Defining Urban Forestry

Unit B. Plant Wildlife Management

Problem Area 5. Urban Forestry

Lesson 1. Defining Urban Forestry

New Mexico Content Standard:

Pathway Strand: Natural Resources and Environmental Systems

Standard: I: Recognize importance of resource and human interrelations to conduct management activities in natural habitats.

Benchmark: I-D: Employ environmental and wildlife knowledge to demonstrate natural resource enhancement techniques.

Performance Standard: 2. Demonstrate forest stand improvement techniques.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Define urban forestry.
2. Explain the benefits of an urban forests and urban trees.
3. Describe various aspects of urban forest management.
List of Resources. The following resources may be useful in teaching this lesson:

Recommended Resources. One of the following resources should be selected to accompany the lesson:


Other Resources. The following resources will be useful to students and teachers:


List of Equipment, Tools, Supplies, and Facilities

Writing surface
Overhead projector
Transparencies from attached masters
Copies of student lab sheets
Calculators
Biltmore stick
Measuring tape

Terms. The following terms are presented in this lesson (shown in bold italics):

Arboriculture
Arborist
Certified arborists
Street tree ordinances
Tree ordinances
Tree protection ordinances
Urban forestry
View ordinances
Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Choose a tree at the school or within the community with which all the students are familiar. Ask the students to put a monetary value on the tree. Have them volunteer their opinions. Then lead a discussion in which the students are challenged to identify what makes a tree valuable. Compile the list of values on a chalkboard or overhead for all to see.

Summary of Content and Teaching Strategies

Objective 1: Define urban forestry.

Anticipated Problem: What is urban forestry?

I. Urban forestry is a specialized segment of forestry.
   A. Urban forestry takes place in the populated areas of cities, towns, and suburban areas. Populated areas offer unique challenges in managing the trees not often found in traditional forests. Air pollution, confined growing space, and compacted soils are some factors that can make the management of trees difficult.
   B. Urban forestry requires a great deal of management by people. The culture or care of trees is arboriculture. Professionals that see to the culture of trees are known as arborists.
   C. Certification enhances an arborist’s credentials. State and national organizations provide certification training and testing. Certified arborists have proven through studies and exams that they are qualified for tree care work. They are typically regarded as being “professionals” in the areas of tree nutrition/fertilization, tree identification/selection, tree installation/establishment, safety/climbing, tree risk assessment, tree biology, pruning, diseases diagnosis/treatment, soil/water relationships, forest ecology, tree preservation/construction, and cabling/bracing.

Begin the lesson with an interest approach to capture the attention of the students. Clearly state the objectives of this lesson. Have students read selected portions of text materials and instruct them to take notes. Lead a lecture-discussion. Ask questions during instruction to gauge student understanding of the concepts.
Objective 2: Explain the benefits of an urban forests and urban trees.

Anticipated Problem: What are the benefits of urban forest and urban trees?

II. Benefits from urban forests may be related to the quality of life, the environment, and economics.

A. Healthy urban forests improve the quality of life. Trees clean the air. They remove smog, dust, and pollutants from the air we breathe. That is important since we take 23,000 breaths in a day!

B. Trees produce oxygen. An acre of trees produces enough oxygen everyday for 18 people.

C. An acre of trees absorbs carbon dioxide. An acre of trees absorb enough carbon dioxide in one year’s time to offset the amount produced in driving a car 26,000 miles.

D. Trees serve as barriers. Trees can lower sound pollution. Reduced noise levels near places of work and residence improve quality of life. Trees can block unsightly views such as industrial areas or highways. Trees also serve as windbreaks, which is particularly useful in the winter months.

E. Trees have a cooling effect on hot summer days. Air temperature under a large shade tree can be 15 degrees cooler than the temperature in the sun. As a result, cooling costs can be 10-50 percent lower.

F. A single large deciduous tree in leaf provides protection from ultraviolet radiation. The Sun Protection Factor (SPF) has been estimated at 10-20.

G. Trees are beautiful. Many trees have showy flowers, attractive foliage, interesting bark, and stunning fall colors. Well-landscaped houses with mature trees can be valued at 10-15 % more than houses lacking trees.

H. Although difficult to measure, trees have a positive psychological affect on humans. Research has shown urban forests to be good for mental health.

I. Urban forests contribute to a healthy environment. They can reduce storm water runoff and reduce soil erosion. Trees produce oxygen needed by animals. Urban forests provide food and shelter for wildlife.

Prepare the students by having them read related sections of text materials identified in the resources list. Require students to take notes on the major points presented in the chapter. TM: B5–1A—The Value Of Urban Trees can be used to illustrate points. Follow the reading session with a discussion on the benefits of an urban forest. Have the students expand their notes based on the discussion. The discussion can also serve as a way to monitor students’ mastery of the material.
**Objective 3:** Describe various aspects of urban forest management.

**Anticipated Problem:** What are various aspects of urban forest management?

III. There are multiple aspects to managing an urban forest.

A. Urban forests are managed with different uses in mind. In urban settings trees impact watersheds, wildlife, fish habitats, recreational activities, aesthetics, general tree care, and wood production.

B. Urban forestry management programs have a variety of objectives. One objective includes inventorying trees as to species, size, age, and value. Care and maintenance of existing trees is important. Care includes the monitoring and managing of insect pests and diseases. An urban forest is constantly changing. Therefore, removal of trees due to death, decline, or safety considerations is necessary. By the same token, installation of trees is required to maintain the urban forest. Urban forestry management programs also address the need of educating the public on the role of trees in the environment. The general goals for most community forest programs tend to be similar.

1. Establish and maintain maximum tree cover.
2. Maintain trees in a healthy condition through good cultural practices
3. Establish and maintain an optimal level of age and species diversity.
4. Promote conservation of tree resources.
5. Select, situate, and maintain street trees appropriately to maximize benefits and minimize hazard, nuisance, hardscape damage, and maintenance costs.
6. Centralize tree management under a person with the necessary expertise.
7. Promote efficient and cost-effective management of the urban forest.
8. Foster community support for the local urban forestry program and encourage good tree management on privately owned properties.
9. Facilitate the resolution of tree-related conflicts between citizens.

C. Municipalities often adopt tree ordinances to meet goals of attaining a healthy, vigorous, and well-managed community forest. Tree ordinances provide the authorization and standards for management activities. Tree ordinances can be grouped into three basic categories:

1. **Street tree ordinances** primarily cover the planting and removal of trees within public rights-of-way. They often contain rules regarding private trees, which pose a hazard to the traveling public. Tree planting requirements, such as those requiring tree planting in parking lots are generally outlined.

2. **Tree protection ordinances** involve protection for native trees or trees with historical significance. These ordinances usually require that a permit be obtained before protected trees can be removed and in some cases, pruned.

3. **View ordinances** outline rules pertaining to trees that block views or sunlight.

Lead a lecture-discussion on the aspects of an urban forestry management program. Call upon students to participate in the discussion. Use visual aids, such as a chalkboard or overhead projector. Transparency
master TM: B5–1B—Urban Forestry Management. Invite the community or county forester to visit the classroom and discuss the goals of their management programs. Prepare the students in advance by having them develop questions for the guest speaker. Discuss how trees are evaluated. Then, have the students evaluate the value of local trees using LS: B5–1A. Follow up by having the students complete the exercise associated with LS: B5–1B—Conducting A Ground Survey. Assess student mastery of the material with examination tools provided.

**Review/Summary.** At the conclusion of the lesson review the learning objectives with the students. Summarize the material that has been covered during the class discussions, supervised study, and other learning experiences. Review the terms and definitions of the terms. Have the students explain the concepts associated with each objective. Use their responses as the basis for determining any areas that need additional review. Questions at the end of the chapters in the textbooks may also be used in the review/summary.

**Application.** Application can involve one or more of the following student activities using attached lab sheets:

- LS: B5–1A—Evaluating Shade Trees
- LS: B5–1B—Conducting A Ground Survey

**Evaluation.** Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. A sample written test is attached. Test questions found in the recommended resource materials might also be applicable.

**Answers to Sample Test:**

**Part One: Matching**
1 = e, 2 = a, 3 = c, 4 = h, 5 = f, 6 = b, 7 = d, 8 = g

**Part Two: Completion**
1. Certification
2. quality of life, the environment, and economics.
3. 18
4. sound, views, wind
5. 15
6. 10-15 percent
7. watersheds, wildlife, fish habitats, recreational activities, aesthetics, general tree care, and wood production.
8. mental health
9. Street tree ordinances
10. Tree protection ordinances

**Part Three: Short Answer**

1. Tree nutrition/fertilization, tree identification/selection, tree installation/establishment, safety/climbing, tree risk assessment, tree biology, pruning, diseases diagnosis/treatment, soil/water relationships, forest ecology, tree preservation/construction, and cabling/bracing.

2. 1. Trees clean the air.
   2. Trees produce oxygen.
   3. Trees absorb carbon dioxide.
   4. Trees serve as barriers.
   5. Trees have a cooling effect on hot summer days.
   6. Trees provide protection from ultraviolet radiation.
   7. Trees are beautiful.
   8. Trees have a positive psychological affect on humans.
   9. Trees contribute to a healthy environment.

3. 1. Establish and maintain maximum tree cover.
   2. Maintain trees in a healthy condition through good cultural practices.
   3. Establish and maintain an optimal level of age and species diversity.
   4. Promote conservation of tree resources.
   5. Select, situate, and maintain street trees appropriately to maximize benefits and minimize hazard, nuisance, hardscape damage, and maintenance costs.
   6. Centralize tree management under a person with the necessary expertise.
   7. Promote efficient and cost-effective management of the urban forest.
   8. Foster community support for the local urban forestry program and encourage good tree management on privately owned properties.
   9. Facilitate the resolution of tree-related conflicts between citizens.
Lesson B5–1: Defining Urban Forestry

Part One: Matching

**Instructions.** Match the term with the correct response. Write the letter of the term by the definition.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Arboriculture</td>
<td>guidelines to meet goals of attaining a healthy, vigorous, and well-managed community forest.</td>
</tr>
<tr>
<td>b. Arborist</td>
<td>the culture or care of trees.</td>
</tr>
<tr>
<td>c. Certified arborists</td>
<td>proven through studies and exams that they are qualified for tree care work.</td>
</tr>
<tr>
<td>d. Street tree ordinances</td>
<td>rules pertaining to trees that block views or sunlight.</td>
</tr>
<tr>
<td>e. Tree ordinances</td>
<td>involve protection for native trees or trees with historical significance.</td>
</tr>
<tr>
<td>f. Tree protection ordinances</td>
<td>professionals that see to the culture of trees.</td>
</tr>
<tr>
<td>g. Urban forestry</td>
<td>cover the planting and removal of trees within public rights-of-way.</td>
</tr>
<tr>
<td>h. View ordinances</td>
<td>a specialized segment of forestry that takes place in the populated areas of cities, towns, and suburban areas.</td>
</tr>
</tbody>
</table>

Part Two: Completion

**Instructions.** Provide the word or words to complete the following statements.

1. ___________ enhances an arborist’s credentials.

2. Benefits from urban forests may be related to the ___________, the ___________, and ___________.

3. An acre of trees produces enough oxygen everyday for ____ people.

4. Trees serve as barriers by blocking ___________, ___________, and ___________.

5. Air temperature under a large shade tree can be ____ degrees cooler than the temperature in the sun.

6. Well-landscaped houses with mature trees can be valued at _____ % more than houses lacking trees.
7. In urban settings trees impact __________, __________, __________, ______________, ____________, and ______________.

8. Research has shown urban forests to be good for ________________.

9. __________________ often contain rules regarding private trees, which pose a hazard to the traveling public.

10. __________________ involve protection for native trees or trees with historical significance.

**Part Three: Short Answer**

**Instructions.** Provide information to answer the following questions.

1. What are 12 areas in which a certified arborist is trained?

2. What are 9 contributions provided by urban forests?

3. What are nine goals common to community forest programs?
THE VALUE OF URBAN TREES

- Trees clean the air by removing smog, dust, and pollutants from the air we breathe.
- An acre of trees produces enough oxygen everyday for 18 people.
- Trees absorb carbon dioxide produced by cars and trucks.
- Trees serve as sound barriers cutting noise levels where we work and live.
- Shade trees cool the air temperature on a hot summer days.
- A single large deciduous tree in leaf provides Sun Protection Factor (SPF) estimated at 10-20.
- Many trees have showy flowers, attractive foliage, interesting bark, and stunning fall colors.
- Trees have a positive psychological affect on humans.
- Trees reduce storm water runoff and provide wildlife habitat.
URBAN FORESTRY MANAGEMENT PROGRAM OBJECTIVES

1. Inventory trees as to species, size, age, and value.

2. Care for and maintain existing trees.

3. Monitor and manage insect pests and diseases.

4. Remove trees due to death, decline, or safety considerations.

5. Install trees to maintain the urban forest.

6. Educate the public on the role of trees in the environment.
Lab Sheet

EVALUATING SHADE TREES

Objective:

Students will evaluate the monetary value of a tree in the community.

Materials:

Guidelines for evaluating shade trees
Calculator
Paper and pencil

Procedure:

1. Identify a tree in the community with a diameter at breast height in excess of 8 inches.
2. Assess the monetary value of select trees on the school campus or within the community using the following evaluation methods from the International Society of Arboriculture, http://www.isa-arbor.com.

Monetary Method of Evaluating Shade Trees

In determining the monetary value of shade and ornamental trees, consider four basic features: size, kind, location and condition of a tree.

Tree size can be designated in several ways. The International Society of Arboriculture (ISA) believes the area of the cross-section of the trunk at breast height (4 1/2 feet above ground line) is the best means of expressing the size of shade trees when, 4 value related to size is to be determined. The cross-section trunk area can be calculated from the trunk diameter by using the formula $0.7854 \times D^2$.

Example: A tree with an 8-inch diameter will have an area of cross-section of trunk at breast height of 50.26 sq. in.

$0.7854 \times 8 \times 8 = 50.2656$ sq. in.

Not all species and varieties of shade trees are of equal value. The same kind of tree may have different values in different areas of the country. Therefore, it’s necessary to compile a list of trees growing in each area and to segregate there into groups based on relative values. It is recommended that the trees in Group 1 be valued at 100 percent, Group 2 at 80-percent, Group 3 at 60 percent, Group 4 at 40 percent and those in Group 5 at 20 percent. Species factors are rated in Table 1 beginning on page 61.
Location is a multipurpose factor of position, site condition, functional values and aesthetic values. Position is meant to indicate the type of area in which the tree or trees are located, such as streets, malls, arboreta, industrial, wooded and residential areas. Site is interpreted to mean the relationship of the tree to its surroundings, including ecological and environmental conditions such as open soil or cut areas, pavement, windswept situations or air-polluted areas. Functional aspects include the benefits the plant or plants give such as air temperature control and noise abatement. Aesthetic factors encompass the characteristics of bark, foliage, branching habit, flower and fruit.

**Evaluation of Location Position**

<table>
<thead>
<tr>
<th>Location position</th>
<th>Percent rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feature or historical trees</td>
<td>90-100</td>
</tr>
<tr>
<td>Average residential, landscape trees</td>
<td>80-90</td>
</tr>
<tr>
<td>Malls</td>
<td>75-80</td>
</tr>
<tr>
<td>Public and commercial area trees</td>
<td>70-80</td>
</tr>
<tr>
<td>Arboreta and park trees</td>
<td>60-80</td>
</tr>
<tr>
<td>Golf course trees, strategically located</td>
<td>60-80</td>
</tr>
<tr>
<td>City streets and boulevards</td>
<td>60-80</td>
</tr>
<tr>
<td>Screen and windbreak trees</td>
<td>60-70</td>
</tr>
<tr>
<td>Recreational and picnic area trees</td>
<td>60-70</td>
</tr>
<tr>
<td>Industrial area trees</td>
<td>50-70</td>
</tr>
<tr>
<td>Out-of –city highway trees*</td>
<td>40-60</td>
</tr>
<tr>
<td>Native, open woods trees</td>
<td>30-40</td>
</tr>
<tr>
<td>Dense forest trees*</td>
<td>10-20</td>
</tr>
</tbody>
</table>

*Does not include areas under forest management

Few shade trees are perfect specimens. As trees become large and old, they often become defective in one or several ways. The person making an appraisal must consider the condition of the tree and judge how nearly each tree approaches a perfect specimen. With respect to condition of the tree, the ISA suggests five percentage classes with values ranging from 100 percent to 20 percent.

**Guide for Judging the Condition of a Shade Tree**

<table>
<thead>
<tr>
<th>Trunk condition:</th>
<th>Sound and solid (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sections of bark missing (3)</td>
<td></td>
</tr>
<tr>
<td>Extensive decay and hollow (1)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Growth rate:</th>
<th>More than 6-inch twig elongation (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2- to 6-inch twig elongation (2)</td>
</tr>
<tr>
<td></td>
<td>Less than 2-inch twig elongation (1)</td>
</tr>
</tbody>
</table>
Structure:  
- Sound (5)
- One major or several minor limbs dead (3)
- Two or more major limbs dead (1)

Insects and Diseases:  
- No pests present (3)
- One pest present (2)
- Two or more pests present (1)

Crown Development:  
- Full and balanced (5)
- Full but unbalanced (3)
- Unbalanced, lacking full crown (1)

Life Expectancy:  
- Over 30 years (5)
- 15 to 20 years (3)
- Less than 5 years (1)

Total Points

Determining Condition Class (Using Total Points Above)

<table>
<thead>
<tr>
<th>Total Points</th>
<th>Condition Class</th>
<th>Condition Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>26-23</td>
<td>Excellent</td>
<td>80-100</td>
</tr>
<tr>
<td>22-19</td>
<td>Good</td>
<td>60-80</td>
</tr>
<tr>
<td>18-14</td>
<td>Fair</td>
<td>40-60</td>
</tr>
<tr>
<td>13-10</td>
<td>Poor</td>
<td>20-40</td>
</tr>
<tr>
<td>9-0</td>
<td>Very Poor</td>
<td>0-20</td>
</tr>
</tbody>
</table>

Basic Formula Method of Evaluation

The procedure: Determine the diameter of the tree taken 4 1/2 feet above ground level. Calculate the cross-section area of the trunk in square inches by squaring the diameter and multiplying by 0.7854. The resulting figure is then multiplied by the dollar value per square inch ($27) to determine the basic dollar value. The basic dollar value is then subjected to percentages allotted to species, condition and location to give the monetary value of the tree.

Computing the Value of Tree by Basic Formula Method

diameter squared (0.7854) ($27) (species percentage) (condition percentage) (location percentage) = Value of Tree

Any means or formula for evaluating shade trees must be flexible. No hard and fast rules can be set up that will hold up in all cases. The judgment and opinions of the appraiser are always a factor in determining the value.
CONDUCTING A GROUND SURVEY
(Adapted from the International Society of Arboriculture)

The ground survey is one of the most basic methods for gathering urban forestry data. Ground surveys are used to gather the baseline data for tree inventories.

Objective:
Students will learn how to conduct a survey of trees in the community.

Materials:
Guidelines for conducting a ground survey
Paper and pencil
Maps of the areas to be surveyed
Measuring equipment (varies with objectives - may include Biltmore stick, tape measures, rangefinders, GPS receivers, etc.)

Procedure:
1. Identify areas in the community to be surveyed and obtain area maps.
2. Survey the trees in the area using the following survey methods outlined by the International Society of Arboriculture, http://www.isa-arbor.com. Record the location of the trees and measure various tree characteristics, including species, age, size, health, and damage factors. Persons that specialize in forest survey methods (e.g., university forestry department faculty, forestry consultants, state and federal forestry staff) can be consulted before undertaking a forest survey.

Look specifically for canopy dieback, improper pruning practices, prohibited practices (vandalism, posted signs), specific disease and pest problems, tree type, trunk diameter, and planting site characteristics.

The use of hand-held GPS receivers provides a means to determine tree or plot coordinates in the field.

Some common measurements recorded in foot surveys are described below.

1. Tree size. Measurements of tree size can include such measurements as tree canopy spread, diameter at breast height (DBH), and tree height. Within species, DBH is generally correlated with tree height and age, but due to the influence of site conditions on tree growth rate, DBH may not always be a good indicator of tree age.
2. Canopy cover. Canopy cover provided by individual trees can be estimated by measuring the maximum canopy diameter and a second diameter at a right angle to the first. Canopy area can then be calculated using the formula for the area of an ellipse, i.e.,

\[ \text{Area} = \pi \times r_1 \times r_2 \]

where \( \pi = 3.14159 \), and \( r_1 \) and \( r_2 \) are the two radii (i.e., half the diameters). If tree canopies are symmetrical, a single diameter can be measured and the formula for the area of a circle (\( \pi \times r^2 \)) is used. The total area covered by tree canopy can be divided by the area of the site to obtain percent canopy cover. This methodology works best for areas with non-overlapping tree canopies, such as parking lots or other relatively open areas.

3. Tree diameter (DBH). Tree trunk diameter at breast height (4.5 ft height if English units are used) is one of the most commonly measured tree size statistics.

4. Tree height. There are many methods for measuring tree height. Tree height can be measured directly with a calibrated measuring pole or indirectly through trigonometric relationships by using a clinometer or a similar device. Many websites describe methods for measuring tree height. Five easy methods for measuring tree height are given at the Woodland Restoration for Wisconsin Schools, Earth Partnership for Schools Program, University of Wisconsin-Madison Arboretum website http://wiscinfo.doit.wisc.edu/arboretum/woodland/tree_height.htm.

Evaluating tree condition as good, fair, or poor. The USDA Forest Service Inventory and Analysis program has detailed standardized methods for rating tree condition. Illustrated manuals describing these methods are available online at . The Neighbourwoods inventory program, are available on the Internet at http://www.forestry.utoronto.ca/urban/community/neighbourwoods.html includes scales for evaluating the following conditions: unbalanced crown, weak or yellowing foliage, defoliation, dead or broken branches, poor branch attachment, lean, pruning scars, basal/trunk scars, conks, rot/cavity, cracks, girdling roots, exposed surface roots, trenching/grade change.


Conflicts that develop between trees and infrastructure are often evaluated in ground surveys. The proximity of overhead wires, buildings or other structures, other trees, traffic signs, and sidewalks and curbs can all require management actions to maintain public health and safety or tree health.