The Science Standards of Learning
Curriculum Framework
Board of Education
Commonwealth of Virginia

Environmental Science

Modified to include pacing and resources for instruction by LCPS for School Year 2012-2013
### 2012-2013 Environmental Science
**Pacing Guide At a Glance**

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This is a suggested sequence of topics and may be adjusted to school resources.
Introduction to Loudoun County’s Science Curriculum

This Curriculum Guide and Framework is a merger of the Virginia Standards of Learning (SOL) and the Science Achievement Standards of Loudoun County Public Schools. Many sections are copies or modifications of Virginia’s SOL documents. Suggestions on pacing and resources represent the professional consensus of LCPS teachers concerning the implementation of these standards.

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K-12 Safety in the Science Classroom

In implementing the Science Standards of Learning, students must know how to follow safety guidelines, demonstrate appropriate laboratory safety techniques, and use equipment safely while working individually and in groups.

Safety must be given the highest priority in implementing the K-12 instructional program for science. Correct and safe techniques, as well as wise selection of experiments, resources, materials, and field experiences appropriate to age levels, must be carefully considered with regard to safety precautions for every instructional activity. Safe science classrooms require thorough planning, careful management, and constant monitoring of student activities. Class enrollment should not exceed the designed capacity of the room.

Teachers must be knowledgeable of the properties, use and proper disposal of all chemicals that may be judged as hazardous prior to their use in an instructional activity. Such information is referenced through the MSDS forms (Materials Safety Data Sheets). The identified precautions involving the use of goggles, gloves, aprons, and fume hoods must be followed as prescribed.

While no comprehensive list exists to cover all situations, the following should be reviewed to avoid potential safety problems. Appropriate safety procedures should be used in the following situations:

- Observing wildlife; handling living and preserved organisms; and contact with natural hazards such as poison ivy, ticks, mushrooms, insects, spiders, and snakes
- Field activities in, near, or over bodies of water
- Handling of glass tubing, sharp objects, glassware, and labware
- Natural gas burners, Bunsen burners, and other sources of flame/heat
- Hazards associated with direct sunlight (sunburn and eye damage)
- Use of extreme temperatures and cryogenic materials
- Hazardous chemicals including toxins, carcinogens, flammable and explosive materials
- Acid/base neutralization reactions/dilutions
- Production of toxic gases or situations where high pressures are generated
- Biological cultures, their appropriate disposal, and recombinant DNA
- Power equipment/motors
- High voltage/exposed wiring
- Laser beam, UV, and other radiation

The use of human body fluids or tissues is generally prohibited for classroom lab activities. Further guidance from the following sources may be taken into account:

- OSHA (Occupational Safety and Health Administration)
- ISEF (International Science and Engineering Fair Rules)
- Public health departments and local school division protocols.

For more detailed information about safety in science, consult the LCPS Science Safety Manual.
The Role of Instructional Technology in Science Education

The use of current and emerging technologies is essential to the K-12 science instructional program.

Specifically, technology must

- Assist in improving every student’s functional literacy. This includes improved communication through reading/information retrieval (the use of telecommunications), writing (word processing), organization and analysis of data (databases, spreadsheets, and graphics programs), selling one’s idea (presentation software), and resource management (project management software).

- Be readily available and used regularly as an integral and ongoing part in the delivery and assessment of instruction.

- Include instrumentation oriented toward the instruction and learning of science concepts, skills, and processes. Technology, however, should not be limited to traditional instruments of science such as microscopes, labware, and data-collecting apparatus but should also include computers, robotics, interactive-optical laser discs, video-microscopes, graphing calculators, CD-ROMs, global positioning systems (GPS), probeware, on-line telecommunication, software and appropriate hardware, as well as other emerging technologies.

- Be reflected in the “instructional strategies” generally developed at the local school division level.

In most cases, the application of technology in science should remain “transparent” unless it is the actual focus of the instruction. One must expect students to “do as a scientist does” and not simply hear about science if they are truly expected to explore, explain, and apply scientific concepts, skills, and processes.

As computer/technology skills are essential components of every student’s education, it is important that these skills are a shared responsibility of teachers of all disciplines and grade levels.
Meaningful Watershed Educational Experiences

The “Stewardship and Community Engagement” Commitment of the Chesapeake 2000 agreement clearly focuses on connecting individuals and groups to the Bay through their shared sense of responsibility and action. The goal of this Commitment formally engages schools as integral partners to undertake initiatives in helping to meet the Agreement.

Two objectives developed as part of this goal describe more specific outcomes to be achieved by the jurisdictions in promoting stewardship and assisting schools. These are:

- **Beginning with the class of 2005, provide a meaningful Bay or stream outdoor experience for every school student in the watershed before graduation from high school.**
- **Provide students and teachers alike with opportunities to directly participate in local restoration and protection projects, and to support stewardship efforts in schools and on school property.**

There is overwhelming consensus that knowledge and commitment build from firsthand experience, especially in the context of one’s neighborhood and community. Carefully selected experiences driven by rigorous academic learning standards, engendering discovery and wonder, and nurturing a sense of community will further connect students with the watershed and help reinforce an ethic of responsible citizenship.

**Defining a Meaningful Bay or Stream Outdoor Experience**

A meaningful Bay or stream outdoor experience should be defined by the following.

- **Experiences are investigative or project oriented.**
  Experiences include activities where questions, problems, and issues are investigated by the collection and analysis of data, both mathematical and qualitative. Electronic technology, such as computers, probeware, and GPS equipment, is a key component of these kinds of activities and should be integrated throughout the instructional process.

  The nature of these experiences is based on learning standards and should include the following kinds of activities.

  - Investigative or experimental design activities where students or groups of students use equipment, take measurements, and make observations for the purpose of making interpretations and reaching conclusions.
  - Project-oriented experiences, such as restoration, monitoring, and protection projects, that are problem solving in nature and involve many investigative skills.

**Experiences are richly structured and based on high-quality instructional design.**

**Experiences are an integral part of the instructional program.**
Experiences are part of a sustained activity.

Experiences consider the watershed as a system.

Experiences involve external sharing and communication.

Experiences are enhanced by natural resources personnel.

Experiences are for all students.

Experiences such as tours, gallery visits, simulations, demonstrations, or “nature walks” may be instructionally useful, but alone do not constitute a meaningful experience as defined here.

The preceding text contains excerpts from:
Chesapeake Bay Program Education Workgroup
STEWARDSHIP AND MEANINGFUL WATERSHED EDUCATIONAL EXPERIENCES
http://vaswcd.org/?s=meaningful+watershed+education+experience

The link in found in the Virginia Department of Education Instructional Resources for Science:
http://www.doe.virginia.gov/instruction/science/resources.shtml


Each LCPS K-12 Science Pacing Guide indicates where the Meaningful Watershed Educational Experiences fit into the Virginia Standards of Learning. Resources for these experiences are cited in the Resources section of each standard.

Many of the resources are from Lessons from the Bay and Virginia’s Water Resources a Toolkit for Teachers. These and other watershed resources are posted in CLARITY in the Watershed resources folder.
Internet Safety

The Internet allows students to learn from a wide variety of resources and communicate with people all over the world. Students should develop skills to recognize valid information, misinformation, biases, or propaganda. Students should know how to protect their personal information when interacting with others and about the possible consequences of online activities such as social networking, e-mail, and instant messaging.

- Students need to know that not all Internet information is valid or appropriate.
- Students should be taught specifically how to maximize the Internet’s potential while protecting themselves from potential abuse.
- Internet messages and the people who send them are not always what or who they seem.
- Predators and cyberbullies anonymously use the Internet to manipulate students. Students must learn how to avoid dangerous situations and get adult help.

Cybersafety should be addressed when students research online resources or practice other skills through interactive sites. Science teachers should address underlying principles of cybersafety by reminding students that the senses are limited when communicating via the Internet or other electronic devices and that the use of reasoning and logic can extend to evaluating online situations.

If students are using online tools for written communications, address the general safety issues appropriate for this age group.

Don’t be Fooled by a Photograph
http://www.nationalgeographic.com/xpeditions/lessons/03/g68/hoaxphoto.html

This lesson, based on a doctored photograph of a shark, can help students understand that not all they see online is true.

Students learning how to think logically can evaluate information on the Internet for accuracy and logical validity.

Students doing research must explore the difference between fact and opinion and recognize techniques used to persuade others of a certain point of view.

Remind students that personal observations and opinions can be communicated on the Internet as if they are fact.

Students can explore a pseudoscience topic (e.g., Bermuda Triangle, palm reading, Bigfoot) through Internet sites. They apply the scientific method while exploring the topic.

Teachers can help students understand that data collected and presented on the Internet may be flawed due to many variables, including equipment malfunction, human bias, or presentation mechanisms.

If students are using online tools for written communications, address the general safety issues appropriate for this age group.
As students learn to express opinions with convincing arguments, emotions likely will become heated. Students should be apprised of the dangers of cyberbullying.

Additional information about Internet safety may be found on the Virginia Department of Education’s Website at http://www.doe.virginia.gov/support/safety_crisis_management/internet_safety/index.shtml
Investigate and Understand

Many of the standards in the Science Standards of Learning begin with the phrase “Students will investigate and understand.” This phrase was chosen to communicate the range of rigorous science skills and knowledge levels imbedded in each standard. Limiting a standard to one observable behavior such as “describe” or “explain” would have narrowed the interpretation of what was intended to be a rich, highly rigorous, and inclusive content standard.

“Investigate” refers to scientific methodology and implies systematic use of the following inquiry skills:

• Observing
• Classifying and sequencing
• Communicating
• Measuring
• Predicting
• Hypothesizing
• Inferring
• Defining, controlling, and manipulating variables in experimentation
• Designing, constructing, and interpreting models
• Interpreting, analyzing, and evaluating data

“Understand” refers to various levels of knowledge application. In the Science Standards of Learning these knowledge levels include the ability to

• Recall or recognize important information, key definitions, terminology, and facts
• Explain the information in one’s own words, comprehend how the information is related to other key facts, and suggest additional interpretations of its meaning or importance
• Apply the facts and principles to new problems or situations, recognizing what information is required for a particular situation, explaining new phenomena with the information, and determining when there are exceptions
• Analyze the underlying details of important facts and principles, recognizing the key relations and patterns that are not always readily visible
• Arrange and combine important information, facts, and principles to produce a new idea, plan, procedure, or product
• Make judgments about information in terms of accuracy, precision, consistency, or effectiveness.

Therefore, the use of “investigate and understand” allows each content standard to become the basis for a broad range of teaching objectives, which the local school division will develop and refine to meet the intent of the Science Standards of Learning.
Science
Standards of Learning

Goals
The purpose of scientific investigation and discovery are to satisfy humankind’s quest for knowledge and understanding and to preserve and enhance the quality of the human experience. Therefore, as a result of science instruction, students will be able to:

1. Develop and use an experimental design in scientific inquiry
2. Use the language of science to communicate understanding
3. Investigate phenomena using technology
4. Apply scientific concepts, skills, and processes to everyday experiences
5. Experience the richness and excitement of scientific discovery of the natural world through the historical and collaborative quest for knowledge and understanding.
6. Make informed decisions regarding contemporary issues taking into account the following:
   - public policy and legislation
   - economic costs/benefits
   - validation from scientific data and the use of scientific reasoning and logic
   - respect for living things
   - personal responsibility
   - history of scientific discovery
7. Develop scientific dispositions and habits of mind including:
   - curiosity
   - demand for verification
   - respect for logic and rational thinking
   - consideration of premises and consequences
   - respect for historical contributions
   - attention to accuracy and precision
   - patience and persistence
8. Explore science-related careers and interest.
COURSE TITLE: Environmental Science

PREREQUISITES: Completion of 2 science lab credits (Earth Science & Biology suggested)

DESCRIPTION: In science, a special emphasis is placed on the research process in all grades. Environmental science provides opportunity to synthesize the disparate pieces of physics, chemistry, earth science and biology while developing the Naturalist Intelligence. Students will gain an understanding of ecological concepts including, air, water, soil, biological diversity and human impacts. Inquiry skills will be developed through fieldwork, service projects, and collaborative investigation while using appropriate technology. Because of the interdisciplinary focus, students are challenged with diverse topics, rigorous reading requirements, and opportunity for written and oral presentation.

MAIN TOPICS: Topics of Investigation include: Air, atmospheric structure, pollution, weather dynamics, Biodiversity, Bioethics, Conservation, Ecology, Energy production, consumption, alternatives, Environmental economics, Land, geomorphology, soil, use and reclamation, Natural History of Loudoun, Populations, biodiversity, limiting factors, Water, watershed ecology, vernal pools, pollution

Natural History of Loudoun
(This unit is not necessarily taught as a discrete unit, but as a theme that runs through each successive unit throughout the school year.)

- Recognize resident species
- Use biological keys to identify local species
- Use maps and test kits to describe the soils, rocks, minerals and geologic history of Loudoun County
- Survey local watershed and describe the dynamics of watersheds

Suggested Activities:
- Macroinvertebrate studies
- Amphibian surveys
- Create a collection representing native species
- Microinvertebrate studies
- Geologic surveys
Introduction to the Biosphere

ECOLOGY (1st quarter, 3 week unit)
- Determine biotic and abiotic factors resulting in Earth’s biomes
- Identify and recognize importance of biodiversity hotspots
- Define and distinguish population, community, and ecosystem

Suggested Activities:
- Trace species adaptations to biome characteristics
- Niche competition activities
- Gradient analysis of species distribution

POPULATIONS (1st quarter, 3 week unit)
- Mathematically model populations
- Quantify influence of various cultures on human population parameters
- Analyze effect of human population on resource distribution and biodiversity
- Model effects of limiting factors on natural populations

Suggested Activities:
- Calculate time to extinction and probability of extinction
- Zero population growth lab activity
- Oh, Deer
- Owl Lab (middleschoolscience.com)

BIODIVERSITY (1st quarter, 3 week unit)

LIMITING FACTORS
- Calculate diversity indices and distinguish between alpha & beta diversity
- Explain relationships between species adaptation and environment
- Discuss factors contributing to sustainability of ecosystems
- Hypothesize consequences of small population size on genetic diversity

Suggested Activities:
- Smithsonian Biodiversity Plot
- Sample local area & calculate diversity indices
- Macroinvertebrate stream studies
- Amphibian surveys
**Atmosphere**

**AIR (2nd quarter, 4 week unit)**

**STRUCTURE, WEATHER DYNAMICS and POLLUTION**
- Investigate atmospheric structure, evolution and dynamics
- Study chemistry of air pollution
- Evaluate environmental impact of weather dynamics

*Suggested Activities:*
- Driving the Bay to Exhaustion (CBF activity)
- Acid Rain Analysis by each School for data sharing

**Geosphere**

**LAND (2nd quarter, 4 week unit)**

**GEOMORPHOLOGY, SOIL, USE & RECLAMATION**
- Evaluate the relationship between geomorphology and environmental processes
- Describe soil development, healthy soil management, soil erosion, and soil conservation technique
- Compare and contrast land use models
- Investigate effects of habitat patterns such as fragmentation, edge effect, connectivity, resource design
- Assess economic and aesthetic value of land
- Examine the impacts of resource extraction and land reclamation efforts

*Suggested Activities:*
- Lethal Lots (Love Canal)
- Park management and design
- Lack of different resource extraction policies
- Swiss Cheese Game (Forest Biodiversity Monitoring Resource)
Hydrosphere

WATER (3rd quarter, 9 week unit)
OCEANS, WATERSHED ECOLOGY, VERNAL POOLS, POLLUTION

- Apply the legal definition of a wetland to policies related to use and preservation
- Investigate watershed ecology
- Evaluate and describe groundwater systems and its relationship to the water cycle
- Analyze importance of Vernal Pool systems
- Distinguish between point and non-point source pollutant
- Evaluate water issues such as eutrophication, dams, ground water pollution, soil erosion, etc
- Analyze aesthetic and economic value of water

Suggested Activities:
Water quality testing
Stream monitoring
Drainage basin and pattern tracing
Chesapeake Bay Foundation trips
Canoe trips
Project Wet
We All Live Downstream activity
Dragonfly Pond
Red River Dam
Save a Drop! Don’t Be a Drip!
Resource Sustainability

BIOETHICS (4th Quarter, 2 week unit)
- Develop a personal environmental philosophy
- Survey local environmental issues
- Demonstrate familiarity with various environmental mensuration techniques

Suggested Activities:
- How to lie with statistics
- Issue analysis

CONSERVATION/ ALTERNATIVE ENERGIES (4th Quarter, 2 week unit)
- Distinguish between renewable and nonrenewable resources
- Demonstrate an understanding of natural cycles (water, rocks, nitrogen, carbon, phosphorous)
- Survey methods of waste management techniques including recycling
- Perform basic risk analysis
- Investigate the causes and consequences of habitat loss
- Examine the role of zoning on conservation

Suggested Activities:
- Trash analysis
- Case studies of habitat loss
- Water treatment plant visitation

ENERGY (4th Quarter, 2 week unit)
PRODUCTION & CONSUMPTION
- Calculate the impact of net primary production
- Evaluate alternative sources of useable energy
- Trace energy through the trophic levels
- Describe the by products and impacts of energy consumption

Suggested Activities:
- Diet for a Small Planet
- The Last Days of Ancient Sunlight
- Cost benefit of alternative vs. traditional sources
- Solar Lab Contest
- M & M/ Popcorn Renewable/Nonrenewable Resources

ENVIRONMENTAL ECONOMICS (4th Quarter, 2 week unit)
- Perform cost benefit analysis and describe limitations of quantifying intrinsic value
- Describe structure of local and federal government and its impact on environmental issues
- Evaluate major environmental legislation (Clean air act, Endangered Species Act, etc.)

Suggested Activities:
- Sample public opinion on an environmental issue
Suggested Reading

How Many People Can the Earth Support
A Sand County Almanac
Silent Spring
River of Grass, Marjorie Stoneman Douglas
Tragedy of the Commons
Earth in the Balance
The Land Ethic
Forgotten Pollinators
Walden: My Life in the Woods
Chesapeake Bay Foundation Book
Turning the Tide
Chesapeake Bay Blues

Periodicals

Endangered Species Bulletin
Published bimonthly by the U.S. Fish & Wildlife Service. To get a free subscription mail or fax your mailing information to
U.S. Fish & Wildlife Service
Division of Endangered Species
4401 N. Fairfax Drive, Room 420
Arlington, VA 22203
(fax) 703.358.1735

Bay Journal
A free is subscription available by sending your mailing information to:
Alliance for the Chesapeake Bay
6600 York Road, Suite 100
Baltimore, MD 21212
(410) 377-6270 or
email: mail@acb-online.org
also available on line at: http://www.bayjournal.com
Equipment Sources

Acorn Naturalists
17821 East 17th Street #103
PO Box 2423
Tustin, CA 92781-2423
http://www.acornnaturalists.com
(800) 422-8886

Ben Meadows Company
PO Box 80549
Atlanta, GA 30366-9821
http://www.benmeadows.com
(800) 241-6401

Carolina Biological Supply Company
http://www.carolina.com/
Phone: 800-334-5551
Fax: 800-222-7112

Sargent Welch
PO Box 5229
Buffalo Grove, IL 60089
http://www.sargentwelch.com
(800) 676-2540

Wards Natural Science
PO Box 92912
Rochester, NY 14692-9012
http://www.wardsci.com/
800-962-2660
Teaching Guides & Protocols

**Amphibian Monitoring Methods & Field Guide** (Smithsonian),
Dr. Joseph C. Mitchell, University of Richmond (you must take the course at the CRC in Front Royal to receive this resource)

**Exploring Earth Science in the Shenandoah National Park**
Hydrology and Groundwater
Landforms and Lifeforms
Soils and Watersheds
Geologic Hazards and Land Use
(You must take the course in the Shenandoah National Park to receive this resource.)

**Forest Biodiversity Program** (Smithsonian)
http://nationalzoo.si.edu/Education/ClassroomPartnerships/BioDivMonPro/default.cfm
Center for Conservation Research
Education Office
1500 Remount Rd
Front Royal, VA 22630
Jennifer Buff
Kelly Cauthorn
540.635.6540

**Project Learning Tree Environmental Education Activity Guide**
PLT Exploring Environmental Issues: Focus on Forests
PLT Green Works: Connecting Community Action and Service-Learning
http://www.plt.org/
VA contact:
Lisa Deaton
Virginia Department of Forestry
2229 E Nine Mile Road
Sandston, VA 23150.0
Phone: 804-328-3031
Fax: 804-328-3033
Email: deatonl@dof.state.va.us
Web: www.cnr.vt.edu

**Project Wet Curriculum & Activity Guide**
http://www.projectwet.org
VA contact:
Ann Regn, amregn@deq.state.va.us Department of Environmental Quality, 629 East Main Street, Suite 900, PO Box 10009, Richmond, VA 23240-0009. (804) 698-4442.
Website: http://www.deq.state.va.us/
Project Wild K-12 Activity Guide
http://www.projectwild.org/
VA contact:
Project WILD Coordinator
Virginia Department of Game & Inland Fisheries
4010 West Broad
PO Box 11104
Richmond, VA 23230
Tel: (804) 367-0188
Fax: (804) 367-9147
E-mail: sgilley@dgif.state.va.us
website: http://www.dgif.state.va.us

Project Underground
VA contact:
Carol Zokaites
Karst Education Coordinator
Virginia Department of Conservation and Recreation
Division of Natural Heritage
Karst Project
7502 Lee Highway, 2nd Floor
Radford, VA 24141
540.731.4057
Fax: 540.831.4058
E-mail: czokaites@dcr.state.va.us

Tree Identification Techniques Training Manual, Smithsonian Conservation & Research Center (you must take the course at the CRC in Front Royal to receive this resource)

Watershed Experiences: Field Experiences for Virginia Biology Students
Bay Grass Restoration
Monitoring Water Quality
Analyzing Wetlands
Oyster Restoration
(A copy of this resource was sent to every high school in Virginia.)
Web Sites

http://apcentral.collegeboard.com/apc/Controller.jsp
AP Central – College Board – Information about AP Environmental Science. Register at the site for the AP Environmental ListServe.

http://www.cnr.vt.edu/dendro/dendrology/doctor/doctor.cfm
Ask Dr. Dendro

http://www.audubonnaturalist.org/
Audubon Naturalist Society

Banshee Reeks Park

http://blueridgecenter.org
Blue Ridge Center for Environmental Stewardship

http://darwin.bio.uci.edu/~sustain/bio65/Titlpage.htm
BIODIVERSITY and CONSERVATION - A Hypertext Book by Peter J. Bryant School of Biological Sciences, University of California, Irvine
The origin, nature and value of biological diversity, the threats to its continued existence, and approaches to preserving what is left

http://www.cbf.org/
Chesapeake Bay Foundation

Claude Moore Park

http://www.savenature.org/
Center for Ecosystem Survival

http://www.birds.cornell.edu/
Cornell Lab of Orthinology, Information on individual birds plus results from citizen science programs which gives a snapshot of bird distribution

http://www.enature.com
eNature.com: field guides and much more

http://www.eeexchange.org/
Environmental Education Exchange – water conservation, recycling, waste management, endangered species, etc.

http://www.enviroliteracy.org
The Environmental Literacy Council
http://www.epa.gov/lawsregs/
Environmental Laws (EPA) Clean Water, Clean Air, Super Fund, etc

http://www.epa.gov/epahome/students.htm
E.P.A. Teacher's page

http://cfpub.epa.gov/surf/locate/index.cfm
EPA: Surf your water shed

On the Trail of the Missing Ozone (An on-line comic book)

http://www.envirothon.org/
Envirothon - North America’s Largest High School Environmental Competition

http://csmres.jmu.edu/geollab/vageol/vahist/index.html
Geological Evolution of Virginia and the Mid-Atlantic Region

http://www.wm.edu/geology/virginia/
The Geology of Virginia

http://www.healthywater.org
Healthy Water Healthy People

http://www.iwla.org/sos/
Izaak Walton League, Save our Streams

http://www.ket.org/trips/forest/
Kentucky Division of Forestry – Electronic Field Trip to the Forest

http://www.gwu.edu/~bygeorge/sept6ByG!/leip.html
Loudoun County Environmental Indicators Project (LEIP)
20101 Academic Way, Ashburn, Virginia 20147

http://www.loudounwatershedwatch.org/
Loudoun Watershed Watch
Loudoun’s Stream Monitoring Project Organized to Protect the Water Resources of Our County

http://www.hobart.k12.in.us/webquests/storey/stats.html
Lying with Stats (A webquest)

http://www.mms.gov/omm/pacific/kids/educate.htm
MMS Pacific OCS Region
A curriculum for K-8 and High School that teaches basic math and science principles through the eyes of a tidepool.
http://www.weyerhaeuser.com/Sustainability/MountStHelens
Mount Saint Helens Forest Learning Center

http://arborday.org/
The National Arbor Day Foundation

http://www.neetf.org/
National Environmental Education and Training Foundation

http://www.need.org/
National Energy Education Development - The mission of the NEED Project is to promote an energy conscious and educated society.

http://www.noaa.gov/
National Oceanic and Atmospheric Association

http://www.coralreef.noaa.gov/
Welcome to NOAA's Coral Reef online. Here you will find the latest news on coral reefs as well as links to the various NOAA web sites with additional information.

http://www.nps.gov
The National Park Service presents Exploring the Real Thing — a Statewide guide to Curriculum-based programs at National Park sites.

National Science Education Standards

http://www.naturalinquirer.org/
Natural Inquirer – online journal of nature news for students

http://www.natureserve.org/
Nature Serve - a network connecting science with conservation. Information on individual plant and animal distribution and rarity that relates to conservation

http://www.cnr.vt.edu/PLT/potomacshenandoah/index.html
Restoring the Chesapeake a 4-H and VA Department of Forestry Project for the Potomac/Shenandoah Watershed

http://www.stroudcenter.org/
Stroud Water Research Center

http://www.forestinfo.org/
Temperate Forest Foundation – resources, videos, facts, teacher tours

http://wow.nrri.umn.edu/wow/under/primer/index.html
Understanding Lake Ecology
http://www.census.gov/dmd/www/teachers.html
U.S. Census Bureau – census data and map source, classroom activities

http://www.ba.ars.usda.gov/rindex/plants.html
USDA index of plants

U.S. Department of the Interior Bureau of Land Management

http://www.blm.gov/weeds
U.S. Department of the Interior Bureau of Land Management, invasive weeds

http://www.epa.gov/
U.S. Environmental Protection Agency - Protecting health and safeguarding the environment

http://www.epa.gov/safewater/
U.S. Environmental Protection Agency – Save Water Curriculum Materials

http://www.dcr.virginia.gov/
Virginia Department of Conservation and Recreation

http://www.dcr.virginia.gov/natural_heritage/
Virginia Department of Conservation and Recreation – CAVE resources

http://www.deq.state.va.us/education/
VA Department of Environmental Quality online directory of environmental education resources

Virginia Department of Forestry

http://www.dcr.virginia.gov/
VA Dept of Soil and Water Conservation

http://www.vaforestry.org/
Virginia Forestry Association

http://www.deq.state.va.us/vanaturally/
Virginia Naturally Linking Virginians to the Environment

http://www.vernalpool.org/vernal_1.htm
The Vernal Pool Association

http://www.aquaventurer.org/
Water Environment Federation – Global Timeline and Database of Water Use, Abuse and Treatment
http://wow.nrri.umn.edu/wow/index.html
Water on the Web

http://wise.berkeley.edu
Web-Based Science Inquiry Environment (WISE) – Gypsy Moth Study and many others

http://watermonitoring.uwex.edu/wav/monitoring/coordinator/werc-locations.html
Wisconsin Water Education and Water Action Volunteers
Local Resources and Contacts

Ron Circe
Loudoun County Virginia Department of Parks, Recreation, and Community Services.
Banshee Reeks Nature Preserve
703.669.0316
571.233.1085

Blue Ridge Center for Environmental Stewardship
11661 Harpers Ferry Road
Purcellville VA 20132
(540) 668-7640
(540) 668-7649 FAX
e-mail: info@blueridgecenter.org
http://www.blueridgecenter.org/

Elizabeth Lewis
Loudoun County Virginia Department of Parks, Recreation, and Community Services.
Claude Moore Park
703.444.1275

Debbie Dillon
Urban Horticulturist
Loudoun County Office of Virginia Cooperative Extension
30-B Catoctin Circle, Southeast
Leesburg, VA 20175
703.777.0373
tax: 703.771.5844
e-mail: ddillion@vt.edu
Debbie is also the contact for speakers from the Master Gardeners.
The Master Gardeners have a Demo Garden in Ida Lee Park.

Pat Mcllvaine
Loudoun Soil & Water Conservation District
703.777.8395
e-mail: loudoun-swed@va.nacdnet.org

Larry Stipek
Loudoun County Mapping & Geographic Information
703.777.0552
e-mail: LSTIPEK@loudoun.gov
Tony Hayes, Recycling Specialist
**Loudoun County Office of Solid Waste Management**
906 Trailview Blvd, SE, Suite B
Leesburg, VA 20175
703.771.5514

Audubon Naturalist Society
**Rust Sanctuary**
Sarah Posid, Naturalist (703-669-0000)
Cliff Fairweather, Manager (703-669-1234)

James H. Suddreth
**Virginia Lakes and Watershed Association**
(Resource to provide speakers to classes)
*Chief of Stormwater Management*
**Loudoun County**
211 Gibson Street, NW, Suite 123
Leesburg, VA 20176
703.771.5552
e-mail: jsuddret@loudoun.gov

Jeff Kirwan
Grant Recipient and Training:
**Using GPS and GIS to Direct Watershed Education and Restoration Efforts in the Potomac/Shenandoah Valley**
Extension Specialist
College of Natural Resources
Virginia Tech Mail Code 0324
Blacksburg, VA 24061
540.231.7265
e-mail: jkirwan@vt.edu

David L. Trauger
Director of Natural Resource Programs
**College of Natural Resources Virginia Tech**
Northern Virginia Center
7054 Haycock Road
Falls Church, VA 22043-2311
703.538.8362
e-mail: dtrauger@vt.edu
## Environmental Science Start-Up Inventory

### Equipment:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Number per school</th>
<th>Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acid Rain Survey Set</td>
<td>Set to evaluate rain and freshwater for acidity. Includes 50 sample tubes, ten comparator charts and jumbo tear off dispensers with Hydrion pH 0-13 wide range test paper and enough Hydrion pH 3.0-6.0 test paper for 400 determinations</td>
<td>1</td>
<td>Sargent Welch WLS-65262-25</td>
</tr>
<tr>
<td>Soil Sampling Tube</td>
<td>A 12” steel sampler with a 1” core diameter, saw toothed tip, and cut-away side for core examination prior to removal.</td>
<td>1</td>
<td>Sargent Welch WLS-74921</td>
</tr>
<tr>
<td>Screen Sieves Set</td>
<td>High Impact plastic sieves 6” in diameter, one bottom pan and lid. Used to separate and grade soil and rock samples. (Set of 4 mesh sizes 5, 10, 60, 230)</td>
<td>1</td>
<td>Sargent Welch WL6820R</td>
</tr>
<tr>
<td>Doublet Magnifier, 10 x</td>
<td>Double lens mounted in a chrome-plated folding case, 3” open length with a 23 mm diameter lens.</td>
<td>4</td>
<td>Carolina Biological ER-60-2116</td>
</tr>
<tr>
<td>Dual Plastic Magnifier, 3x and 6x</td>
<td>Contains a 1¾” diameter, 3x lens and a ¾” diameter, 6x lens mounted in a plastic handle. Overall length, 4½”.</td>
<td>15</td>
<td>Carolina Biological ER-60-2276</td>
</tr>
<tr>
<td>LaMotte Deluxe Water Quality Education Outfit</td>
<td>The kit contains all the information and equipment needed to set-up a water quality monitoring program. Includes <em>The Monitor’s Handbook</em>, a comprehensive guide to water quality testing and <em>The Water Quality Educator</em> CD-ROM. Materials to perform tests for dissolved oxygen, pH, nitrate-nitrogen, alkalinity, phosphate, turbidity, and temperature. All packed in water-proof case</td>
<td>1</td>
<td>Carolina Biological Er-65-2450</td>
</tr>
<tr>
<td>Carolina Chemical Characteristics of Soil Kit</td>
<td>A comprehensive look at soil chemistry and its interaction with environmental changes and effects on plant growth.</td>
<td>1</td>
<td>Carolina Biological ER-18-1049</td>
</tr>
<tr>
<td>Carolina Population Density and Biomass Study Kit</td>
<td>Quadrant sampling methods and scientific investigation are key features. Critical ecological concepts such as energy transfer, 1st and 2nd law of thermodynamics, and productivity are coupled with population studies and biomass calculations.</td>
<td>1</td>
<td>Carolina Biological ER-18-3600</td>
</tr>
<tr>
<td>Zo Seine</td>
<td>Used for collecting small aquatic invertebrates in open water, this versatile net can be used as a kick-net or drift net. Made from 600 micron nylon</td>
<td>1</td>
<td>Carolina Biological ER-65-1311</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Quantity</td>
<td>Supplier</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
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<tr>
<td>bolting cloth, the seine measures 1 m x 1 m. Includes 52” hardwood handles and weights along bottom edge of net.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Reel Fiberglass measuring tape</td>
<td>200 ft (60 m) in length. Side one in meters, side two in feet.</td>
<td>1</td>
<td>Forestry Suppliers, Inc OTR-18m-200</td>
</tr>
<tr>
<td>Trees: North American Trees Identified by Leaf, Bark and Seed (fan cards)</td>
<td>Guide to trees. 2.5” x 10” cards features color photograph of the bark and a cutout of the leaf.</td>
<td>12</td>
<td>Acorn Naturalists #FG-6705</td>
</tr>
<tr>
<td>Animal Track Guides (fan cards)</td>
<td>Water-proof plastic cards feature 22 different animal tracks commonly found in North America. Each tag measures 1¼” x 4”.</td>
<td>12</td>
<td>Acorn Naturalist #T-11113</td>
</tr>
<tr>
<td>Key to Macroinvertebrate Life in the River Key to Life in the Pond</td>
<td>University of Wisconsin-Extension in cooperation with the Wisconsin Department of Natural Resources.</td>
<td>15</td>
<td>Copied, laminated and distributed from Science Supervisor</td>
</tr>
<tr>
<td>ID Cards Tracks, Northeast Winter Twigs, Northeast Leaves, Eastern Shells, Northeast Ferns, Aquatic Macroinvertebrates</td>
<td>Wallet size, laminated cards Kinglet P.O. Box 77 Ripton, VT 05766 802.388.4082 <a href="mailto:kinglet@together.net">kinglet@together.net</a></td>
<td>15</td>
<td>Kinglet P.O. Box 77 Ripton, VT 05766 802.388.4082 <a href="mailto:kinglet@together.net">kinglet@together.net</a></td>
</tr>
</tbody>
</table>
### Books and Field Guides

<table>
<thead>
<tr>
<th>Book</th>
<th>Author(s)</th>
<th>ISBN Publisher</th>
<th>Number per school</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trees of Virginia</td>
<td>Virginia Department of Forestry</td>
<td>Virginia Department of Forestry (ordered from on-line publications) <a href="http://www.dof.state.va.us">www.dof.state.va.us</a></td>
<td>12</td>
</tr>
<tr>
<td>A Sand County Almanac</td>
<td>Aldo Leopold</td>
<td>0345345053 Ballantine Books</td>
<td>30</td>
</tr>
<tr>
<td>Peterson Field Guides: Eastern Birds</td>
<td>Roger Tory Peterson</td>
<td>Houghton Mifflin Company</td>
<td>12</td>
</tr>
<tr>
<td>Golden Guide: Weeds</td>
<td></td>
<td>1582381607</td>
<td>12</td>
</tr>
<tr>
<td>Wildflowers (Fandex Family Field Guides)</td>
<td>Ruth Rogers Clausen</td>
<td>0761114645 Workman Publishing Company</td>
<td>12</td>
</tr>
<tr>
<td>Newcomb’s Wildflower Guide</td>
<td>Lawrence Newcomb</td>
<td>0316604429 Little Brown &amp; Co</td>
<td>12</td>
</tr>
<tr>
<td>Save Our Streams: Monitor’s Guide to Aquatic Macroinvertebrates</td>
<td>Loren Larkin Kellogg</td>
<td>0941675068 Publication of the Izaak Walton League of America</td>
<td>12</td>
</tr>
<tr>
<td>Make Waves: Career Paths in the Water Environment</td>
<td>WEF</td>
<td>Water Environment Federation (WEF) 601 Wythe Street Alexandria, VA 22314</td>
<td>2</td>
</tr>
<tr>
<td>National Audubon Society Field Guide to Insects and Spiders</td>
<td>Lorus Milne and Lorus J. Milne</td>
<td>0394507630 WL63190 Sargent Welch</td>
<td>15</td>
</tr>
<tr>
<td>Life in the Chesapeake Bay</td>
<td>Alice Jane Lipson Robert L. Lipson</td>
<td>080185475X Johns Hopkins University Press, 2nd edition</td>
<td>15</td>
</tr>
</tbody>
</table>