Guide Book

Helpful Hints to Make Your Team a Contender

The Missouri Envirothon Program

What

The Envirothon is a problem-solving, natural resource education program for high school students. In the field, teams of students are challenged to hone critical thinking skills and work as a team. They answer written questions and conduct hands-on investigation of environmental issues in five categories – Soils/Land Use, Aquatic Ecology, Forestry, Wildlife, and Current Environmental Issues. In addition to a written test, the teams also present an oral presentation solving a specific natural resource issue.

Why

The Envirothon stimulates, reinforces, and enhances students' interest in the environment and our state's natural resources. The concept was created by the Pennsylvania Association of Conservation Districts as an outdoor hands-on competition. From "Environmental Olympics," the concept expanded to other states; and when the national competition was added in 1988, the name was changed to Envirothon. Envirothon affords a unique approach to teaching environmental education, and it's fun!

The continuing support of the program reflects the participation and support of the county conservation districts, clubs, agencies, and private corporations.

How

Reference materials for students and teachers are available through local soil and water conservation districts. Envirothon can also be used as a curriculum guide for classroom study. Conservation districts in conjunction with cooperating agencies, educators, community, and interest groups conduct regional competitions. The top three teams of the regional competitions advance to the state competition held in early May. The winning team represents Missouri at the National Envirothon.

The Missouri Envirothon Program Goals

Education

Solutions to today's natural resource problems may originate as a grass-roots concern for nurturing our quality of life. Envirothon can be adopted by local schools to enhance the current environmental curriculum.

The challenges facing educators are formidable. Envirothon affords a ready-made program that fosters a well-rounded approach to teaching environmental education.

Future

Tomorrow's problems will be more challenging but the solutions will be more apparent if students are encouraged to become environmentally aware, action-oriented adults who learn where to go for answers.

The competitive nature of the program motivates students to expand their knowledge of natural resource issues. Through this program, students will realize their responsibility as stewards of our natural resources.

Outcome

Missouri State Envirothon goals include the following:

- Promote environmental awareness and stewardship
- Develop students' critical thinking, cooperative problem solving, and decision-making skills
- Present balanced options for management of our renewable and nonrenewable natural resources
- Provide awareness of and accessibility to resource organizations offering assistance in natural resource issues

History

The Envirothon concept began in Pennsylvania in 1979 as an outgrowth of a vocational agricultural land judging contest. Conservation Districts felt there was a need for a statewide environmental program highlighting different disciplines within the natural resource field. By the mid-eighties, New York, Ohio, Massachusetts, and Maine had their own state Envirothon programs and interest was spreading to other states. In 1988, the first National Envirothon was held in Pennsylvania with five states participating. In 1993, 26 states participated in the National Envirothon in New York. Currently there are teams from over 40 states and the Canadian Provinces competing in the National Envirothon.

In 1998, Missouri held its first state Envirothon. Ten teams participated in the pilot event. Since then, the participation in the Missouri Envirothon has grown significantly. There are now seven regional competitions with three teams from each region advancing to the state competition. The Missouri state champion team has represented Missouri at the National Envirothon each year since 1998.

Contest Structure Overview

Overall

Envirothon provides students with an integrated approach to exploring five natural resource categories. It tests their creative, critical-thinking and team-building skills in a competitive format. Envirothon is a "day in the field" that tests students' knowledge and problem-solving skills at four ecostations – Soils/Land Use, Aquatic Ecology, Forestry, Wildlife, and a fifth station on Current Environmental Issues. In addition there is also an oral presentation station where the team presents a solution to a conservation issue provided prior to the competition. One visual aid is permitted and submitted at registration.

Written questions and hands-on activities at the ecostations are developed by conservation district and resource conservation experts. Agencies and interest groups help devise, time, and monitor appropriate testing stations set up in the field.

Day of Contest

Themes, written questions, and problem-solving tasks may be site specific, so each State Envirothon will be new and different. When the teams arrive at the state event location, they will register, confirm pre-registration information, and receive a brief orientation on contest format, rules, and scoring.

Teams will be assigned a test station rotation. Good teamwork, cooperative decision making, free exchange of ideas, and information pooling is important. All test stations are staffed by a monitor. Each test station requires approximately 40 minutes. Completed test sheets will be graded on site. Lunch is provided for the entire group at the state competition. After the competition and scoring is completed, everyone assembles for the announcement of the winning team. The top team is eligible for the National Envirothon contest, a challenging four-five day event. The Missouri Envirothon Committee works closely with this team to help prepare for the contest and arrange trip logistics.

Rules and Regulations

How to Use This Guide

Introduction

The Envirothon competition is designed to get students involved in learning about many different environmental disciplines. The amount of information provided to Envirothon Teams may seem overwhelming to team members and advisors. This guide is designed to help teams prepare for the Envirothon by encouraging team work and a multi-disciplinary approach to environmental problem solving.

1. There are five topic areas and five team members. A team could assign each member an area of primary concentration and secondary concentration. This way, each team will have two members knowledgeable about each topic. Then, team members can share information with the others in practice sessions. Another way to divide the labor is to have several team members focus on natural history and identification and other members focus on the resource management issues for each section. Assessing the skills of each member will determine which is the best approach for your team. Remember, no resource professional can know everything. Teamwork is essential in the real world. Learning how to work as a team is essential to your success in Envirothon.

2. Make sure all team members are familiar with basic ecological terms and current environmental issues. They should also develop an understanding of the inter-relationship between all the topic areas and how the management of one resource may affect another.

3. Map reading is an important skill for natural resource professionals. Learn how to read and interpret a US Geologic Survey topographic map as an introduction to other map resources. Learn how to locate a site on a soil survey and interpret soil mapping units.

4. This guide contains sections on each of the five study areas. The introduction gives a rationale for studying the topic. The objectives provide a detailed outline of the kinds of information teams are expected to know. Based on these objectives, students can develop a strategy for studying each topic. Practice exercises are included for teams to use to strengthen their skills.

5. Each registered team is provided study materials for the Envirothon. Each section in this material contains an outline and a list of references. Resource professionals may be available through your local soil and water conservation district office to help the team prepare for the competition.

6. Advisors are encouraged to use the resource materials to develop environmental units for their classrooms. This will expand the Envirothon

program to include more students than just those on the team. (In 1994, the Envirothon Program reached an estimated 3,000 individuals).

Soils/Land Use

Introduction

One of our most important natural resources is soil. This resource is often overlooked by students and teachers interested in environmental issues. Professional conservationists, however, recognize the importance of soil in natural resource management and the interrelationships between soil, water, and other resources. Soil provides a growth medium for all plant life on our planet, including food and energy resources. Soil also provides habitat, filters water, and is used in constructing buildings.

Key Points to Understand -
Envirothon Students should be able to:

- recognize soil as an important, dynamic resource,
- describe basic soil properties and soil formation factors.
- use the USDA Soil Survey to locate soil map units and soil descriptions and understand what they mean.
- know how wetlands are defined in Missouri
- determine basic soil properties and limitations, such as red oximorphic features (mottling) and permeability, by observing a soil pit or soil profile.
- identify types of soil erosion and discuss methods for reducing erosion.
- identify tools used by a soil scientist
- utilize soils information in land use planning discussions
- discuss how soil is a factor in, or is impacted by, nonpoint source pollution

Practice Exercises

Choose a site. Using a soils map, locate soil map units on the site. Color code types by drainage classifications. Discuss soils in relationship to land use. Determine if the land was modified to accommodate present use or how it might have to be modified for proposed uses. Discuss pros and cons of these modifications.

Dig a soil pit or go to an area where there is excavation going on (get permission if needed). Safety is paramount. Students and teachers must not enter pits that are more than waist deep. Pits or vertical banks can cave in, causing serious injury or death! Look at the soil profile and measure the soil horizons. Determine soil properties and depth to high water table. Check your results with a soil survey. What limitations may be apparent in using a soil survey in this small area?

Identify an area that is eroding. Determine what is causing the erosion and develop a proposal to stop the erosion.

Prime farmland is a classification used by the US Department of Agriculture to identify soils which are excellent for crop production. What are the characteristics of prime farmland soils? Research and identify prime farmland soils in Missouri. Determine where most of the prime farmland soils are located. How is this information being used by the State? By farmers?

Land use decision-makers need to take soil types into consideration. Discuss the merits of depth to water table as it applies to: 1)on-site septic systems; 2)establishment of a tree farm; 3)underground storage tanks; 4)vegetable production; and 5)construction of new soccer fields.

Sample Test Questions for Soils

1. What is a colluvial soil?
    Answer: Soil material moved by creep, slide or local wash, or
    Soil moved by gravity

2. Name the five soil forming factors:
    Answer: Parent
    Living Organisms
    Topography
    Climate
    Time

(When looking at a soil pit...)

3. For the indicated topsoil horizon:
    Possible Answers:
        The texture of the soil is... (e.g.- silt loam)
        The structure of the soil is... (e.g.- subangular blocky)
        The color is... (e.g.- Brown)
        The name of this horizon is... (e.g.- A or Ap)

4. What area would be most likely to have an E horizon?
Answer: A forest

5. Why is an E horizon light in color?
Answer: Leaching of organic matter and iron

6. Most of Missouri soils are 1) acidic or 2) alkaline (circle one). Why?
Answer: Free lime is leached out
Bases leached

Aquatic Ecology

Introduction

Water and water resources affect every facet of our lives, from business to pleasure to actual survival. The protection of our water resources, both quantity and quality, is vitally important. To properly protect these resources, we must first understand them and the factors that impact them.

Key Points to Understand -

Envirothon Students Should be able to :

- identify the processes and phases for each part of the water cycle (evaporation, transpiration, condensation, precipitation, surface runoff, and percolation).
- analyze the interaction of the competing uses of water for water supply, hydropower, navigation, wildlife, recreation, waste assimilation, and other.
- delineate a watershed boundary for a small water body.
- understand the physical changes of water and how it affects the content of suspended gases such as oxygen and carbon dioxide. Be able to discuss how these changes affect the aquatic environment.
- understand the difference between surface water and groundwater.
- be able to explain the different types of aquifers and how each type relates to water quantity and quality.
- identify common fish, amphibians, aquatic macroinvertibrates, and aquatic plants found in Missouri. Be familiar with life cycles of common fish species occurring in Missouri. Specific or unusual organisms will be identified through the use of a

key.

- distinguish between cold water, cool water, and warm water fisheries. Be able to identify examples of fish in each type.

- describe the characteristics of Missouri's aquatic habitats and ecosystems - including streams, lakes, ponds, and other wetland types.

- when given a description of a type of aquatic habitat, identify the organisms most likely to live there.

- briefly describe the benefits of wetlands, both function and value.

- describe the benefits of riparian areas, both function and value.

- describe changes to the aquatic ecosystem based on alterations to the aquatic habitat.

- identify the agencies responsible for providing the protection and management of water resources.

- know the methods used to assess and manage aquatic environments. This includes sampling techniques and water quality parameters used to monitor point and non-point pollutants.

- know the difference between point and nonpoint pollution, and be able to identify examples of each.

- be able to discuss steps involved with point and nonpoint pollution control.

- be familiar with major laws that protect water quality, both surface and groundwater.

- know the differences between the water quality classifications, and be able to use the water classification guide in the state statutes to identify and rate specific watercourses.

- be able to answer questions based on the National Wetland Inventory maps. (located at SWCD/NRCS offices)

- describe major threats and sources of damage done to water resources, including groundwater in Missouri.

Practice Exercises

Choose a small watercourse near your school using the USGS topographic map. Outline the watershed boundary surrounding that feature. What is the major land use?

Using the Water Quality Classifications Guide of Missouri, choose five streams in your county. Determine the present potential quality of the water. Find out what general types of macroinvertibrates are likely to be found in those classifications.

Choose a wetland in your county. Determine the main functions of the wetland. Make a list of the different land uses around the wetland - then list possible impacts by pollution to the wetlands from those land uses.

Go to a local stream or river. By observing the stream bottom, determine from a field guide what fish are likely to breed there. Do the same for a local pond based on the estimated water depth. Find out which areas in your town are stocked with fish each year.

In your community, find examples of three types of wetlands. Identify three species of plants in each.

Sample Test Questions for Aquatics

1. What is the term for water pollution that can be traced to a point of discharge?
   Answer: point source pollution

2. Define a watershed.
   Answer: All the land draining to a single point.

3. How does the dominant vegetation in a forest (versus a prairie or glade) act to protect the soil against erosion?
   Answer: Intercepts rainfall - dissipates energy
   Roots are more massive
   Leaves (forest litter) protects soil on forest floor

4. List four important processes that make up the water cycle
   Answer: Evaporation
   Precipitation
   Condensation
   Transpiration

5. Name four of the five types of erosion.

Answer: Raindrop or splash
Sheet
Rill
Gully/ Streambank
Wind

Forestry

Introduction

The science of forestry is a lot more than just the study of botany. Forests are dynamic ecosystems, with numerous factors influencing their development. It is important to understand the cause and effect relationships that impact individual trees, as well as forest community development and growth. Forest communities are precious natural resources that, for example, support wildlife, influence water quality, and provide numerous marketable goods. Forest management is challenging work that requires a clear understanding of forestry dynamics.

Key Points to Understand -

Envirothon Students will be able to:

- Understand the basic natural history of Missouri's forests, including:
  - forest land use and ownership
  - what are the major forest tree species
  - forest products and productivity
  - climate

- Understand forest ecology concepts and factors affecting them, including:
  - the relationship between soil and forest types
  - tree communities
  - vegetation differences (be able to identify trees and shrubs)
  - regeneration
  - competition
  - succession

- Understand the cause and effect relationship of factors affecting tree growth and forest development (climate, insects, microorganisms, wildlife, etc.)

- Understand functions and values of riparian areas as filters, transformers, sinks,

temperature regulators, and energy source. What kinds of problems may result with the loss of riparian areas?

- Understand how wildlife habitat relates to:
  - forest communities
  - forest species
  - forest age structure
  - snags and den trees
  - availability of mast trees

- Be able to identify trees and shrubs without keys, and with and without leaves:
  - primary Missouri trees: ???
  - primary Missouri shrubs: ???

- Understand how the following issues are affected by forest health and management
  - biological diversity
  - forest fragmentation
  - air quality
  - aesthetics
  - pest control
  - fire
  - global warming
  - recreation

- Understand basic forest management concepts and tools, such as:
  - how do clearcuts, shelterwood cuts, and group selection cuts differ?
  - be able to use a Biltmore stick for measuring tree diameter and to estimate boardfeet of harvestable lumber
  - be able to distinguish Best Management Practices (BMPs) for timber harvest

- Understand the value of trees in urban/suburban setting, and the factors affecting their health and survival

Practice Exercises

Name the two of the most important soil features affecting tree growth in Missouri and describe the limitations that they place on tree growth. How do forests contribute to the development of soils? You may be asked, given a particular stand of trees at the test site, what kind of soil and environmental conditions must be present for that stand of trees to exist.

Go out to a stand of trees and identify all of them. Practice without using a key, if you can. Measure them and determine as much silvicultural information from them as possible. What environmental factors would be the greatest threat to the development of each tree type?

Identify a local stream that runs through a farm and a stream that runs through an urbanized neighborhood. What kind of vegetative buffer exists there? Describe the resultant effects on the water quality of these streams if vegetative buffer strips are developed or removed from along the streams.

Go into a wooded area and identify its stage of development. What benefits does it have for wildlife habitat? What kind of forest products could be derived from this area? If a developer were to come to this area, what recommendations would you give for its management?

Differentiate between a service forester, a consulting forester, and an industrial forester. You may want to call some foresters to discuss this with them. What kind of information could each of these foresters give you if you were interested in developing a management plan for your 30-acre woodlot?

Sample Test Questions for Forestry

1. What is the standard height at which one measures diameter at breast height?
   Answer: 4.5 feet

2. Snags are:
   a. trees with large crowns that aren't easily removed with a skidder
   b. the shredded bark of red cedars that results from the climbing activity of squirrels
   c. live trees with cavities constructed by primary excavators
   d. standing dead trees at least 15 cm (6 in) in diameter and 3 m (10 ft) tall
   e. partially felled trees that have caught on other tree limbs during the cutting process

3. Give the standard names used by foresters to the size classes of forest trees listed below:

Youngest trees, up to 3 ft. (1 m) tall:	Seedling
Trees up to 4 in. (10 cm) diameter, regardless of height:	Sapling
Larger trees, up to 1 ft. (30 cm) in diameter:	Pole (or pole-sized)
Forest trees larger than 1 ft (>30 cm) in diameter:	Timber (or sawtimber)

4. What is the state tree of Missouri?
   Answer: Dogwood

5. Name two trees in Missouri that are commonly found in riparian areas.
   Several Answers: Silvermaple, Cottonwood, Sycamore, Willow, Box Elder, Pin Oak, Hackleberry, Pecan

Wildlife

Introduction

Diverse wildlife populations are valuable from many standpoints: as indicators of a healthy ecosystem, for recreation, and for aesthetics. Understanding a species' requirements and habits is the first step in ensuring the continuing existence of that particular animal. Proper protection and management of an animal's habitat will encourage optimum populations.

Key Point to Understand -

Envirothon Students should be able to:

- identify common wildlife species from silhouettes, mounted specimens, or pictures. (Part of an animal may be shown instead of the whole animal). Keys will be used for more extensive identification.
- identify common wildlife species based on wildlife sign. Sign can include animal fur, hair, feathers, tracks, gnawings, rubbings, pellets, and scat.
- answer questions concerning the natural history of wildlife species occurring in Missouri.
- identify wildlife species from natural history information.
- identify basic wildlife survival needs.
- describe specific adaptations of wildlife to their environment and toll in the ecosystem.
- describe predator/prey relationships and be able to identify examples.
- describe food chains and food webs and be able to identify examples.
- describe factors that limit or enhance population growth.
- identify habitat requirements for specific species.
- evaluate a given habitat and select or list species most likely to live there.
- describe ways habitat can be improved for specific species by knowing their

requirements.

- discuss concepts of carrying capacity and limiting factors.
- discuss how forestry practices can enhance or impact wildlife habitat.
- answer questions concerning hunting regulations and how they pertain to wildlife management.
- describe various ways people can help in the protection, conservation, management, and enhancement of wildlife populations.
- identify agencies responsible for providing the protection and management of wildlife resources.
- identify wildlife species that are listed as endangered or threatened and describe the main causes that have led to the depleted populations.
- describe major consequences of wetland destruction on wildlife.
- identify non-native wildlife species that have been introduced into Missouri accidentally and purposely.
- identify the most common carriers of rabies and Lyme disease.
- describe the cause, transmission, and symptoms of rabies and Lyme disease in people and wildlife.

Practice Exercises

Using a field guide to birds, identify two raptor species and determine their habitat requirements. Do the same for two waterfowl species and two passerine species.

Choose a large mammal and track its food chain down to its lowest possible component.

List the animals likely to be found in a mature forest.

Name three fur-bearers found in your area of Missouri. Determine whether there is an open trapping season on them and be able to discuss why or why not. Check the current hunting regulations, list the maximum number of deer legally allowed by one person in Missouri.

Go to the woodlot and list four habitat types found there. Identify at least one species

that uses each habitat type. Evaluate each habitat for how well it meets each species' basic needs. Make management recommendations to improve the habitat for a specific species.

Find a wetland that shows evidence of present or past beaver activity.

Sample Test Questions for Wildlife

(This question relates to a Prairie or Grassland Ecostation)
1. Give the common names of five wildlife species that you would expect to utilize this ecostation as a primary source for shelter (insects not qualified):

Answers: Meadowlark, Bobwhite Quail, Kingbird, Prairie King Snake, Cotton Rat-Field Rat

(This question relates to a Glade Ecostation)
2. Identify three limiting factors that make this ecostation unsuitable for many of Missouri's native mammals:

Answers: Reduced prey species
Lack of Cavities
This soils for dens

(These questions relate to a Forest Ecostation)
3. What do you predict is the carrying capacity (low, medium, or high) for woodchuck at this ecostation area?

Answer: Low

4. What evidence did you use to determine your reply?

Answer: Forested habitat
Few legumes
Rocky without crops
This soil

Current Environmental Issues

Introduction

This station changes every year to highlight environmental issues that face Missouri and the nation. The hosting state for the national competition selects the current issue for that year. Current issue information from previous years is available upon request. Missouri has added economic impact, energy and sustainable agriculture to the topics addressed by the National Envirothon.

In addition to a hands-on testing station on the current environmental issue, there is an oral presentation station. At this station, the students will work together as a team to present a solution to an environmental issue posed to them prior to the competition. The students will be judged on numerous points including presentation skills, solution feasibility, participation, etc….

Example of a Current Environmental Issue on Land Use Management

Introduction

As more is learned about effective environmental management, it has become evident that an interdisciplinary approach to land use planning is needed. Natural resource managers are challenged to balance not only conservation and development, but also the competing resources they are trying to protect. For example, best management practices that are good for water quality may not be best for air quality. Students interested in environmental careers need to understand the many different types of land use (e.g., agricultural, forestry, mining, residential, open space, waste disposal, commercial, etc.) and the complexity of the issues faced by resource managers.

Objectives

Key Point to Understand -

In Preparation for Envirothon Problem Solving, Students should be able to:

- identify current issues in Missouri related to each topic.
- list federal, state, and local laws that regulate our land usage.
- identify local land use boards/commissions and discuss their role in land use management.
- understand the concept of watershed planning as a multidisciplinary approach to land use planning.
- use a variety of resource maps to gather information about an area.
- identify local resource agencies and professionals as contacts for land use planning efforts.
- discuss private property rights vs. public good issues, including the "taking" issue.

Practice Exercises

Imagine that your town has recently acquired 50 acres of open space along a popular fishing stream. The area near the stream is relatively flat and wet pastureland (15 acres) and the remaining land is forested upland with moderate slopes and shallow to bedrock in some places. Three groups in town are interested in the area as follows: the local housing authority needs low income housing, the recreation department needs more soccer fields, and the town needs more cemetery space. Develop proposals for each of the local needs. Then evaluate them from a resource management standpoint.

Volunteer Support

Call your local Soil and Water Conservation District office to obtain contacts for resource professionals to help prepare a team for competition. Your local district staff can also provide information regarding your regional competition and registration.

1. Northwest Region
Heather Keith

Regional Coordinators
660-359-2006 ext. 101

2. Northeast Region
Audrey Rayl /
Lena Sharp

Regional Coordinators
660-767-5276 ext. 3
660-327-4117 ext. 3

3. Central Region
Tina Dulaban

Regional Coordinator
660-547-2353 ext. 3

4. St. Louis Region
Theresa Dunlap

Regional Coordinator
636-922-2833 ext. 3

5. Southwest Region
Debbie Henderson/
Stephanie Auffert

Regional Coordinator
417-345-2312 ext. 3
417-276-3388 ext. 3

6. Southeast Region

Regional Coordinators

7. Kansas City Region
Dave Fry/Susie
Struchtemeyer

Regional Coordinators
816-228-1161 ext. 3
660-584-8732 ext. 3

Missouri Envirothon
Peggy Lemons /
Judy Stinson

State Coordinators
573-893-5188 ext. 3 /
573-751-1783

Missouri Envirothon Regions