SC Envirothon
2021 Coaches Manual

Photo courtesy of the World Business Council for Sustainable Development

Water Resource Management: Local Control and Local Solutions

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1 Introduction and Goals

Welcome to the 2021 South Carolina Envirothon! This handbook contains information you will need to know to participate in this event. We are sure your participation will be beneficial and prove to be a valuable learning experience.

The Envirothon is an integrated education experience. Over the course of several months of study participants prepare themselves for testing in the six stations. The current topic is ***Water Resource Management: Local Control and Local Solutions***. This year's Envirothon is a tremendous opportunity to learn more about the issues surrounding this topic, while promoting teamwork and critical thinking skills in your students.

Designed to foster cooperation and teamwork, teams are tested not only on their basic knowledge in these topic areas, but their ability to apply that knowledge to solve real-life problems. Problem solving and teamwork are skills that will enhance the participants' ability to take leadership roles after high school or college, no matter what their chosen field or career.

The Envirothon began in Pennsylvania in 1979 in a single county. The program had such appeal that by 1988, it had expanded into three states and had taken on a national scope. Since that time, the program has grown to include 48 states, 9 Canadian Provinces, Puerto Rico, Guam and China.

The overall goal of the Envirothon is to promote environmental education so that succeeding generations will be more environmentally literate and possess the skills and knowledge to make informed decisions regarding the environment.

The Ecosystems Approach

One goal of the Envirothon is to promote the desire of students to learn more about the environment, and to apply principles of resource management and ecology. Any ecological system (ecosystem) consists of a community of living organisms and their local physical environment. The living and non-living elements of an ecosystem are connected through flows of energy and the cycling of chemical elements. No single organism, population or species is able to produce all of its own food and to recycle all of its metabolic products. This ecosystem concept is important because it conveys one of the key insights that we have learned from the science of ecology....everything is related to everything else.

Another goal of Envirothon is for students to develop critical thinking and problem solving skills. Environmental problems are effectively addressed by considering the interacting elements of a system, not each sector in isolation. Ecosystem management is currently the standard approach for many government, industry and community based initiatives. The South Carolina Envirothon has adopted the ecosystems approach. Written tests will occur at testing stations. Each station will focus on one of the five core subject areas. However, each station will incorporate elements of the other subjects. Questions at the stations, as well as the oral presentation scenario, will be multifaceted to ensure that students will be challenged to think critically and consider "the big picture".

2 Quick Facts for Teachers and Administrators

The Envirothon is North America's largest environmental competition for high school students.

The SC Envirothon was first formally endorsed by SC Superintendent of Education, Inez Tenenbaum in November of 1999 as a worthwhile educational experience. Superintendent Jim Rex also endorsed the program in 2009.

The 2021 Virtual SC Envirothon Competition will be very different from our traditional SC Envirothon Competitions. Teams will compete during the first week of May 2021 by completing five exams corresponding to the various stations and performing their oral presentation over a recorded virtual meeting. A test moderator will be present and the host of the virtual meeting. All team members will be required to show their workspace prior to beginning the exams and keep their cameras on throughout the exams. A team captain will be responsible for sharing their screen with the other teammates to collaborate on the test and present their oral presentation slideshow.

Registration deadline is Friday, April 2, 2021. Registration packets must include a Team Registration Form and a Participant Waiver for each teammate, alternate, and coach. More details will be provided to coaches and a testing time scheduled after registration deadline.

Team registration fee has been lowered to $100 for the 2021 competition. Soil and Water Conservation Districts typically serve as team sponsors. Each South Carolina county has its own Soil and Water Conservation Districts. To find your local district's contact information, visit this website: http://www.dnr.sc.gov/conservation/index.html

T-shirts will be provided for participants of the virtual competition, however, they will be sent post-competition. **Be sure students do not wear identifiable clothing during the virtual competition that may indicate where their team is located**.

The team scoring the highest overall will go on to represent the state at the National Conservation Foundation Envirothon scheduled for **July 25 - July 31, 2021 in Lincoln, Nebraska**. The University of Nebraska will be hosting the National Conservation Foundation Envirothon.

3 Teachers and student comments

"The Envirothon makes a difference to me because…."

Anonymous quotes from student evaluations of Envirothon competitions:

"Envirothon has taught me a great deal about problems in our neighborhoods. Now I know how to deal with it and pass on my knowledge."
"I realized that environmental science is more interesting than I thought."
"I gained knowledge of water quality and nonpoint-source pollution."
"The competition was great. I enjoyed it. The experience was wonderful. I made new friends at the competition."
"The most important part of the competition to me was learning how to synthesize all the information into an Oral Presentation."
"I learned that different areas have different species of wildlife, trees, etc."
"The most important part of the competition for me was working with friends on a long-term goal."
"Nonpoint source pollution has more effect on the environment than I realized."
"I learned a lot of valuable information for the future."
"I learned a lot about the world around us."
"What was most important to me was learning to do things differently for the environment."
A past participant looking back at the experience said, "Besides the scholarship money, which was definitely nice, participating in the Envirothon program allowed me to further explore my environmental interests and encouraged a bigger world view than I think I might otherwise have had coming out of high school. I think any program that encourages environmental stewardship that can be offered to students in South Carolina should be, if at all possible - I feel like getting involved and being proactive at a young age is enriching and incredibly important."

Comments from Coach Evaluation Forms:

"My students really enjoy the Envirothon and we learn a lot together!"

— Twila Shaw, James Island Christian School, Charleston

"The Envirothon is science in action and emphasizes real world problems!"

— Robert Brady, Blue Ridge High School, Greer

"This is a valuable program, especially for students who are interested in South Carolina's natural resources."

— Cynthia Gardner, White Knoll High School, Lexington

"It's a great way to involve students and it fits easily into my daily lesson plans."

— Stephanie Taylor, Mauldin High School, Mauldin

"The Envirothon competition has been a wonderful tool in teaching my students about our environment! It encourages teamwork and the desire to learn as much as possible. Thanks to the coordinators of the Envirothon for listening to the suggestions of the students over the past four years that we have been involved. It means a lot to them to know that their opinion is valuable. The second and third place prizes that were added last year have been particularly encouraging to the team. These prizes encourage even a fledgling team to participate. Thanks for all you do for our students!

— Ruth Taylor, Mayo High School for Science, Math and Technology, Darlington SC

4 Sponsors

The South Carolina ENVIROTHON is conducted in partnership with:

SC Department of Natural Resources
SC Soil and Water Conservation Districts
SC Forestry Commission
SC Department of Education
Clemson University
USDA - Natural Resources Conservation Service
Soil & Water Conservation Society - SC Chapter
Central Carolina Technical College
Francis Marion University
Lynches River County Park

Funding is provided by many sponsors (individuals, agencies, industry, Soil and Water Conservation Districts and businesses). For more information about our sponsors, or if you desire to financially support the South Carolina ENVIROTHON, please contact Brooke Myres, SC Envirothon Coordinator (myresb@dnr.sc.gov) or visit our sponsor webpage: http://www.dnr.sc.gov/education/Envirothon/sponsorsbenefits.html .

5 Rules for Competitors

**Some rules are not applicable to the virtual competition setting (i.e., travel arrangements). If you have a question regarding the rules, please reach out to Brooke Myres (myresb@dnr.sc.gov) or Deanne Myrick (myrickd@dnr.sc.gov).

1. Students in grades 9-12 or their equivalent as of January 1, 2020 are eligible to participate.

2. Teams must have at least three and not more than five members. Each team must be accompanied to the competition by a coach or advisor. Transportation to and from the competition is the responsibility of the team and their coach/sponsors.

3. A school may send up to two teams to the state competition. Each team will consist of members from the same school, organization and/or association. Two schools may unite to send a joint team, but then forfeit their rights to send individual teams (a school may not contribute members to more than one team).

4. **Only ONE alternate will be allowed per team.** Additional students will not be allowed to participate in the competition. **Alternates must register with team within team registration paperwork and at the registration table the morning of the competition to participate.** Alternates **may not** wander into competition area outside of being assigned to an alternate team.

5. Thirty (30) minutes will be allotted for each of the six testing stations during the competition.

6. There will be written questions at each of the five testing stations. Question format may be true/false, multiple choice, matching, fill in the blank, or practical exercises. An oral presentation will be given at the orals station.

7. Test questions will be taken from the information in the suggested references provided to coaches by the Envirothon Committee.

8. During the competition, team members will work together to answer the test questions, completing one test and submitting it to the resource professional in charge of the station before moving on to the next station. Once the competition has begun, the team will rotate through all six stations **AS A TEAM.**

9. The resource professional in charge of the testing station has final authority with respect to the test questions and answers.

10. In the event of a tied score for first, second or third place, the team with the highest score on the Oral Presentation will be considered the winner. Further rules are documented and available to determine winners in the event a tie still exists.

11. Oral presentations will be evaluated by a panel of five judges. The high and low score from each panel will be discarded and a team's oral presentation score will be the average of the remaining three scores.

12. **Any of the top three winning teams may be eligible to attend the National Conservation Foundation Envirothon Competition. If the first place team is unable to attend, the second place team will be asked and so forth. As a winning team, you are representing the state of South Carolina and the team must be prepared to attend the National Conservation Foundation Envirothon Competition. Upon receiving state awards, travel to and registration for the international event will begin. Note the dates in advance and plan to leave these dates open. Being on a winning team in the state competition obligates the coach(es) and all original competing students of the team to this commitment.**

13. In the event a procedural dispute or question arises that is not covered in this manual or its addenda, the issue will be decided by a committee made up of the resource persons assigned to the testing stations and the Envirothon Coordinator.

14. Team members (or others with the teams) with allergies or medications must bring their own supplies. Richland County EMTs are on hand but may be called away for emergencies.

15. **Cameras, video recorders, laptops, cell phones, smart watches, tape recorders and all other electronic devices are prohibited in the vicinity of the testing stations**. Students found in the testing areas with cell phones or **SMART WATCHES** will have the item confiscated and that team may face disqualification. Allowances will be made in advance for press and staff.

16. The competition will be held outside regardless of the weather. Team members should wear appropriate clothing (sneakers, jeans/shorts, tee shirts). If it is warm and sunny, please consider sunscreen. **(Do not wear any item of clothing that may identify your team by city, county or school.)** Competition t-shirts will be provided and must be worn during the competition.

Any infraction of the rules will be reviewed by the Steering Committee and may become grounds for disqualification. The rules of the SC Envirothon are subject to change on a majority vote of the Steering Committee. Any changes will be published and distributed prior to the State Competition.

6 Coach Pre-Competition Checklist

The Coach is the backbone of the SC Envirothon team. This person serves to organize the team, motivate the members, and present materials pertinent to the Envirothon. Throughout the year, the coach guides the team's preparation for the competition. There are two major components of the coach's job--teaching team skills and transferring to the members a strong environmental ethic. A coach has a tremendous responsibility and is to be congratulated for making such an important contribution to the growth of the team members' knowledge and experience.

Maintain close contact with the local Conservation District Office (find contact information here: **http://www.dnr.sc.gov/conservation/index.html**). Ensure the following check-list is completed:

_____ **$100.00 Registration Fee** is paid and participation confirmed with local Soil & Water Conservation District by the registration deadline of **April 2, 2021. All registration fees are non-refundable after this date.**

_____ Access to electronic devices with a camera has been arranged with each participant.

_____ A team captain has been identified and is familiar with the competition platform (how to share a screen, how to access the exam, etc.)**.**

_____ Coach has sent in the COMPLETE Team Registration Packet by the **April, 2, 2021** deadline to Deanne Myrick at SCDNR: PO Box 167, Columbia, SC 29202 OR MyrickD@dnr.sc.gov. Make sure ALL required participant forms have been submitted. Failure to do so may be grounds for disqualification.

_____ Team members are familiar with rules of the competition and agree to attend the International Competition if on a winning team (summer dates must be left open).

_____ Team members are trained in each of the five test areas: Soils, Aquatics, Forestry, Wildlife, and the Current Topic.

_____ Team has prepared their oral presentation PDF in accordance with the rules and team captain is prepared to share the presentation during scheduled testing time.

_____ An alternate team captain has been considered who would take the team captains place in means of technical difficulties or team captain's inability to compete.

7 Day of the Event Reminders

1. **BE ON TIME**! Allow ample time to log into platform, confirm all students are prepared and in an appropriate test setting with no potential testing resources surrounding them.

2. Students will still be allowed oral presentation index cards for the oral presentation portion of the competition. This is the only resource that should be in the vicinity of the students work area. Cards should not be referenced or touched during active test taking. *Please emphasize this with your students*!

3. Students will be expected to show their workspace to moderator prior to test start. Please remind them of this! They should not have any potential resources that could be used on the test surrounding them. They can have a drink and their index cards.

4. Remind students that cell phones and electronic devices should be put away. Students accessing electronic devices outside of the one being used for the competition is means for disqualification.

5. Pets and other potential distractions should be kept out of the area to avoid distractions.

6. Deanne Myrick will reach out to coaches of winning teams to gather information for the prizes.

7. **Familiarity with the rules and regulations of the competition is expected of all coaches and team members.** Ignorance of a rule is not an acceptable excuse for failure to comply.

8 Awards and Recognition

Awards will be given in the form of a scholarship to the college or university of the recipient's choice. All participants will receive an SC Envirothon T-Shirt and promotional items.

1st Place - $1,000 per student, $1,000 coach
2nd Place - $500 per student, $500 coach
3rd Place - $250 per student, $250 coach

CLAIMING YOUR SCHOLARSHIPS AND AWARDS

After the competition ends and winners are announced, information will be collected from the winners. The information must be completed so that SC Envirothon has a record of individual's names, addresses and other personal information. A check will be mailed to the winning team coaches approximately (4) weeks following the competition. For claiming scholarships, see the sample letter below.

SAMPLE LETTER

April __, 20__

Congratulations! As a member of the First Place Team at the 20__ SC Envirothon, you have won a $1,000 College Scholarship!

To claim your scholarship, you must be enrolled in an accredited two-year or four-year college or university. Once you are registered with your school, send a written request to the address below:

Brooke Myres PO Box 167 Columbia, SC 29202

Along with your letter, you must include:

- proof of enrollment (a notarized letter from the registrar or a copy of your official transcript)
- the address of the college Treasurer's Office.
- a copy of this letter

Checks will be made payable directly to the school and mailed to the Treasurer's Office. Scholarship requests take 4-6 weeks to process. Please include your school ID number if available.

Your scholarship will be available to you for five years from the date of this letter.

If you have any questions regarding your scholarship, feel free to contact Brooke Myres, at (803) 609-7051 or email her at MyresB@dnr.sc.gov .

9 Soils/Land Use

Station Manager: Emory Holsonback, United States Department of Agriculture - Natural Resources Conservation Service

Learning Objectives:

1. Define soil, know the importance of soil, and describe basic soil properties. (ref. 3, 6, 10)

2. Explain the diagnostic significance of soil color. Be able to describe how soil color is measured and what processes produce different colors. (ref. 6, 10)

3. Know the 12 soil orders of soil taxonomy. (ref. 6, 9, 10)

4. Describe the factors which influence soil texture and structure and be able to explain how these properties influence a soil's ability to retain water and nutrients and its tendency to erode. Explain how this further influences the hydrologic and nutrient cycles in an ecosystem. (ref. 3, 6, 10)

5. Derive information from a hard copy of a soil survey book, as well as web soil survey, and explain the interaction between soil type and plant communities as well as suitability for various land use practices. Also be knowledgeable of the information and data that can be obtained from using web soil survey. (ref. 4, 6, 10)

6. Explain and/or describe the features of a soil profile, the five factors of soil formation, and the origin of soil parent materials. (ref. 1, 3, 4, 6, 10)

7. Describe various soil constituents (sand, silt, clay, organic matter) and their properties. (1, 3, 6, 10)

8. Describe South Carolina Major Land Resource Areas and what they indicate about SC geology, climate and land uses. (ref. 10)

9. List the benefits of a healthy soil and the four basic soil health principles to improve soil health and sustainability. (ref. 7, 8)

10. Understand the indicators of soil health, including physical, chemical, and biological properties and its role in the agroecosystem. (ref. 7, 8)

11. Understand the basics of the Land Capability Classification System. (ref. 3, 4, 6)

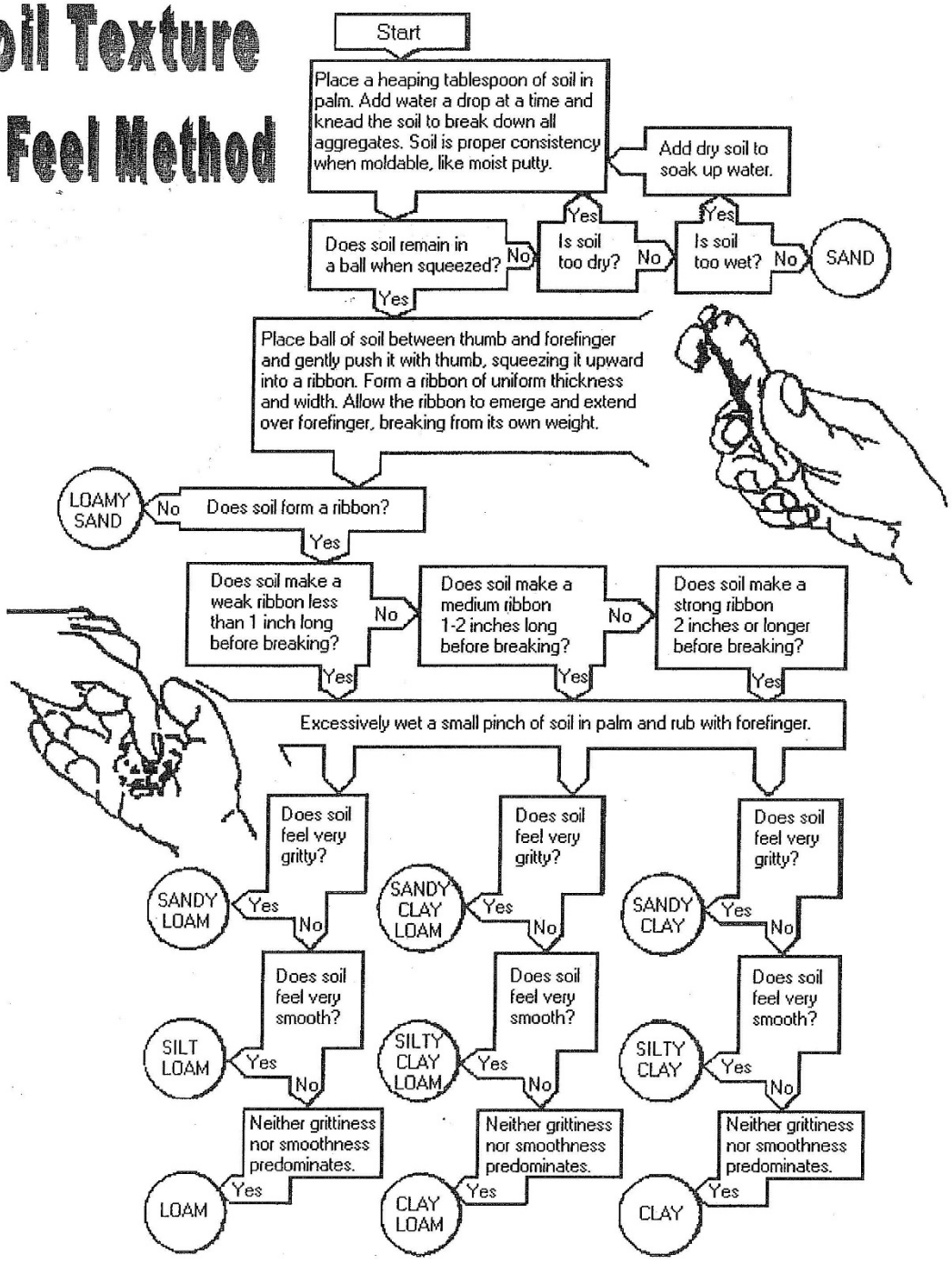
12. Identify the various types of soil erosion, factors affecting the rate of soil erosion, and best management practices and/or conservation systems used to control soil erosion. (ref. 6, 7, 8)

13. Define and list several benefits of wetlands. Also, understand soil drainage classes and recognize the characteristics of hydric soils. (ref. 2, 3, 4, 5, 6)

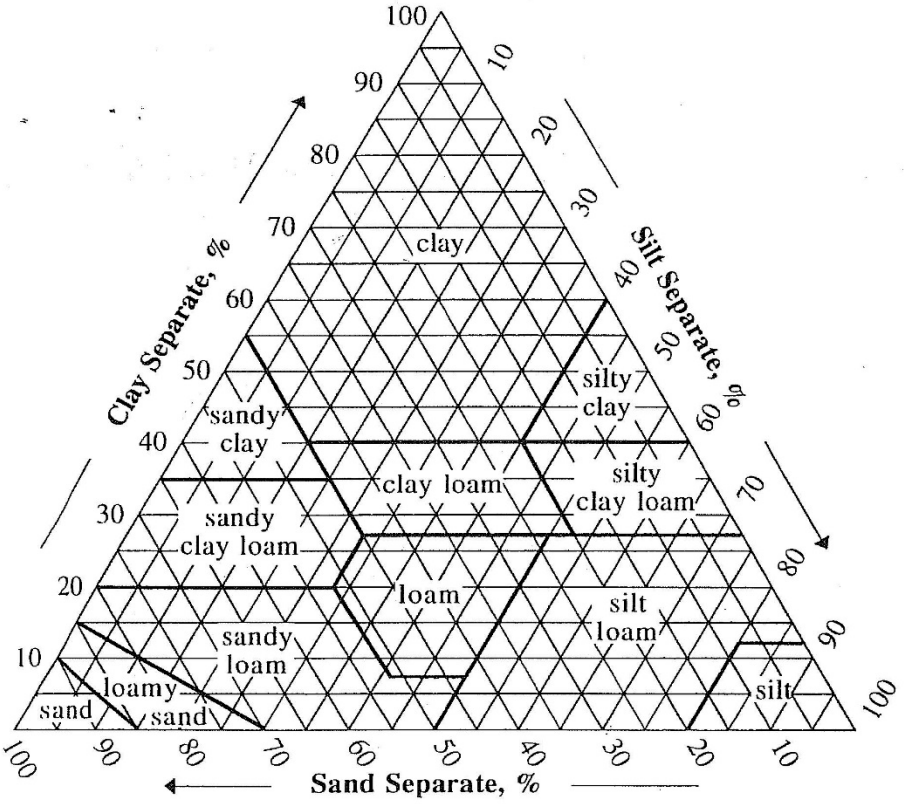
Resources/References:

1. **Field Book for Describing and Sampling Soils**
   https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052523.pdf
2. **Field Indicators of Hydric Soils in the United States**
   https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053171.pdf
3. **From the Surface Down**
   https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053238.pdf
4. **NRCS Web Soil Survey/Published Soil Surveys**
   https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm
   https://www.nrcs.usda.gov/wps/portal/nrcs/surveylist/soils/survey/state/?stateId=SC#
5. **NRCS Wetlands**
   https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/wetlands/
6. **North Carolina Soils Resource Manual**
   https://drive.google.com/file/d/17xOR9OkTKhRqkTqy3wvDxaDSgcTtuDZA/view
7. **Ray the Soil Guy - Soil Health Lessons in a Minute**
   https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/soils/health/?cid=stelprdb1048858
8. **Soil Health**
   https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/soils/health/
   https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/soils/health/?cid=stelprdb1049236
9. **Soil Orders**
   https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_053588
10. **Soil PowerPoint Presentation**
    http://www.dnr.sc.gov/education/Envirothon/pdf/SoilsStudyMaterial2019.pdf

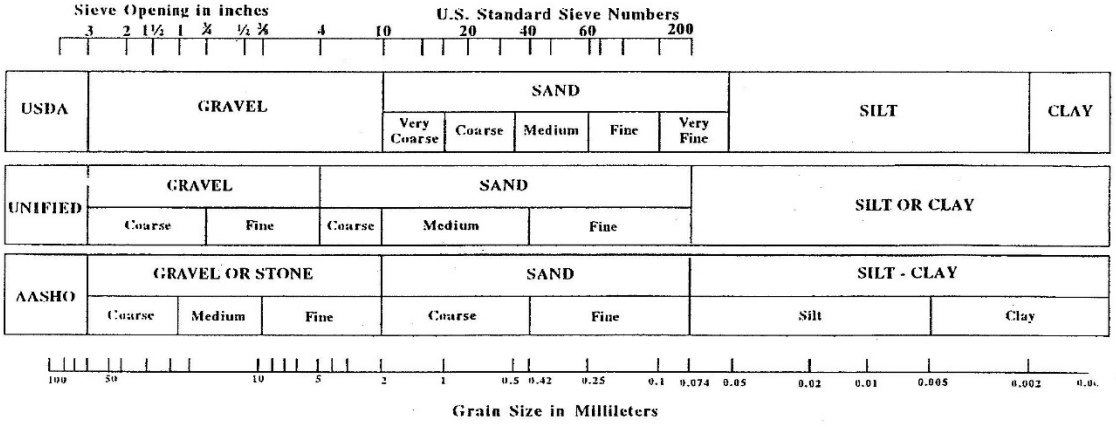
Soil Texture by Feel Method



originally published in Thien, Steve, "A flow diagram for teaching texture-by-feel analysis," *Journal of Agronomic Education*, 1979, vol. 8, pp. 54-55.



COMPARISON OF PARTICLE SIZE SCALES



2.
10 Aquatic Ecology

Station Manager: Jeff Steinmetz - Francis Marion University

Adapted by Jeff Steinmetz from the National Conservation Foundation Envirothon Guidelines

Learning Objectives

Most of these objectives come directly from the main National Conservation Foundation Envirothon webpage; however, I've added a few tweaks / additional references. Below are the objectives and a list of additional resources. The official Envirothon curriculum guide for the Aquatic Ecology section can be found here: https://www.envirothon.org/aquatic-ecology . There are some excellent resource links available on this guide, so I tried not to repeat those below. The links below are primarily *additional* resources you may find helpful. There were no content changes from last year. The only changes I made from last year were to: update bad/broken links (if current links don't work, try cutting and pasting directly into your browser – some seem to have trouble hotlinking).

Key Point 1: Abiotic Factors

1. Learning Objective 1: **Understand the water cycle**
    a. Know how it relates to erosion, salinization and climate change
        i. http://www.nytimes.com/gwire/2009/05/14/14greenwire-climate-change-water-shortages-conspire-to-cre-12208.html?pagewanted=all
        ii. https://water.usgs.gov/edu/watercycle.html

2. Learning Objective 2: **Know what a watershed is**
    a. Know how to delineate a watershed and identify stream order
        i. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_014819.pdf
        ii. http://www.wvca.us/envirothon/pdf/Watershed_Delineation_2.pdf
        iii. https://en.wikipedia.org/wiki/Strahler_number
    b. Know the features of a healthy vs. unhealthy watershed.
        i. https://www.epa.gov/hwp

3. Learning Objective 3: **Understanding water chemistry**
    a. Know how to interpret water chemistry tests
        i. Temperature, pH, dissolved oxygen, biological oxygen demand (BOD), conductivity, turbidity, nitrate, nitrite, ammonia, phosphate, total phosphorous, mercury, PCBs
            1. http://water.epa.gov/scitech/swguidance/standards/wqslibrary/sc_index.cfm (click on SC, then on the water classification & standards regulation to open a .pdf file)
    b. Know how biological organisms and water chemistry are affected by these parameters

Key Point 2: Biotic Factors

1. Learning Objective 1: **Understand food webs**
    a. Know how to construct a food web
    b. Know how matter and energy flow through a food web
        i. https://www.learner.org/series/the-habitable-planet-a-systems-approach-to-environmental-science/ecosystems/online-textbook/

2. Learning Objective 2: **Carrying capacity**
    a. Know what carrying capacity is and how it relates to animal populations
    b. Know how competing water usages could affect the carrying capacity of stream organisms, riparian forests and human needs
        i. http://en.wikipedia.org/wiki/Carrying_capacity

3. Learning Objective 3: **Taxonomy**
    a. Know how to identify common, rare, threatened, endangered, and nuisance aquatic organisms (especially macroinvertebrates and fish) using a key
        i. https://stroudcenter.org/macros/key/
        ii. http://dnr.maryland.gov/streams/Documents/dnr_bugsheet.pdf
        iii. http://www.dnr.sc.gov/freshwater.html
        iv. http://www.clemson.edu/extension/hgic/plants/other/landscaping/hgic1709.html

4. Learning Objective 4: **Biotic Water Quality**
    a. Know how organisms can be used to test water quality, e.g., using an Index of Biotic Integrity (IBI) or similar test
    b. Know why these may be preferable over water chemistry tests
        i. http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/biocriteria/index.cfm
        ii. https://dnr.maryland.gov/streams/Documents/dnr_bugsheet.pdf
        iii. http://www.epa.gov/wetlands/wetlands-monitoring-and-assessment

Key Point 3: Aquatic Environments

1. Learning Objective 1: **Habitats**
    a. Be able to identify various aquatic environments (wetland, lake, stream, estuary) based on physical, chemical and/or biological characteristics

2. Learning Objective 2: **Aquifers**
    a. Know the characteristics of different types of aquifers
    b. Know the current threats to groundwater supplies
        i. https://water.usgs.gov/edu/earthgwaquifer.html (note the "Learn More" links on the left)
        ii. http://water.usgs.gov/ogw/aquiferbasics/

3. Learning Objective 3: **Wetland function**
    a. Know the ecological function and society benefit of wetlands
        i. http://www.epa.gov/wetlands/why-are-wetlands-important

4. Learning Objective 4: **Riparian Zones**
    a. Know what riparian areas are and their function and use
        i. https://content.ces.ncsu.edu/agricultural-riparian-buffers

Key Point 4 – Water Protection and Conservation

1. Learning Objective 1: **Preventing invasive species**
    a. Know how enforcement agencies and educational programs can help prevent the spread of aquatic invasive species
        i. http://www.dnr.sc.gov/water/envaff/aquatic/index.html
        ii. http://www.clemson.edu/extension/hgic/plants/other/landscaping/hgic1709.html
        iii. http://www.dnr.sc.gov/water/envaff/aquatic/img/illegalaqua.pdf

2. Learning Objective 3: **Government law and policy**
    a. Know the federal and state laws that protect aquatic habitats
        i. E.g. Safe Drinking Water Act, Clean Water Act, etc.
            1. http://www.epa.gov/laws-regulations/summary-clean-water-act
            2. http://www.epa.gov/laws-regulations/summary-safe-drinking-water-act
    b. Utilize this information to propose management decisions that would improve the quality of water in a given situation.

3. Learning Objective 2: **Government agencies and GIS**
    a. Know the federal and state agencies involved in water protection and regulation
        i. E.g. SC DHEC, SC DNR, U.S. EPA, USGS, etc.
            1. https://www.scdhec.gov/environment/your-water-coast/how-dhec-measures-surface-water-quality
            2. https://www.scdhec.gov/environment/your-water-coast
            3. http://www.dnr.sc.gov/water.html
            4. http://www.scdhec.gov/Agency/RegulationsAndUpdates/LawsAndRegulations/Water/
    b. Understand that Geographic Information Systems (GIS) is a useful and important tool in water management
        i. http://www.esri.com/Industries/water_resources

4. Learning Objective 4: **Pollution**
    a. Know what point and non-point sources of pollution are and be able to give examples of each
    b. Know some common sources of both point and nonpoint pollution
    c. Know how both types of pollution can be reduced
    d. Know what fish consumption advisories are and what the common advisories are in SC
        i. http://www.waterencyclopedia.com/Po-Re/Pollution-Sources-Point-and-Nonpoint.html
        ii. http://water.epa.gov/polwaste/nps/whatis.cfm
        iii. http://www.scdhec.gov/FoodSafety/FishConsumptionAdvisories/

5. Learning Objective 5: **Water use**
    a. Know the major uses of water in the United States
        i. http://water.usgs.gov/watuse/
    b. Understand the interaction of competing uses of water (e.g. water supply, industry, irrigation, hydropower, navigation, wildlife, recreation, waste assimilation, etc).
        i. Understand the fight between North and South Carolina over water on Catawba River
            1. I've written a case study on this that you can find here: https://sciencecases.lib.buffalo.edu/collection/detail.html?case_id=603&id=603

6. Learning Objective 6: **Water conservation**
    a. Understand what water conservation is, and why it's important every time you turn on a faucet.
        i. http://www.conservation.org/what/Pages/fresh-water.aspx

List of General Resources. See Learning Objectives for specific references/links for topics.

EPA's Office of Water Homepage: www.epa.gov/ow

DHEC's Bureau of Water: www.scdhec.gov/water

USGS Water Science for Schools: http://water.usgs.gov/edu/

USDA National Water Management Center:
http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/nwmc/

NRCS National Water and Climate Center: http://www.wcc.nrcs.usda.gov

SC DHEC Water and Coast: http://www.scdhec.gov/HomeAndEnvironment/Water/

SC DNR Water: http://www.dnr.sc.gov/water.html

Center for Watershed Protection: www.cwp.org

How's My Waterway? https://www.epa.gov/waterdata/hows-my-waterway

Non Point Source Pollution primer: http://dnr.wi.gov/topic/nonpoint/

American Rivers. https://www.americanrivers.org/

11 Forestry

Station Manager: James Miller - SC Forestry Commission

Learning Objectives:

1. Identify common South Carolina trees without a key.
2. Identify specific or unusual species through the use of a dichotomous key.
3. Understand how wildlife diversity relates to: forest communities, forest species, forest age structure, snags and den trees, availability of food and cover, and riparian zones.
4. Understand basic forest management concepts such as: harvesting techniques, regeneration methods, and insect and disease control.
5. Be familiar with the use of a Biltmore stick, compass and other forestry tools.
6. Understand how following Best Management Practices will help protect soil and water quality.

Additional Resources:

Natural role of fire: **https://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Wildland-Fire/Prescribed-Fire/The-Natural-Role-of-Fire**

Forest Trees of SC: **http://www.state.sc.us/forest/pubs/foresttreesofsc.pdf**

Managing the Family Forest in the South: **https://www.srs.fs.fed.us/pubs/49889**

South Carolina's Best Management Practices: **http://www.state.sc.us/forest/rbfrc.htm**

https://content.ces.ncsu.edu/estimating-the-volume-of-a-standing-tree-using-a-scale-biltmore-stick

Basal Area: http://extension.msstate.edu/publications/information-sheets/using-the-msu-basal-area-angle-gauge

12 WILDLIFE

Station Manager: Jennifer Majors – Lynches River County Park

Learning Objectives:

1. Understand and define basic ecological terms.

2. Understanding the importance of water quality and quantity as a foundation in a healthy ecosystem.

3. Understanding how sustainable and best management practices enhance and protect water quality and quantity for humans and wildlife.

4. Understand the undesirable environmental impacts associated with fertilizer and pesticide usage and their impact on biodiversity at various levels.

5. Understand how wildlife adapts to environmental and weather-related issues such as drought.

6. Be familiar with federal laws, regulations and policies concerning water uses, aquatic habitat conservation, and fisheries resources.

7. Understand the difference between point source and non-point source pollution and how each affects wildlife.

8. Understand how hydromodification activities change a water body's physical structure as well as its natural function and how this can lead to detrimental effects on wildlife.

9. Understand and be able to identify keystone species and how they affect a food chain and ecosystem.

10. Identify common wildlife management practices and methods that are being used to manage and improve wildlife habitat.

Definitions

- **Adaptation**: special characteristics that make an organism more suited to its environment.
- **Aquaculture**: farming of plants and animals that live in water, such as fish, shellfish, and algae.
- **Biodiversity:** the variability among living organisms from all sources, including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems.
- **Carrying Capacity:** the number of people, other living organisms, or crops that a region can support without environmental degradation
- **Hydromodification:** the alteration of the natural flow of water through a landscape, and often takes the form of channel modification or channelization.

- **Keystone Species**: a species on which other species in an ecosystem largely depend, such that if it were removed the ecosystem would change drastically.

- **Limiting factor**: any ingredient of a habitat that is deficient and prevents a species from increasing. Example: water would be a limiting factor in times of drought.

- **Natural Resource**: resources found in our natural environment.

- **Non-Point Source (NPS) Pollution**: pollution discharged over a wide land area, not from one specific location.

- **Point Source Pollution**: any single identifiable source of pollution from which pollutants are discharged, such as a pipe, ditch, ship or factory smokestack.

Additional Resources

- NCF Current Competition
https://envirothon.org/the-competition/current-competition/

- The National Wildlife Federation: Water Resource Management
https://www.nwf.org/Our-Work/Waters/Water-Resource-Management

- Ecology and Society: Save water or save wildlife?
https://www.ecologyandsociety.org/vol22/iss2/art12/

- Hydromodification
http://www.beachapedia.org/Hydromodification

- SCDNR Water Planning
http://hydrology.dnr.sc.gov/water-planning.html

- Impacts of Pesticides on Wildlife
https://www.beyondpesticides.org/programs/wildlife

- Balancing water supply and wildlife
https://www.nature.com/news/2010/100929/full/news.2010.505.html

- Get the Grade: A Game about Natural Resource and Water Management
https://www.worldwildlife.org/pages/get-the-grade-a-game-about-natural-resource-and-water-management

- Nonpoint Source Pollution
http://www.pollutionissues.com/Na-Ph/Nonpoint-Source-Pollution.html

13 Water Resource Management: Local Control and Local Solutions

Station Manager: Joshua Castleberry - Central Carolina Technical College

Learning Objectives:

1. Understand how groundwater and surface water systems function.

2. Understand the importance of water quality and quantity as a foundation in a healthy ecosystem.

3. Understand a variety of water quality indicators in different landscapes.

4. Understand a variety of water quantity indicators in different landscapes.

5. Understand how sustainable and best management practices enhance and protect water quality and quantity for humans and wildlife.

6. Understand the differences of local, regional, and national systems that manage natural resources and the importance of each in water resources.

7. Understand the social, economic, political impacts of natural resources management and decision making.

Follow the link below to the NCF Envirothon webpages on the current topic and learning resources.
https://envirothon.org/the-competition/current-competition/

14 Oral Presentation

Station Managers: Chanda Cooper, Richland SWCD and Sam Ward, Horry SWCD

General Learning Objectives:

1. Research the scientific, political, historical and social issues surrounding the current topic. Evaluate the evidence and construct a solution for this issue.

2. Using materials and information gathered in your research construct and present your solution during your scheduled testing time. Presentation will be recorded and then watched by a diverse judging panel of resource and communication professionals. You may use a slideshow in .pdf format as a visual aid (no audio/video or animations allowed). Students are also allowed five (5) 3.5 x 5 inch index cards to assist them during the presentation. This is one card per student to be used and available ONLY during oral presentation portion of the virtual competition. No materials other than the aids mentioned above are allowed. **The team captain should have the finalized PDF file of your slideshow ready to be presented via screen share during your scheduled competition slot.**

3. Respond to questions from the moderator at the conclusion of your presentation. Questions may be direct (on the material you presented) or indirect (interpretive, based on assumed background knowledge).

Oral Presentation Scenario

Team members are asked to research issues and information surrounding the scenario below. Any source of information is allowed although teams should carefully screen their facts for accuracy and objectivity. Teams will be allowed ten (10) minutes to present, with two (2) minutes of question and answer period following the presentation. All team members must speak and participate in the presentation. A slideshow in .pdf format is allowed as a visual aid (see materials list on page 28).

Oral Presentation Written and Developed by:

Joshua Castleberry, Instructor of Environmental Engineering Technology - Central Carolina Technical College

Scenario:

Hoodooville is a small town in the Santee Watershed. Like many rural towns in South Carolina it has its own small municipal water treatment system. The system serves the approximately 9,300 residents, and gets its water from the Broad River. The water is treated for National Safe Drinking Water Act (NSDWA) primary standards and disinfected. Hoodooville does not Fluoridate the water, though they always meet their NSDWA primary standards and generally meet their secondary standards. Hoodooville hovers just above the median average household income for the State, and with a few attractions in the area, the town is showing slow, though constant, population growth.

It is important to remember that Hoodooville Municipal Water Systems (HMWS) has not shown any violations, but they are starting to feel the strain of an aging infrastructure and aging workforce. At the Town Hall meeting, representatives of HMWS voice their concerns for the future of the water system. After the meeting, all of the ideas were sorted into three general categories:

Tie In

One faction wanted to tie into the much larger system of the town of Northwest, SC. That system serves close to 90,000 residents and is willing to sell water to HMWS for just $0.005/ gallon, which is about $0.0025/ gal more than the residents currently pay. The residents would still need to pay for distribution maintenance and repair, but they would no longer need to maintain their current water treatment plant. Northwest does add Fluoride to their water which HMWS does not. Some Hoodooville residents are excited at the prospect of fewer visits to the dentist, but some don't feel the additional cost is worth the additional treatment. A few (very vocal) residents are concerned that the Fluoridation is an unnecessary health risk.

Upgrade System

One group thinks that they should upgrade the current facility. They believe that with help from rural infrastructure grants they could get enough capital to convert the facility to be primarily a groundwater withdrawal (also known as a deep well) system with 20% more capacity. With the far more stable water from the aquifer, they estimate that they could treat and distribute the water for about the same cost as buying it from Northwest. As with the tie in option, the residents would still need to pay for distribution maintenance and repair.

Just leave it Alone

When deciding which action to take it's always a good idea to evaluate the option of taking no action. Many of the residents fell into this category. Some expressed apathy to the situation, while others simply didn't want a rate increase. A few in this category reminded the assembled body that HMWS had had no violations and were faithfully serving the people of Hoodooville. Why fix it if it isn't actually broken? They recognized that there was a risk of eventual system failure, but expressed that should be a problem for later on down the road when newer technologies may be more readily available. In addition, they reasoned, we could start saving now for upgrades when we need them.

Your job is to help the Hoodooville residents pick the best option. You will need to investigate the options fully and give plenty of supporting evidence for your decision. Remember that there are 9,000+ residents with a wide spectrum of education level, life experience, and interest in the topic. For some additional insight, here are some facts about water systems in SC. Some may be directly relevant to your decision.

In South Carolina, by the numbers:

- 200 small water systems (serving approximately 90,000 residents) have failed their annual SCDHEC inspections.
- There are significant complaints of violations of secondary water quality standards such as color, taste, and odor. National Secondary Drinking Water Regulations (NSDWRs) are Non-enforceable standards set forth by the EPA.
- Local residents often complain about their water and sewer bills, but according to the 2019 Municipal Water and Sewer Rate Survey Summary, costs for fresh water from the tap costs between $0.0025 and $0.01 per gallon.
- About 800,000 SC residents get their drinking water from small water systems (compared to 4.2 Million residents who get their water from large systems or largely unregulated private wells).
- 360,000 residents get their water from small systems which do NOT treat for lead.
- 300 Small water systems (serving about 235,000 residents) do not add Fluoride to their drinking water (which is a local choice).
- 88% of violations issued by SC Department of Health and Environmental Control (SCDHEC) were issued to small water systems.
- The average age of Water Industry operators in SC is 55.

With specific questions related to this scenario, please contact Joshua Castleberry, MEERM. Program Manager Environmental Engineering Technology. Central Carolina Technical College. castleberryjs@cctech.edu or 803.778.6601

15 Oral Presentation Rules

Materials allowed for Oral Presentations:

Teams may use a slideshow in .pdf format as a visual aid (no audio/video or animations allowed). Students are also allowed five (5) 3.5 x 5 inch index cards to assist them during the presentation (one card per student – only to be used or accessed during oral presentation component of virtual competition). No materials other than the aids mentioned above are allowed**.**

Scoring procedures:

A panel of judges with expertise in the current topic, natural resource management and public communication will score the presentation of each team using the score sheet found at the end of this section of the manual. Also included is a detailed explanation of the scoring procedure. In accordance with National Conservation Foundation Envirothon procedure, the highest and lowest scores will be dropped, and the remaining three scores averaged. This average will be the team's score for Oral Presentation.

Teams are allowed 10 minutes to present but are stopped at 12.5 minutes to allow for questions and answers. The following outlines the scores allocated based on length of presentation:

2.5 – 5.5	minutes	2 points
5.5 – 7.5	minutes	3 points
7.5 – 9.5	minutes	4 points
9.5-10.5	minutes	5 points
10.5-12.5	minutes	4 points

Teams will be notified when there is 5-minutes remaining, 1-minute remaining, and 30-seconds remaining in their presentation time.

TOTAL SCORE: ____

South Carolina Envirothon
Judges Scoring Sheet for Team Oral Presentations

Team Number: _____

Judge's Initials: _____

Scale for Scoring:	
0 = not at all	6 = good
2 = poorly	8 = excellent
4 = fair	10 = outstanding

PART 1: Preparation and Presentation (60 Points Max.) PART 1 Total: _____

A. How well did the presentation address or identify:

The interrelationship between natural resources, different management strategies and human health and well-being	**0**	**2**	**4**	**6**	**8**	**10**
All the stakeholders affected	**0**	**2**	**4**	**6**	**8**	**10**
Relevant influences on or by the major resource areas (soil, water, forestry, wildlife)	**0**	**2**	**4**	**6**	**8**	**10**
Knowledge of new technologies/science that addresses the issues	**0**	**2**	**4**	**6**	**8**	**10**
Other environmental problems related to the issue	**0**	**2**	**4**	**6**	**8**	**10**

B. References:

Were references and resources cited in the presentation?	**0**	**2**	**4**	**6**	**8**	**10**

PART 2: Application of the Data (80 Points Max.) PART 2 Total: _____

Team demonstrated a solid understanding of the political issues related to the problem	**0**	**2**	**4**	**6**	**8**	**10**
Team demonstrated a solid understanding of the environmental issues related to the problem	**0**	**2**	**4**	**6**	**8**	**10**
Team demonstrated a solid understanding of the economic issues related to the problem	**0**	**2**	**4**	**6**	**8**	**10**
Team demonstrated a solid understanding of the social/cultural issues related to the problem	**0**	**2**	**4**	**6**	**8**	**10**
Team presented ONE viable opinion/solution to the problem, addressing the resource issue	**0**	**2**	**4**	**6**	**8**	**10**
All main parts of the presentation were clearly stated and supported	**0**	**2**	**4**	**6**	**8**	**10**
Solution(s) presented address(es) the long-term sustainability of the resources	**0**	**2**	**4**	**6**	**8**	**10**
The land-use decision proposed addresses the concerns of all the stakeholders	**0**	**2**	**4**	**6**	**8**	**10**

PART 3: Quality of the Presentation (40 Points Max.) PART 3 Total: _____

Presentation was well organized with a clear introduction and a strong conclusion	**0**	**2**	**4**	**6**	**8**	**10**
Participants enhanced the presentation with eye contact, gestures, voice inflection and originality	**0**	**2**	**4**	**6**	**8**	**10**
Visual aids were used to support major points	**0**	**2**	**4**	**6**	**8**	**10**
Questions were answered logically and concisely	**0**	**2**	**4**	**6**	**8**	**10**

PART 4: Required Elements (20 Points Max.) PART 4 Total: _____

Two points for each team member that participated in the oral presentation	**0**	**2**	**4**	**6**	**8**	**10**
Up to five points if the presentation was completed within the allotted time (only worth 5 points)	**0**	**1**	**2**	**3**	**4**	**5**
Up to five points if a viable plan (solution) was presented (only worth 5 points)	**0**	**1**	**2**	**3**	**4**	**5**

16 A Clarification of the SC Envirothon Judging Sheet

In order to ensure the consistency of judging, the following guidelines have been prepared. In general, the point values can be interpreted as follows (see a more detailed analysis for each category below):

0- Not at all.
2- Major misconceptions or gaps; ineffective, inadequate, inappropriate.
4- Some misconceptions or flaws; minimally effective, somewhat appropriate.
6- Complete, and accurate; effective, adequate and appropriate.
8- Complete, very detailed, logical, ideas well supported and well organized; highly effective, all details appropriate.
10- Profound, in-depth, done in an insightful manner; extremely effective, points to an extremely effective strategy.

AN EXPANSION OF EACH SECTION OF THE JUDGING SHEET:
PART I: PREPARATION AND PRESENTATION OF THE PLAN (60 POINTS MAX)

A. How well did the presentation address or identify:

1. The interrelationship between the environment, natural resources, and different natural resource management strategies?

0- Not at all.
2- Major flaws or misconceptions in the interrelationships.
4- Identified most of the key interrelationships but had some misconceptions or gaps
6- Identified key interrelationships appropriately and adequately, along with appropriate management strategies.
8- Presents major and minor interrelationships and management strategies in a clear and effective manner with supporting evidence.
10- Addresses all interrelationships and develops a most effective combination of management strategies in a logical, insightful and well defended manner addressing all aspects of the problem.

2. All the different players/interest groups affected by the problem?

0- No players identified.
2- Only one or two players identified with major flaws in their interests or who is affected.
4- Most of the players and their interests presented with some misconceptions or gaps.
6- All the major players identified appropriately with their viewpoints accurately expressed.
8- Major and minor players identified and their interests are accurately expressed in a well organized manner.
10- Very comprehensive analysis of the players and their needs and interests, done in a well-organized and insightful manner clearly conveying the complexity of the issue. Done in a clear and very logical presentation.

The judging criteria for section A, 3-5 is similar. Use the following criteria for these sections: 3- 5. How well did the presentation address or identify: 3) The major natural resources areas (aquatics, forestry, soils, wildlife), 4) new alternatives/technologies that address the topic's issues, 5) the specific environmental problem (the oral scenario)?

0- None at all.
2- Many of the issues involved are not covered or major misconceptions in addressing these issues.
4- All the main issues (where appropriate) are addressed but there are misconceptions or gaps in how they are addressed.
6- All key issues (where appropriate) are addressed in an adequate manner.
8- Major and minor issues (where appropriate) are addressed in a detailed and appropriate and logical manner with support information.
10- All major and minor issues affected (where appropriate) are addressed in a multidisciplinary manner. The analysis is profound, in-depth, done in an insightful manner. All issues addressed are done utilizing extremely effective strategies.

B. Were references and resources cited in the team presentation?

0- None cited
2- Only one or two sources are cited or citations are inappropriate for their use.
4- Several resources cited, however there are gaps in the citations
6- Four or five resources cited and used appropriately.
8- Adequate resources cited from several different viewpoints supporting the major points of the presentation.
10- All points are supported with citations from many different viewpoints. Citations and resources used shows in-depth research and a desire to investigate all major areas of concern. Citations listed in an organized fashion.

PART II APPLICATION OF DATA (80 points maximum)

The format of the judging in sections A-D is very similar. For sections A-D judges can use the following criteria. The team demonstrated a solid understanding of: A) political, B) ecological/environmental, C) economic, D) social and cultural issue(s) related to the problem.

0- No A- political, B- ecological/environmental, C- economic, D- social and cultural issues considered.
2- Only a few of the considerations are mentioned or their understanding of the issues has major flaws.
4- Most of the major considerations are presented and addressed, however there are some misconceptions or gaps in the presentation.
6- All the major considerations are identified and addressed in an appropriate manner.
8- A detailed presentation of the considerations is given in a well-supported and organized manner. A high level of understanding is also exhibited in the question and answer period.
10- The analysis of the issues is very complete and in-depth. These issues are presented in a well thought- out and insightful manner which shows a complete understanding of the considerations and how they should be addressed. A high level of understanding is also exhibited in the question and answer period.

E. The team presented ONE viable solution to the problem addressing the resource issue.

0- No plan presented.
2- The plan has major flaws and is inadequate or inappropriate.
4- The plan presented has numerous minor flaws with gaps in the topics it addresses.
6- The plan addresses all the key concerns and provides a reasonable solution to the problem.
8- The plan provided covers the concerns of the problem very completely, and is presented in a detailed, logical and well organized manner.
10- The plan provided addresses all the aspects of the problem in an elegant, in-depth manner. The solution developed is insightful, very effective, and efficient.

F. The main parts were clearly stated and supported, (conclusion was clearly defined and convincing).

0- No supporting details for the conclusions reached.
2- Supporting details are severely flawed, confusing, or have large gaps in the presentations. The conclusion does not match the material presented.
4- Some of the supporting details are provided but have some misconceptions or have several gaps. The conclusion is unclear or unconvincing.
6- All the main points are clearly stated with supporting details. The conclusion matches the supporting details.
8- The presentation is organized in a very logical manner. All the major and minor points are supported accurately and covers the topic completely. The conclusion clearly comes from the body of the presentation and is very convincing. This includes clearly showing how the conclusion was reached after considering the alternatives.
10- The body of the presentation clearly lays out the details of the conclusion with supporting details. This is done in a highly effective manner. The presentation is insightful and detailed leading to a most convincing conclusion. This includes clearly showing how the conclusion was reached was an extremely effective solution.

G. Solution in the presentation has potential to be applied or implemented with long term sustainability to natural resources.

0- No solution is provided.
2- The solution presented is unrealistic or has major misconceptions or flaws.
4- The solution presented Is somewhat workable but contains some misconceptions or flaws.
6- The solution presented is workable and presents solutions to short-term and long-term problems. The solution is adequate and accurate. It covers all the major areas of concerns.
8- The solution presented is detailed, complete and realistic. It provides for the long-term sustainability of natural resources in a cost effective manner, and addresses all the concerns.
10- The solution presented provides an insightful, multidisciplinary approach to the problem. All natural resource concerns are dealt with in a manner which allows for short-term concerns and long-term sustainability. The solution proposed clearly supports how it addresses all the concerns by utilizing an extremely effective alternative.

H. Did the solution reflect or address the concerns of all affected groups and issues?

0- No attempt was made to address the concerns of affected groups and issues.
2- The needs of most groups affected or issues have not been addressed.
4- The needs of most groups have been considered but many have not been addressed adequately.
6- The needs of most groups and issues have been addressed in an adequate fashion.
8- The needs of all the groups and issues have been addressed in a complete and detailed manner.
10- The needs of all the groups and issues have been addressed by combining the common interests in the most effective manner while not jeopardizing the long-term sustainability of the environment, and balancing political, economic, social and cultural concerns. This is done in a detailed and insightful manner that shows sensitivity to the needs of all groups affected.

PART III QUALITY OF THE PRESENTATION (40 points maximum)

A. Presentation was well organized with a clear introduction and strong conclusion.

0- No introduction or conclusion.
2- Introduction and/or conclusion are very hard to follow with very little organization in the presentation.
4- Introduction and/or conclusion are somewhat difficult to follow. Minimal organization in the rest of the presentations.
6- Clear introduction and strong conclusions. Adequate organization throughout the presentation.
8- Clear introduction and strong conclusion. The presentation has a very logical flow and is very well organized.
10- Excellent organization throughout. The presentation is very easy to follow and compelling. The organization enhances the understanding and keeps one's full attention throughout the presentation.

B. Participants enhanced the presentation (eye contact, gestures, voice inflection, originality, exhibited professionalism, etc.).

0- No attempt to engage the audience was made - monotone voice, no eye contact, etc.
2- Very limited presentation skills for a majority of the presenters, leading to an ineffective presentation.
4- Several of the presenters have limited presentation skills.
6- All the presenters do an adequate job of presenting, using the skills listed above.
8- All the presenters utilize good presentation skills, leading to an effective presentation.
10- Extremely effective presentation skills, used appropriately in a variety of ways leading to a creative and highly effective presentation.

C. Visual aids were used to make major points and show conclusions (visual aids should be correct, eye appealing, readable, neat, etc.).

0- No visuals were used.
2- Visuals are unreadable, messy, or contain major flaws in the information.
4- Visuals contain minor flaws or do not convey the major points or conclusions completely.
6- Visuals convey the major points and conclusion in an adequate manner, no spelling errors, readable, neat

and appealing.

8- Visuals convey the major points and conclusions (including all the features listed above) in a particularly eye catching manner.

10- Creative and very effective use of visuals to convey the major points and conclusions. Visuals greatly enhance the presentation and are used in a highly appropriate manner.

D. Questions were answered logically and concisely by all team members participating.

0- No questions answered.
1- Answers contain many major misconceptions or gaps.
2- Answers contain some misconceptions or flaws.
3- Answers are accurate and adequate. All the team members are involved in answering the questions.
4- Answers given by all the members are concise and organized in a logical manner. All the details are appropriate.
5- Questions are answered in an insightful manner (as well as being logical and concise). The answers show an in-depth understanding of the material.

PART IV REQUIRED ELEMENTS (20 points)

A. Add up to ten points for each team member's participation in the presentation (Each team member gets up to 2 points for equal oral participation in presentation. (For each team member: 0- No participation, 1- limited participation, 2- full participation).

B. Add 5 points if the presentation was within the 9.5-10.5 timeframe. Teams are allowed 10 minutes to present, but are stopped at 12.5 minutes to allow for questions and answers. Add 2 points if the presentation was within 2.5 – 5.5 minutes, 3 points if it was between 5.5 – 7.5 minutes, 4 points if it was between 7.5 – 9.5 minutes, 5 points if it was between 9.5-10.5 minutes, and 4 points if is between 10.5-12.5 minutes. Teams will be notified when there is 5 minutes remaining, 1 minute remaining, and 30 seconds remaining in their presentation time.

C. Add up to five points if the presentation accomplished the task of presenting a plan.

0- No plan presented.
I- Plan with major misconceptions or gaps.
2- Plan with some misconceptions or flaws.
3- Plan is complete and accurate.
4- Plan is complete, very detailed, logical, well supported and well organized.
5- Plan is profound, in-depth, insightful and extremely effective.

17 Glossary of Environmental Terms:

Acclimatization: A process of adaption of an introduced species and their offspring in a new environment.
Adaptation: Changes in an organism's physiological structure or function or habits that allow it to survive in new surroundings.
Agronomic: relating to the scientific study of soil management, land cultivation, and crop production.
Algal bloom: A condition which occurs when excessive nutrient levels and other physical and chemical conditions facilitate rapid growth of (usually) phytoplankton algae in aquatic or marine systems. Factors that foster algal bloom formation and growth include: temperature, light, pH, the availability of nutrients, lack of competition from other micro-organisms, and the absence of predators. Typically, only one or a few species are involved and the bloom is recognized by discoloration of the water resulting from the high density of pigmented cells. Algae that die and sink to the bottom stimulate growth of decomposers, especially bacteria. Decomposition can result in the depletion of oxygen in the deeper water layers, and these conditions may result in fish kills or replacement with less valuable species more tolerant of higher phosphorus and lower oxygen levels. Algal blooms may also be of concern as some species of algae produce neurotoxins. At the high concentrations reached during blooms, these may cause death if affected water is ingested.
Anadromous fish: born in fresh water, spends most of its life in the sea and returns to fresh water rivers, streams, and/or lakes to spawn. Salmon, smelt, shad, striped bass, and sturgeon are common examples.

Anaerobe: An organism that can only exist in the absence or near-absence of gaseous or dissolved oxygen.

Aquifer: any permeable geological formation, be it a layer of soil, sand, gravel, or rock, containing and/or conducting ground water that will yield usable quantities of water for wells, springs, streams, impoundments etc. Some productive aquifers are in fractured rock (carbonate rock, basalt, or sandstone). The study of water flow in aquifers and the characterization of aquifers is hydrogeology.

Arboreal: describes a species that lives in trees.

Archaeology: study of past human cultures by examining the materials remains and other deposits left at archaeological sites such as shell rings and mounds. Trained professionals only conduct archaeology, but opportunities to visit with archaeologists often arise.

Artifact: An object that has been manipulated by human hands into a tool or implement.

Assimilative capacity of water: the natural ability of a body of water to use and decompose potential pollutants without harmful effects to the environment and without damage to aquatic life or humans who consume the water. In environmental permitting, the assimilative capacity of a water body is defined as the maximum amount of pollutant load that can be discharged without impairing water quality for its designated best usage.

Basal Area: A measurement of the cross-sectional area of a stand of trees at 4.5 feet aboveground expressed in square feet per acre (ft2/ac).

Benthic Organism: Any organism that lives in or near the bottom of a water body.

Biltmore Stick: This scaling tool is a straight wooden stick graduated for direct readings of tree diameters and heights. The stick allows you to measure the diameter at a point 4.5 feet above stump height and also the merchantable height in terms of 16 foot logs. With these two measurements, the board foot volume of the tree may be determined. The actual volume table is printed on the stick.

Bioaccumulation/Biomagnification: The accumulation of a harmful substance such as a radioactive element, a heavy metal, or an organochlorine in an organism, especially an organism that forms part of the food chain. The process by which a concentration of a substance increases as it moves up the food chain.

Biodiversity I: Refers to the variety and variability among living organisms and the ecological complexes in which they occur. Diversity can be defined as the number of different items and their relative frequencies. For biological diversity, these items are organized at many levels, ranging from complete ecosystems to the biochemical structures that are the molecular basis of heredity. Thus, the term encompasses different ecosystems, species, and genes

Biodiversity II: The variation of life forms within a given ecosystem, biome, or for the entire Earth. Biodiversity is often used as a measure of the health of biological systems. The biodiversity found on Earth today consists of many millions of distinct biological species, which is the product of nearly 3.5 billion years of evolution.

Bioenergy: Energy derived from biofuel.

Biofuel: Any fuel derived from biomass. Agricultural products specifically grown for conversion to biofuels include corn and soybeans. Research and development is currently being conducted to improve the conversion of non-grain crops, such as switchgrass and a variety of woody crops, to biofuels.

Biological control: Control method involving a biological control agent that is a natural enemy of a target pest.

Biological integrity: is "the ability to support and maintain a balanced, integrated, and adaptive community of organisms having a species composition, diversity and functional organization comparable to those of natural habitats within a region" (Karr, J. R. and D. R. Dudley. 1981). Biological integrity is equated with pristine conditions, or those conditions with no or minimal disturbance. The reference condition is commonly associated with biological integrity, and the threshold is some proportion of the reference condition.

Biological Oxygen Demand (BOD): An indirect measure of the concentration of biologically degradable material present in organic wastes. It usually reflects the amount of oxygen consumed in five days by biological processes breaking down organic waste.

Biomass: Organic material made from plants and animals, containing stored energy from the sun. Biomass is a renewable energy source because we can always grow more trees and crops, and waste will always exist. Some examples of biomass fuels are wood, crops, manure, and some garbage.

Biophilic Design: Biophilia is a term popularized by E.O. Wilson to describe the extent to which humans are hard-wired to need connection with nature and other forms of life. More specifically, Wilson describes it this way: “Biophilia…is the innately emotional affiliation of human beings to other living organisms. Innate means hereditary and hence part of ultimate human nature.” (Wilson, 1993, p.31). *Biophilic design* then, recognizes the need for healing gardens and spaces in hospitals and workspaces, and for homes and apartments that provide abundant daylight, natural ventilation, plants and greenery.

Browse: Leaves, buds, twigs, etc. of shrubs or trees that are eaten by wildlife.

Buffer Strip: A relatively undisturbed section of forest adjacent to an area requiring special attention or protection such as a stream or lake.

Carrying Capacity: 1. In recreation management, the amount of use a recreation area can sustain without loss of quality. 2. In wildlife management, the maximum number of animals or plants an area can support during a given period.

Catadromous fish: fish that live in fresh water, and breed in the ocean. The most remarkable catadromous fishes are freshwater eels of genus *Anguilla*, whose larvae drift from spawning grounds in the Sargasso Sea, sometimes for months or years, before entering freshwater rivers and streams as juveniles referred to as glass eels or elvers.

Cave: Any natural cavity or series of cavities beneath the surface of the earth. Such cavities are usually classed as caves only if they are large enough to permit entrance by humans. The term is generally synonymous with cavern and is commonly applied also to wind- or water-eroded rock cavities.

Chiefdom: Highest level of social organization reached by prehistoric Native Americans. Chiefdom usually has status differences, depends on an agricultural economy, build monumental architecture such as mounds.

Competition: The struggle for survival that occurs when organisms, trees, vegetation or wildlife all make similar demands on environmental resources such as food or sunlight.

Coral Bleaching: A process in which corals expel the algal cells (zooxanthellae) that normally live within their tissue. These algae give corals their characteristic brownish color, and once they have been expelled, the white skeleton shows through a coral's transparent tissue, giving it a bleached white appearance.

Corridor: A pathway which serves as a conduit for wildlife to move from one patch of land to another, which can also be as small as a brushy fencerow or as large as a streamside management zone. Areas of continuous habitat that permit animals to travel securely from one habitat to another.

Cover: A description of the protection and seclusion afforded by a combination of vegetation and topography. Some types of cover are: brood, escape, nesting, roosting and winter cover.

Cryptogenic species: Species that are neither clearly native nor exotic.
Diadromous Fish: Fish that travel between salt and fresh water.

Dichotomous Key: A two branched key that can help you quickly identify trees in the field. Leaves are used for the identifying characteristics. Each line in the key has two choices. Read the descriptions on these two lines and decide which fits your tree best. The choosing between two characteristics continues through the key until identification is complete.

Dissolved Oxygen (DO): The oxygen freely available in water, vital to fish and other aquatic life and for the prevention of odors. DO levels are considered a most important indicator of a water body's ability to support desirable aquatic life. Secondary and advanced waste treatment are generally designed to ensure adequate DO in waste-receiving waters.

Ecofact: A non-artifact such as pollen, animal bones, and shellfish remains, antler tine or carving, carbonized materials such as wood, nuts, corn or other plant remains.

Ecological Site: A distinctive kind of land with specific soil and physical characteristics that differs from other kinds of land in its ability to produce distinctive kinds and amounts of vegetation and in its ability to respond similarly to management actions and natural disturbances.

Ecosystem: The interacting system of a biological community and its non-living environmental surroundings.

Ecotone: A habitat created by the juxtaposition of distinctly different ecological zones containing different habitats such as an edge habitat or a zone of transition between habitat types. For example, the intertidal zone is an ecotone occurring at the intersection between the subtidal zone and dry land. An ecotone often contains species characteristic of both overlapping habitat types as well as other species occurring only within the zone itself.

Electricity: The flow of electrical power or charge and is a secondary energy source. The energy sources we use to make electricity can be renewable or non-renewable, but electricity itself is neither renewable nor non-renewable.

Endemic: Plant or animal species that is native to a particular area; sometimes they can only be found in that one particular geographic area. **Endemic**: A species or taxonomic group that is restricted to a particular geographic region because of such factors as isolation or response to soil or climatic conditions.

Energy Conservation: The practice of decreasing the quantity of energy used while achieving a similar outcome of end use.

Endangered Species: A species of native fish, wildlife, or plants found by the Secretary of the Interior to be threatened with extinction because its habitat is threatened with destruction, drastic modification, or severe curtailment, or because of over exploitation, disease, predation, or other factors its survival requires assistance.

Environmental Justice: The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Eutrophication: The process by which lakes, ponds, and streams become enriched with inorganic plant nutrients, especially phosphorus and nitrogen. This process happens naturally over a long period of time as dead organic matter accumulates, and is one step in the normal succession of the freshwater ecosystem. Cultural or artificial eutrophication occurs when human activity such as sewage effluent or leachate from fertilized fields causes a lake, pond, or fen to become over-rich in organic and mineral nutrients, which speed up plant and algal growth and eventually increases the plant and algal death rates. The bacterial decomposition of the dead plants and algae consumes the oxygen dissolved in water, sometimes suffocating fish and other aquatic plant and animal life.

Extirpated species: A species that has been destroyed or removed completely and no longer exists in a particular area, region, or habitat. The species, however, may exist elsewhere.

Feature: Features are of great interest to archaeologists. Features can be large like mounds or shell rings, or small like a posthole for a prehistoric house or a deposit of periwinkle shells within a shell ring. A hearth used 800 years ago to heat a clay walled hut is yet another type of feature.

Fecal Coliform Bacteria: Bacteria found in the intestinal tracts of mammals. Their presence in water or sludge is an indicator of pollution and possible contamination by pathogens.

Fecundity: The quality or power of producing offspring in large numbers. The inherent reproductive potential of a species.

Feedstock: A substance used as a raw material in an industrial process. Biomass feedstocks include herbaceous and woody energy crops, agricultural food and feed crops, agricultural crop wastes and residues, wood wastes and residues, aquatic plants, and other waste materials including some municipal wastes.

Fossil Fuel: A general term for buried combustible geologic deposits of organic materials, formed from decayed plants and animals that have been converted to crude oil, coal, natural gas, or heavy oils by exposure to heat and pressure in the earth's crust over hundreds of millions of years.

Genetic Diversity: A level of biodiversity that refers to the total number of genetic characteristics in the genetic makeup if a species.

Geomorphology: the branch of geology that examines the earth's topographic features including their classification, description, nature, origin, development, and relationships to underlying structures, as well as the history of geologic changes as recorded by these surface features. Geomorphology can be used to provide predictive power for activities such as stream restoration.

Geothermal Energy: Taps into heat underneath the Earth's crust to boil water that is then used to drive electric turbines to heat buildings, homes, or in other non-electrical purposes.

Grazing Management: The manipulation of grazing and browsing animals to accomplish a desired result.

Ground Water: The supply of fresh water found beneath the Earth's surface usually in aquifers, which supply wells and springs. Because ground water is a major source of drinking water, there is growing concern over contamination from leaching agricultural or industrial pollutants or leaking underground storage tanks.

Habitat: The physical area where an organism lives. A place where a plant or animal naturally lives and grows.

Hectare: A metric measurement for land area. 1 hectare = 10,000 square meters, or about 2.5 acres. (abbreviation: ha).

Home Range: The geographic area to which an animal generally restricts its activities.

Homestead Act of 1862: An act passed by Congress in 1862 promising ownership of a 160-acre tract of public land to a citizen or head of a family who had resided on and cultivated the land for five years after the initial claim.

Human–wildlife conflict: any interaction between humans and wildlife that results in negative impacts on human social, economic or cultural life, on the conservation of wildlife populations, or on the environment.

Hybrid: Offspring resulting from a cross between two different species (or genetically distinct individuals within the same species) that may be naturally occurring or the result of controlled crosses, or being genetically modified.

Hydrogen: The most abundant element in the universe, and an important factor in our energy future. Hydrogen fuel cells can produce power without emitting any pollutants; their only byproducts are water and heat. Hydrogen can both carry and store energy and can be used in a wide variety of applications, including portable devices that use batteries, transportation vehicles, and a number of stationary power sources.

Hydropower: The capture of the energy of moving water for some useful purpose. Hydropower plants capture the energy of falling water to generate electricity. A turbine converts the kinetic energy of falling water into mechanical energy. Then a generator converts the mechanical energy from the turbine into electrical energy.

Impaired Streams: Streams that do not meet the water quality standards set by the state based on classified uses (ie. fishing, swimming, shellfish).

Indicator Species: Plants or animals whose abundance and health are a reflection of environmental quality and conditions.

Indigenous: originating, growing, occurring in and characteristic of a particular region or environment.

Infrastructure: The basic network or foundation of capital facilities or community investments which are necessary to support economic and community activities.

Injurious species: An introduced species that causes economic or environmental harm to humans.

Instream flow: the amount of water needed to adequately provide for downstream uses occurring within a stream channel. These users cover some or all of the following uses: human drinking water, aquatic habitat, recreation, wetlands, navigation, hydropower, riparian vegetation, and water quality, including waste assimilation. Flow is measured in volume of water per unit of time, usually cubic feet per second (cfs). This gauges the amount of water flowing past a point in the river at a given time.

Integrated pest management (IPM): pest management approach that considers the life cycle of a targeted species and intervenes in reproduction, growth, or development to reduce pest populations to a level not harmful to crops. IPM also works to maintain populations of beneficial insects.

Invasive species: an invasive species is a species that does not naturally occur in a specific area and whose introduction does or is likely to cause economic or environmental harm, or harm to human health. Invasive species become a nuisance through rapid spread and increase in numbers, often to the detriment of native species.

Karst: The typical surface terrain of a limestone region, characterized by an abundance of sinkholes, disappearing streams, exposed rock outcrops or ledges, and underground caverns.

Keystone Species: A keystone is the stone at the top of an arch that supports the other stones and keeps the whole arch from falling. A keystone species is a species on which the persistence of a large number of other species in the ecosystem depends; a species that plays a critical role in maintaining the structure of an ecological community and whose impact on the community is greater than would be expected based on its relative abundance or total biomass.

Late Archaic Period: a period from roughly 5000-3000 years ago. During this time complex hunter-gatherer tribal societies began to construct shell rings, fashion pottery vessels and live a semi sedentary lifeway.

Limiting Factor: A condition whose absence or excessive concentration is incompatible with the needs or tolerance of a species or population, and which may have a negative influence on their ability to thrive. Any ingredient of habitat that is deficient and prevents a species from increasing.

Mast: fruits or nuts used as a food source by wildlife. Hard mast is the fruit or nuts of trees such as oaks, beech, walnut, chinquapin, and hickories. Soft mast includes the fruits and berries of dogwood, viburnums, elderberry, huckleberry, spice bush, grape, raspberry, and blackberry.

Microclimate: A small area (such as a cove) that has different physical characteristic (such as soils, soil moisture, soil fertility, exposure to sunlight) than its surrounding landscape. Because of these differences, microclimates create unique habitats that support plants and animal species that are uncommon in the surrounding landscape.

Mississippian period: a period from 1000 to four hundred years ago. During this time earthen mound building, corn agriculture, and complex societies living in permanent villages were ruled by ruled by hereditary chiefs.

Mound: Artificially constructed village feature constructed of baskets loads or dirt, shaped like a truncated cone and used as a platform for chief's houses temples or both.

Naturalized: To establish a self-sustaining population of exotic species in the wild outside of its natural range.

Non-Point Source of Pollution: Diffuse pollution sources (i.e. without a single point of origin or not introduced into a receiving stream from a specific outlet). The pollutants are generally carried off the land by storm water. Common non-point sources are agriculture, forestry, urban, mining, construction, dams, channels, land disposal, saltwater intrusion, and city streets.

Non-renewable: Energy resources, such as coal, oil and natural gas that cannot be replenished by nature as fast as they have been used. It took hundreds of millions of years to form many of these resources and they are in limited supply.

Nuclear Energy: Energy in the nucleus (core) of an atom. There is enormous energy in the bonds that hold atoms together. Nuclear energy can be used to make electricity, but first the energy must be released. It can be released from atoms in two ways: nuclear fusion (when atoms combine) and nuclear fission (when atoms split).

Osmosis: The movement of water molecules across a selectively permeable membrane from an area of low solute concentration (high water potential) to an area of high solute concentration (low water potential). Osmosis will occur whenever the water concentrations are different on either side of a differentially permeable membrane.

Organic Production Systems: An ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity.

Pastureland: Grazing lands comprised of introduced or domesticated native forage species that are used primarily for the production of livestock. They receive periodic renovation and/or cultural treatments such as tillage, fertilization, mowing, weed control and may be irrigated. They are not in rotation with crops.

Pathway: Mode by which a species establishes and continues to exist in a new environment.

Photosynthesis: a biochemical process in which plants, algae, and some bacteria use chlorophyll to harness the energy of light to synthesize life sustaining organic compounds such as carbohydrates. Ultimately, nearly all living things depend on energy produced from photosynthesis for their nourishment, making it vital to life on Earth. It is also responsible for producing the oxygen that makes up a large portion of the Earth's atmosphere. Plants use carbon dioxide gas and water to produce glucose and oxygen gas in accordance with the following formula: $12H_2O + 6CO_2 + \text{light} \rightarrow C_6H_{12}O_6$ (glucose) $+ 6O_2 + 6H_2O$.

Pollination: The act of transferring pollen grains from the male anther of a flower to the female stigma.

Precocial: Newly hatched birds that are covered with down and are capable of moving around when first hatched, as opposed to altricial which are born naked and helpless.

Rangeland: Land on which the plant community is comprised of predominately native or indigenous grasses, grasslikes (e.g. sedges), forbs and/or shrubs. Rangeland includes natural grasslands, savannas, shrublands, most deserts, tundra, alpine communities, coastal marshes and wet meadows.

Renewable Energy: Any sustainable energy source that comes from the natural environment. The most common forms of renewable energy are solar, wind, water or hydro, biomass and geothermal energy. Renewable energy sources are maintained or replaced by nature, relatively quickly, after use.

Riparian Buffer: Planting of trees, shrubs, grasses that catch pollutants in both surface and groundwater before those pollutants reach a water body, such as a stream or lake. Riparian buffers also improve fish and wildlife habitats.

Riparian Corridor: Part of the floodplain situated closest to the channel, or taking place along or near the bank of a river.

Salt-water wedge: A wedge-shaped intrusion of ocean saltwater into a fresh-water estuary or tidal river; it slopes downward in the upstream direction, and salinity increases with depth because of higher density. During a rising tide, the sea water forces its way upstream beneath the seaward flow of freshwater.

Sedimentation: The removal of large volumes of soil from the land, and their deposition in waterways.

Shell Ring: Artificial deposit of shell occurring as a ring, crescent, horseshoe shape or mound of shell and other artifacts and ecofacts.

Solar Power: The technology of obtaining usable energy from the light of the sun. Solar energy is the solar radiation that reaches the earth and can be converted directly or indirectly into other forms of energy, such as heat and electricity.

- **Active Solar Systems:** Use solar collectors and additional electricity to power pumps or fans to distribute the sun's energy. The heart of a solar collector is a black absorber which converts the sun's energy into heat. The heat is then transferred to another location for immediate heating or for storage for use later.
- **Passive Solar Systems:** Do not use any mechanical equipment to move the sun's energy. This technique uses building elements such as walls, windows, floors and roofs, in addition to exterior building elements and landscaping, to control heat generated by solar radiation.
- **Photovoltaic Solar Systems**: Photovoltaic (PV) cells convert sunlight to electricity. PV cells are semiconductor devices, usually made of silicon, which contain no liquids, corrosive chemicals or moving parts. They produce electricity as long as light shines on them, require little maintenance, do not pollute and operate silently.

Stocking Rate: The amount of land area allocated to each animal unit for the entire grazing period in one year.

Sustainability and **Sustainable Living:** The ability to achieve continuing economic prosperity while protecting the natural systems of the planet and providing a high quality of life for its people.

Synanthropization: refers to the adaptation of animal populations to human-created conditions.

Synurbization: denotes an adjustment within animal populations to specific conditions of the urban environment, in connection with regular existence (often breeding) in the wild state.

Tidal freshwater marsh: freshwater marshes close enough to coasts to experience significant tides but far enough upriver or in the estuary to be beyond the reach of oceanic salt water. This set of circumstances usually occurs where fresh river water runs to the coast and where the morphology of the coast amplifies the tide as it moves inland.

Tidal Power: Achieved by capturing the energy contained in moving water mass due to tides. Two types of tidal energy can be extracted: kinetic energy of currents between ebbing and surging tides and potential energy from the difference in height between high and low tides.

Traditional Energy: The sources and methods we currently use to generate stable, inexpensive, and readily available supplies of energy.

Unintentional introduction: An unintended introduction made as a result of a species utilizing humans or human delivery systems as vectors for dispersal outside its natural range.

Urban Forests: ecosystems composed of trees and other vegetation that provide cities and municipalities with environmental, economic and social benefits. They include street and yard trees, vegetation within parks and along public right of ways, water systems, fish and wildlife.

Urbanization: refers to changes in landscape (environment) caused by urban development

Whole-farm Planning: A holistic approach to farm management used to identify and prioritize environmental issues on a farm without compromising the farm business.

Wildlife Openings: Openings maintained to meet food or cover needs for wildlife. They may contain native vegetation or planted crops and can be maintained by burning, disking, mowing, planting, or fertilizing.

Wind Power: The conversion of wind energy into more useful forms, usually electricity using wind turbines (machines for converting the kinetic energy in wind into mechanical energy).

Notes: