specialized education who uses scientific principles to explain, understand, observe or forecast the earth's atmospheric phenomena and/or how the atmosphere affects the earth and life on the planet ([www.ametsoc.org/policy/whatisam.html](http://www.ametsoc.org/policy/whatisam.html)).

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## Congratulations to the Georgia Students Honored in 2007 River of Words Youth Poetry & Art Contest!

**The results are in for River of Words Youth Poetry and Art Contest.** Congratulations go to the 7 Georgia students honored through the International River of Words program and the 36 students who received state River of Words awards. Over 18,000 entries were received from around the world for the International contest and 2061 of those were from Georgia!

**Shalini Ramachandran**, grade 12, Parkview High School in Lilburn, was a **National Finalist in Poetry**. Her teacher was Mary Lynn Huie, who mentored many other successful students this year.

### The following Georgia students were honored with National Poems of Merit Awards:

Shalini Ramachandran, with two additional poems selected for Merit Awards // Caila Blanta, 14, Parkview High School, Lilburn, teacher: Mary Lynn Huie // Preena Desai, 18, Tucker High School, Tucker, teacher: David Hirsch // Ting Gou, 17, Parkview High School, Lawrenceville, teacher: Mary Lynn Huie, also with two winning Merit entries

### The following Georgia students were named National Finalists in Art:

Jamaal Beazer, 5, Bolton Academy, Atlanta, teacher: Bart Susany // Ali Eustis, 16, Holy Innocents' Episcopal School, Atlanta, teacher: Renee Gracon // Hannah Leathers, 15, Druid Hills High School, Atlanta, teacher: Betsy Eppes

**Entries from Georgia were judged again for the state River of Words contest and the students were honored in a ceremony held in May at the Chattahoochee Nature Center. The winning Georgia state and national entries have been reproduced in a printed journal and displayed in two traveling exhibits. One exhibit is managed by the GA Center for the Book and sent to libraries throughout the state. The second exhibit is available for free checkout to educators, festivals, conferences, nature centers, and other interested parties. The state and national winners' work are posted on the River of Words ion of the Georgia Project WET web site - GAProjectWET.org.**



**Would You Do it: Save?** by Michelle Landry, Grade 12, Druid Hills High School, Atlanta, Teacher: Betsy Eppes, State Winner

### The following Georgia students were named State Winners in Poetry:

Chelsey Adams, 12, GA Military College Prep., Milledgeville, teacher: Patty Anderson // Joan Bedinger, 14, Dickerson Middle School, Marietta, teacher: Rebecca Johnson // Ben Ebbinghouse, 12, J.C. Booth Middle School, Peachtree City, teacher: Jennifer Ritter // Katelyn Fitzgerald, 13, J.C. Booth Middle School, Peachtree City, teacher: Jennifer Ritter // Chloe Franklin, 13, J.C. Booth Middle School, Peachtree City, teacher: Jennifer Ritter // Thomas Gaines, 11, Flynt Middle School, Griffin, teacher: Susie Gaines // Linda Hall, 11, Porterdale Elementary, Porterdale, teacher: Lesley Hanchey // Cole Kilby, 8, Upson Lee South Elementary, Thomaston, teacher: Sheryl Farr // Krystle Kvalheim, 18, Washington-Wilkes Comprehensive High, Washington, teacher: Jennifer Atkinson // Elizabeth Marr, 7, Casa Montessori School, Marietta, teacher: Cyndia Hunicutt // Skye Mills, 11, South Effingham Middle, Guyton, teacher: Shannon Heard // Bissell Pendergrast, 18, Holy Innocents Episcopal School, Atlanta, teacher: Renee Gracon // David Polefrone, 7, Casa Montessori School, Marietta, teacher: Cyndia Hunicutt // Rebecca Shafron, 11, The Davis Academy, Alpharetta, teacher: Molly O'Brien // Chelsea Williams, 16, Bulloch Academy, Register, teacher: Diane Hathaway

### The following Georgia students were named State Winners in Art:

Jesse Abbott, 13, Demorest // Roxanne Addison, 17, Druid Hills High School, Atlanta, teacher: Betsy Eppes // Dan Albero, 7, Lewis Elementary School, Kennesaw, teachers: Kathy Frost and Karen Feathers // Jason Barbieri, 7, Pharr Elementary School, Lawrenceville, teacher: Staley Smith // John P. Bieller, 11, Columbia County 4H, Martinez, teacher: Shirley Williamson // Andy Cornett, 16, Druid Hills High School, Atlanta, teacher: Betsy Eppes // Christopher Dong, 9, Tritt Elementary, Marietta, teacher: Tamera Neal // Lillie Duncan, 7, Maranatha Christian Academy, Cumming, teacher: Lyndrid Patterson // Molly Duncan, 17, Druid Hills High School, Atlanta, teacher: Betsy Eppes // Emily Galberd, 6, Shakerag Elementary, Duluth, teacher: Karen Klein // Mikala Groshong, 8, Lewis Elementary School, Kennesaw, teacher: Kathy Frost and Karen Feathers // Andrew Henderson, 9, Chalker Elementary School, Acworth, teacher: Iris Rice // Chieh-Yin Kuo, 10, Atlanta // Michelle Landry, 17, Druid Hills High School, Atlanta, teacher: Betsy Eppes // Alona Lazarenko, 16, Evans // Taylor Morgan, 15, Bulloch Academy, Statesboro, teacher: Diane Hathaway // Kelsey Primis, 13, South Forsyth Middle School, Suwanee, teacher: Patti Grammens // Jenna Rubia, 14, Coastal Middle School, Wilmington Island, teacher: Mary Jo Fina // Heather Rutt, 17, Evans High School, Martinez, teacher: Pamela Segers // Sushma Sudhi, 13, J.C. Booth Middle School, Peachtree City, teacher: Jennifer Ritter // Grace Willhoite, 8, Casa Montessori School, Marietta, teacher: Hedwig O'Brien

# WET WORKSHOPS

VISIT THE [www.GAProjectWET.org](http://www.GAProjectWET.org) CALENDAR FOR THE LATEST INFORMATION ON AVAILABLE WORKSHOPS.

## Projects WET, WILD & Learning Tree Facilitator Training

### The Effects of Drought on Water Quality, Wildlife and Forests in Georgia

UGA Griffin Campus-Stuckey Building • 1109 Experiment Street, Griffin, GA 30224

Thursday & Friday, November 15 & 16, 2007 (Workshop hours 8:00 am – 6:00 pm each day)

#### PLT, WET & WILD

- Environmental education for Pre-K–12 students
- Correlated to the Georgia Performance Standards and Character Education program.
- Research Based and Field Tested
- Designed by educators
- Interdisciplinary and activity-based
- Classroom Friendly
- Fun for students and instructors
- Can be used indoors and outdoors
- Supports “No Child Left Behind” Law for Education Reform

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

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

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

#### Aspiring Facilitators

- Facilitator training is for individuals interested in conducting workshops for their school or organization; Professional Learning Units or continuing education credits are available.
- Become a leader in environmental education!
- We provide educational materials and resources to help you make your workshops a success!
- Network with other natural resource professionals and learn about other educational resources!

#### Special Focus

- Learn from knowledgeable guest speakers about the effects of drought.
- Engage in drought-themed activities from the Projects.
- Take home the Drought in Georgia poster and four-lesson unit for 6th grade earth science teachers as a special bonus.

Participants must attend the entire workshop to be certified in all three projects. We are unable to discount the fees on a per project basis.

**Hurry, space is limited! Registration Deadline November 2, 2007**

Name: \_\_\_\_\_

School, Comp. or Org: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

E-Mail: \_\_\_\_\_

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

Purchase Order # \_\_\_\_\_

(Authorization MUST BE ATTACHED. Registration cannot be processed with out form. ALL PURCHASE ORDERS WILL BE INVOICED.)

#### \$90 Workshop Registration Fee includes:

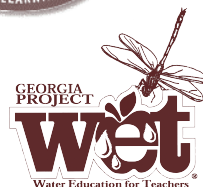
Lunch and snacks both days and resource materials for all projects (Confirmation, directions and a list of hotels will be sent upon receipt of payment)

#### Return registration form and check payable to

EEA/Project WET | Monica Kilpatrick | Georgia Project WET

4220 International Pkwy Ste 101 | Atlanta, GA 30354

(404) 362-6536 Phone | (404) 675-6245 Fax | Or email her at [monica\\_kilpatrick@dnr.state.ga.us](mailto:monica_kilpatrick@dnr.state.ga.us)



# MAKE THE GEORGIA CONNECTION



Make the Georgia Connection provides state-specific background information and correlations to the Georgia Performance Standards for some of your favorite Project WET lessons. In this issue we focus on drought in Georgia. The information below may be used with **A Drop in the Bucket**, **Back to the Future**, **Dilemma Derby**, **Hot Water**, **Super Bowl Surge**, **Water Works** and **Wet Work Shuffle**.

## Drought in Georgia

Written by Beth Ball, Environmental Outreach Assistant, Georgia Adopt-A-Stream and Georgia Project WET

Drought is defined as a period of drier than normal conditions that results in water-related problems. Meteorological drought occurs when the precipitation amount is less than normal compared to levels over time. Agricultural drought is caused by low moisture levels in the topsoil. During this type of drought, conditions can change drastically with one good rainstorm. Hydrological drought is a long lasting condition that affects surface and groundwater levels.

Unusually dry conditions can cause farmers to lose crops, livestock, and income. In 2006 Georgia farmers reported \$819.4 million in production value losses due to drought conditions (<http://www.caed.uga.edu/publications/2006/pdf/CR-06-06.pdf>.)

When dry conditions persist for weeks, months, or years, hydrological drought is the result. The flow of water in streams and rivers decreases and water levels in lakes, wells, and reservoirs can fall, causing problems in municipal and industrial water supplies as well as water quality and habitat issues. Earlier this year officials in Heard County in west Georgia said the county's two water sources had dried up due to the drought.

In Georgia, the EPD Director, working with the State Climatologist, consults with the State Drought Response Committee members and then determines whether to declare a drought response. There are four levels of drought response, which legally designate restrictions

on watering, for the purpose of conservation. The appropriate level of response is determined by the severity of the drought.

Drought severity is determined through data from monitoring streamflows, lake levels, precipitation (rainfall in the last 90 days and expected precipitation), groundwater levels and soil moisture, as well as other factors. This data is collected by a variety of scientists including climatologists and meteorologists, researchers at the United States Geological Survey and National Weather Service, staff of the Georgia Environmental Protection Division, as well as water utilities managers and University of Georgia cooperative extension agents.

In 1991, the University of Georgia (UGA) established the Georgia Automated Environmental Monitoring Network to collect reliable weather information for agricultural and environmental applications. Each station monitors air temperature, relative humidity, rainfall, solar radiation, wind speed, wind direction, soil temperature at 2, 4, and 8 inch depths, atmospheric pressure, and soil moisture every 1 second. Data are summarized at 15-minute intervals and at midnight a daily summary is calculated. A microcomputer at UGA's Griffin Campus initiates telephone calls to each station periodically and downloads the recorded data. The data are processed immediately and disseminated via [www.GeorgiaWeather.net](http://www.GeorgiaWeather.net) (<http://www.griffin.uga.edu/aemn/>).

- **May 2007 was the driest May in Georgia history out of 113 years. The state average precipitation was 0.66 inches, compared to an average of 3.69.**
- **April-June was the 3rd driest in Georgia history. The last time it was this dry was 1986. January-June was also the 3rd driest.**
- **As of June 2007, 104 out of 159 Georgia counties were classified as being in extreme drought, a condition that weather experts expect to see only once every 50 years.**

SOURCE: David Stooksbury, State Climatologist and Associate Professor Engineering and Atmospheric Sciences, The University of Georgia

Activity	Georgia Performance Standards – Science*
<b>A Drop in the Bucket</b>	S5E1c / S6E3a / S6E5i / S6E6b / S7CS1a / S7CS3a,d / S7CS5a / S7CS7b-d / S7S8c / S7CS10c,d / SCSH1a,b / SCSH3a,b,f / SCSH4a / SCSH6c,d / SCSH7a,b,c,e / SCSH8b-f / SCSH9a,c,d / SP52b / SPS5a / SPS6a-e / SB4a-f /
<b>Back to the Future</b>	S6E3a / S6E5c / S6E5h / S6E5i / S6E6b / S7CS1b / S7CS3a / S7CS3d / S7CS5a / S7CS6c / S7CS7c,d / S7CS9b,e / S7CS10c / SPS6d / SB4a-f / SB5d,e / SCSH1a,c / SCSH3a-e / SCSH4a,b / SCSH6b-d / SCSH7b,e / SCSH8b,c,f / SCSH9a-d / SC2b / SC5a / SC6c / SC7a / SP1a / SP3a / SP3e
<b>Dilemma Derby</b>	S7CS4a / S7CS6b / SCSH1a-b / SCSH3a,b,f / SCSH6c,d / SCSH7a-c,e / SCSH8b,c,e,f / SCSH9a,c,d / SB4a,b,d,e,f / SB5e
<b>Hot Water</b>	SCSH1a-c / SCSH3a,b / SCSH4a,b / SCSH6b-d / SCSH7a,c,e / SCSH8b-f / SCSH9a-d / SB4a,d / SB5e
<b>Super Bowl Surge</b>	S3L2a,b / S5L4b / S7CS1b / S7CS5a,b / S7CS6a-c / S7CS7a-d / S7CS9a,b / S7CS10c / SCSH1a-c / SCSH3a-f / SCSH4a,b / SCSH6b-d / SCSH7a,b,d,e / SCSH8b,c,f / SCSH9a-d / SB4a-f / SB5e / SP1a / SP3a,e
<b>Water Works</b>	S3L2b / S4L1b-d / S7CS5a,b / S7CS7a,b / S7CS8b,c / S7CS9a,b
<b>Wet Work Shuffle</b>	S7CS5a,b / SCSH1a,b / SCSH3a-c / SCSH4a / SCSH5e / SCSH6b,d / SCSH7a,b,e / SCSH8c,e,f / SCSH9a-d / SB4a-d

\*A complete list of Georgia Performance Standards/Project WET correlations including Language Arts, Math, Social Studies and Science can be found at [www.GAPProjectWET.org](http://www.GAPProjectWET.org).

# Investigating Drought

## Scientific Processes for Determining Drought

**Lesson Plan Template** Wiggins, G., & McTighe, J. (2004). Understanding by design professional development workbook. Alexandria, VA: Association for Supervision and Curriculum Development.

**One of four lessons from the Drought in Georgia unit for 6th Grade Earth Science Teachers found on [www.ConserveWaterGeorgia.net](http://www.ConserveWaterGeorgia.net).**

## Teacher Background Information

A variety of scientists study drought conditions, including climatologists, meteorologists, researchers at the United States Geological Survey and National Weather Service, members of the Georgia Environmental Protection Division staff as well as water utilities managers and cooperative extension agents. These professionals have training and expertise in monitoring and analyzing critical factors and indicators associated with drought.

Scientists study a great deal of data to analyze drought conditions and to make decisions. A sophisticated system for measuring drought was developed by meteorologist Wayne Palmer for the National Weather Service in 1965. Now known as the Palmer Drought Severity Index (PDSI), it uses temperature and rainfall to determine dryness and has become a semi-official drought index. The Georgia Automated Environmental Monitoring Network (AEMN) was established in 1991 by the College of Agriculture and Environmental Sciences of the University of Georgia to assist with the monitoring of conditions such as drought. In addition, officials at the Environmental Protection Division of the Georgia Department of Natural Resources look at many indicators of moisture in the state, including groundwater levels, streamflows, reservoir levels, rainfall for the last 90 days, expected precipitation in the next 90 days, and water use patterns across the state. Scientists also use simple tools such as rain gauges and soil moisture probes to analyze various drought conditions.

Researchers investigate drought and other natural phenomena through the process of scientific inquiry. This process is guided by observations, targeted questions and hypotheses, experimental procedures and investigational design, collection of valid and reliable data through appropriate tools, analysis of data to determine reasonable explanations, and communication of results for necessary action.

## Language:

- **analyze** – to examine methodically by separating into parts and studying the interrelationships of those parts
- **climatologist** – a scientist who studies climate as the prevailing weather conditions of a place, including climate data, the analysis of causes of the differences in climate, and the application of climate data to the solution of specific problems
- **meteorologist** – a scientist who studies the atmosphere and atmospheric conditions
- **monitor** – to keep track of systematically with a view to collecting information; to test or sample on a regular basis
- **scientific inquiry/processes** – investigation done through a step-by-step, logical method; a body of techniques for investigating phenomena and acquiring new knowledge or correcting or integrating previous knowledge; generally includes the steps of observing, hypothesizing, testing, concluding, and reporting and discussing results



## Desired Outcomes

### Goals:

**S6E3. Students will recognize the significant role of water in earth processes.**

- b. Relate various atmospheric conditions to stages of the water cycle.

**S6CS4. Students will use tools and instruments for observing, measuring, and manipulating equipment and materials in scientific activities.**

- c. Read analog and digital meters on instruments used to make direct measurements of length, volume, weight, elapsed time, rates, and temperature, and choose appropriate units for reporting various quantities.

**S6CS6. Students will communicate scientific ideas and activities clearly.**

- a. Write clear, step-by-step instructions for conducting scientific investigations, operating a piece of equipment, or following a procedure.
- b. Understand and describe how writing for scientific purposes is different than writing for literary purposes.
- c. Organize scientific information using appropriate tables, charts, and graphs, and identify relationships they reveal.

**S6CS9. Students will investigate the features of the process of scientific inquiry.**

- a. Scientific investigations are conducted for different reasons. They usually involve collecting evidence, reasoning, devising hypotheses, and formulating explanations.
- b. Scientists often collaborate to design research. To prevent bias, scientists conduct independent studies of the same questions.
- c. Accurate record keeping, data sharing, and replication of results are essential for maintaining an investigator's credibility with other scientists and society.
- d. Scientists use technology and mathematics to enhance the process of scientific inquiry.

### Students will understand that...

- drought and water use impact the availability of water resources
- scientists and other professionals engage in drought research utilizing appropriate skills and training
- scientists use specialized tools and techniques to collect and analyze data about drought conditions
- scientists look at a variety of indicators and references to determine drought conditions
- scientific inquiry is a process for questioning, investigating, gathering data, explaining, and communicating.

### Essential Questions...

- What interests, education, and training do scientists need to study drought?
- What tools do scientists use to study drought?
- How do scientists determine if we are in a drought situation?
- What skills are involved in scientific inquiry concerning drought?

### Students will know...

- that scientists utilize training, knowledge, and inquiry methods to investigate drought
- that scientists collect and analyze drought data by means of specialized tools and resources
- that scientists constantly monitor and evaluate drought conditions in Georgia
- that scientific inquiry is an organized series of logical, methodical steps.

### Students will be able to...

- describe the job of a scientist who studies drought
- list tools and resources that scientists use to study drought.
- perform simple soil moisture and rainfall measures
- discuss ways that scientists determine if a drought situation exists
- outline and plan a method of scientific inquiry.

## Lesson Hook:

Students review introductory letter from a professional scientist who is directly involved in studying drought and soil conditions in Georgia. (See Student Copy Page on page 8.)

## Assessment

### Performance Tasks:

Using a scientifically sound inquiry process, students work in groups to develop a written plan. Groups present their plans to the class, as teachers note the inclusion of the following scientific inquiry/scientific process components in each plan:

- Statement of the problem
- Research question or hypothesis
- A research plan or design
- Measurements or tests to collect data under controlled conditions
- Analysis and interpretation of the data
- Communication of conclusions based on the data

Students will use rain gauges and/or soil moisture probes or other appropriate instrumentation to make observations and collect local data associated with drought conditions.

### Other Evidence:

Students summarize how the Georgia Environmental Protection Division determines if Georgia is in a drought and subsequent actions (Review information at <http://www.caes.uga.edu/topics/disasters/drought/restrictions/faq.html>).

## Plan of Action

### Tasks:

#### Part A: Thinking Scientifically About Drought: 120 minutes

1. Following students' reading of the scientist's letter designated in the Lesson Hook, teachers review vocabulary (found at the end of the Teacher Background Information section) and the scientific processes (outlined in the Assessment section above).
2. Teachers then ask students to think like scientists to develop a process for collecting and analyzing information to answer the research question: How do we determine if Georgia is in a drought situation?
3. Teachers pose the following additional questions: What evidence or observations do we need to determine if there is a drought? How could we collect data? What could we measure? How could we best measure it? What tools would we need? How do we analyze, interpret and communicate our findings and results? Where could we find information to help answer questions about drought?
4. Teachers facilitate the process of investigating drought with appropriate inquiry worksheets (<http://trackstar.4teachers.org> Search scientific method for model worksheets) to guide the planning effort and allow time for students to work in groups to create a plan that should include use of rain gauges/soil probes (See Part C below) and all of the following steps of scientific inquiry: statement of the problem, research question or hypothesis, a research plan/design, collection of data, analysis and interpretation of data, communication of conclusions. Guidelines for science fair projects are also helpful for outlining the scientific processes, as provided in the Web site: <http://school.discovery.com/sciencefaircentral/scifairstudio/handbook/scientificmethod.html>

#### Part B: Determining A Drought Situation: 60 minutes

1. Teachers explain how the Director of the Environmental Protection Division determines if the state is in a drought (Review the information at <http://www.caes.uga.edu/topics/disasters/drought/restrictions/faq.html>).
2. Students present their plans to determine Georgia's drought situation and compare their plans from Part A to the state's overall plan.

#### Part C: Using Scientific Tools to Investigate Drought: Time varies depending on student investigations

1. Students use rain gauges and soil probes as part of executing their drought investigation plan from Part A. (Teachers may choose to use these tools for demonstration purposes rather than active student participation if necessary.)
2. Instruments are available at the Web sites listed in the Dragonfly Gazette section of the Georgia Project WET web site – [GAProjectWET.org](http://GAProjectWET.org).