Hagerman National Wildlife Refuge

Scouting Program

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Mission

To be a resource for Scouts working on Merit Badges and other projects that help them advance in rank.

What We Offer

The Hagerman National Wildlife Refuge is home to an incredible variety of wildlife species that depend on the diversity of habitat conserved and protected on the refuge. Access a species checklist to learn what birds, mammals, amphibians and reptiles, fish, and endangered species live or spend time on our 12,000 acre refuge.

Our nature trails and day use areas provide scouts a range of options for viewing wildlife and plants. Check out our visitor activities page to learn more about how to access what Hagerman has to offer.

How Our Scouting Program Works

- We offer a welcome message and Hageman National Wildlife Refuge overview once you arrive.
- We can help you customize your itinerary in advance to maximize use of the facilities for Scouting rank advancement and merit badge work.
- Our visitor center has a general-purpose room you can reserve for classroom work.
- Our staff and volunteers can be a subject matter expert resource. We offer hands on learning activities for many of the requirements for the merit badges listed in this document.

About this Document

Below you will find a list of BSA merit badges. We have highlighted the requirements we feel can be completed at Hagerman National Wildlife Refuge.

Other Resources

- Friends of Hagerman
- Boy Scouts of America
- Circle Ten Council
- Merit Badge Requirements

Merit Badges (MB) Identified that Can be Completed, or Significantly Completed at HWLR

- Backpacking
  - HWLR has a number of trails that might be of interest to backpackers.
  - Over-night camping is by special permission only. Please contact Courtney Anderson for details.
- Bird Study
  - All of this MB can be completed at HWLR.
  - Full outline below
- Camping
  - Requirement 9C as well as others can be completed at HWLR.
  - Over-night camping is by special permission only. Please contact Courtney Anderson for details.
- Environmental Science
  - This MB or the Sustainability MB is required for Eagle
  - Many of the requirements for this badge can be completed at HWLR
  - Full outline below
- Exploration
  - Under consideration
- Fishing
  - Most of this MB is 'explain', 'demonstrate', or 'discuss'. Requirement #9 (catch a fish) can be completed at HWLR.
- Fish and Wildlife Management
  - Many of the requirements for this badge can be completed at HWLR.
  - Full outline below
- Hiking
  - Some of the requirements for this badge can be completed at HWLR.
  - HWLR has a number of trails that might be of interest to hikers.
- Insect Study
  - Many of the requirements for this badge can be completed at HWLR.
  - Full outline below
- Mammal Study
  - Some of the requirements for this badge can be completed at HWLR.
  - Full outline below
- Nature
  - Many of the requirements for this badge can be completed at HWLR.
  - Full outline below
- Photography
  - Under development
  - HWLR Photography Club is a resource
- Plant Science
  - We are organized to support counselors with Option 3
  - Full outline below
- Reptile and Amphibian Study
  - We are organized to support counselors with requirement 9
  - Full outline below
- Soil and Water Conservation
  - Most or all of the requirements for this badge can be completed at HWLR.
  - Full outline below

EAGLE SCOUT PROJECTS

Note that the Eagle service project is to be "...helpful to any religious institution, any school, or your community...", which means you need to be discerning while selecting a project. You are looking for a project to do for an organization that is non-profit, meaning they provide services to the community at large for purposes other than making a profit. No projects are allowed for businesses or other profit-making organizations.

Next, note carefully the word "leadership". The title of the project workbook is the "Eagle **Leadership** Service Project". The word "leadership" precedes the word "service" for a very important reason. The purpose of the project is to give you a personal, direct way to demonstrate to your board of review that you have leadership skills. The service delivered, while important, is sort of a bonus. As you consider project ideas, ask yourself "How will this allow me to demonstrate leadership?" The answers to that question will require recruiting some helpers, giving them specific tasks to do, providing them with instructions so that they know their jobs, coordinating the preparations and work so that everything gets done, and monitoring the work so that it is done satisfactorily. You could do a service project by yourself, but you can't do an Eagle Leadership Service Project without leading other people.

Examples ('Selecting an Eagle Project' website)

List of potential Eagle Scout Projects that could be completed at Hagerman Wildlife Refuge:

1. Signs for the Butterfly Garden's plants
2. Construct a viewing platform at Crow Hill Trail
3. Honey Locust Removal and Prairie Restoration – Harris Creek Trail, Bennet Lane, and Goode Day Use Area
4. Installment of grills at Goode Day Use Area and/or Big Mineral Day Use Area
5. Open to other suggestions with approval

LIFE SCOUT PROJECTS

While a Star Scout, participate in six hours of service through one or more service projects approved by your Scoutmaster. At least three hours of this service must be conservation-related.

List of Life Scout Service Projects that could be completed at Hagerman Wildlife Refuge:

1. Clean up trails with loppers, pole saw, and rake
2. Clean up trash anywhere on the refuge
3. Remove invasive species – please contact Courtney depending on the season
4. Outdoor Crew work days (First Tuesday and Fourth Saturday of the month)

Please note that the refuge requires Scouts 18 and under are to be accompanied by a parent or guardian.

Note: Highlighted in green are selected requirements for badges that can be completed utilizing HWLR facilities.

Bird Study

1. Explain the need for bird study and why birds are useful indicators of the quality of the environment.
2. Show that you are familiar with the terms used to describe birds by sketching or tracing a perched bird and then labeling 15 different parts of the bird. Sketch or trace an extended wing and label six types of wing feathers.
3. Demonstrate that you know how to properly use and care for binoculars.
   a. Explain what the specification numbers on the binoculars mean.
   b. Show how to adjust the eyepiece and how to focus for proper viewing.
   c. Show how to properly care for and clean the lenses.
4. Demonstrate that you know how to use a bird field guide. Show your counselor that you are able to understand a range map by locating in the book and pointing out the wintering range, the breeding range, and/or the year-round range of one species of each of the following types of birds:
   a. Seabird
   b. Plover
   c. Falcon or hawk
   d. Warbler or vireo
   e. Heron or egret
   f. Sparrow
   g. Nonnative bird (introduced to North America from a foreign country since 1800)
5. Observe and be able to identify at least 20 species of wild birds. Prepare a field notebook, making a separate entry for each species, and record the following information from your field observations and other references.
   a. Note the date and time.
   b. Note the location and habitat.
   c. Describe the bird's main feeding habitat and list two types of food that the bird is likely to eat.
   d. Note whether the bird is a migrant or a summer, winter, or year-round resident of your area.
6. Explain the function of a bird's song. Be able to identify five of the 20 species in your field notebook by song or call alone. For each of these five species, enter a description of the song or call, and note the behavior of the bird making the sound. Note why you think the bird was making the call or song that you heard.
7. Do ONE of the following:
   a. Go on a field trip with a local club or with others who are knowledgeable about birds in your area.
      (1) Keep a list or fill out a checklist of all the birds your group observed during the field trip.
      (2) Tell your counselor which birds your group saw and why some species were common and some were present in small numbers.
      (3) Tell your counselor what makes the area you visited good for finding birds.
   b. By using a public library, the internet, or contacting the National Audubon Society, find the name and location of the Christmas Bird Count nearest your home and obtain the results of a recent count.
      (1) Explain what kinds of information are collected during the annual event.
      (2) Tell your counselor which species are most common, and explain why these birds are abundant.
      (3) Tell your counselor which species are uncommon, and explain why these were present in small numbers. If the number of birds of these species is decreasing, explain why, and what, if anything, could be done to reverse their decline.

8. Do ONE of the following. For the option you choose, describe what birds you hope to attract, and why.
    a. Build a bird feeder and put it in an appropriate place in your yard or another location.
    b. Build a birdbath and put it in an appropriate place.
    c. Build a backyard sanctuary for birds by planting trees and shrubs for food and cover.

Environmental Science

1. Make a timeline of the history of environmental science in America. Identify the contribution made by the Boy Scouts of America to environmental science. Include dates, names of people or organizations, and important events.
2. Define the following terms: population, community, eco- system, biosphere, symbiosis, niche, habitat, conservation, threatened species, endangered species, extinction, pollution prevention, brownfield, ozone, watershed, airshed, nonpoint source, hybrid vehicle, fuel cell.
3. Do ONE activity from EACH of the following categories (using the activities in this pamphlet as the basis for planning and projects):
    a. Ecology
        (1) Conduct an experiment to find out how living things respond to changes in their environments. Discuss your observations with your counselor.
        (2) Conduct an experiment illustrating the greenhouse effect. Keep a journal of your data and observations. Discuss your conclusions with your counselor.
        (3) Discuss what is an ecosystem. Tell how it is maintained in nature and how it survives.
    b. Air Pollution
        (1) Perform an experiment to test for particulates that contribute to air pollution. Discuss your findings with your counselor.
        (2) Record the trips taken, mileage, and fuel consumption of a family car for seven days, and calculate how many miles per gallon the car gets. Determine whether any trips could have been combined (“chained”) rather than taken out and back. Using the idea of trip chaining, determine how many miles and gallons of gas could have been saved in those seven days.
        (3) Explain what is acid rain. In your explanation, tell how it affects plants and the environment and the steps society can take to help reduce its effects.
    c. Water Pollution
        (1) Conduct an experiment to show how living things react to thermal pollution. Discuss your observations with your counselor.
        (2) Conduct an experiment to identify the methods that could be used to mediate (reduce) the effects of an oil spill on waterfowl. Discuss your results with your counselor.
        (3) Describe the impact of a waterborne pollutant on an aquatic community. Write a 100-word report on how that pollutant affected aquatic life, what the effect was, and whether the effect is linked to biomagnification.
    d. Land Pollution

(1) Conduct an experiment to illustrate soil erosion by water. Take photographs or make a drawing of the soil before and after your experiment, and make a poster showing your results. Present your poster to your counselor.

(2) Perform an experiment to determine the effect of an oil spill on land. Discuss your conclusions with your counselor.

(3) Photograph an area affected by erosion. Share your photographs with your counselor and discuss why the area has eroded and what might be done to help alleviate the erosion.

e. Endangered Species

(1) Do research on one endangered species found in your state. Find out what its natural habitat is, why it is endangered, what is being done to preserve it, and how many individual organisms are left in the wild. Prepare a 100-word report about the organism, including a drawing. Present your report to your patrol or troop.

(2) Do research on one species that was endangered or threatened but which has now recovered. Find out how the organism recovered, and what its new status is. Write a 100-word report on the species and discuss it with your counselor.

(3) With your parent's and counselor's approval, work with a natural resource professional to identify two projects that have been approved to improve the habitat for a threatened or endangered species in your area. Visit the site of one of these projects and report on what you saw.

f. Pollution Prevention, Resource Recovery, and Conservation

(1) Look around your home and determine 10 ways your family can help reduce pollution. Practice at least two of these methods for seven days and discuss with your counselor what you have learned.

(2) Determine 10 ways to conserve resources or use resources more efficiently in your home, at school, or at camp. Practice at least two of these methods for seven days and discuss with your counselor what you have learned.

(3) Perform an experiment on packaging materials to find out which ones are biodegradable. Discuss your conclusion with your counselor.

g. Pollination

(1) Using photographs or illustrations, point out the differences between a drone and a worker bee. Discuss the stages of bee development (eggs, larvae, pupae). Explain the pollination process, and what propolis is and how it is used by honey bees. Tell how bees make honey and beeswax, and how both are harvested. Explain the part played in the life of the hive by the queen, the drones, and the workers.

(2) Present to your counselor a one-page report on how and why honey bees are used in pollinating food crops. In your report, discuss the problems faced by the bee population today, and the impact to humanity if there were no pollinators. Share your report with your troop or patrol, your class at school, or another group approved by your counselor.

(3) Hive a swarm OR divide at least one colony of honey bees. Explain how a hive is constructed. Before you choose requirement g-3 you will need to first find out whether you are allergic to bee stings. Visit an allergist or your family physician to find out. If you are allergic to bee stings, you should choose another option within

requirement 3. In completing requirement g-3 your counselor can help you find an established beekeeper to meet with you and your buddy. Ask whether you can help hive a swarm or divide a colony of honey bees. Before your visit, be sure your buddy is not allergic to bee stings. For help with locating a beekeeper in your state, visit www.beeculture.com and click on "Bee Resources," then "Find a Local Beekeeper."

4. Choose two outdoor study areas that are very different from one another (e.g., hilltop vs. bottom of a hill; field vs. forest; swamp vs. dry land). For BOTH study areas, do ONE of the following:
    a. Mark off a plot of 4 square yards in each study area, and count the number of species found there. Estimate how much space is occupied by each plant species and the type and number of non-plant species you find. Write a report that adequately discusses the biodiversity and population density of these study areas. Discuss your report with your counselor.
    b. Make at least three visits to each of the two study areas (for a total of six visits), staying for at least 20 minutes each time, to observe the living and nonliving parts of the ecosystem. Space each visit far enough apart that there are readily apparent differences in the observations. Keep a journal that includes the differences you observe. Then, write a short report that adequately addresses your observations, including how the differences of the study areas might relate to the differences noted, and discuss this with your counselor.
5. Using the construction project provided or a plan you create on your own, identify the items that would need to be included in an environmental impact statement for the project planned.
6. Find out about three career opportunities in environmental science. Pick one and find out the education, training, and experience required for this profession. Discuss this with your counselor, and explain why this profession might interest you.

Fish & Wildlife Management

1. Describe the meaning and purposes of fish and wildlife conservation and management.
2. List and discuss at least three major problems that continue to threaten your state's fish and wildlife resources.
3. Describe some practical ways in which everyone can help with the fish and wildlife conservation effort.
4. List and describe five major fish and wildlife management practices used by managers in your state.
5. Do ONE of the following:
    a. Construct, erect, and check regularly at least two artificial nest boxes (wood duck, bluebird, squirrel, etc.) and keep written records for one nesting season.
    b. Construct, erect, and check regularly bird feeders and keep written records of the kinds of birds visiting the feeders.
    c. Develop and implement a fishery improvement project or a backyard wildlife habitat improvement project. Share the results with your counselor.

d. Design and construct a wildlife blind near a game trail, water hole, salt lick, bird feeder, or birdbath and take good photographs or make sketches from the blind of any combination of 10 wild birds, mammals, reptiles, or amphibians.

6. Do ONE of the following:
    a. Observe and record 25 species of wildlife. Your list may include mammals, birds, reptiles, amphibians, and fish. Write down when and where each animal was seen.
    b. List the fish and wildlife species in your state that are classified as endangered, threatened, exotic, non-native, game species, furbearers, or migratory game birds. Discuss with your counselor management practices in place or being developed for at least three of these species.
    c. Start a scrapbook of North American fish and wildlife. Insert markers to divide the book into separate parts for mammals, birds, reptiles, amphibians, and fish. Collect articles on such subjects as life histories, habitat, behavior, and feeding habits on all of the five categories and place them in your notebook accordingly. Articles and pictures may be taken from newspapers or science, nature, and outdoor magazines, or from other sources including the Internet (with your parent's permission). Enter at least five articles on mammals, five on birds, five on reptiles, five on amphibians, and five on fish. Put each animal on a separate sheet in alphabetical order. Include pictures whenever possible.
7. Do ONE of the following:
    a. Determine the age of five species of fish from scale samples or identify various age classes of one species in a lake and report the results.
    b. Conduct a creel census on a small lake to estimate catch per unit effort.
    c. Examine the stomach contents of three fish and record the findings. It is not necessary to catch any fish for this option. You may visit a cleaning station set up for fishermen or find another, similar alternative.
    d. Make a freshwater aquarium. Include at least four species of native plants and four species of animal life, such as whirligig beetles, freshwater shrimp, tadpoles, water snails, and golden shiners. After 60 days of observation, discuss with your counselor the life cycles, food chains, and management needs you have recognized. After completing requirement 7d to your counselor's satisfaction, with your counselor's assistance, check local laws to determine what you should do with the specimens you have collected.
8. Using resources found at the library and in periodicals, books, and the Internet (with your parent's permission), learn about three different positions held by fisheries and/or wildlife professionals. Find out the education and training requirements for each position.

Insect Study

1. Do the following:
    a. Explain to your counselor the most likely hazards associated with exposure to ants and bees and what you should do to anticipate, help prevent, mitigate, and respond to these hazards.
    b. Discuss the prevention of and treatment for health concerns that could occur while working with ants and bees, including insect bites and anaphylactic shock.

2. Tell how insects are different from all other animals. Show how insects are different from centipedes and spiders.
3. Point out and name the main parts of an insect.
4. Describe the characteristics that distinguish the principal families and orders of insects.
5. Do the following:
    a. Observe 20 different live species of insects in their habitat. In your observations, include at least four orders of insects.
    b. Make a scrapbook of the 20 insects you observe in 5a. Include photographs, sketches, illustrations, and articles. Label each insect with its common and scientific names, where possible. Share your scrapbook with your merit badge counselor.
6. Do the following:
    a. From your scrapbook collection, identify three species of insects helpful to humans and five species of insects harmful to humans.
    b. Discuss the use of integrated pest management vs. chemical methods of insect control. What are the advantages and disadvantages of each?
7. Explain the symbiotic relationship between bees and humankind. Explain what colony collapse disorder (CCD) is and some of the possible causes. Discuss how CCD affects our food supply.
8. Compare the life histories of a butterfly and a grasshopper. Tell how they are different.
9. Raise an insect through complete metamorphosis from its larval stage to its adult stage (e.g., raise a butterfly or moth from a caterpillar).*
10. Do ONE of the following:
    a. Observe an ant colony in a formicarium (ant farm). Find the queen and worker ants. Explain to your counselor the different chambers found within an ant colony.
    b. Study a hive of bees. Remove the combs and find the queen. Estimate the amount of brood and count the number of queen cells. Explain how to determine the amount of honey in the hive.
11. Tell things that make social insects different from solitary insects.
12. Tell how insects fit in the food chains of other insects, fish, birds, and mammals.
13. Find out about three career opportunities in insect study. Pick one and find out the education, training, and experience required for this profession. Discuss this with your counselor, and explain why this profession might interest you.

Mammal Study

1. Explain the meaning of "animal," "invertebrate," "vertebrate," and "mammal." Name three characteristic that distinguish mammals from all other animals.
2. Explain how the animal kingdom is classified. Explain where mammals fit in the classification of animals. Classify three mammals from phylum through species.
3. Do ONE of the following:
    a. Spend 3 hours in each of two different kinds of natural habitats or at different elevations. List the different mammal species and individual members that you identified by sight or sign. Tell why all mammals do not live in the same kind of habitat.
    b. Spend 3 hours on each of 5 days on at least a 25-acre area. List the mammal species you identified by sight or sign.

c. From study and reading, write a simple life history of one nongame mammal that lives in your area. Tell how this mammal lived before its habitat was affected in any way by man. Tell how it reproduces, what it eats, what eats it, and its natural habitat. Describe its dependency upon plants, upon other animals (including man), and how they depend upon it. Tell how it is helpful or harmful to man.

4. Do ONE of the following:
   a. Under the guidance of a nature center or natural history museum, make two study skins of rats or mice. Tell the uses of study skins and mounted specimens respectively.
   b. Take good pictures of two kinds of mammals in the wild. Record the date(s), time of day, weather conditions, approximate distance from the animal, habitat conditions, and any other factors you feel may have influenced the animal's activity and behavior.
   c. Write a life history of a native game mammal that lives in your area, covering the points outlined in requirement 3c. List sources for this information.
   d. Make and bait a tracking pit. Report what mammals and other animals came to the bait.
   e. Visit a natural history museum. Report on how specimens are prepared and cataloged. Explain the purposes of museums.
   f. Write a report of 500 words on a book about a mammal species.
   g. Trace two possible food chains of carnivorous mammals from soil through four stages to the mammal.
5. Work with your counselor, select and carry out one project that will influence the numbers of one or more mammals.

Nature

1. Name three ways in which plants are important to animals. Name a plant that is protected in your state or region, and explain why it is at risk.
2. Name three ways in which animals are important to plants. Name an animal that is protected in your state or region, and explain why it is at risk.
3. Explain the term "food chain." Give an example of a four-step land food chain and a four-step water food chain.
4. Do all of the requirements in FIVE of the following fields:
   a. Birds
      (1) In the field, identify eight species of birds.
      (2) Make and set out a birdhouse OR a feeding station OR a birdbath. List what birds used it during a period of one month.
   b. Mammals
      (1) In the field, identify three species of wild mammals.
      (2) Make plaster casts of the tracks of a wild mammal.
   c. Reptiles and Amphibians
      (1) Show that you can recognize the venomous snakes in your area.
      (2) In the field, identify three species of reptiles or amphibians.
      (3) Recognize one species of toad or frog by voice; OR identify one reptile or amphibian by eggs, den, burrow, or other signs.
   d. Insects and Spiders

(1) Collect, mount, and label 10 species of insects or spiders.
(2) Hatch an insect from the pupa or cocoon; OR hatch adults from nymphs; OR keep larvae until they form pupae or cocoons; OR keep a colony of ants or bees through one season.

e. Fish
(1) Catch and identify two species of fish.
(2) Collect four kinds of animal food eaten by fish in the wild.

f. Mollusks and Crustaceans
(1) Identify five species of mollusks and crustaceans.
(2) Collect, mount, and label six shells.

g. Plants
(1) In the field, identify 15 species of wild plants.
(2) Collect and label seeds of six plants OR the leaves of 12 plants.

h. Soils and Rocks
(1) Collect and identify soils found in different layers of a soil profile.
(2) Collect and identify five different types of rocks from your area.

Plant Science

1. Make a drawing and identify five or more parts of a flowering plant. Tell what each part does.
2. Explain photosynthesis and tell why this process is important. Tell at least five ways that humans depend on plants.
3. Explain how honeybees and other pollinating insects are important to plant life.
4. Explain how water, light, air, temperature, and pests affect plants. Describe the nature and function of soil and explain its importance. Tell about the texture, structure, and composition of fertile soil. Tell how soil may be improved.
5. Tell how to propagate plants by seeds, roots, cuttings, tubers, and grafting. Grow a plant by ONE of these methods.
6. List by common name at least 10 native plants and 10 cultivated plants that grow near your home. List five invasive nonnative plants in your area and tell how they may be harmful. Tell how the spread of invasive plants may be avoided or controlled in ways that are not damaging to human, wildlife, and the environment.
7. Name and tell about careers in agronomy, horticulture, and botany. Write a paragraph about a career in one of these fields that interests you.
8. Choose ONE of the following options and complete each requirement:
   Option 1: Agronomy
   a. Describe how to prepare a seedbed.
   b. Make and use a seed germination tester to test 50 seeds of four of the following plants: corn, cotton, alfalfa, soybeans, clover, wheat, rice, rye, barley. Determine the percentage of live seeds.
   c. Tell about one important insect pest and one important disease that damage each of the following: corn, small grains, cotton. Collect and name five weeds that compete with crops in your locality. Tell how to control these weeds without harming people, wildlife, or useful insects.

d. On a map of the United States, identify the chief regions where corn, cotton, forage crops, small grain crops, and oil crops grow. Tell how climate and location of these regions make them leaders in the production of these crops.
e. Complete ONE of the following alternatives:
   (1) Corn
      i. Grow a plot of corn and have your plot inspected by your counselor. Record seed variety or experimental code number.
      ii. Tell about modern methods of commercial corn farming and the contributions that corn makes to today's food and fuel supply.
      iii. Tell about an insect that can damage corn, and explain how it affects corn production and how it is controlled.
   (2) Cotton
      i. Grow a plot of cotton and have your plot inspected by your counselor.
      ii. Tell about modern methods of commercial cotton farming, and about the uses of cotton fiber and seed and the economic value of this crop.
      iii. Tell about an insect that can damage cotton, and explain how it affects cotton production and how it is controlled.
   (3) Forage Crops
      i. Collect, count, and label samples of each for display: perennial grasses, annual grasses, legumes, and broadleaf weeds. Indicate how each grass and legume is used. Keep a log of the site where you found each sample and share it with your counselor.
      ii. Explain how legumes can be used to enrich the soil and how they may deplete it under certain conditions. Explain how livestock may enrich or deplete the soil.
      iii. Name five poisonous plants that are dangerous to livestock, and tell the different ways of using forage crops as feed for livestock.
   (4) Small Grains
      i. Give production figures for small grain crops listed in the U.S. Statistical Report or Agricultural Statistics Handbook for the latest year available.
      ii. Help in harvesting a crop of grain. Tell how to reduce harvesting losses and about modern methods of growing one small grain crop.
      iii. Visit a grain elevator, flour mill, cereal plant, feed or seed company. Talk with the operator. Take notes, and describe the processes used and tell your patrol, troop, or class about your visit.
   (5) Oil Crops
      i. Grow a plot of soybeans and have your plot inspected by your counselor.
      ii. Tell about modern methods of growing soybeans on a commercial scale, and discuss the contributions soybeans make to our food supply.
      iii. Explain why a killing frost just after emergence is critical for soybeans.

Option 2: Horticulture

a. Visit one of the following places and tell what you learned about horticulture there: public garden, arboretum, retail nursery, wholesale nursery, production greenhouse, or conservatory greenhouse.

b. Explain the following terms: hardiness zone, shade tolerance, pH, moisture requirement, native habitat, texture, cultivar, ultimate size, disease resistance, habit, evergreen, deciduous, annual, perennial. Find out what hardiness zone you live in and list 10 landscape plants you like that are suitable for your climate, giving the common name and scientific name for each.

c. Do ONE of the following:
   (1) Explain the difference between vegetative and sexual propagation methods, and tell some horticultural advantages of each. Grow a plant from a stem or root cutting or graft.
   (2) Transplant 12 seedlings or rooted cuttings to larger containers and grow them for at least one month.
   (3) Demonstrate good pruning techniques and tell why pruning is important.
   (4) After obtaining permission, plant a tree or shrub properly in an appropriate site.

d. Do EACH of the following:
   (1) Explain the importance of good landscape design and selection of plants that are suitable for particular sites and conditions.
   (2) Tell why it is important to know how big a plant will grow.
   (3) Tell why slower-growing landscape plants are sometimes a better choice than faster-growing varieties.

e. Choose ONE of the following alternatives and complete EACH of the requirements:
   (1) Bedding Plants
      i. Grow bedding plants appropriate for your area in pots or flats from seed or cuttings in a manufactured soil mix. Explain why you chose the mix and tell what is in it.
      ii. Transplant plants to a bed in the landscape and maintain the bed until the end of the growing season. Record your activities, observations, materials used, and costs.
      iii. Demonstrate mulching, fertilizing, watering, weeding, and deadheading, and tell how each practice helps your plants.
      iv. Tell some differences between gardening with annuals and perennials.
   (2) Fruit, Berry, and Nut Crops
      i. Plant five fruit or nut trees, grapevines, or berry plants that are suited to your area. Take full care of fruit or nut trees, grapevines, or berry plants through one season.
      ii. Prune a tree, vine, or shrub properly. Explain why pruning is necessary.
      iii. Demonstrate one type of graft and tell why this method is useful.
      iv. Describe how one fruit, nut, or berry crop is processed for use.
   (3) Woody Ornamentals
      i. Plant five or more trees or shrubs in a landscape setting. Take full care of the trees or shrubs you have planted for one growing season.
      ii. Prune a tree or shrub properly. Explain why pruning is necessary.
      iii. List 10 trees (in addition to those listed in general requirement 5 above) and tell your counselor how each is used in the landscape. Give the common and scientific names.

iv. Describe the size, texture, color, flowers, leaves, fruit, hardiness, cultural requirements, and any special characteristics that make each type of tree or shrub attractive or interesting.

v. Tell five ways trees help improve the quality of our environment.

(4) Home Gardening

i. Design and plant a garden or landscape that is at least 10 by 10 feet.

ii. Plant 10 or more different types of plants in your garden. Tell why you selected particular varieties of vegetables and flowers. Take care of the plants in your garden for one season.

iii. Demonstrate soil preparation, staking, watering, weeding, mulching, composting, fertilizing, pest management, and pruning. Tell why each technique is used.

iv. Tell four types of things you could provide to make your home landscape or park a better place for birds and wildlife. List the common and scientific names of 10 kinds of native plants that are beneficial to birds and wildlife in your area.

Option 3: Field Botany

a. Visit a park, forest, Scout camp, or other natural area near your home. While you are there:

(1) Determine which species of plants are the largest and which are the most abundant. Note whether they cast shade on other plants.

(2) Record environmental factors that may influence the presence of plants on your site, including latitude, climate, air and soil temperature, soil type and pH, geology, hydrology, and topography.

(3) Record any differences in the types of plants you see at the edge of a forest, near water, in burned areas, or near a road or railroad.

b. Select a study site that is at least 100 by 100 feet. Make a list of the plants in the study site by groups of plants: canopy trees, small trees, shrubs, herbaceous wildflowers and grasses, vines, ferns, mosses, algae, fungi, lichens. Find out which of these are native plants and which are exotic (or nonnative).

c. Tell how an identification key works and use a simple key to identify 10 kinds of plants (in addition to those in general requirement 5 above). Tell the difference between common and scientific names and tell why scientific names are important.

d. After gaining permission, collect, identify, press, mount, and label 10 different plants that are common in your area. Tell why voucher specimens are important for documentation of a field botanist's discoveries.

e. Obtain a list of rare plants of your state. Tell what is being done to protect rare plants and natural areas in your state. Write a paragraph about one of the rare plants in your state.

f. Choose ONE of the following alternatives and complete EACH of its requirements:

(1) Tree Inventory

i. Identify the trees of your neighborhood, a park, a section of your town, or a Scout camp.

ii. Collect, press, and label leaves, flowers, or fruits to document your inventory.

iii. List the types of trees by scientific name and give common names. Note the number and size (diameter at 4 feet above ground) of trees observed and determine the largest of each species in your study area.

iv. Lead a walk to teach others about trees and their value, OR write and distribute materials that will help others learn about trees.

(2) Transect Study

i. Visit two sites, at least one of which is different from the one you visited for Field Botany requirement 1.

ii. Use the transect method to study the two different kinds of plant communities. The transects should be at least 500 feet long.

iii. At each site, record observations about the soil and other influencing factors AND do the following. Then make a graph or chart to show the results of your studies.

a) Identify each tree within 10 feet of the transect line.

b) Measure the diameter of each tree at 4 feet above the ground, and map and list each tree.

(3) Nested Plot

i. Visit two sites, at least one of which is different from the one you visited for Field Botany requirement 1.

ii. Mark off nested plots and inventory two different kinds of plant communities.

iii. At each site, record observations about the soil and other influencing factors AND do the following. Then make a graph or chart to show the results of your studies.

c) Identify, measure, and map each tree in a 100-by-100-foot plot. (Measure the diameter of each tree at 4 feet above the ground.)

d) Identify and map all trees and shrubs in a 10-by-10-foot plot within each of the larger areas.

e) Identify and map all plants (wildflowers, ferns, grasses, mosses, etc.) of a 4-by-4-foot plot within the 10-by-10-foot plot.

(4) Herbarium Visit

i. Write ahead and arrange to visit an herbarium at a university, park, or botanical garden; OR, visit an herbarium website (with your parent's permission).

ii. Tell how the specimens are arranged and how they are used by researchers. If possible, observe voucher specimens of a plant that is rare in your state.

iii. Tell how a voucher specimen is mounted and prepared for permanent storage. Tell how specimens should be handled so that they will not be damaged.

iv. Tell about the tools and references used by botanists in an herbarium.

(5) Plant Conservation Organization Visit

i. Write ahead and arrange to visit a private conservation organization or government agency that is concerned with protecting rare plants and natural areas.

ii. Tell about the activities of the organization in studying and protecting rare plants and natural areas.

iii. If possible, visit a nature preserve managed by the organization. Tell about land management activities such as controlled burning, or measures to eradicate invasive (nonnative) plants or other threats to the plants that are native to the area.

Reptile and Amphibian Study

1. Describe the identifying characteristics of six species of reptiles and four species of amphibians found in the United States. For any four of these, make sketches from your own observations or take photographs. Show markings, color patterns, or other characteristics that are important in the identification of each of the four species. Discuss the habits and habitats of all 10 species.
2. Discuss with your merit badge counselor the approximate number of species and general geographic distribution of reptiles and amphibians in the United States. Prepare a list of the most common species found in your local area or state.
3. Describe the main differences between:
    a. Amphibians and reptiles
    b. Alligators and crocodiles
    c. Toads and frogs
    d. Salamanders and lizards
    e. Snakes and lizards
4. Explain how reptiles and amphibians are an important component of the natural environment. List four species that are officially protected by the federal government or by the state you live in, and tell why each is protected. List three species of reptiles and three species of amphibians found in your local area that are not protected. Discuss the food habits of all 10 species.
5. Describe how reptiles and amphibians reproduce.
6. From observation, describe how snakes move forward. Describe the functions of the muscles, ribs, and belly plates.
7. Describe in detail six venomous snakes and the one venomous lizard found in the United States. Describe their habits and geographic range. Tell what you should do in case of a bite by a venomous species.
8. Do ONE of the following:
    a. Maintain one or more reptiles or amphibians for at least a month. Record food accepted, eating methods, changes in coloration, shedding of skins, and general habits; or keep the eggs of a reptile from the time of laying until hatching; or keep the eggs of an amphibian from the time of laying until their transformation into tadpoles (frogs) or larvae (salamanders).
    b. Choose a reptile or amphibian that you can observe at a local zoo, aquarium, nature center, or other such exhibit (such as your classroom or school). Study the specimen weekly for a period of three months. At each visit, sketch the specimen in its captive habitat and note any changes in its coloration, shedding of skins, and general habits and behavior. Find out, either from information you locate on your own or by talking to the caretaker, what this species eats and what are its native habitat and home range, preferred climate, average life expectancy, and natural predators. Also identify any

human caused threats to its population and any laws that protect the species and its habitat. After the observation period, share what you have learned with your counselor.

9. Do TWO of the following:
    a. Identify at night three kinds of toads or frogs by their voices. Imitate the song of each for your counselor. Stalk each with a flashlight and discover how each sings and from where.
    b. Identify by sight eight species of reptiles or amphibians.
    c. Using visual aids, give a brief talk to a small group on three different reptiles and amphibians.
10. Tell five superstitions or false beliefs about reptiles and amphibians and give a correct explanation for each. Give seven examples of unusual behavior or other true facts about reptiles and amphibians.

Soil and Water Conservation

1. Do the following:
    c. Tell what soil is. Tell how it is formed.
    d. Describe three kinds of soil. Tell how they are different.
    e. Describe the three main plant nutrients in fertile soil. Tell how they can be put back when used up.
2. Do the following:
    a. Define soil erosion.
    b. Tell why soil conservation is important. Tell how it affects you.
    c. Name three kinds of soil erosion. Describe each.
    d. Take pictures of or draw two kinds of soil erosion.
3. Do the following:
    a. Tell what is meant by conservation practices.
    b. Describe the effect of three kinds of erosion-control practices.
    c. Take pictures or draw three kinds of erosion-control practices.
4. Do the following:
    a. Explain what a watershed is.
    b. Outline the smallest watershed that you can find on a contour map.
    c. Outline, as far as the map will allow, the next larger watershed which also has the smaller one in it.
    d. Explain what a river basin is. Tell why all people living in a river basin should be concerned about land and water use in the basin.
5. Do the following:
    a. Make a drawing to show the hydrologic cycle.
    b. Demonstrate at least two of the following actions of water in relation to soil: percolation, capillary action, precipitation, evaporation, transpiration.
    c. Explain how removal of vegetation will affect the way water runs off a watershed.
    d. Tell how uses of forest, range, and farmland affect usable water supply.
    e. Explain how industrial use affects water supply.

6. Do the following:
    a. Tell what is meant by water pollution.
    b. Describe common sources of water pollution and explain the effects of each.
    c. Tell what is meant by 'primary water treatment', 'secondary waste treatment', and 'biochemical oxygen demand'.
    d. Make a drawing showing the principles of complete waste treatment.
7. Do TWO of the following:
    a. Make a trip to two of the following places. Write a report of more than 500 words about the soil and water and energy conservation practices you saw.
        (1) An agricultural experiment.
        (2) A managed forest or woodlot, range, or pasture.
        (3) A wildlife refuge or a fish or game management area.
        (4) A conservation-managed farm or ranch.
        (5) A managed watershed.
        (6) A waste-treatment plant.
        (7) A public drinking water treatment plant.
        (8) Industry water use installation.
        (9) Desalinization plant.
    b. Plant 100 trees, bushes and/or vines for a good purpose.
    c. Seed an area of at least one-fifth acre for some worthwhile conservation purpose, using suitable grasses or legumes alone or in a mixture.
    d. Study a soil survey report. Describe the things in it. Using tracing paper and pen, trace over any of the soil maps; and outline an area with three or more different kinds of soil. List each kind of soil by full name and map symbol.
    e. Make a list of places in your neighborhood, camps, school ground, or park having erosion, sedimentation, or pollution problems. Describe how these could be corrected through individual or group action.
    f. Carry out any other soil and water conservation project approved by your merit badge counselor.