

Forestry: Course Outline

- I. Natural History of Forests in Iowa
 - A. Historical Perspective of Iowa's Woodlands
 - B. Forest Ecology
 - 1. Forest Types
 - a. Urban
 - b. Upland
 - c. Bottomland
 - d. Riparian
 - 2. Forest Succession
 - C. Tree Identification
 - 1. Using Dichotomous Keys
 - 2. Using Forest & Tree Guides
 - D. Tree Growth
 - 1. Leaves
 - 2. Stems
 - 3. Roots
 - 4. Flowers
 - 5. Seeds/Nuts
 - E. Forest Structure (Layers)
 - 1. Canopy
 - 2. Understory
 - 3. Shrub
 - 4. Litter
 - 5. Herbaceous
- II. Forest Inventory
 - A. Land Measurements
 - 1. Land Survey
 - 2. Compass
 - 3. Global Positioning System (GPS)
 - 4. Site Analysis
 - a. Climate
 - b. Soil
 - c. Vegetation
 - B. Forest Measurements
 - 1. Timber Cruising
 - 2. Log Measurements
 - 3. Standing Timber Measurements
 - 4. Diameter Breast Height (DBH)
 - 5. Hypsometer
 - 6. Clinometer
- III. Forest Management
 - A. Management Agencies

1. Local
2. State
3. Federal
- B. Multiple Use Management
 1. Economic Considerations
 2. Social / Recreation Considerations
 3. Sustained Yield & Agriculture Diversity
- C. Timber Harvesting
 1. Harvesting Procedures
 - a. Safety
 - b. Transportation
 - c. Equipment
 2. Harvest Systems
 - a. Shelterwoods
 - b. Clearcutting
 - c. Highgrading
- D. Marketing Timber
 1. Processes
 2. Tree Selection
 3. Value
 4. Selling/Advertising
 5. Contracts
 6. Inspection
- E. Forest Products
 1. Wood Characteristics, Identification, and Uses
 2. Christmas Trees
 3. Maple Syrup
 4. Black Walnut
 5. Energy Production

IV. Forest Stand Improvement

- A. Preparing a Woodland Stewardship Plan
 1. Woodland Inventory
 2. Identifying Potential Management Practices
 3. Assessing Labor and Finances
 4. Developing a Management Activity Schedule
- B. Forest Regeneration
 1. Site Selection
 2. Species Selection
 3. Site Preparation
 4. Planting Methods
 5. Tree Sources

- C. Woodland Improvement Practices
 - 1. Crop Tree Release
 - 2. Thinning
 - 3. Pruning
 - 4. Weeding
 - 5. Fire
- D. Protecting the Forest Resource
 - 1. Fire
 - 2. Grazing
 - 3. Disease: Entomology and Pathology
 - 4. Environmental Damage
- E. Managing Woodlands for Wildlife
 - 1. Site Quality
 - 2. Space
 - 3. Food
 - 4. Shelter
 - 5. Water
 - 6. Managing for Selected Species
- F. Conservation Practices
 - 1. Erosion Control
 - 2. Windbreaks
 - 3. Riparian Buffers
 - 4. Conservation Easements

- V. Careers Associated with Forestry
 - A. Governmental
 - 1. Local
 - 2. State
 - 3. Federal
 - B. Private

- VI. Appendix
 - A. Terms
 - B. Resources
 - C. Curriculum Standards
 - 1. Agriculture
 - 2. Science

Forestry: Terms

acre
alternate
annual ring
arboriculture
aspect
back-fire
basal area
bearing
biltmore stick
board foot
bottomland
bole
broad leaf
burl
cambium
canopy
clearcut
climax
clinometer
closed crown
conifer
conservation
cord
cork
compound
cotyledon
crown
crown density
cruising
deciduous
defoliation
dendrochronology
dendrometer
density
diameter-breast-height - DBH
diameter tape (D-tape)
dominate trees
ephemerals
even-aged forest
firebreak
forest
girdle
Greenhouse Effect
hardwood
harvest cutting
hypometer
improvement cutting
increment bore
intermediate cutting
litter
log scale
merchantable
mixed stand
mycorrhiza
old growth
opposite
over mature
palmate
phloem
photosynthesis
pinnate
pith
pistil
pole
pollen
prescribed burning
pruning
pulpwood
pure stand
re-forestation
release cutting
renewable resource
riparian forest buffer
root collar
root hairs
rotation
salvage cutting
sanitation cutting
sapling
sapwood
sawlog
saw timber
savanna
second growth
seedling
seed tree
shade tolerant
shelterbelt

shelter wood
silviculture
simple
site index
snag
softwood
springwood
stand
succession
summerwood
sustained yield
thinning
Timber Stand Improvement - TSI

tolerant
transpiration
tree farm
understory
uneven-aged forest
upland
wedge prism
whorled
windbreak
wolf tree
woodland
xylem

Forestry: Resources

The following resources were suggested by the writers and reviewers. There are many additional resources available and many more being developed daily, especially via the web. Website resources contain lists of publications related to specific topics. Individual books or pamphlets from websites were not listed because of space. Please view these as a starting point and add others to the list as you develop your specific course objectives.

Websites:

Conservation Districts of Iowa

Conservation Districts of Iowa (CDI) is a nonprofit organization devoted to providing educational programs on the conservation of soil, water, and other natural resources. CDI coordinates Iowa's Envirothon program.

<http://www.cdiowa.org>

Forest Service

Provides publications, and articles on forest issues and a link to United States Geological survey for maps

<http://www.fs.fed.us/>

Iowa Department of Agriculture and Land Stewardship

Information and publications related to Iowa's Agriculture and Conservation/Natural Resource issues and programs

<http://www.agriculture.state.ia.us/default.htm>

Iowa Department of Natural Resources

Publications on conservation/natural resources including, Project Learning Tree, Project Wild, Project WILD *Aquatic*, and supplements to these programs which provide background information relative to wildlife and their management.

<http://www.iowadnr.gov>

Iowa State University Extension Publications

Extensive publication list for all aspects of forestry.

<http://www.extension.iastate.edu/pubs>

Iowa State University Forestry Extension

Identification of common trees of Iowa with an interactive key

<http://www.extension.iastate.edu/pages/tree/>

Books, CD's, Pamphlets:

Background Information on Iowa's Forest Resources. IDNR,
<http://www.iowadnr.gov/education/backinfo.html>

Field Guides. A variety of Field Guides, each with their own unique qualities, are available from many sources. It is important to know how to use a Field Guide to identify specimens.

Forest and Shade Trees of Iowa. Iowa State University Press, 1984.

Iowa's Natural Heritage. Iowa Academy of Science and Iowa Natural Heritage Foundation. 1982. Call Iowa Natural Heritage at 1-515-288-1846.

Managing Our Natural Resources. Camp, William G., etal. 2002. DELMAR, 4th ed.
<http://www.Agriscience.Delmar.com>

Stewards of Streams – Buffer Strip Design, Establishment, and Maintenance. ISU Extension, <http://www.extension.iastate.edu/pubs>

Wildflowers of Iowa Woodlands. Runkel, Sylvan, T. and Alvin F. Bull, Wallace Homestead Book Co., Des Moines, Iowa. 1979.

Forestry: Curriculum Standards and Benchmarks

Agricultural Education Standards, Benchmarks, and Performance Indicators

Agricultural Business, Supply & Service

Standard AB-1: Understand problem-solving, analysis, and decision-making in agriculture.

Benchmarks

A. Analyze situation, use problem-solving approach and make appropriate decisions.

1. Compare the advantages and disadvantages of biological, chemical and cultural pest controls.
3. Interpret the results from a soil and/or tissue test.
4. Determine appropriate land use management based on soil evaluation needs.

Standard AB-12: Understand basic technical skills and knowledge in the occupational area of agricultural business, supply and service.

Benchmark

L. Apply technical skills in a hands-on experiential setting in agriculture.

32. Identify the types of tillage methods used in crop production.
34. Explain the role of primary and secondary nutrients used in crop production.
39. Read a soil classification map.

Agricultural Production

Standard AP-10: Understand basic computational and informational technology.

Benchmark

J. Apply computational and informational technologies to analyze and solve mathematical problems.

1. Evaluate and demonstrate use of current technology in land surveying and measuring.
2. Utilize digitized soil surveys to establish a soil sampling method and formulate a nutrient.

Standard AP-12: Understand basic technical skills and knowledge in the occupational area of production agriculture.

Benchmark

K. Apply technical skills in a hands-on experiential setting in agriculture.

4. Analyze the environmental effect that agricultural stewardship may have on surface and ground water, wildlife, soil, air, and people.

19. Explain soil and water conservation practices and their part in federal program compliance.
20. Explain the factors involved with seed and plant selection.
21. Identify and demonstrate plant growth and reproduction.
22. Identify and select biological and chemical pest controls for agronomic production.
34. Use the survey plat of township, range and section to describe an area.

Horticulture

Standard H-1: Understand problem solving, analysis, and decision-making in agriculture.

Benchmarks

A. Analyze situations, use problem-solving approach, and make appropriate decisions.

1. Identify and differentiate between (may be a combination of) disease damage, pest and insect damage, chemical and environmental damage in a plant.
2. Use observational techniques to identify healthy, quality plants.
3. Interpret data of soil sample analysis.
5. Choose an appropriate plant for a specific location in a home or business.
6. Choose plants of appropriate mature size, shape, texture, and function for a given site.

Standard H-8: Understand the concept of adapting to change in agriculture.

Benchmark

H. Develop strategies to effectively adapt to new situations and rapid changes in agriculture.

3. Identify issues and trends in horticulture concerning environmental and conservation problems.

Standard H-10: Understand basic computational and informational technology.

Benchmark

J. Apply computational and informational technologies to analyze and solve mathematical problems.

1. Measure a tree trunk accurately using a caliper.

Standard H-12: Understand basic technical skills and knowledge in the occupational area of Horticulture.

Benchmark

L. Apply technical skills in a hands-on experiential setting in agriculture.

2. Take soil samples.
26. Identify plants using a botanical key.
27. Identify herbaceous and woody ornamental plants by common name.
28. Explain the process of producing, harvesting, and storing ornamental plants (i.e. trees, shrubs, Christmas trees, and perennials).
34. Identify Midwestern turf grasses by common name.

51. Explain the process of photosynthesis.
52. Explain factors affecting plant growth: light, water, temperature, humidity, nutrients (micro/macro) soils, atmosphere, and pollutants.
53. Explain the principles of nutrient uptake.
54. Define and identify hardiness zones.
55. Explain the system of scientific nomenclature for plants (e.g., families, genus, and species).
56. Explain plant propagation from seed, cuttings, divisions, and layering.
65. Explain the principles of integrated pest management.

Natural Resources

Standard NR-1: Understand problem solving, analysis, and decision-making in agriculture.

Benchmark

A. Analyze situation, use problem-solving approach and make appropriate decisions.

1. Assess and implement BMPs (Best Management Practices) related to agriculture drainage wells, erosion control, irrigation of wastewater, irrigation of groundwater, use of storage tanks (i.e., fuels, Anhydrous Ammonia, etc.) and wellhead and source of water protection which improve water quality.
2. Evaluate alternative solutions to Iowa air pollution problems.
3. Evaluate benefits and uses of native plants and animals, as well as their negative uses.
6. Evaluate means of solving local wildlife resource problems.
8. Determine soil amendments necessary based on soil tests, realistic yield goals, and the fertility level of a given piece of land.
9. Identify and evaluate conservation tillage systems and their productivity, profitability and environmental impact.
10. Evaluate means of solving local water resource problems.
11. Collecting, understanding, and analyzing samples to assess water quality and analyze findings.
12. Evaluate various solid waste disposal systems by their environmental impact.
13. Evaluate means of solving Iowa forest resource problems.

Standard NR-4: Understand the use of entrepreneurial knowledge and skills in agriculture.

Benchmark

D. Use appropriate communication skills in a variety of occupational situations in agriculture.

3. Recognize the importance of technical assistance.

Standard NR-7: Understand the principles of planning.

Benchmark

G. Apply planning strategies in natural resources management.

1. Develop an individual resource conservation plan to include crop, pasture, woodlands, wildlife, farmstead, and urban considerations.
2. Identify the role geologic resources have in land use planning.
3. Develop a wildlife management plan for a given area.
6. Develop plans which incorporate the use of federal, state, and local agriculture programs to sustain resources (i.e., buffer strips).

Standard NR-8: Understand the concept of adapting to change in agriculture.

Benchmark

H. Develop strategies to effectively adapt to new situations and rapid changes in agriculture.

1. Identify contemporary natural resources issues/concerns relating to agriculture.
2. Adapt to environment/situation.

Standard NR-9: Understand global and cultural diversity issues.

Benchmark

I. Demonstrate a working knowledge of the relationship between global/cultural diversity and occupational success in agriculture.

1. Describe global environmental impact.
2. Explain global positioning systems and graphic information systems and understand practice application.

Standard NR-10: Understand basic computational and informational technology.

Benchmark

J. Apply computational and informational technologies to analyze and solve mathematical problems.

1. Estimate water needs for a community and farm operation.
2. Measure and calculate land area, length, and percent slope.

Standard NR-11: Understand the concept of career development and improvement – lifelong learning.

Benchmark

K. Develop strategies to make a successful transition from school to work.

1. Identify a minimum of five (5) environmental and natural resource occupations and explain the job requirements, major activities performed by persons in these occupations and availability by location.
2. Explain the connection between the natural resources occupations, agribusiness, and technology.

Standard NR-12: Understand basic technical skills and knowledge in the occupational area of natural resources.

Benchmark

L. Apply technical skills in a hands-on experiential setting in agriculture.

1. Explain the economic impact of the loss of wildlife, habitat, urban sprawl, and navigation on wildlife resources.
3. Select alternative grazing practices to eliminate grazing of woodlands.
4. Identify alternative forest management practices that reduce “high grading” of timber harvest.
5. Describe the connections between land use, rural Iowa, and agriculture.
6. Locate a plot of land given a legal description.
8. Explain the impact agriculture, industry, and population centers have on natural resources and the environment.
9. Use soil survey, topography maps, aerial photos, and other natural resources inventories to interpret, compare (limits and potentials), and plan wise land management.
10. Identify federal, state, and local regulations related to soil and water conservation, water quality, forestry, air quality, and wildlife. Explain their applicability to resource management.
12. Determine crops and crop management that will provide habitat for wildlife.
13. Perform wildlife habitat improvements; be knowledgeable of wildlife habitat technologies.
15. Explain a minimum of five timber stand improvement practices.
16. Identify woodland changes caused by pests and fire.
17. Explain important principals and economic values in managing trees for wood products, Christmas tree production, wildlife, recreation, windbreak, water recycling, air pollution, and energy.
18. Identify a minimum of fifteen (15) Iowa tree species and their common uses and planting objectives.
19. Demonstrate the proper planting of a tree based on soil conditions, size conditions, and land use objectives.
20. Describe how Iowa climate and weather is relevant to natural resources and agricultural resource management.
21. Identify techniques for improvement of aquatic habitats.
23. Select appropriate conservation practices that will reduce erosion and improve water quality on a farm and urban area.
24. Describe the types of wind and water erosion and determine soil erosion rates and resulting economic and environmental losses to society.
25. Explain the principles of integrated crop (fertility levels, pests) management.
26. Explain the techniques of crop cultivation and how they interrelate with the environment.
27. Identify a minimum of 50 plants by their common names.
30. Explain current issues involved in natural resource management.
33. Explain State and Federal Ag and Natural Resource Management Agencies and their functions.
34. Explain the hydrologic cycle.

Agricultural Mechanics

Standard AM-10: Understand basic computational and informational technology.

Benchmark

J. Apply computational and informational technologies to analyze and solve mathematical problems.

3. Calculate board feet, square feet, and linear foot of lumber or metal

Standard AM-12: Understand basic technical skills and knowledge in the occupational area of agricultural mechanics.

Benchmark

L. Apply technical skills in a hands-on experiential setting in agriculture.

26. Identify types of erosion control structures.

Source: Iowa Content Standards and Benchmarks for Agricultural Education, Iowa Department of Education, 1999.

Science Standards

Standard 5: Understands the structure and function of cells and organisms.

Level III

3. Knows the levels of organization in living systems, including cells, tissues, organs, organ systems, whole organisms, ecosystems, and the complementary nature of structure and function at each level
5. Knows that organisms have a great variety of body plans and internal structures that serve specific functions for survival (e.g., digestive structures in vertebrates, invertebrates, unicellular organisms, and plants)

Level IV

3. Understands the processes of photosynthesis and respiration in plants (e.g., chloroplasts in plant cells use energy from sunlight to combine molecules of carbon dioxide and water into complex, energy-rich organic compounds and release oxygen to the environment)
4. Knows how cell functions are regulated through changes in the activity of the functions performed by proteins and through the selective expression of individual genes, and how this regulation allows cells to respond to their environment and to control and coordinate cell growth and division

Standard 6: Understands relationships among organisms and their physical environment.

Level IV

1. Knows how the interrelationships and interdependencies among organisms generate stable ecosystems that fluctuate around a state of rough equilibrium for hundreds or thousands of years (e.g., growth of a population is held in check by environmental factors such as depletion of food or nesting sites, increased loss due to larger numbers of predators or parasites)
2. Knows how the amount of life an environment can support is limited by the availability of matter and energy and the ability of the ecosystem to recycle materials
3. Knows that as matter and energy flow through different levels of organization in living systems and between living systems and the physical environment, chemical elements (e.g., carbon, nitrogen) are recombined in different ways
5. Knows ways in which humans can alter the equilibrium of ecosystems, causing potentially irreversible effects (e.g., human population growth, technology, and consumption; human destruction of habitats through direct harvesting, pollution, and atmospheric changes)

Standard 7: Understands biological evolution and the diversity of life.

Level III

1. Knows basic ideas related to biological evolution (e.g., diversity of species is developed through gradual processes over many generations; biological adaptations, such as changes in structure, behavior, or physiology, allow some species to enhance their reproductive success and survival in a particular environment)
3. Understands the concept of extinction and its importance in biological evolution (e.g., when the environment changes, the adaptive characteristics of some species are insufficient to allow their survival; extinction is common; most of the species that have lived on the Earth no longer exist)
5. Knows ways in which living things can be classified (e.g., taxonomic groups of plants, animals, and fungi; groups based on the details of organisms' internal and external features; groups based on functions served within an ecosystem such as producers, consumers, and decomposers)

Level IV

2. Understands the concept of natural selection (e.g., when an environment changes, some inherited characteristics become more or less advantageous or neutral, and chance alone can result in characteristics having no survival or reproductive value; this process results in organisms that are well suited for survival in particular environments)
3. Knows how variation of organisms within a species increases the chance of survival of the species, and how the great diversity of species on Earth increases the chance of survival of life in the event of major global changes
7. Knows how organisms are classified into a hierarchy of groups and subgroups based on similarities that reflect their evolutionary relationships (e.g., shared derived characteristics inherited from a common ancestor; degree of kinship estimated from the similarity of DNA sequences)

Standard 12: Understands the nature of scientific inquiry.

Level IV

4. Uses technology (e.g., hand tools, measuring instruments, calculators, computers) and mathematics (e.g., measurement, formulas, charts, graphs) to perform accurate scientific investigations and communications
7. Knows that investigations and public communication among scientists must meet certain criteria in order to result in new knowledge and methods (e.g., arguments must be logical and demonstrate connections between natural phenomena, investigations, and the historical body of scientific knowledge; the methods and procedures used to obtain evidence must be clearly reported to enhance opportunities for further investigation)

Standard 13: Understand the scientific enterprise.

Level IV

2. Understands that individuals and teams contribute to science and engineering at different levels of complexity (e.g., an individual may conduct basic field studies; hundreds of people may work together on a major scientific question or technological problem)
3. Understands the ethical traditions associated with the scientific enterprise (e.g., commitment to peer review, truthful reporting about the methods and outcomes of investigations, publication of the results of work) and that scientists who violate these traditions are censored by their peers
5. Understands that science involves different types of work in many different disciplines (e.g., scientists in different disciplines ask different questions, use different methods of investigation, and accept different types of evidence to support their explanations; many scientific investigations require the contributions of individuals from different disciplines; new disciplines of science, such as geophysics and biochemistry, often emerge at the interface of older disciplines)
6. Knows that creativity, imagination, and a good knowledge base are all required in the work of science and engineering

Source: Compendium of K-12 Standards, McREL, 2004.

<http://www.mcrel.org/compendium/SubjectTopics.asp?SubjectID=2>