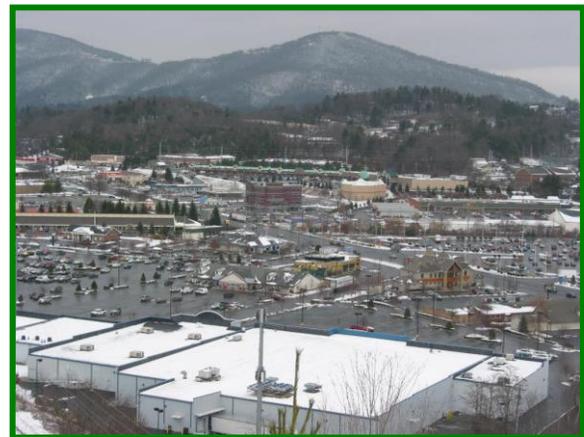


# *Urban Forestry Master Management Plan*

Town of Boone, North Carolina



Adopted by  
Boone Town Council  
October 15, 2009

**DAVEY**   
**RESOURCE GROUP**  
A Division of The Davey Tree Expert Company

# ***Urban Forestry Master Management Plan***

***Town of Boone, North Carolina***

Adopted by  
Boone Town Council  
October 15, 2009

Prepared for  
**Town of Boone**  
1510 Blowing Rock Road  
Boone, North Carolina 28607  
828-268-6960

Prepared by  
**Davey Resource Group**  
1500 North Mantua Street  
Kent, Ohio 44240  
800-828-8312

# Table of Contents

---

Executive Summary .....	iv
Background and Purpose .....	iv
Vision .....	iv
Major Goals .....	v
Major Recommendations .....	vi
Implementation.....	vi
Benefits.....	vi
1.0 Introduction .....	1
1.1 Vision Statement of the Urban Forestry Master Management Plan.....	3
1.2 History of Boone’s Urban Forest .....	4
1.2.1 Development of Urban Forestry in Boone.....	5
1.3 Benefits and Values of the Urban Forest.....	6
1.3.1 General Benefits and Values.....	7
1.3.2 Boone Tree Benefits and Values.....	7
2.0 Public Process.....	10
2.1 Stakeholders’ Public Meeting .....	10
2.2 Interviews .....	10
2.3 Questionnaire .....	10
3.0 Review Existing Plans and Regulations .....	11
3.1 Plans .....	11
3.1.1 2006 Comprehensive Plan Update.....	11
3.1.2 Boone Master Tree Plan .....	16
3.1.3 Tree Maintenance Plan .....	19
3.1.4 Boone Smart Growth Audit .....	20
3.2 Regulations.....	21
3.2.1 Unified Development Ordinance .....	21
3.2.2 Other Boone Ordinances.....	24
4.0 Current Tree Management Structure .....	25
4.1 Town Organization and Urban Forestry Management Responsibilities .....	25
4.1.1 Development Services Department.....	25
4.1.2 Public Works Department.....	26
4.1.3 Mayor and Town Council .....	26
4.2 Analysis of Current Tree Management Structure.....	26
4.2.1 Budget.....	26
4.2.2 Policy .....	27
4.2.5 Political Support .....	27
4.3 Management Structure Recommendations.....	27
4.4 Reserved.....	29
5.0 Tree Inventory Analysis and Assessment of Tree Canopy Cover .....	30
5.1 Tree Inventory Analysis .....	30
5.2 Assessment of Tree Canopy Cover .....	31
5.3 Creating and Maintaining a Tree Inventory .....	36

5.4	Using Tree Benefit Models .....	36
5.4.1	i-Tree Eco .....	37
5.4.2	i-Tree Streets.....	38
5.4.3	Summary of Tree Benefit Models.....	38
6.0	Urban Forestry Management Recommendations .....	39
6.1	Risk Tree Management .....	39
6.1.1	Priority Tree Maintenance .....	39
6.1.2	Useful Life .....	39
6.1.3	Priority Tree Maintenance Summary .....	40
6.2	Mature Tree Care .....	40
6.2.1	Routine Pruning Program .....	41
6.2.2	Small Growth-Habit Trees.....	41
6.2.3	Five-Year Cycle.....	42
6.2.4	Fertilization.....	42
6.2.5	Irrigation .....	42
6.2.6	Insect and Disease Control .....	43
6.2.7	Cabling and Bracing .....	43
6.3	Young Tree Care .....	44
6.3.1	Training Pruning Program .....	44
6.3.2	Three-Year Maintenance Cycle .....	45
6.3.3	Mulching.....	45
6.3.4	Watering .....	46
6.3.5	Training of Personnel.....	46
6.4	Tree Planting .....	46
6.4.1	Developing an Effective Tree Planting Program .....	46
6.4.2	Tree Species Diversity .....	46
6.4.3	Tree Species Selection.....	47
6.4.4	Tree Planting Process.....	47
6.4.5	Tree Mulching.....	48
6.4.6	Tree Fertilization.....	48
6.4.7	Tree Pruning .....	48
6.4.8	Tree Purchases .....	48
6.4.9	Master Tree Planting Plans and Designs .....	49
6.6	Future Risk Tree Management.....	50
6.6.1	Addressing Disease and Insect Monitoring .....	50
6.6.2	Emergency Response.....	51
6.7	Tree Preservation.....	52
6.7.1	Legislation .....	52
6.7.2	Tree Preservation Ordinances.....	52
6.7.3	Riparian Setbacks and Easements.....	53
6.7.4	Conservation Development.....	53
6.7.5	Conservation Easements and Donations.....	54
6.7.6	Create a Tree mitigation Site.....	54
6.7.7	Historic Tree Designation.....	54
6.7.8	Construction Damage and Tree Preservation.....	55

6.8	Educational Tools.....	60
7.0	Funding Sources.....	61
7.1	Establish a Boone Tree Bank.....	61
7.2	Other Funding Tools.....	63
8.0	Management Goals.....	65
8.1	Major Goal Areas, Statements, and Objectives.....	65
8.2	Goals, Objectives, and Recommendations.....	68
9.0	Conclusion.....	70
9.1	Management Goal Areas and Key Recommendations.....	70
9.2	Plan Implementation.....	71

## **Figures**

1.	Canopy Coverage in Boone.....	36
----	-------------------------------	----

## **Tables**

1.	Town of Boone Canopy Coverage.....	34
2.	Town of Boone Canopy Coverage by Zoning Class.....	37
3.	Town of Boone Canopy Coverage by Slope Class.....	38
5.	Symptoms and Signs of Construction Activity Damage.....	60
6.	Major Construction Impacts and Methods to Minimize Damage.....	61
7.	Goals, Objectives, and Recommendations.....	68

## **Appendices**

- A. Definitions
- B. Interview Questions and Project Review
- C. Tree Fertilization, Planting, Prune, Removals Specifications
- D. Tree Planting and Pruning Guidelines
- E. Tree Emergency Manual For Public Officials
- F. i-Tree Storm Information
- G. Contracting Tree Work

# Executive Summary

---

## Background and Purpose

The loss of trees and canopy cover during recent development on steep hillsides within Boone has created much interest and has motivated the Town to seek an analysis of its urban forest and urban forestry management program and develop a professional management plan to protect and enhance this resource. As in many American communities, city leaders and urban forest stakeholders in Boone question whether or not the current governmental structure, organizational values, and municipal resources are sufficient to support the rational and effective management of the urban forest.

Therefore, the Town of Boone has taken the proactive step of creating an *Urban Forestry Master Management Plan*. This Plan intends to provide strategies, goals, policies, standards, and actions to protect, enhance, expand, and preserve the tree canopy for the benefit of the community. The Plan will help coordinate and improve the Town's tree management in an equitable, economic, and sustainable manner. Moreover, the Plan will be a valuable strategic planning tool and serve as a road map in recovering the loss of tree canopy.

This Plan was systematically developed by a comprehensive review of existing Town ordinances, specifications and standards, and other master tree planting plans, through interviews with key Town staff and leaders, using public participation input, analyzing inventory data and field observations, and by applying national arboricultural standards and best management practices. This is a customized *Urban Forestry Master Management Plan* for the Town of Boone based on local conditions, resources, and priorities.

## Vision

The Town of Boone's *Urban Forestry Master Management Plan* is both a current management document and a long-term planning tool. Initially, the Plan will help coordinate and improve the Town's tree management actions in an equitable, efficient, and sustainable manner and focus on applying current arboricultural standards and practices to municipal tree care and planting efforts. In the long-term, the Plan will be a valuable strategic planning tool, serving as a road map to guide the growth and progress of the Town's comprehensive urban forest management program.

The *Urban Forestry Master Management Plan* takes its vision, in part, from the *2006 Comprehensive Plan Update*, *Boone Master Tree Plan*, and *Boone Smart Growth Audit 2007*. All of the documents reflect the Town's desire to retain a high quality of life by focusing on actions to increase the benefits and values of trees, and to improve the responsible management of Boone's urban forest. The Tree Board, Town staff, elected officials, and citizens have this vision for the future of the Town's urban forest:

### **Urban Forestry Master Management Plan Vision Statement**



*The Town of Boone will have a safe, healthy, and diverse tree canopy by promoting tree preservation and planting within the Town.*



*With the use of professional urban forestry leadership and staff, appropriate legislation, efficient management of Town resources, and public education and support, the Town's future urban forest will be viewed as an important community asset. It will support and benefit all citywide programs, goals, and mandates and the citizen's well-being.*



*The urban forest will uniquely define The Town of Boone's character, and be a major factor in its continued growth and livability.*

## Major Goals

The overarching goals of Boone's *Urban Forestry Master Management Plan* is to guide the Town's efforts to recover the loss of tree canopy and enhance all tree-related benefits by recommending strategies and actions to improve the Town's urban forest management in an equitable, economic, and sustainable manner. The *Urban Forestry Master Management Plan* seeks to be used along with the Land Use Master Plan and will achieve its goals by recommending strategies, goals, policies, standards and actions to protect, enhance, expand, and preserve the tree canopy for the benefit of the community.

Through public participation, input from Town staff, and a detailed analysis of urban forestry conditions, five management goal areas emerged as priorities for Boone:

### 1. **Tree Planting and Increased Forest Canopy Cover**

Boone's canopy cover has been estimated at 34.7%, and it is rapidly disappearing due to forest removal on private property and lack of new and replacement tree planting on public and private properties. Without an adequate forest canopy cover, Boone will not realize the many tangible and intangible benefits trees provide, and the character of the Town will suffer.

### 2. **Improved Tree Planting/Protection Legislation and Policies**

The Town should review and improve ordinances, guidelines, and policies regarding tree planting and tree and forest protection, and create or enact new legislation and policies as needed. These policies will serve as an official statement by the Town regarding the importance and value of trees in the community.

### 3. **Expanded Education and Public Relations**

Citizens, businesses, Town staff and leaders, and developers need continued education and marketing targeted to increase their awareness of the benefits of trees. They need to be aware of the availability of Town resources and the various ways they can become more involved in the urban forest management program and be a part of the solution.

### 4. **Improved Funding**

Critical to the program's success is adequate funding.

### 5. **Improved Urban Forest Maintenance**

Proper and timely tree maintenance is required to maximize tree benefits, increase service life, improve aesthetics, and ensure public safety. Maintenance programs are critical to the survival, vitality, and growth of existing trees and of newly planted trees.

## Major Recommendations

The *Urban Forestry Master Management Plan* presents recommendations in each major goal area and outlines programs and procedures for achieving success on small and large task items. The major recommendations for reaching the Town's goals include:

1. Achieve an overall tree canopy cover of 40% by a combination of updating and implementing the *Boone Master Tree Plan*, revising current legislation, enacting new legislation, creating incentives for private property owners to plant trees on private properties, and ensuring there is adequate funding for tree planting and maintenance.
2. Improve Town tree planting/protection legislation by reviewing and amending, as needed, the Boone Unified Development Ordinance, and Section 99 of the Town Code. Create new technical standards as a document separate from the ordinances and create a new tree ordinance that clearly states the Town's responsibility for public trees.
3. Continue public and citizen urban forestry outreach efforts, and create an educational program for elected officials and Town employees. Market the urban forestry program with regular presentations at conferences and to local groups.
4. Support and seek new public and private funding sources to support a comprehensive urban forestry program.
5. Implement and expand various tree maintenance programs, and conduct a complete public tree inventory every ten years using a tree data software program to manage the data. Train employees and use current and accepted best management practices and arboricultural standards.

## Implementation

The recommendations made in this Plan are intended to be considered and implemented over a period of ten years. The results of the Plan's implementation, in relation to the overarching goal and final measurable result of achieving an average of 40% canopy cover for the Town, may take 20 years or more.

Trees are long-lived organisms. Planting trees today will provide benefits for future generations of Town citizens. However, by having systematic tree planting and maintenance programs in place, and by having adequate funding, staffing, regulations, and public education resources today, the future public tree population and overall urban forest will be expanded and sustainable.

Boone can achieve a 40% canopy cover. Using the analysis and recommendations of the Plan, the Town's rights-of-way, parks, greenways, and other public properties can be planted to increase canopy cover. New and existing residential and commercial developments can be required and encouraged to plant more trees. Using computer modeling programs, tree planting efforts can be measured to predict the levels of canopy cover in various areas; an acre of newly planted oak trees will not have a large collective canopy now, but in 20 years the change can be dramatic.

## Benefits

Boone's urban forests are municipal assets that appreciate over time because they are alive and growing. They provide tangible and intangible benefits to the Town and its citizens. Because of their significance to the environmental, social, and economic well-being of the Town, trees and the urban forest should be professionally managed and protected to preserve them now for all citizens and to expand them for future citizens.

## 1.0 Introduction

---

Municipal governments across the country have begun to understand the importance of their role in the proper management, control, and protection of the natural environment. They now realize that in addition to serving the community by providing economic development, public safety, social services, and other basic municipal programs, elected officials and municipal staff are now being challenged, and even mandated by state and federal government, to take the lead in solving the problems of air pollution, water quality, stormwater control, solid waste disposal, wildlife protection, and other environmental issues.

The Town of Boone realizes it must respond to a growing list of environmental concerns to protect the quality of life in their community while simultaneously ensuring growth and complying with environmental regulations.

The urban forest within Boone may have once been considered only an aesthetic resource, but can now be looked to as a major component in the Town's plan to comply with environmental regulations, increase development, and maintain a high quality of life. The Town's *2006 Comprehensive Plan Update* contains several references to preserving and enhancing the community forest in Boone, including the implementation of the *Boone Master Tree Plan*. This comprehensive tree plan was developed in 1995 to provide detailed plans for new street tree plantings, with recommendation for parks, greenways, and the downtown area.

The loss of trees and canopy cover during recent development on steep hillsides within Boone has created much interest and has motivated the Town to seek an analysis of its urban forest and urban forestry management program and develop a professional management plan to protect and enhance this resource. As in many American communities, city leaders and urban forest stakeholders in Boone question whether or not the current governmental structure, organizational values, and municipal resources are sufficient to support the rational and effective management of the urban forest.

Therefore, the Town of Boone has taken the proactive step of creating an *Urban Forestry Master Management Plan*. This Plan intends to provide strategies, goals, policies, standards, and actions to protect, enhance, expand, and preserve the tree canopy for the benefit of the community. The Plan will help coordinate and improve the Town's tree management in an equitable, economic, and sustainable manner. Moreover, the Plan will be a valuable strategic planning tool and serve as a road map in recovering the loss of tree canopy. Definitions of many terms used within this Plan are found in Appendix A.

With professional guidance and assistance from Davey Resource Group, Boone's Tree Board, Town staff, elected officials, and citizens worked together to develop the Plan. A summary of the objectives designed to reach the Town's goals for this Plan includes:

1. Review and analyze the Town's current urban forestry data, planning policies, development regulations, construction standards, master tree plans, and other useful documents and information.
2. Perform on-site surveys of public trees on streets, in parks, universities, and other areas as needed or directed.

3. Conduct interviews with Town personnel, elected officials, various commission members, and other key stakeholders.
4. Produce a draft version of the Plan for review and comment.
5. Complete the final version of the Plan.

The following sections of the *Urban Forestry Master Management Plan* present the results of the analysis, interviews, and public input throughout this project. The recommendations made in this Plan are based on the conclusions of the analysis and input in combination with urban forest best management practices and current arboricultural standards.

The urban forest, as a municipal asset, is as important to Boone's economic and political viability as are water and sewage facilities, transportation systems, and community support services. The quality and availability of all these assets are indicators of Boone's ability to encourage people to live and support businesses to prosper within the Town limits.

The value of Boone's public and private urban forest can be calculated using several models and methodologies. All would indicate that trees provide significant benefits to Boone's residents. Beyond simply dollars and cents, the Town should increase and be actively engaged in urban forest management and public education for both philosophical and practical reasons. Like other towns, Boone is challenged to quickly dispel the persistent belief held by citizens, developers, and staff that the Town exists separate from nature rather than within it, and that the hillsides, forests, and streams are individual features rather than a connected ecosystem. This belief has had enormous consequences for how Boone has developed thus far, and changes in this attitude will positively affect how the Town plans its future; designs and builds the roads, neighborhoods, and commercial areas; addresses regulated environmental issues; and ultimately manages the urban forest.

Boone's *Urban Forestry Master Management Plan* is a starting point and guide for viewing and using the urban forest to accomplish the many goals of recent planning efforts, to secure a better future, and to maintain the charm, history, and livability that are hallmarks of Boone.

## 1.1 Vision Statement of the Urban Forestry Master Management Plan

The Town of Boone's *Urban Forestry Master Management Plan* is both a current management document and a long-term planning tool. Initially, the Plan will help coordinate and improve the Town's tree management actions in an equitable, efficient, and sustainable manner and focus on applying current arboricultural standards and practices to municipal tree care and planting efforts. In the long term, the Plan will be a valuable strategic planning tool, serving as a road map to guide the growth and progress of the Town's comprehensive urban forest management program.

The *Urban Forestry Master Management Plan* takes its vision, in part, from the *2006 Comprehensive Plan Update*, *Boone Master Tree Plan*, and *Boone Smart Growth Audit 2007*. All of the documents reflect the Town's desire to retain a high quality of life by focusing on actions to increase the benefits and values of trees, and to improve the responsible management of Boone's urban forest. The Tree Board, Town staff, elected officials, and citizens have this vision for the future of the Town's urban forest:

### ***Urban Forestry Master Management Plan Vision Statement***



*The Town of Boone will have a safe, healthy, and diverse tree canopy by promoting tree preservation and planting within the Town.*



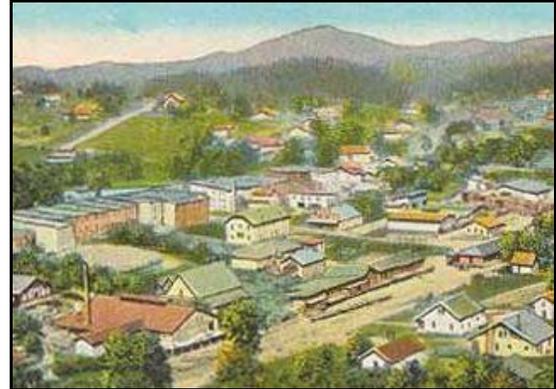
*With the use of professional urban forestry leadership and staff, appropriate legislation, efficient management of Town resources, and public education and support, the Town's future urban forest will be viewed as an important community asset. It will support and benefit all citywide programs, goals, and mandates and the citizen's well-being.*



*The urban forest will uniquely define The Town of Boone's character, and be a major factor in its continued growth and livability.*

## 1.2 History of Boone's Urban Forest

The Town of Boone is located in Watauga County, North Carolina. Its elevation of 3,333 feet above sea level makes it the highest elevation town (over 10,000 in population) in the eastern United States. Most of the developed part of Town is located in a valley that is surrounded by forested mountains reaching 4,000 feet in elevation. Nearby Howard Knob reaches over 4,400 feet. This prominent topography creates a strong identity for the Town.



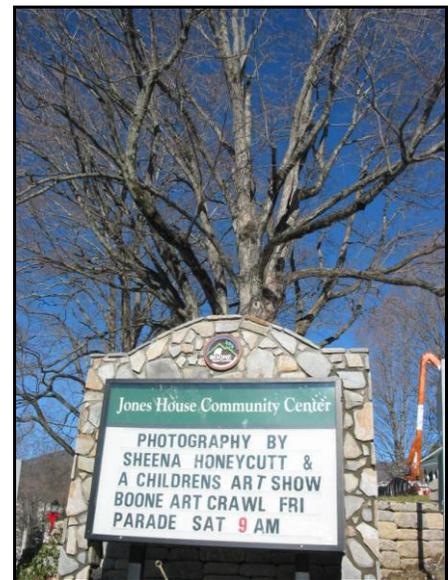
The Town was incorporated in 1872 and takes its name from Daniel Boone, a one-time resident. Early efforts were sought to preserve historic trees around Town, including a large-diameter oak (*Quercus* spp.) located near the site of Daniel Boone's home. By 1907, the Town had a well-established street system with several buildings in the valley and farms located along the edge of the Town stretching to the adjacent steep hillsides.

The Town has since grown in size and now has a population of over 14,000 residents. It is known as a university town, health services center, and market center, providing services to its residents and thousands who live in the nearby hills. Many refer to it as the "Heart of The High Country".



Boone's modern urban forest is a combination of the preserved historic trees, plantings that occurred in the developed areas of Town, and the surrounding steep slopes with prominent stands of second growth white pine and mixed hardwoods. Many large trees still exist in Town and include the large sugar maples (*Acer saccharum*) located in front of the Jones House Community Center in downtown.

The Town of Boone is not only at the crossroads between mountains and lowlands, town and country, but it is also at the crossroads of preserving its past and ensuring its future. Watauga County and Boone are both experiencing rapid growth. Both are highly prized for home sites by those at retirement age and by college students as the University continues to grow in size. While the Town expects and welcomes the growth, there are mounting concerns about how to protect the elements that gave Boone its character, charm, and quality of life, and how to preserve them for current and future citizens. The goal is to avoid destroying the very thing that attracts people to live, work, and stay in Boone.



### 1.2.1 Development of Urban Forestry in Boone

Protecting and preserving the Town's urban, suburban, and rural trees and forests is an important concern of Town leaders and citizens. Historically, this valuable resource has been dramatically reduced and is currently threatened by development and urban growth pressures within the Town and in the surrounding County.

Boone has long valued its urban forest resources. For over 15 years, the Town has been designated a Tree City, USA by the National Arbor Day Foundation and has achieved the Foundation's Growth Award for the last four years.

Many public areas dedicated to trees and other plants have been established in Boone. In 1966, the Daniel Boone Native Gardens were established. This three-acre site, with a display of native trees, shrubs, and wildflowers, is maintained by the Garden Club of North Carolina. The Town maintains the adjacent Daniel Boone Hill site as an open space with an arboretum of tree species not normally found in the area. It was developed in cooperation with North Carolina State University and the North Carolina Urban Forestry Council.



Tree planting along public streets and greenways increased in the 1980s as the Town planned for the planting of trees in the downtown area. The local Chamber of Commerce's Community Development Committee has supported other tree planting projects including those along State Farm Road and U.S. 321. A number of other groups have been involved with plantings along area greenways.

In 1989, the Community Appearance Commission recommended new regulations that required new developments to plant trees. The Town Council adopted the recommendations and included them as part of the Unified Development Ordinance. Many of the required plantings make a definite impact on the Town's landscape.

In the early 1990s, the Town's Community Appearance Commission recommended the creation of a plan for trees within Boone that would include an updated tree inventory and a planting plan. In that same period, the update of the *Boone Comprehensive Plan* included language about trees within the 17 listed objectives. In 1995, a *Boone Master Tree Plan* was prepared and included tree planting recommendations for 15 streets and 6 areas in Boone. The Plan included maps that showed the specific locations of recommended tree species at each site.

The Town's Tree Board was created by ordinance in 1998 and consists of six members. It serves in an advisory capacity to the Town Council and the Community Appearance Commission. It is given authority to make studies and recommend plans, goals, and other objectives relating to the urban forest of the Town.

The *Town of Boone Unified Development Ordinance*, adopted in 1998, established Viewshed Protection Districts. These Districts were meant to reduce tree clearing and minimize the visual impact of land development activities within areas that were within view of major traffic corridors and at least 100 feet in elevation above the corridor.

Additional components within the *Town of Boone Unified Development Ordinance* created Landscape Standards and a Guide for Landscaping that included general information about Tree Preservation and Care During Construction.

Boone's *Comprehensive Plan* was updated again in 2006 and included recommendations for policies that expand the scope and effectiveness of the Town's street tree planting program, and implement Boone's *Street Tree Master Plan*. It also recommends continuing to support the Town's tree preservation standards and to evaluate the effectiveness of the tree regulations since their establishment and amend them as necessary.

During the period 2004 through 2008, Boone received the Tree City USA Growth Award by achieving significant milestones in its urban forestry program. In 2004, the Town created the position of Urban Design Specialist. This position has responsibilities as the Town's professional tree manager. In 2005, the Urban Design Specialist increased communication efforts by distributing brochures about tree care and tree topping to garden centers and nurseries. The Tree Board also obtained a hand-held computer that was capable of assisting the Urban Design Specialist with tree inventory and mapping needs. In 2006, a new section was added to the Town's ordinances to effectively enforce improper pruning, and the Town developed a leaf composting and recycling program for residents. Communication efforts were again emphasized in 2007, as a Tree Preservation Award was established and presented to members of the development community. The ordinance was again updated with additions that helped enforce anti-topping efforts and improved quality of tree work by adding standards developed by American National Standards Institute (ANSI).

Also in 2007, the Town commissioned a *Boone Smart Growth Audit* that contains an assessment of, and recommendations for dealing with, rapid growth and development. Among its recommendations was a revision of the tree and landscape protection standards. The audit suggested that protection of woodlands and canopy was often more advantageous than protection of individual trees.

A history of urban forestry in Boone would not be complete without mentioning the impact of Appalachian State University. Many significant and historic trees have been preserved as the campus grows, and new plantings are well designed and maintained by a staff of arborists.



### 1.3 Benefits and Values of the

## Urban Forest

### 1.3.1 General Benefits and Values

Collectively, the trees along streets, in parks and yards, by streams, on farms, and in other open spaces make up Boone’s urban forest system. Whether they are native, young saplings, newly planted landscape trees, or mature shade and woodland trees, the whole forest canopy contributes to other efforts that strive to make the Town a better, safer, more beautiful place to live, work, and play.

Trees play an important role in Boone, beyond providing people shade on a hot day, seasonal beauty, or a place for wildlife to thrive. Trees can:

- Absorb and filter air pollution.
- Reduce energy consumption by shading homes and buildings.
- Moderate stormwater flow and reduce flooding, prevent soil erosion, and stabilize hillsides.
- Improve water quality by buffering ponds, streams, and rivers from pollutants.
- Increase property values and help businesses attract customers and retain employees.

During the process to develop the Plan, citizens and key stakeholders clearly expressed their deep appreciation for the value of trees in the Town.

### 1.3.2 Boone Tree Benefits and Values

The *2006 Comprehensive Plan Update* details three main *policy areas* that “establish a foundation for on-going planning to the year 2010.” Each policy area includes topics that will individually and collectively help Boone achieve a better and balanced future. Public landscape trees and forest ecosystems support and enhance each of these *policies* and can contribute greatly to their successful implementation.

1. **Policy Area: *The Economy***—Boone’s economic base has shifted from one of a traditional industrial and agricultural sector toward the service sector. The growth of Appalachian State University, Watauga Medical Center, and the tourism industry are prime examples of this shift. Trees and forests can support and enhance a community’s economic development plans and projects. Benefits and values trees provide to this policy area are as follows:
  - Technically sound hillside development will preserve natural beauty yet allow desired economic growth.
  - Effective buffering and landscaping with natural materials and trees can enhance development projects and encourage longer visits by shoppers in retail areas.
  - Development land values increase when trees are present.
  - Homebuyer interest and homeowner satisfaction are increased when trees are preserved and major landscape elements are already established at the time of occupancy.

- Trees and open space increase property values, tax revenues, income levels, real estate sales turn-around rates, jobs, worker productivity, the recruitment of buyers, and the number of customers in a given area and decrease unoccupied periods for apartment and commercial buildings.
- Including street trees in landscape design increases all property values.

2. **Policy Area: *Infrastructure***—Boone’s infrastructure policy area of the Comprehensive Plan includes the many issues surrounding environmental quality. Protection of watersheds, steep slopes, and ridges are two areas of prime importance to area residents. Trees and infrastructure are often perceived in conflict with each other; however, careful planning will allow a community to enjoy the benefits and services of each. Benefits and values trees provide to Infrastructure policy area issues are:

- Trees enhance transportation routes—sidewalks, streets, and walking trails—by contributing beauty and functionality, such as shade and shelter.
- Trees absorb, filter, and moderate air pollution from vehicles on transportation routes.
- Trees screen roads and walkways from other adjacent land uses, creating visual and noise buffers.
- Trees can reduce the amount of sediment that runs off developed and developing land.
- Trees efficiently serve the community as a “biogenic utility” and important infrastructure component by providing energy conservation, stormwater mitigation, and pollution moderation services even after accounting for planting and future maintenance costs.
- A comprehensive urban forestry program adhering to current industry standards and performing routine and preventive tree maintenance uses municipal funds more efficiently than a reactive-based management system.
- Proactive urban forestry management programs increase public safety and decrease municipal liability for tree risk situations.
- Trees make parks more desirable locations for recreational and leisure activities.
- Trees and forests offer educational and interpretive opportunities for park programs.

3. **Policy Area: *Community***—Boone serves as the economic, government, and education center of the region. As these community leadership roles have increased, the Town has tried to retain its identity as a small mountain town. Its appearance is important not only for quality of life issues for residents, but also for attracting desirable businesses. Benefits and values trees provide to this element of the Comprehensive Plan are as follows:
- Individual mature trees on historic sites are markers and living witnesses of significant events and places.
  - Trees and landscape are significant features of the Town’s lasting contributions to community design, such as roads, public buildings, and parks.
  - New tree planting can complement historic sites and preservation efforts.
  - Trees balance the built environment within the natural world.
  - Maintaining trees according to accepted industry standards can greatly improve a community’s overall appearance.
  - Planting trees along roadways can dramatically improve the streetscape.
  - A diverse urban forest can protect a community’s tree assets by reducing the risk of catastrophic losses from invasive pests.

## **2.0 Public Process**

---

A crucial element of developing the *Urban Forestry Master Management Plan* was soliciting information from key stakeholders and citizens of Boone. Stakeholder input was used to assist Davey in identifying opportunities, issues, actions, and goals for the Plan. A stakeholders' public meeting was held in the afternoon and evening of December 3, 2008, and interviews were held with elected officials, Town staff (Development Services and Public Works), and boards and commission members. Comments were solicited through a comment period and through a questionnaire. A Project Overview Handout and the questionnaire were provided to stakeholders at interviews and public meetings. Both are found in Appendix B.

### **2.1 Stakeholders' Public Meeting**

On December 3, 2008, a meeting was held to solicit input from the public. The meeting was held at the Town of Boone Council Chambers after newspaper notices were published. After a brief introduction and presentation of the management plan issues, an opportunity was provided for citizens to comment. Attendees included members of the development community, local arborists, Town Council members, and other interested citizens. Each participant was asked to complete a questionnaire and was provided a "Project Overview". Both documents are found in Appendix B.

### **2.2 Interviews**

To gather more insight about the Town's current operations, issues, and goals, interviews were conducted with Tree Board members, Town staff, and elected officials. Interviewed positions include: Mayor; Director of Development Services; Planning Supervisor; Urban Design Specialist; Director of Public Works; Facilities Maintenance Superintendent; and Landscape Specialist. Interview questions are included in the questionnaire found in Appendix B. Although individual comments gathered during the personal interviews are confidential, they provided valuable information that was used to develop the Plan.

### **2.3 Questionnaire**

Participants of the public meeting, and all Town staff and elected officials that were interviewed, were given questionnaires to provide additional feedback for the Plan. The questionnaire (included in Appendix B) was comprised of a set of general questions that were asked of all participants, and a "group-specific" set of questions for elected officials, Town staff, members of boards and commissions, and citizens and business owners.

## 3.0 Review Existing Plans and Regulations

---

An important preliminary task accomplished during development of the *Urban Forestry Master Management Plan* was the review of existing plans, regulations, and other documents that affect or are used in the management of Boone's urban forest. The following sections summarize the findings of the review of each plan and regulation, make appropriate recommendations, and suggest action steps for each document.

As Boone's *Urban Forestry Master Management Plan* was developed, the Town was also in the process of creating the *2030 Master Land Use Plan*. It is currently in the draft stage and was not reviewed for this project.

### 3.1 Plans

#### 3.1.1 2006 Comprehensive Plan Update

Originally prepared in 1993, *Boone's Comprehensive Plan* has been a policy-oriented document that establishes a foundation for on-going planning to the year 2010. The *2006 Comprehensive Plan Update* was approved by the Town Council on March 18, 2006 and details three main policy areas. Each policy area includes topics that will individually and collectively help Boone achieve a better and balanced future.

Section 1.3.2 of this *Master Management Plan*, *Boone Tree Benefits and Values*, provides a list of the benefits and values of trees in the three main policy areas.

Within each of the three policy areas, the *2006 Comprehensive Plan Update* identifies a set of Policy Categories that contain the Policies and Actions that were identified as statements of local government principle. Policies and Actions that are related to tree issues are identified below:

- 1. Policy Area: *The Economy***—Boone's economic base has shifted from one of a traditional, industrial, and agricultural sector toward the service sector. Appalachian State University, Watauga Medical Center, and the tourism industry are prime examples of this shift. While there is agreement that the area wants higher paying jobs, residents do not favor attracting any and all types of business and economic growth. This is especially true in the area of commercial and industrial development. Residents are only supportive if the new developments are appropriate and will not compromise the long-term environmental quality of the area.

##### ***A. Policy Category: Economic Development***

***Policy*** – *The Town shall protect and enhance a high quality of life, image, cultural amenities, and natural beauty as the most effective, long-term component of an economic development strategy.*

***Action*** – *Continue to evaluate and amend development regulations to help ensure aesthetic quality in the area and preserve the natural beauty of the area.*

***Action*** – *Adopt analytically sound, technically based hillside development regulations to preserve natural beauty.*

**Action** – Balance the benefits of economic development projects with special concern for environmental quality issues.

**Policy** – New firms and expanding businesses that complement the natural resources and beauty of the region shall be especially recruited and encouraged.

**B. Policy Category: Commercial Development**

**Policy** – Effective buffering and/or landscaping shall be provided where a large scale or automobile-oriented commercial or office use adjoins an existing planned residential use.

**C. Policy Category: Industrial Development**

**Policy** – Industrial development shall be located on land which is physically suitable and has unique location advantage for the industry. Advanced planning for the identification of such land shall be encouraged.

**D. Policy Category: Agricultural and Rural Development**

**Policy** – Farms and woodlands shall be recognized as an integral part of the planning area's open space system.

**Action** – Farms and woodland open spaces shall be conserved through a comprehensive rural area conservation strategy, to include rural area density standards, tax incentives, conservation easements, and other means. These areas should be considered in the planning for pedestrian ways, bikeways, greenways, and other open space needs.

**Policy** – Agriculture, forestry, and low-density residential activities shall be the preferred land uses in the Rural Area, as identified on the Growth Strategy Map. Urban level development shall not be encouraged in the Rural Area.

**Action** – Employ the Town's water and sewer extension policies to encourage a compact development pattern.

**E. Policy Category: Downtown**

**Policy** – A compatible design character for the downtown area, drawing upon the locality's original High Country small town features, shall be identified, reinforced, and supported to put forth a quality image and sense of place.

**Action** – Prepare an overall landscape strategy for the public right-of-way in coordination with private sector landscape treatments, e.g., street trees, planter boxes, planting beds.

2. **Policy Area: Infrastructure**—Boone’s ability to add new roads is limited by its location within a narrow valley. This creates strain and overloading on many existing roads. The maintenance of existing utilities, and their expansion to meet growing needs, suffer from the same geographic constraints. Maintenance and installation of overhead and underground utilities creates a conflict for space between wires, pipes, roots, and limbs. Stormwater management is yet another area that is constrained by the narrow valley that makes up Boone’s core. Development policies must be in place to assure that existing facilities are not strained to their limit before improvements can be made.

While geographic constraints are a problem for transportation development and utilities, that same geography creates multiple opportunities for the creation of parks, open space, and recreational opportunities. The surrounding forested mountains reaching nearly 1,100 feet above the Town create breathtaking views and are the major physical feature that identifies the Town.

The infrastructure policy area also includes the many issues surrounding environmental quality. Protection of watersheds, steep slopes, and ridges are two areas of prime importance to area residents. Policies and actions where the urban forest can play a feature or supporting role are:

**A. Policy Category: Utilities**

***Policy** – Long-range planning for a possible stormwater collection and treatment system shall be supported, including the development of financial and regulatory strategies.*

***Action** – Prepare a community-wide stormwater management strategy to address the future Implementation of NPDES Phase II program requirements.*

**B. Policy Category: Parks, Recreation, and Open Space**

***Policy** – Future park development and open spaces shall be planned to provide for the rational and equitable distribution of recreation and open space opportunities within the planning area. Public facilities shall be provided to address the unmet needs of area residents lacking access to university or private recreational facilities.*

***Policy** – Financial support shall be provided to the rehabilitation, upkeep, and expansion of existing facilities first, and to new facilities second.*

***Action** – Continue and enhance support for near term improvements to existing parks and facilities.*

***Policy** – In determining future sites for park, recreation, and open space facilities, multiple objectives for natural area conservation, visual enhancement, promotion of cultural and historic preservation, watershed and flood prone area protection shall be considered.*

***Action** – Consider development of a master parks plan which would incorporate multiple policy objectives.*

**Action** – Support the efforts to establish public green spaces and parks in the downtown business district.

**Policy** – Land acquisition for new recreation sites in advance of need shall be encouraged to achieve desirable locations at cost-effective levels.

**Action** – Prepare a long-range, community-wide master parks and recreation plan to identify long-term land acquisition needs in keeping with the growth of the community.

**Action** – Consider the establishment of a land dedication provision or fees in lieu of land dedication in the Town's development regulations. Coordinate such dedications fully with pedestrian, bikeway, or greenway space objectives.

**Action** – Prepare an information pamphlet identifying the tax advantages and process for making property and land easement donations.

**Policy** – Provision of open space and recreational facilities shall be encouraged in private developments and through intergovernmental and public/private partnerships.

**Action** – Employ the neighborhood planning process to identify neighborhood park and recreation needs.

**Policy** – The identification and appropriate development of a system of open space greenways within the planning area shall be encouraged for both recreational and alternative transportation purposes. The use of natural corridors such as streams, floodplains, and secondarily, man-made corridors such as utility and transportation rights-of-way and easements shall be emphasized.

**Action** – Prepare a greenways action plan with the full coordination, leadership, and input of a Greenways Citizen Action Committee.

### **C. Policy Category: Environmental Quality**

**Policy** – Development on ridgetops and excessive slopes shall be strongly discouraged. Where development is allowed, stringent performance standards shall be met.

**Action** – Continue working on the preparation of hillside and ridge-top regulations for consideration and adoption of Town Council.

**Policy** – Development activities in the 100-year floodplain or near lakes or streams shall be carefully controlled. If development must occur, low-intensity uses such as open space, recreation, and adequately buffered agricultural or forestry activities shall be preferred.

**Policy** – Runoff and drainage from development activities shall be of a quality and quantity as near to natural conditions as possible, with special emphasis given to critical watershed areas.

**Policy** – Development which preserves the natural features of the site, including existing topography, streams and significant trees, and vegetation shall be reflected in the Town’s Development Standards.

**Action** – Consider the use of innovative zoning techniques such as density bonuses and transfer of development rights in exchange for preservation of significant environmental features.

**Policy** – Recognizing the economic and environmental costs of commercial and residential stormwater runoff, innovative stormwater management techniques such as permeable sidewalks, driveways, and parking areas shall be encouraged.

3. **Policy Area: Community** — Boone serves as the economic, government, and educational center of the region. As these roles have increased, the Town has tried to retain its identity as a small mountain town. Its appearance is important not only for quality of life issues, but also for attracting desirable businesses. Recent increased needs for multi-unit housing has had a strong impact on the Town and its character.

**A. Policy Category: Community Appearance**

**Policy** – Measures to improve the effectiveness of grading, landscaping, and buffering standards for new and existing developments shall be encouraged.

**Policy** – The significance of street trees in providing visual relief, summer cooling, improved air quality, and livability shall be recognized through public policies and actions to encourage their planting and maintenance.

**Action** – Expand scope and effectiveness of the Town’s street tree planting program in close cooperation with student and citizen volunteer groups, power companies, and other groups.

**Action** – Implement Boone’s Street Tree Master Plan. Prepare an inventory of existing street trees and other significant trees within the urban area.

**Action** – Amend the Town’s site plan review standards to require new commercial and residential developments to plant in accordance with the Street Tree Master Plan and Walkways Long-Range Plan.

### ***B. Policy Category: Community Character***

***Policy*** – *The destruction of significant architectural, historic, scenic, natural, and archaeological resources in the planning area shall be discouraged.*

***Action*** – *Continue to support the Town’s tree preservation standards. Evaluate the effectiveness of the tree regulations since their establishment and amend them as necessary.*

The following recommendations are made that relate to the *2006 Comprehensive Plan Update*:

#### **Recommendations**

1. *The 2030 Master Land Use Plan (in draft form) should address the relevant community forestry topics included in the 2006 Comprehensive Plan Update.*
2. *Create a Policy Category within the “Infrastructure” Policy Area that is titled “Urban Forestry”. Add relevant policies that directly relate to improvement of the Town’s urban forestry program.*

### **3.1.2 Boone Master Tree Plan**

Boone’s Master Tree Plan was completed in 1995. While it is primarily a planting plan and guide, it provides general information about the Town’s tree planting history, an assessment of current conditions, and a map that identifies the acreage of forested areas in Boone. It also identifies 15 streets and 6 areas that are in need of new trees and provides detailed planting plans with locations and species identified. While the Plan has yet to be fully realized, other more recent planning documents support it and encourage its implementation. This includes the *2006 Comprehensive Plan Update* and the *Boone Smart Growth Audit 2007*.

The history section of the Plan identifies the establishment of significant public gardens, tree plantings on public roadways and greenways, and the landscaping and preservation of historic trees at Appalachian State University.

Current conditions of Boone’s landscape is described within forested areas—Daniel Boone Hill, Daniel Boone Native Gardens, downtown, street trees, and Appalachian State University.

An undated map of the forested areas within Boone indicates that 35% of the Boone town limits were forested (not including residential plantings and street trees). The outlying areas that encompass the Extra-territorial Jurisdiction were 80% forested. The author addresses the loss of forested areas on the surrounding hillsides and states that these areas represent a significant contribution to the ‘look’ of Boone.

The 1994 conditions of the remaining areas were addressed as follows:

*Daniel Boone Hill* – Owned and maintained by the Town, it has developed in to an unofficial arboretum. A list of tree species planted on the site in 1993 and 1994 is included. The list is mostly smaller-sized ornamental type of hardwoods.

*Daniel Boone Native Gardens* – Maintained and operated by the Garden Club of North Carolina. A list of tree species on the site is provided and includes a wide range of hardwoods and conifers.

*Downtown* – Bradford Pears (*Pyrus calleryana* ‘Bradford’) planted on the south side of King Street (on public right-of-way), while older trees are located along the north side (on private property). The older trees include large sugar maples (*Acer saccharum*) at the Jones House Community Center. Additional trees are needed as redevelopment occurs.

*Boone street trees* – Many street trees and landscape plantings are installed as new development occurs. Street trees create the most noticeable difference along the business corridors and in the office park areas. A list of tree species currently found along Boone’s streets is provided. Large gaps occur that will need to be addressed with additional plantings.

*Appalachian State University* – The University has arborists who manage the campus landscape. Sugar maple dominates the campus streetscape, although a wide variety of species are currently on campus.

The Plan then identifies and prioritizes 15 streets and 6 additional areas that are in need of additional tree plantings. Basic landscape plans are included for each streetscape and general planting recommendations, including species lists, are provided for the areas. Tree species were selected for specific site conditions and take into account the presence of overhead utility lines, wet areas, steep slopes, leaf litter, and visibility.

A general tree maintenance plan is included that identifies guidelines for tree care on existing trees and those that are proposed in the Plan. Tree planting details are included that are in need of updating.

Another brief section addresses regulatory recommendations and includes the following main points:

*Preservation* – This section recommends preservation of historic parking areas and building footprints (currently exempt from preservation). It also recommends tree preservation in special areas in Town such as steep slopes, waterways, entrance corridors, etc. The section also addresses improving pruning standards and increased retention standards for site clearing on new developments.

*Maintenance* – This section reiterates current requirements that maintenance is required for newly planted trees that are planted by ordinance regulations on developed sites. The Town has an inventory of required trees that have been planted and regularly inspects them to ensure compliance.

*Planting* – This section recommends that the Town pursue easements from adjacent property owners to allow new municipal tree plantings in high-priority areas. It also recommends that the “single-family home” exemption for tree preservation be lifted and that preservation requirements be applicable to all development activities. Subdivision regulations should be amended to require street tree plantings along all newly constructed streets. The Town’s overall canopy cover can be increased by additional plantings on the already existing arboretums and along existing greenways.

### **Recommendations**

1. *Continue to provide funding of the completion of the Master Tree Plan (high priority) and update the plan to achieve a 90% stocking level for street trees.*
2. *While the Plan is an excellent source of information about where to plant and what to plant, it needs to be updated and expanded in the maintenance and regulatory section. If updates are not made to the maintenance and regulatory sections, then it should be revised and titled the “Boone Tree Planting Master Plan”.*
3. *Include the use of current arboricultural and horticultural industry standards such as American National Standards Institute (ANSI) Z133 and A300.*
4. *Support the efforts of public and private arboretums. Their efforts increase canopy cover, but also serve as excellent educational opportunities.*
5. *Increase the Town’s canopy cover by planting trees along newly acquired easements along waterways.*
6. *Perform a complete public tree inventory of trees along streets and within mowed and maintained areas of parks, and include the results in an updated Urban Forestry Master Management Plan.*
7. *Utilize existing models such as i-Tree Streets or i-Tree Eco to calculate the benefits that trees are providing in Boone.*

### 3.1.3 *Tree Maintenance Plan*

The Town's *Tree Maintenance Plan* is a three-page document that provides general guidelines for maintenance of trees along roadside rights-of-way (existing trees), and the maintenance of newly planted trees recommended in the *Boone Master Tree Plan*. The guidelines include the following:

#### *Roadside Trees (existing)*

- All maintenance is performed in the interest of public safety.
- Visibility and clearance distances are maintained at intersections, curves, traffic signs, and street lights. Trees are pruned to a height of 14–16 feet.
- Potentially dangerous and/or dead trees and branches are removed.
- The Town avoids pruning of fruit trees and ornamentals, leaving this to adjacent property owners.
- Public relations are important as tree maintenance activities occur.
- Street trees are scheduled for a four- to six-year rotation that will require a five-person crew and a truck and chipper working four weeks a year.

#### *Newly Planted Trees*

- Tree planting occurs during the dormant season.
- Watering is performed the first year with a two-person crew and a truck-mounted, 300-gallon tank, pump, and hose.
- Water meter boxes have been purchased and will be installed in areas where Town plantings occur.
- Proper drainage is key when choosing locations for new trees.
- Fertilizer is applied to street trees on a regular basis.
- Inspections are performed regularly for pest problems and general health. “Integrated Pest Management” principles are followed.
- Structural pruning is performed at the time of planting. Dead and broken branches are removed over the next few years and additional structural pruning takes place.
- Guy wires are used, when needed, for new plantings and are removed within a year.
- Mulch is applied to Town trees annually in the spring.
- Grates and guards are maintained on sidewalk trees where present.
- Litter and leaf pick-up occurs where needed.

## **Recommendations**

1. Continue to make public safety a high priority in planning and implementing tree maintenance activities.
2. Require the use of current arboricultural and horticultural industry standards such as American National Standards Institute (ANSI) Z133 and A300. Include technical specifications that provide guidance on how to perform maintenance activities (Appendix C and Appendix D)
3. Include opportunities for educating citizens about tree care during maintenance of public trees. Develop small brochures or information sheets to distribute to residents and that answer “frequently asked questions.”
4. Perform a complete public tree inventory of trees along streets and within mowed and maintained areas of parks, and include the results in an updated Urban Forestry Master Management Plan. Inventory data should be stored in software that allows tracking of work history to determine whether maintenance occurs according to the planned cycle of four to six years. The maintenance plan should include information about updating the inventory data on a regular basis.

### **3.1.4 Boone Smart Growth Audit**

In 2007, the Town completed the *Boone Smart Growth Audit*, with the intent to assess current growth policies and implementation measures for the expressed purpose of revising existing plans, policies, and practices as may be necessary to promote accepted principles of Smart Growth within the desired context of Boone. The Audit produced 70 broad strategic initiatives related to policies and ordinances in Boone. The initiatives were developed after interviews with stakeholders and thorough reviews of existing regulatory and planning documents.

The 70 initiatives were arranged into a matrix, organized by Smart Growth Principle categories, priority, and implementing agency. The matrix also identifies other initiatives that the Audit initiatives should be coordinated with. Several are identified to coordinate with the upcoming *2030 Master Land Use Plan*, currently in the draft stage.

In the Open Space category, the Audit identified a need to revise tree and landscape protection standards. The deforestation of many areas within and near Boone is creating a negative impact on aesthetics and environmental systems. The Audit suggests emphasizing greater protection of forest canopy versus protection of individual trees. Benefits of the woodland protection approach include the following:

- Easier to administer with a smaller sized municipal staff.
- Consistent with environmental, stormwater, and air quality goals.
- Tree preservation is more successful when groups of trees remain.

Additional questions are raised about effective tree preservation ordinance language. They include the following:

- **Location:** Tree preservation ordinances should consider all trees on the site, not just those outside of the proposed building footprints. Giving protection status only to trees outside of a building footprint creates no incentive for designers to build around trees.
- **Amount:** Should the level of tree preservation be determined by numbers of trees,

or only a number of each species?

- **Mitigation:** When tree preservation is simply not feasible, a mitigation process should clearly spell out replanting requirements.
- **Protection During Construction:** Trees identified as protected must receive adequate measures to ensure that they are actually protected. Identification of root protection zones is important.

### **Recommendation**

1. Update current tree preservation language to reflect the preservation of tree stands versus individual trees.

## **3.2 Regulations**

Boone regulates its urban forest through a variety of legislation. Most legislation has been created and amended over time on the local level. The following is a discussion of the primary legislation and regulations affecting the urban forest in the Town.

### **3.2.1 Unified Development Ordinance**

The Town of Boone *Unified Development Ordinance* was adopted in 1977 and has been amended several times since then. It guides all development in the corporate boundaries of the Town as well as additional areas outside of the corporate boundary known as the planning jurisdiction area. It is the intent of the Town that the ordinance and its provisions implement the policies established in the Town's *Comprehensive Plan*.

While the Development Services Department is responsible for administration, review, inspection, and enforcement of its provisions, the Planning Commission, Community Appearance Commission, Tree Board, Board of Adjustment, and Town Council have key roles in enhancing the equity and effectiveness of the Ordinance.

The *Unified Development Ordinance* does recognize the value of trees and takes several measures to account for and protect them:

- **Article III, Part III, Sections 36-40. Tree Board.** A six-member Tree Board is established that has advisory authority to make studies and recommendations to the Council and Community Appearance Commission. The Board can also develop recommendations for policies, ordinances, procedures, plans, and other means for maintaining the Town's urban forest program. They can also develop educational programs and special projects.
- **Article IX, Part I, Section 160. Viewshed Protection District.** A Viewshed Protection District is established that limits land disturbance on areas that are at least 100 feet in elevation above major traffic corridors and visible from the corridor. The extent of land disturbance is partly a function of tract size. The ordinance requires that foliage and trees on these areas be protected.
- **Article XIII, Section 223. Cluster Development.** Cluster Development is permitted in areas where it will increase the protected area of the tract.

- **Article XIII, Section 224. Buffer Areas Required.** Buffer areas are required along all perennial waters. No vegetation removal in the buffer areas is permitted.
- **Article XVI, Part I, Section 285. Special Requirements for Land Disturbing Activities Involving Steep Slopes.** Special requirements are established for land disturbance on steep slopes. Perennial stream buffers that restrict tree removal are established.
- **Article XX. Landscape Standards.** Planting and preservation of landscape material is regulated in this Article. Screening and buffer planting requirements are included along with additional requirements described below.
- **Article XX, Section 365. Subdivisions.** Requires a tree survey in areas of land disturbance associated with new subdivisions. Survey must show species, location, and diameter of all trees 8 inches in diameter and greater. Trees with “drip lines outside the land disturbing limits associated with proposed streets, drainage, utilities and storm water management areas” are to be preserved.
- **Article XX, Section 366. Street Trees and Shrubs Along Dedicated Street.** Street yards are required to be between 10 and 25 feet wide. One 2½-inch caliper tree is required for every 30 feet along street frontage. Site triangle requirements are included.
- **Article XX, Section 370. Preservation of Existing Trees and Vegetation.** Preservation of groups of trees is recommended during development. Additionally, tree preservation requirements include the following:
  - Tree preservation guidelines provide credits for healthy preserved trees that can be used to satisfy planting requirements for buffers, street trees, and parking lots.
  - Preserved trees and the location of protective barriers must be shown on Landscape and Grading Plans. Preserved trees that die from construction activities will be replaced with the number of trees which were credited to the existing tree.
  - Trees with “driplines outside the building footprint” are to be preserved. (Subdivisions must refer to Section 365.)
  - A tree survey will be prepared and include species, location, and diameter of all trees 8 inches in diameter and greater on the site.
  - Barriers must be installed prior to grading that protects the dripline area of the tree. The barrier locations must be shown on submitted engineered plans.
  - Protected trees that die will be replaced using the replacement credits described above. If protected trees die as a result of construction, fines of \$100 per inch in diameter of the subject tree will be levied.
- **Appendix B of the Unified Development Ordinance.** A “Guide for Landscaping” that provides definitions and specifications for landscape plans, tree preservation, tree care during construction, tree planting, and tree maintenance.

## **Recommendations**

1. *Article XVI, Part I, Section 285. Special Requirements for Land Disturbing Activities Involving Steep Slopes. Require the protection of canopy coverage on steep slopes based on the amount of slope. Higher slopes require higher percent retention of canopy. This will also require making changes to Section 370, Preservation of Existing Trees and Vegetation. Preservation of canopy will support the recommendation made in the Comprehensive Plan and the Boone Smart Growth Audit. It will also support the viewshed requirements in Section 160 of the Unified Development Ordinance.*
2. *Article XX, Section 365, Subdivisions, and Section 370, Preservation of Existing Trees and Vegetation. Combine and re-write these sections to include definitions of woodlands (contiguous canopy of 5,000 square feet) and individual trees in non-woodland settings. All development activities should be treated equally with regards to canopy preservation. On sites proposed for development, require a tree survey of trees over 8 inches in diameter unless they are located greater than 50 feet away from disturbed areas (proposed).*

*Require delineation of woodland canopy areas and create a table of individual tree data. Require higher percent retention of tree canopy on sites with steep slopes versus sites with milder slopes. Require individual trees removed to be replaced on an "inch-for-inch" basis utilizing "adjusted diameter" that take into account a tree's diameter, species, and condition. Provide for mitigation of trees removed that exceed required rates of preservation. (Dollars paid in lieu of trees planted.) Exceeding preservation limits (and mitigation) are only allowed in cases where a site would be deemed unbuildable. Establish allowable limits to exceed requirements for exhibiting special need.*

*Delete references in the current ordinance to preserving trees that are outside of building footprints or land disturbance limits. The current language has no incentive for developers to preserve trees. These revisions support recommendations made in the Boone Smart Growth Audit.*

3. *Appendix B of the Unified Development Ordinance, Guide for Landscaping. Consider moving this technical reference of standards to a separate document referred to as "Tree and Landscape Guidelines." This technical reference can then be updated and edited without making changes to ordinances.*
4. *Consider the creation of a separate Tree Ordinance that references all or part of current ordinances in Boone that reference trees. This can be a difficult task to create and to maintain. But it will provide one clear document to view all tree related regulations in Boone. If a separate ordinance is not created, prepare a booklet with all tree-related ordinances "bundled" into one document. The Tree and Landscape Guidelines can be included with this document. Include sample tree surveys and tree preservation plans. This will help to standardize the type of products you review for permits and approval processes.*
5. *Establish a Tree Bank (an "account" within the Town's financial system) that can accept funds from fees, fines, and mitigation payments from tree-related activities. Funds can then be used to plant and maintain trees in Boone.*

### 3.2.2 Other Boone Ordinances

Boone's Town Code contains sections that impact trees on public property. The Code recognizes the value of trees and takes measures to account for and protect them. Section 99 is administered by the Public Works Department and assigns authority for trees on public rights-of-way and public property to the Town.

- **Section 99. Trees and Shrubs.** Trees and shrubs on public property are defined, and authority for them is assigned to the Town. They are protected from damage unless a permit is obtained. Violations carry a \$100 fine plus replacement of the tree.

#### **Recommendations**

1. *Section 99, Trees and Shrubs, should be revised to include fines that equal the full value of the tree as calculated by the appraisal methodology described in "Guide For Plant Appraisal", published by The International Society of Arboriculture.*
2. *Require a permit for any work on public rights-of-way or other public property that will potentially damage trees, including tree roots. Utility installations and many infrastructure repairs will damage tree roots and cause irreversible damage that may create a tree with excessive risk of collapse.*
3. *The permit need not be seen as a hindrance or obstacle to doing tree work or tree planting on public property, but rather more of an organized method of ensuring knowledge and communication between the **Administrator** and the party applying to do the work or planting. The permit would have the **Administrator** inspect the site prior to planting and give guidance as to proper species, size, and final location. For tree pruning and removals, the **Administrator** would give guidance on the appropriateness of the maintenance task and ensure proper arboricultural standards were followed.*
4. *Add a section that requires all work on public trees to be performed according to American National Standards Institute (ANSI) A300 and ANSI Z133 standards for Tree Care Operations. This will prohibit topping and provide a clear expectation of quality when work is performed on public trees.*

## 4.0 Current Tree Management Structure

---

The management of the urban forest within the Town boundaries is the responsibility of many entities and individuals. If the urban forest is defined as the individual landscape trees and total forest canopy cover within Boone, then the primary stewards of this resource are the private property owners. Most of the land in Boone is privately owned and controlled. Therefore, the greatest challenge, as well as the greatest opportunity for protecting and enhancing the Town's urban forest, lies with educating and working with citizens.

However, the responsibility for a significant portion of the current and future urban forest lies directly with the Town of Boone. Publicly owned land includes street rights-of-way, parks, and other municipal land holdings. Several Town government departments have direct control over and responsibilities for tree maintenance and planting. Other Town entities, such as various advisory commissions, business organizations, and volunteer groups, have indirect influences on the quality and quantity of the urban forest.

Currently, the Town's tree management structure can be described as *decentralized*. This means no single agency or staff position has direct, comprehensive, and ultimate legislative or management responsibilities for public trees. In the Town of Boone, many municipal agencies and entities directly and indirectly affect urban forest management, including: Development Services Department; Public Works Department; Mayor and Town Council; and the Town Manager.

### 4.1 Town Organization and Urban Forestry Management Responsibilities

#### 4.1.1 Development Services Department

The Development Services Department enforces the adopted land use and zoning regulations included in the *Town of Boone Unified Development Ordinances*. The Development Services staff provides inspections on construction sites, ordinance violations, bond processing/release, and tree preservation to ensure that development conforms to Town regulations and to ensure protection of public health, safety, and general welfare. These responsibilities impact the privately owned urban forest more than the publicly owned urban forest and, therefore, can likely have the greatest and most long-term impact on the Town's total canopy cover.

The Town's *Urban Design Specialist* position and the advisory Tree Board are organized in this department. Because of the land development process responsibilities and inspection duties, the *Urban Design Specialist* is primarily used and funded by the Development Services Department's budget to implement and perform duties such as plan review, site inspections, enforcement actions.

The Tree Board is also supported by the Development Services Department. The Board assists the *Urban Design Specialist*, Development Services Department, Town Council, and the citizens with a variety of urban forest projects, studies, education programs, and planning. This Board is authorized and assigned responsibilities in Article III, Part III, Sections 36–40, *Tree Board*, in the Town of Boone Unified Development Ordinance.

The Development Services Department also supports other boards and commissions. The decisions, policies, and actions of the Planning Commission and Community Appearance Commission can have positive and negative influences on public trees.

### **4.1.2 Public Works Department**

This department has direct responsibilities for tree management on public rights-of-way and other public properties including city parks and greenways. Tree pruning and removal, stump removal, leaf collection, and woody debris disposal are all duties assigned to Public Works. Additionally, the Department's right-of-way permits regulate street tree planting and damage.

This department indirectly affects public trees through their mowing responsibilities, snow and ice removal activities, street, curb, and sidewalk repair work, and water quality programs.

Of all Town agencies, the Department of Public Works has the greatest equipment inventory and staffing level for public tree maintenance. The Department also utilizes contractual services for tree maintenance tasks.

### **4.1.3 Mayor and Town Council**

The Town of Boone operates under the Council-Manager form of government. The Town Council is the legislative body of the Town and is empowered by the charter to make Town policy. The Council is composed of the mayor and five council members elected at large on a non-partisan basis.

These elected officials are key to the growth and success of the Town's urban forestry program. As the ultimate policy-making group and representatives of the citizens, the mayor and council can have direct influence over the current and future management of the urban forest. They can approve new and improved tree ordinances, support increases in program funding, support additional staffing levels, and generally make urban forestry issues a priority for the Town.

## **4.2 Analysis of Current Tree Management Structure**

Boone's goal is to have a larger, healthy, diverse, and functional urban forest and thriving residential and business communities. The dynamics of balancing urban forest management and other Town needs, responsibilities, and assets are diverse and complex and suggest a dedicated, interdisciplinary, flexible approach and organization.

However, the current constraints for comprehensive and effective urban forest management in Boone can be considered formidable.

### **4.2.1 Budget**

There is no "magic" formula for determining how much funding is needed for a proactive, sustainable forestry program. Every urban forest is different and urban forestry programs may be at differing stages of development. The simple answer is that there should be sufficient funding to carry out preventive tree maintenance, perform emergency response, and conduct adequate planting, as well as for support management, staff, equipment, and contractual services.

However, there are some national guidelines and statistics that can be used as a general indicator of whether an urban forestry program is adequately funded. The following information can be used to gauge a local urban forestry program's level of funding as compared to national averages, statistical research, and general funding guidelines. This information is only provided for qualitative comparisons, and should

not be considered in any way as a rule for adequate levels of funding for the Town of Boone.

### **Funding Guidelines and Statistics**

- The National Arbor Day Foundation requires that a community forestry program be supported by an annual budget of at least \$2 per capita as one qualification for its Tree City, USA program. The NADF believes this is a *minimum* amount necessary to provide tree maintenance, planting, and management services to the public.
- A common generalization is that a more realistic average urban forestry budget is \$5 per capita.
- Based on reports submitted to the NADF for Tree City, USA certification, communities with a similar population level as Boone have an average municipal urban forestry budget of \$172, 500 and an average per capita expenditure for urban forestry activities of \$9.57.

#### **4.2.2 Policy**

While the Town of Boone has a Unified Development Ordinance that addresses many tree issues related to development activities, there is no over-arching administrative or regulatory policy for managing the overall public urban forest. A tree ordinance that brings together all tree-related regulations would be a big step to providing a clear definition of responsibilities in Boone.

Without a tree ordinance or formal policy authorized by Council or without an administrative policy from the Town Manager, there is only limited coordination in providing for an efficient and comprehensive urban forest management program. The lack of a Town urban forestry policy can allow Town agencies to operate with conflicting or inadequate urban forest management standards. The lack of a policy also means there is no measure by which to judge the Town's actions as successes or failures.

#### **4.2.5 Political Support**

Support from elected officials and the citizens is critical to implement and maintain an effective comprehensive urban forest management program. The citizens own both the public and private urban forests, and without greater political support and increased citizen understanding and commitment, urban forest management in Boone may not reach its full potential.

### **4.3 Management Structure Recommendations**

A comprehensive, progressive, and proactive urban forest management program requires the coordination of professional talents in land use planning, public works, forestry, parks, and other public services. It requires political, administrative, and private entities to be educated and involved in urban forestry matters. It also requires sufficient funding to allow for professional management responses to a comprehensive urban forestry policy.

***The Administration should propose and Council should approve a Tree Ordinance to include in the Town Code.*** While several sections of the Town’s code of ordinances address tree topics and issues, they are scattered in the Unified Development Ordinance and in other sections of the Town’s code. Moving all of the tree ordinance language to one location would clearly state the Town’s acknowledgement and responsibility for all trees on public property, would express the Town’s commitment to the care and preservation of its urban forest on public and private property. This ordinance would also be a legislative representation of the Town’s policy of urban forest management.

***Funding levels for an expanded public tree planting and maintenance program should be increased.*** The current financial resources are not adequate to professionally and comprehensively manage and maintain Boone’s urban forest. Limited, dedicated, or consistent funding is available for increased public tree planting, for routine and preventive maintenance, for insect and disease monitoring and control, and other necessary tasks. It is recommended that a detailed budget analysis be performed that includes:

- Identifying all Town resources spent on urban forestry activities to clearly understand the current level of funding for urban forestry related activities.
- Determining if future budget reallocations and efficiencies can occur.
- Determining the amount of the shortfall to achieve stated goals.
- Identifying potential and best sources of increased financial resources.

### ***Recommendations***

1. *The Administration should propose and Council should approve a Tree Ordinance to be included in the Town Code.*
2. *Funding levels for an expanded public tree planting and maintenance program should be increased.*

## **4.4 Reserved**

## 5.0 Tree Inventory Analysis and Assessment of Tree Canopy Cover

---

### 5.1 Tree Inventory Analysis

Boone's *Urban Design Specialist* is responsible for the inventory and inspection of individual trees that are planted on private property as part of development requirements. This inventory is maintained in the office of the *Urban Design Specialist* along with additional data that make up a partial inventory of public trees along some of Boone's streets.

The initial analysis of the supplied data yielded the following highlights:

Davey Resource Group performed analysis of the 1,794 total inventoried sites. Trees and proposed sites were collected; of these sites, 1,030 (57.41%) are privately owned trees, 535 (29.82%) are N/A that have no data, 229 (12.76%) are Town-owned trees.

Inventoried sites represent either trees or proposed/planting sites. Of the inventoried sites, 981 (54.68%) are Deciduous trees, no type data (N/A) has been recorded for 441 (24.58%) of the inventoried sites, 204 (11.37%) are Proposed sites, and 168 (9.36%) are Evergreen trees.

The total value of Boone's inventoried tree population is estimated to be \$755,640, and the average value per tree is \$421.20. This value is not intended, nor should it be used, as a substitute for a detailed inspection and appraisal by a qualified arborist. These amounts are based on a generalized application of the trunk formula method found in the Council of Tree and Landscape Appraisers' publication, *Guide for Plant Appraisal (9th Edition)*.

Boone's inventoried tree population is comprised of 66 species representing 36 genera.

The genus *Acer* (maple) comprises 27.20% of the overall population, followed by N/A (no available data) 27.09%, *Prunus* (cherry/plum) 7.19%, *Pyrus* (pear) 5.63%, *Cornus* (dogwood) 4.46%, *Betula* (birch) 3.96%, *Quercus* (oak) 3.51%, *Picea* (spruce) 2.95%, *Amelanchier* (serviceberry) 2.68%, and *Pinus* (pine) contributing 2.56%.

The inventoried tree population is dominated by small-sized trees (1 to 6 inches in diameter at breast height [DBH]) representing 51.51% of the total tree population. No DBH data (N/A) has been recorded for 32.22% of the inventoried tree population. Medium trees, which are less than 6-inch DBH, represent 27.54% of the total street tree population, and the remaining 13.87% of the trees are large-sized (25 inches and greater in DBH).

Of the inventoried tree population, there are 845 (47.10%) rated in Good condition, no condition data (N/A) has been recorded for 749 (41.75%) sites, 153 (8.53%) are in Fair condition, and 42 (2.34%) are in Poor condition. There are 5 (0.28%) Dead trees.

Of the 1,794 inventoried sites, 1,758 (97.99 %) are recommended to be maintained and 36 (2.01%) are recommended to be removed. Of the trees to be maintained, 1,240 (69.12%) have no maintenance recommendation data (N/A) available, 461 (25.70%) have a maintenance recommendation of Clean, 46 (2.56%) have a maintenance recommendation of Reduce, and 11 (0.61%) have a maintenance recommendation of Raise.

## 5.2 Assessment of Tree Canopy Cover

Additional data was supplied that permitted an assessment of tree canopy coverage within Boone. Figure 1 is a map of the town limits that shows the tree canopy coverage in green. The data provided was based on a Town Limits area of 3,635.11 acres (Table 2). Tree canopy coverage accounted for 1,264.02 acres (34.77%).

A generally accepted and recommended target is 40% overall canopy cover within a town. Other recommended canopy cover targets are: suburban/residential areas should achieve 50% canopy cover; urban/residential areas should achieve 25%; and central business districts should achieve 15% canopy cover.

Data were analyzed by zoning class within Boone and the results are shown in Table 3. The canopy coverage in all residential areas in Boone is currently at 857.30 acres, or 67.82% of the total canopy cover in Boone. Commercial, Industrial, and Institutional areas are providing 406.72 acres or 32.17% of the total canopy cover in Boone. It is clear that the areas with residential zoning designations are providing the bulk of canopy cover. This indicates that canopy preservation efforts should focus on these areas. Currently, residential subdivisions have fewer tree preservation requirements than other types of development.

**Table 2. Town of Boone Canopy Coverage**

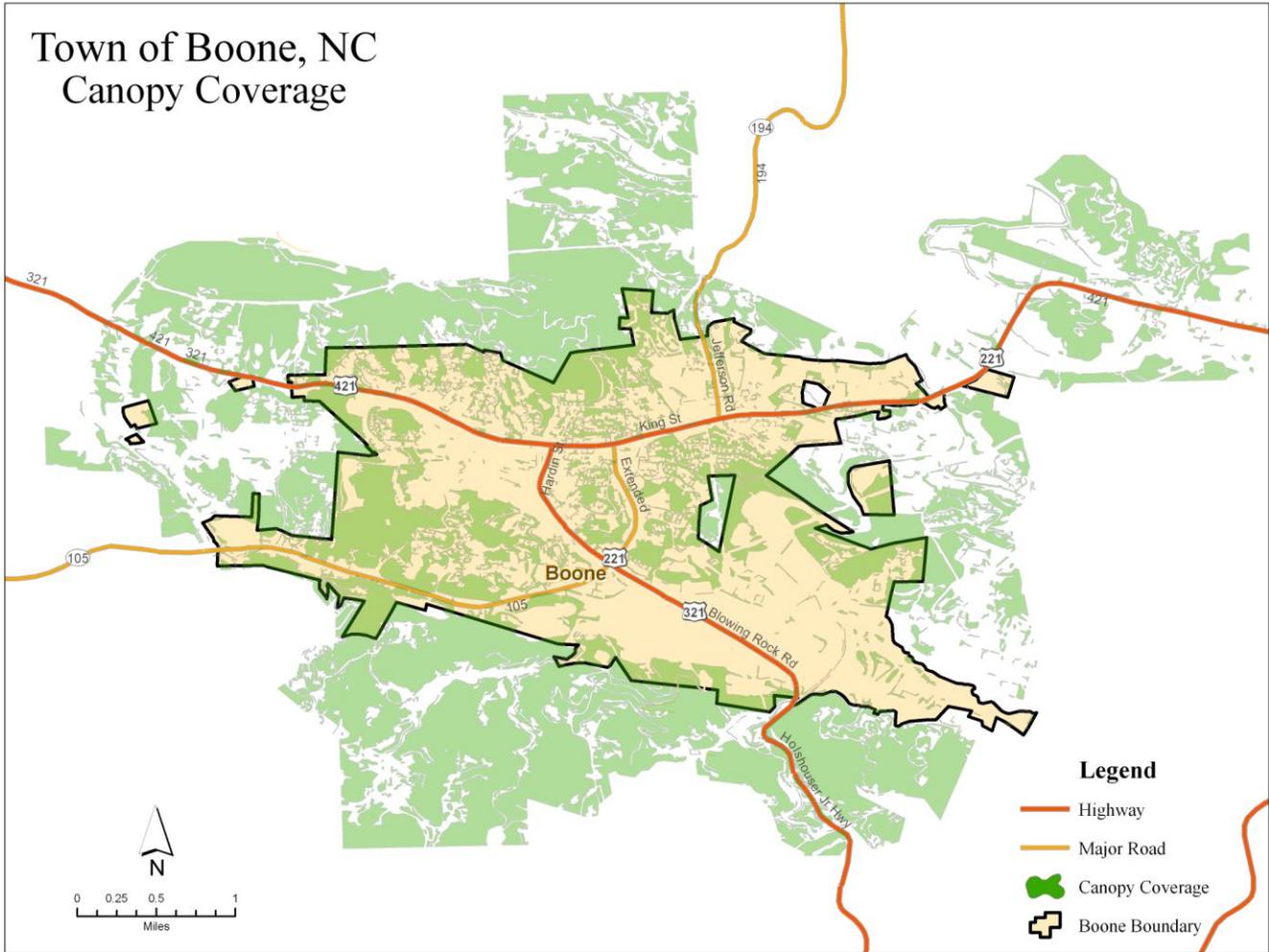
Coverage	Acres	Percent
Town Limits	3635.11	
Canopy	1264.02	34.77%

Boone's overall tree canopy coverage of 34.77% is slightly below the recommended target of 40%. While tree canopy coverage within most of the commercial, office, and industrial zoning classes in Boone is slightly above recommended targets, the residential areas are below targets.

The commercial zoning class is mostly located along the major arterial roadways within Boone and has a tree canopy coverage of 18.49%, slightly above the recommended target of 15% for central business districts. The office/industrial zoning class is located in clustered tracts along the outer edges of Town in rolling to flat terrain and has a tree canopy coverage of 33.39%, well above the central business district target, but slightly below the urban residential target. Since the area is targeted as office and industrial, the current canopy cover of 33.39% seems to be an acceptable percentage. However, the percent canopy coverage can be expected to decrease as more of this area is developed for office or light industrial use unless measures are taken to protect portions of the existing canopy coverage.

The residential areas are broken into high-density and low-density zoning classes. The high-density zoning class occurs mostly within the lower elevations and closer to the core areas of the Town. Recent development has occurred on steep slopes that resulted in significant canopy loss. Its tree canopy coverage of 33.28% falls well below the recommended canopy coverage for suburban residential areas which equals 50%. The low-density residential zoning class in Boone occurs mostly on the steeper slopes on the edges of Town and has 45.74% canopy coverage. While this currently falls short of the target rate of 50% for suburban residential areas, it will see additional canopy losses if tree protection measures are not taken during future development.

The canopy coverage figures and Town acreage figures include only those areas within the Town limits. The Town also has jurisdictional authority of a larger area surrounding the Town limits. This area provides a large percentage of tree canopy coverage and will require tree canopy protection to minimize future canopy losses.



**Figure 1. Canopy Coverage in Boone**

**Table 3. Town of Boone Canopy Cover by Zoning Class**

Zoning Class	Type	Zoning Class Area (Acres)	Zoning Class Area (Percent of Town Area)	Canopy Coverage in Zoning Class (Acres)	Canopy Coverage (Percent of Total Canopy Coverage in Town)	Canopy Coverage (Percent of Canopy Coverage within each Zoning Class)
B-1 Central Business	Commercial, High	52.66	1.45%	1.87	0.15%	3.54%
B-3 General Business	Commercial, High	867.13	23.85%	166.28	13.15%	19.18%
B-2 Neighborhood Business	Commercial, Low	34.01	0.94%	8.24	0.65%	24.22%
<b>Commercial Total</b>		<b>953.80</b>	<b>26.24%</b>	<b>176.38</b>	<b>13.95%</b>	<b>18.49%</b>
M-1 Light Industrial	Office, Industrial, Institutional	96.65	2.66%	26.19	2.07%	27.10%
O/I Office/Institutional	Office, Industrial, Institutional	241.56	6.65%	38.76	3.07%	16.04%
University	Office, Institutional	351.67	9.67%	165.38	13.08%	47.03%
<b>Office, Industrial, Institutional Total</b>		<b>689.89</b>	<b>18.98%</b>	<b>230.34</b>	<b>18.22%</b>	<b>33.39%</b>
MH Mobile Home Park	Residential, High	12.55	0.35%	0.12	0.01%	0.99%
R-3 Multiple-Family Residential	Residential, High	417.73	11.49%	143.09	11.32%	34.25%
<b>Residential, High Density Total</b>		<b>430.28</b>	<b>11.84%</b>	<b>143.22</b>	<b>11.33%</b>	<b>33.28%</b>
R-1 Single-Family Residential	Residential, Low	1075.86	29.60%	565.65	44.75%	52.58%
R-1A Single-Family Residential w/ Accessory Apartment	Residential, Low	49.61	1.36%	18.09	1.43%	36.47%
R-2 Two-Family Residential	Residential, Low	36.82	1.01%	5.12	0.40%	13.89%
R-4 Two-Family / Mobile Home	Residential, Low	20.13	0.55%	10.58	0.84%	52.56%
R-A Residential / Agricultural	Residential, Low	371.80	10.23%	113.20	8.96%	30.45%
RR Residential Rehabilitation	Residential, Low	6.91	0.19%	1.43	0.11%	20.67%
<b>Residential, Low Density Total</b>		<b>1561.13</b>	<b>42.95%</b>	<b>714.08</b>	<b>56.49%</b>	<b>45.74%</b>

Canopy coverage was also analyzed by slope class within Boone’s Town limits. The results of this analysis are shown in Table 4. Slope classes were created to identify the topography of each class. The steep slope class (slopes between 30% and 50%) and very steep slope class (slopes steeper than 50%) are consistent with Section 285 of Boone’s Unified Development Ordinance “*Special Requirements for Land Disturbing Activities Involving Steep Slopes.*”

Level ground has 2.77% canopy coverage. The percent canopy coverage in Boone increases as the slope percentage increases. The steep slope class has 70.06% canopy coverage and the very steep slope class has 77.36% canopy coverage. Again, these figures indicate that efforts at preserving canopy should focus on the steeper sloped areas within Boone.

The level and moderate sloped ground in Boone provides only a small portion of Boone’s canopy. Level ground provides 1.70% of the Town’s canopy and moderately sloped ground provides 9.01% of the Town’s canopy. The sloped ground (13-29%) provides 36.76% of the Town’s canopy, and steep sloped ground provides 39.59% of the Town’s canopy. Very steep sloped areas provide 12.94%. These figures also support the need to emphasize tree canopy protection on steeper sloped ground since it provides the majority of Boone’s existing canopy coverage.

**Table 4. Town of Boone Canopy Coverage by Slope Class**

<b>% Slope Rise Class</b>	<b>Slope Class Acres in Town Boundary</b>	<b>Slope Class Acres in Town Boundary (Percent)</b>	<b>Canopy Coverage Within Slope Class (Acres)</b>	<b>Percent of Total Canopy</b>	<b>Percent Canopy Within Slope Class</b>
0-3, Level	785.59	20.07	21.74	1.70%	2.77%
4-12, Moderate Slope	1006.13	25.71	115.30	9.01%	11.46%
13-29, Sloped	1181.80	30.19	470.64	36.76%	39.82%
30-50, Steep Slope	723.43	18.48	506.86	39.59%	70.06%
>50, Very Steep Slope	214.19	5.47	165.70	12.94%	77.36%

### 5.3 *Creating and Maintaining a Tree Inventory*

Boone should consider a complete GIS-based inventory of its street and park trees located within mowed and maintained areas. The current inventory is incomplete and has several gaps in the data.

Inventories should be updated on a regular basis to reflect new plantings, removals, and maintenance procedures performed. An accurate inventory is the best way for the Town to monitor the progress and cost-efficiency of its tree care operations. The primary benefit of an accurate tree inventory is that the community can budget, plan, and anticipate tree-related problems and situations in the most cost-effective manner possible.

The best way to maintain the inventory is to commit to regular, routine data entry. The urban forestry staff could create a simple form for use in the field that contains similar data fields as the software program. This form can easily be used to record new plantings, work histories, changes in tree conditions, and maintenance recommendations. On a daily, weekly, or monthly basis, the information collected should be entered into the inventory database. This task can be performed by the *Urban Design Specialist*, administrative support staff, or trained volunteers.

It is further recommended that a thorough inventory be performed every ten years or more frequently if rapid changes in the urban forest occur, such as severe storms, serious insect and disease problems, or a dramatic increase in new tree planting. Tree inventories should be performed by a professional urban forestry consultant, a *Certified Arborist*, or by the Town's *Urban Design Specialist*. Only a highly qualified professional should make the determinations of condition, safety risk, and maintenance requirements. Volunteers may assist in the inventory process which will increase public awareness and ownership of the urban forest.

#### **Recommendations**

1. *Complete a town-wide GIS based inventory of street trees and park trees in mowed and maintained areas.*
2. *Commit to routine data entry.*
3. *Create a simple form for use in the field with inventory data fields.*
4. *Perform a thorough inventory of public trees every ten years or as needed.*

### 5.4 *Using Tree Benefit Models*

Arboricultural research and technological advances in computer analysis are allowing municipalities to document the benefits of trees beyond aesthetics and real estate values. Tree benefit models use aerial and satellite imagery and tree inventory data to determine the levels and values of public health and safety and other benefits, such as air pollution reduction, stormwater mitigation, and energy conservation.

These benefit models conduct complex statistical analyses of ecosystem and environmental services that trees provide to a community. The reports and maps created can then be used for land-use planning, policy-making, and urban forestry program evaluation.

There are tree benefit models now available for municipalities to use—the Urban Forestry Effects Model (i-Tree Eco) and the Street Tree Resource Analysis Tool for Urban Forest Managers (i-Tree Streets). These models were developed by the U.S. Forest Service and are now part of the i-Tree suite of urban forest management tools. These models have been extensively peer-reviewed for accuracy and are available for the Town to use.

The i-Tree suite of software tools help communities to identify and manage the structure, function, and value of urban tree populations. Together, the suite provides a scientifically sound system for data collection, analysis, and quantification of the benefits and costs of urban forest management.

#### **5.4.1 i-Tree Eco**

i-Tree Eco is a computer model that calculates the structure, environmental effects, and values of the entire urban forest. The model is designed to use standardized field data from randomly located plots or complete inventories. i-Tree Eco results are compatible with ArcView™ for display in GIS systems.

The i-Tree Eco model is currently designed to provide accurate estimates of:

- Urban forest structure (*e.g.*, species composition, number of trees, tree density, and tree health), analyzed by land-use type.
- Pollution removed by the urban forest, and associated percent air quality improvement throughout a year. Pollution removal is calculated for ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, and particulate matter (<10 microns).
- Volatile organic compound emissions and the relative impact of tree species on net ozone and carbon monoxide formation throughout the year.
- Total carbon stored and net carbon annually sequestered by the urban forest.
- Effects of trees on building energy use and consequent effects on carbon dioxide emissions from power plants.
- Compensatory value of the forest, as well as the value of air pollution removal and carbon storage and sequestration.
- Tree pollen allergenicity index.
- Potential impact of pests, such as gypsy moth, emerald ash borer, or Asian longhorned beetle.

The i-Tree Eco software is in the public domain and available at no cost to all interested individuals and organizations through i-Tree. If the Town wants to consider conducting its own i-Tree Eco project, be aware that the program requires specific types and amounts of data to accurately project the structure and benefits of urban vegetation. The validity of results from i-Tree Eco will depend on a large degree to how closely the Town adheres to project setup and sampling protocols. More information can be found at [www.itreetools.org](http://www.itreetools.org).

### 5.4.2 *i-Tree Streets*

i-Tree Streets is a street tree management and analysis tool for urban forest managers who utilize simple tree inventory data to quantify the value of annual environmental and other benefits such as: energy conservation, air quality improvement, carbon dioxide reduction, stormwater control, and property value increases. Uniquely, this model also considers management, maintenance, and planting costs, and can, therefore, produce data on costs-benefits and management needs.

Using simple, non-GIS based tree attribute data from sample plots to complete inventories and community specific information (*e.g.*, program management costs, population, and price of residential electricity), i-Tree Streets applies tree growth and benefits models to calculate:

- Structure (*i.e.*, species composition, extent, and diversity).
- Function (*i.e.*, the environmental and aesthetic benefits trees afford the community).
- Value (*i.e.*, the annual monetary value of the benefits provided and costs accrued).
- Management needs (*i.e.*, evaluations of diversity, canopy cover, planting, pruning, and removal needs).

i-Tree Streets produces a report consisting of graphs, charts, and tables that managers can use to justify funding, create program enthusiasm and investment, and promote sound decision-making. In short, i-Tree Streets can assist managers and communities answer the question whether the benefits of street trees outweigh their management costs.

i-Tree Streets differs from other urban forest analysis and tree benefit software models in many ways:

- i-Tree Streets is designed for analyzing street tree populations, not the entire urban forest.
- It is intended to be utilized as a planning tool, going beyond the reporting of benefits.
- Costs of management, rather than benefits alone, are incorporated to provide a platform for strategic planning.
- i-Tree Streets is not GIS-based; it requires only basic inventory data.

i-Tree Streets also is in the public domain and is available at no cost to communities.

### 5.4.3 *Summary of Tree Benefit Models*

Both i-Tree Eco and i-Tree Streets are benefit models that could assist Boone in supporting the growth of the urban forestry program, and aid the Town in making the right management decisions at the right time. The availability of i-Tree Streets is also further justification for the Town to perform a citywide tree inventory to document the value of street trees and justify management costs.

## 6.0 Urban Forestry Management Recommendations

### 6.1 Risk Tree Management

Situations where injury or property damage has occurred from falling trees are not isolated and are well documented in the media on a regular basis. Along with the potential for personal injury or property damage comes the probability of the responsible parties being held liable for any injuries or damages. Such lawsuits can and have resulted in costly judgments against the defendants.

Public safety must be the primary concern in Boone. Tree removals and pruning are a vital part of safety risk mitigation. The general tree population in the Town is in good to fair condition; however, there are large trees with varying degrees of risk factors existing in the scaffold limbs, trunks, and roots. Consideration must always be made of area usage and the threat of falling limbs or trees to persons and property when putting a pruning and removal plan into action.

External indicators of increased risk trees, such as obvious root zone activity, decay fungi, or included bark, require special attention to meet the public's safety needs. Trees that display decay fungi or obvious signs of wood decay should be carefully monitored and evaluated for safety concerns and risk management. Trees with poor structure, such as those with codominant leaders or multiple trunks, can pose a greater failure risk than trees with good structure. All Town trees (especially trees in the large-size diameter class) with signs of decay and/or poor structure should be examined annually for signs of impending failure.

#### 6.1.1 Priority Tree Maintenance

Initially, Boone should concentrate on reducing the potential risks associated with trees that have serious defects. A complete inventory of street trees and park trees would identify risk trees and provide a foundation for managing risk in the Town.

#### 6.1.2 Useful Life

The useful life of a public tree ends when the cost of maintenance is greater than the value added by the tree to the community. This can be due to either the decline of the tree's condition and increasing maintenance activities or to the costs of repairing damage caused by the tree's presence.

Decline generally starts when the tree has reached a point where it cannot withstand the stresses imposed by its environment. Restrictive growing space, disease, insects, mechanical injury, pollution, and vandalism, among others, can cause stress.

Although some species are more resistant to these urban stresses, all trees in urban settings will eventually decline, whether due to maturity, stress, or senescence.

#### Criteria of Safety Risk Trees



A defective tree, or tree part, that poses a high risk of failure or fracture.



Presence of a target that could be struck by the tree (e.g., people or property).



Environmental hazards may increase the likelihood of tree failure (e.g., severe storms, strong winds, shallow or wet soils, or growing spaces that restrict root or crown development).

The pattern of decline generally begins with persistent limiting site factors that place the tree in a state of chronic stress. This weakens the tree's natural defenses, leaving it more susceptible to injury from pests or unusual weather, such as a single insect-induced defoliation or a late frost. When a tree is stressed, it has difficulty withstanding or combating the circumstance or recovering from such stress. As a result, the tree can become even more vulnerable to insects and disease that continue to reduce its vigor. Often, the first signs of a problem appear at this point.

The age at which a tree reaches the end of its useful life differs by genus and species. Slow-growing trees, such as northern red oak (*Quercus rubra*), are most valuable when they attain maturity. Fast-growing species, such as red maple (*Acer rubrum*), are most valuable as juvenile trees, because they provide benefits quickly and become expensive to maintain as they reach maturity.

The end of a tree's useful life can also be reached while the tree is still healthy if it is growing in a limited site. Useful life, in this instance, is the point at which the cost of related maintenance, such as the repair of hardscape damage, exceeds the value added by the tree. For example, a large, fast-growing tree used in a smaller tree lawn will cause hardscape damage at an early age and periodically throughout its lifetime. The useful life of this tree will be reached before it begins to decline. A smaller tree, on the other hand, would probably not exceed grow space dimensions at any point in its life. The end of its useful life would probably be reached only when it started to decline due to senescence. A smaller tree, as a result, would make better use of this example tree site.

### **6.1.3 Priority Tree Maintenance Summary**

Davey Resource Group strongly encourages the Town to schedule all priority maintenance recommendations to occur in a timely manner to reduce potential safety risks. By doing so, the Town will greatly lessen the potential of injury to citizens, damage to property, and possible liability litigation. Although it would be impossible to expect the Town to perform all needed maintenance activities immediately, an organized and systematic program will achieve the needed results in a timely manner and will demonstrate the Town's sincere attempt to keep all of its streets and public spaces safe for its citizens.

The management of trees on streets, parks, and other public settings can be challenging. Some tree failures can be predicted and some cannot. Although not all hazard trees can be detected, corrected, or eliminated at any given time, having trained personnel perform regular safety risk tree assessments and property inspections can help make public rights-of-way and public property reasonably safe while preserving the aesthetics and other benefits trees provide.

## **6.2 Mature Tree Care**

The benefits and values of trees are maximized when trees reach maturity and become established in their growing location. To maintain this high level of benefits for a longer period, the Town should commit to providing regular scheduled maintenance to its mature trees and prepare for non-routine arboricultural treatments as needed.

A comprehensive mature tree care program primarily centers on routine, or preventive pruning, and the ability to provide fertilization, irrigation, insect and disease control, and cabling and bracing when necessary.

### 6.2.1 Routine Pruning Program

**Routine Pruning** should occur on a cyclical basis for the entire tree population once all priority maintenance removal and pruning activities have been completed. Since the priority maintenance recommendations described above may be accomplished in the first two years, it is recommended that the routine pruning program described here be implemented beginning in the same years if funds exist for the work. If funds do not exist, the routine pruning program can begin after the priority tasks have been completed. This activity is extremely beneficial for the overall health and longevity of street and public space trees. Through routine pruning, potentially serious problems can be avoided because the trees can be closely inspected during these pruning cycles. Proper decisions can be made on declining trees, and any trees that become potential hazards can be managed appropriately before any serious incidents occur.

Small trees currently constitute a considerable portion (51%) of Boone's street and public space tree population. The Town's forestry personnel must recognize that as these small trees reach maturity, more work will be required to maintain a five-year pruning cycle. The Town should develop an organized, documented approach to cyclical tree maintenance that can be easily managed by Town staff and properly trained volunteers, if budgetary issues are a concern.

#### **Routine Pruning**

This activity is extremely beneficial for the overall health and longevity of street and public space trees. Through routine pruning, potentially serious problems can be avoided because the trees can be closely inspected during these pruning cycles. Proper decisions can be made on declining trees, and any trees that become potential hazards can be managed appropriately before any serious incidents occur.

### 6.2.2 Small Growth-Habit Trees

**Small Routine Pruning** is recommended for mature, small growth habit trees, such as the flowering crabapples (*Malus* spp.), callery pears (*Pyrus calleryana*), and flowering dogwoods (*Cornus florida*) in the Town of Boone. These species are genetically small trees and usually attain a maximum height no greater than 25 to 30 feet, but like all urban trees, they require periodic pruning throughout their life span. The primary reason to periodically prune these small growth-habit species is to maintain overall health and vigor through the removal of dead, dying, or diseased branches, as well as branches that may be interfering with the growth of other major branches. By maintaining these trees through periodic small routine pruning, the potential for decay can be minimized and their vigor can be improved by retaining only strong, healthy branches.

Small routine pruning can normally be accomplished from the ground with relatively inexpensive equipment. For this reason, it is recommended that the Town organize a small tree care crew that would be able to easily perform this work with existing equipment. It has been Davey Resource Group's experience that, based on the generally small size of the trees in this category, a crew of two properly trained personnel would be capable of accomplishing the work.

This crew would be responsible for the cyclical trimming of all mature, young trees, as well as the training pruning of young and recently planted trees. Additionally, they can perform clearance-trimming work. This is known as crown raising (elevating of tree limbs), and it will allow vehicles to safely pass on streets or pedestrians to walk on sidewalks. Furthermore, the clearing of limbs away from signs and traffic signals can also be accomplished.

There are also young spruces and pines in Boone. These trees normally require little in the way of training pruning, but inspections should be made to ensure that each tree does not have more than one leader or trunk. Occasionally, pines and spruces will develop codominant leaders that, if not pruned to a single leader, result in a tree with poor structure. Other problems may include the likelihood of creating traffic clearance problems and increased susceptibility to storm damage.

### **6.2.3 Five-Year Cycle**

It is suggested that a five-year cycle be implemented so that street trees are routinely pruned. As happens all too often in many cities, tree pruning consists of trimming by resident request or only if a hazardous situation exists. Routine pruning includes those trees requiring pruning on a cyclical basis to maintain tree form and health. Centralized pruning should be carried out, meaning that all trees in a Town block are trimmed. A certain number of Town streets (and blocks along those streets) and public spaces should be designated for each year's work in order to meet the annual routine pruning goal.

### **6.2.4 Fertilization**

Mature trees should not be placed on a scheduled fertilization program without a documented need. If soil analyses show a distinct and serious nutrient deficiency, or if the tree's root system or growing area has been damaged or contaminated, then the time and expense of fertilization may be worthwhile to save the tree.

### **6.2.5 Irrigation**

All trees need supplemental watering when there are drought conditions. Under drought conditions, the Town, volunteers, and/or the abutting property owner would accomplish watering mature and young trees.

This supplemental irrigation can be accomplished for park and street trees with a water truck and hose and/or deep root watering lance, or with watering aids, such as the widely used Treegator<sup>®</sup> Drip Irrigation Bags. Citizens and abutting business owners should be encouraged to water street trees frequently during the summer, even when there are no drought conditions.

When trees are planted in tree wells, or are growing in restricted rooting areas, such as between streets and sidewalks, they are rarely receiving enough water from natural

rainfall. Additionally, if a tree's roots system has been compromised or damaged by a construction project or accident, whether drought conditions are present or not, supplemental watering during the growing season may be a critical factor in the tree's long-term survival.

### 6.2.6 *Insect and Disease Control*

Generally, mature trees do not have significant insect and disease problems if they are healthy and well cared for. Some degree of insect infestation and disease incidence will always be present, as this is the norm for the natural world.

However, trees in street and other highly urbanized settings can be predisposed to insect and disease problems since they are growing in unnatural and constrained environments. Therefore, it is prudent to include insect and disease monitoring as a routine part of a public tree inspection program. Monitoring will be discussed in more detail in Chapter 6.6, *Future Risk Tree Management*.

It is only when particularly damaging insects, such as gypsy moth and emerald ash borer, are detected, the levels of insect populations are extremely high, or when particularly virulent diseases are diagnosed, that action must be taken. The type and extent of action depends on the type and extent of the insect or disease problem. Biological and synthetic chemical controls are available for most situations. Improved arboricultural knowledge and chemical application technology allows most treatments to be directed into the soil or into the tree, avoiding open, broadcast spraying of the crown, which in a public setting is usually not well-received.

### 6.2.7 *Cabling and Bracing*

Rather than remove or severely prune a mature tree if a structural defect is discovered, the use of structural support can reduce safety risks. Cabling and bracing are the two most common forms of structural support for trees. Other, less common forms of structural support are guying and propping. Structural support is infrequently recommended, but trees with special or historic significance can be spared from removal by using such techniques as cabling and bracing. Generally, this involves installing flexible cables or rigid rods to reduce the chances of failure of defective unions.

#### **Primary Uses of Cabling and Bracing**



**Prevention**—to reduce the chance of failure on a healthy tree with structural weakness (e.g., a specimen oak in good condition but having large limbs with V-crotches).



**Restoration**—to prolong the existence of a damaged tree (e.g., a large sugar maple that lost one of its leaders in a storm, leaving the others suddenly exposed and vulnerable to further damage).



**Mitigation**—to reduce the hazard potential of a tree (e.g., a picturesque multi-stemmed hickory that towers over a picnic shelter).

If the decision is made that a tree needs structural support, there are a few basic considerations. First, only use a *Certified Arborist* who is knowledgeable and experienced in this area. Ask about the important technical aspects of correct cabling and bracing: the strength and material of the hardware; the arrangement of the cables (*e.g.*, simple, triangle, or box) or rods (*e.g.*, single or multiple); and the location, type and size of the entries made into the tree. Be sure to specify in writing that "all work and materials shall be in accordance with ANSI, A300 Tree Care Standards (Part 3), 2005."

## 6.3 Young Tree Care

The most significant population of Boone's inventoried public trees are newly planted or young trees. With the new policy that allows planting on the public right-of-way, more new trees will be added to the Town's urban forest.

It is critical then to understand the proper maintenance techniques required to ensure the longest and safest service life of these trees. The major components of a young tree care program are pruning, mulching, and watering.

### 6.3.1 Training Pruning Program

**Training Pruning** consists of the removal of dead, dying, diseased, interfering, conflicting, and/or weak branches, as well as selective trimming to direct future branch growth on trees less than 20 feet in height. Although this type of pruning is termed training pruning, the word training truly pertains to young or recently planted trees. For these trees, training pruning is used to develop a strong structural architecture of branches so that future growth will lead to a healthy, structurally sound tree. Many young trees may have branch structure that can lead to potential problems as they grow, such as double leaders, many limbs attaching at the same point on the trunk, or crossing/interfering limbs. When trees are small, these problems can be remedied easily and inexpensively.

Training pruning can be accomplished from the ground with a minimum amount of equipment. If structural problems are not corrected while trees are young, they can lead to instances where branches are poorly attached and where decay can develop at the crossing points of interfering limbs. Trees with poor branching can become safety risks as they grow larger and could create potential liability for Boone in the near future.

All newly planted trees should receive their first training pruning within three years following planting. Training pruning should not be done when a tree is planted, because it is already under stress from transplanting and needs as much of its leaf canopy as possible in order to manufacture food and increase root growth for proper establishment in its new site. Only dead or broken branches should be removed at the time of planting, and in the next two years.

### **6.3.2 Three-Year Maintenance Cycle**

Similar to the routine pruning program, the training pruning program would also be accomplished on a cyclical basis, but the work would be scheduled during a three-year cycle rather than the five-year cycle for the routine pruning of larger established trees. As mentioned above, newly planted trees should receive their first training pruning three years after planting. This work can be accomplished throughout the year. Since no bucket truck is required, Town employees can perform this work at any time. This type of work is also highly suitable for properly trained summer interns, part-time employees, and/or volunteers.

### **6.3.3 Mulching**

Mulching is more than an aesthetic treatment in the landscape. Trees that are properly mulched benefit from less drought stress and less cold damage, and tend to grow faster and be more vigorous. Mulch also helps prevent trunk and root damage from mechanical removal of grass and weeds.

Some trees in Boone were observed to have mechanical damage. These are mainly younger trees with injuries caused by lawn mowing equipment, but there are also mature trees with similar damage. This kind of stress on a tree can make it more susceptible to pest problems by providing access to internal wood tissue. There are certain insect pests specifically drawn to wounded trees, and if a tree is already stressed, the additional injury can substantially reduce the tree's ability to sustain defense and maintenance growth. A less visible impact is the effect on roots; decay from trunk damage can spread into the root system.

It is recommended that all small-diameter trees be mulched regularly. Large-diameter trees should also be mulched where the mulch bed will not interfere with other uses of the area.

Mulch can consist of a variety of materials, ranging from the more expensive, but aesthetically pleasing, shredded black hardwood bark, to no-cost rough wood chips. Either type is acceptable and provides the many benefits of mulch.

Generally speaking, mulch is applied in a 2- to 4-inch layer in a 3-foot diameter circle around young trees and as far out as the dripline in mature trees. Mulch is placed in a saucer shape around the tree, meaning the outside edges are slightly higher than the inside, and mulch is never placed directly against the trunk. Mulch is also usually applied once a year, as long as the 2- to 4-inch depth is not exceeded.

Chemical herbicides used in conjunction with mulch is the most effective way of keeping unwanted grass and weeds from growing in the mulched area and near the tree. Many safe, non-restricted, post-emergent sprays, like Round-Up<sup>®</sup>, are available to kill weeds. Effective pre-emergent sprays, like Preen<sup>®</sup>, are available to prevent weeds from ever germinating. When these types of herbicides are used in combination with mulch, public trees will derive the benefits from mulch, avoid mechanical damage, and be more attractive.

### 6.3.4 Watering

This maintenance task was discussed previously, but it is even more critical to water young trees during the first few years after planting as part of their routine care program.

This task can be performed by Town staff or contractors, but is one that is easily accomplished by volunteers and citizens. For example, the use of watering aids, such as the widely used Tregator® Drip Irrigation Bags, waterhoses, and nearby homeowners willing to share their water, will allow volunteers and youth organizations to irrigate several blocks of newly planted trees in a single day.

### 6.3.5 Training of Personnel

Proper training in pruning young tree structural pruning would be required for Town personnel responsible for this task. Additionally, these workers would require an understanding of the growth-habits of the various species being planted, as well as an understanding of tree anatomy and physiology. This training can be received through several sources, including the Town's *Urban Design Specialist and Landscape Specialist*, local urban forestry consultants, and/or International Society of Arboriculture *Certified Arborists*. The tremendous aesthetic and financial benefits to be gained in the years to come from proper pruning of young trees are a strong incentive for educating tree crew personnel concerning proper pruning techniques. The added knowledge gained by the individuals could augment the sense of professionalism in their jobs.

## 6.4 Tree Planting

Considering the ongoing and aggressive land development and Boone's goal to increase canopy cover, tree planting should be a major goal for the Town. Not considering private property, the streets, parks, and other public areas offer ample opportunities for new tree planting. Therefore, it is important to make sure this goal is carried out in the most effective way possible. The trees planted now will have a great impact on the Town's future character and livability.

### 6.4.1 Developing an Effective Tree Planting Program

Tree species and planting location designations are significant components of a municipal tree care program because of the long-term impact of these decisions. It is important to develop an overall planting strategy, initially concentrating on streets and blocks with the greatest need for improvement.

The success of a continuing tree planting program will be judged by the post-planting health of the trees and the amount of money spent on planting and maintaining the new trees. With a small amount of planning, healthy trees with greater life expectancies can be established with minimal initial investment and minor maintenance costs.

### 6.4.2 Tree Species Diversity

Tree plantings in historic districts and new developments add greatly to the aesthetic appeal of the Town. However, species diversity in new plantings should be a primary concern. The dangers (*e.g.*, disease and insects) of planting monocultures have proven to be devastating throughout the eastern and midwestern United States. The goal should be to maintain species diversity throughout the Town such that no more than one species represents 10% and that no one genus comprises more than 20% of the total population.

### 6.4.3 Tree Species Selection

Boone is located in Zone 7 of the USDA Hardiness Zone Map, which identifies the climatic region where the average annual minimum temperature is between 0 and 10 degrees Fahrenheit. Tree species selected for planting in the Town should be appropriate for this zone. In addition, species should be urban-tolerant, and rated as relatively free from insect pests and disease.

In addition to considering site characteristics, such as availability of space, soil pH, and irrigation, species-specific features must also be scrutinized. A major consideration for street trees is the amount of litter dropped by mature trees. Species, such as willow (*Salix* spp.), have weak wood and typically drop many small branches during a growing season. Others, such as American sweetgum (*Liquidambar styraciflua*), drop high volumes of syncarps (fruits). In certain species, such as ginkgo (*Ginkgo biloba*) and osage-orange (*Maclura pomifera*), female trees produce offensive/large fruit; male trees, however, produce no fruit. Furthermore, a few species of trees, including black locust (*Robinia pseudoacacia*), hawthorn (*Crataegus* spp.), and honeylocust (*Gleditsia triacanthos*), may have substantial thorns. These species should be avoided in high traffic areas.

Seasonal color should also be considered when planning tree plantings. Flowering varieties are particularly welcome in the spring, and deciduous trees that display bright colors in autumn can add a great deal of interest to surrounding landscapes.

Above all, tree species should be selected for their durability and low-maintenance characteristics. These attributes are highly dependent on site characteristics as well as species characteristics. Matching a species to its favored climatic and soil conditions is the most important task when planning for a low-maintenance landscape. Plants that are well matched to their environmental and site conditions are more likely to resist pathogens and insect pests, therefore, requiring less maintenance overall.

### 6.4.4 Tree Planting Process

As trees are purchased through local nurseries, the most important consideration should be species selection to increase species diversity throughout Boone.

Once the appropriate trees have been selected for planting, the most important detail to ensure success is the preparation of the planting sites. Appendix D explains the proper method of excavating a planting hole. In general, the tree-planting holes should be relatively shallow (typically slightly less deep than the height of the root ball) and quite wide (three times the diameter of the root ball). Care should be taken so that the root collars of the new trees are at the same level or slightly higher than the surrounding soil grade.

In most situations, it is not recommended to add soil amendments to the planting holes, as this can lead to differences between texture and structure of soils inside the planting holes and the surrounding soil. Such differences can lead to either water being wicked away from or accumulating in the planting holes.

Tree staking hardware should only be installed when necessary to keep trees from leaning (*e.g.*, windy sites) or to prevent damage from pedestrians and/or vandals. Stakes should only be attached to trees with a loose, flexible material, and all staking material must be removed within one growing season.

#### **6.4.5 Tree Mulching**

Mulch should be applied to the surface of the soil around each newly planted tree. Mulch should never be piled up around the root collar (creating mulch volcanoes), but rather should be pulled away from the root collar. Mulch that buries the root collar provides shelter for insects, fungi, and mammals that could damage the tree. Mulch should be applied to an area three times the diameter of the root ball to a depth of two to four inches. Mulch not only suppresses competition from grass and weeds, but also provides a zone where turf maintenance is not needed, thereby keeping lawn mowers and string trimmers safely away and thus preventing mechanical damage. Mulch also helps to hold moisture in the surface of the soil where most of the feeder roots are to be established.

#### **6.4.6 Tree Fertilization**

Any fertilization process should not be thought of as feeding or energizing the trees; instead, arboricultural fertilizers should be understood as essentially replacing soil elements or minerals that are lacking or in short supply for a variety of reasons. Nutrients may be in adequate supply but be unavailable for uptake by the trees because of extreme pH conditions. Application of fertilizer may not improve the situation until measures are taken to alter pH levels or to replace the trees with a species better suited for the existing soil conditions.

Fertilization may not be necessary for the first growing season unless specific nutrient deficiencies exist. At the beginning of the second growing season, fertilizers can be applied to the root zone. Nitrogen is usually the limiting nutrient for plant growth. Soil analysis, particularly when combined with a foliar analysis, can determine when other elements are in short supply. Slow-release fertilizers applied in autumn will help root growth and will still be available the following spring.

#### **6.4.7 Tree Pruning**

Assuming that the proper trees have been selected for each site, pruning young trees to improve branch structure is the most effective method of reducing maintenance costs as trees mature. At the time of planting, the only pruning that should be done is the removal of broken or dead branches. In the second growing season, minor pruning can be performed to remove branches with poor attachments. In subsequent years, selective pruning should be performed to achieve the proper spacing of branches. See Appendix D for more information on proper pruning techniques.

#### **6.4.8 Tree Purchases**

Tree prices, of course, vary based on the species selected, but many nurseries offer trees of 1.5- to 2.5-inch caliper for \$150 to \$250. As the Town plants more trees annually, obtaining a good price for quality trees will become more important. Saving money on the cost per tree will allow a greater number of trees to be purchased.

A good working relationship with a local nursery is beneficial, but it is equally important that good prices and wide species availability be considered. It is recommended that Boone continue to explore local and regional sources for trees and discuss pricing with the current nursery source. Due to the requirement to work towards species diversity, it may be necessary to use several nurseries as sources for trees.

### 6.4.9 Master Tree Planting Plans and Designs

Given the ambitious goal of increasing Boone's canopy cover, it is imperative that Boone continue to update the *Boone Master Tree Plan*. Public opinion rated this management task as a very high priority.

Such a plan would detail the exact location of every available public tree planting site in Boone, provide information of the size and type of the growing space, indicate the presence of utilities, and ultimately assign an appropriate species to that site. With this information collected and analyzed, and entered into the tree inventory database, a logical and citizen-responsive prioritization scheme can be developed to begin tree plantings throughout the Town.

Often, the downtown and other business districts are selected as high-priority areas to increase the beauty and attractiveness. Tree selection for business and shopping areas must take into consideration the need for shoppers to view storefronts, as well as the need to provide enough shade for shoppers. Tree canopies should be open, as in thornless honeylocusts (*Gleditsia triacanthos inermis*), and the branching habit must be high enough to allow pedestrians to walk comfortably beneath the trees. Other options are tall, narrow-growing (fastigate) species, such as Fastigate European hornbeam (*Carpinus betulus 'Fastigiata'*) and many others. These trees can provide beauty, a look of uniformity, and a formal appearance to the shopping district.

Tree plantings in residential areas can be selected to match the existing types of trees growing on each street (*i.e.*, large growth-habit trees or flowering tree species) or can be selected to begin to develop a uniform look for a given street. To create unity, balance, and beauty on a street, it is advantageous to plant the same species or species of similar form and size on both sides of the street, if possible. Keep species diversity in mind when developing any type of tree planting design. Often, in older neighborhoods, one side of the street has utility lines, which precludes the use of large trees.

The primary aesthetic role that street tree plantings can play in a residential neighborhood is to visually link individual homes into a unified scene. It is this unified quality that makes older neighborhoods with large mature trees so attractive in many communities. Either formal or informal planting schemes are appropriate for neighborhood streets. In most instances, medium or large trees, spaced so that their canopies overlap, are desirable. As always, a street tree-planting program must have the objective of species diversity in mind at all times.

#### **Recommendation**

1. *Maintain species diversity throughout the Town such that no more than one species represents 10 percent and that no one genus comprises more than 20 percent of the total population.*
2. *Wherever possible, plant large growth-habit trees that provide shade, provide the greatest environmental and economic benefits, and that are aesthetically pleasing.*
3. *Update the Boone Master Tree Plan for all streets and public properties.*

## 6.6 Future Risk Tree Management

### 6.6.1 Addressing Disease and Insect Monitoring

Urban trees are inherently under stress because of many human-induced factors, primarily limited growing space in non-native, sub-standard soil. Basic elements that influence plant health include sufficient water, light, and a proper balance of nutrients. Too much or too little of any of these environmental conditions may cause plant stress. Insect pests and diseases are opportunists that primarily target stressed trees, making urban trees particularly vulnerable. Sound management practices, a proactive monitoring program, and education are the best tools to help mitigate these potential threats to the health of the urban forest.

The array of disease and insect pests that can threaten the health of forest and urban trees and their treatments are too numerous to completely encompass within the scope of this document. However, a basic discussion on the fundamentals of an Integrated Pest Management (IPM) program, and specifically monitoring, is covered in this section.

Fundamentals of an IPM program are:

1. **Identification:** The proper identification of trees and their existing and potentially harmful pests is necessary to successfully manage a pest outbreak or occurrence. Additionally, understanding each pest's life cycle is important for a positive diagnosis. Knowledge of beneficial and incidental (non-threatening) organisms also plays an important role in the identification and diagnostic process.
2. **Monitoring:** Proactive, regular monitoring for potential threats is perhaps the most important part of an IPM program. Monitoring for pest activity can be done using a variety of techniques, including visual inspection, and, in some cases, use of specialized traps. Regular contact with state and local plant health care officials can help to focus monitoring efforts and increase awareness of emerging threats. In most cases, North Carolina's State Forester, university extension services, State Department of Agriculture, or U.S. Department of Agriculture's state office can provide support for suspicions of potential pest infestations.
3. **Understanding the Economic Threshold Level:** The economic threshold is the level in which the costs involved in managing a pest infestation overshadow the value that a tree or plant is providing. In an urban situation, the economic value of a tree can be tied to the benefits that a tree provides. These benefits include, but are not limited to, aesthetic, environmental, and cultural benefits. This concept, on a general level, amounts to determining whether or not a tree is worth the costs of mitigating against a pest problem compared to its value to the community.

#### **Factors Influencing the Success of a Disease and Insect Monitoring Program**



*Public education and communication.*



*Cooperation and support from state and local agencies.*



*Structured system to report, investigate, and diagnose suspected threats.*

4. **Selecting the Correct Treatment:** Once a pest problem has been properly diagnosed and the decision has been made to treat the problem, selection of the correct treatment is the next step. Selecting treatment is a decision that requires a solid understanding of all the options, chemical or otherwise, for pest management material.
5. **Proper Timing of Management Strategies:** Once an appropriate treatment has been selected, it is important to carefully plan the timing and implementation to maximize effectiveness.
6. **Recordkeeping:** To facilitate future pest management decisions, accurate records should be kept concerning information on pests, treatments, locations, timing, weather conditions, and any other useful information.
7. **Evaluation:** A successful IPM must be evaluated based on experience, successes, and failures in order to focus efforts and resources for the future.

### 6.6.2 Emergency Response

An integral part of urban forest management must include an established procedure for emergency response. Individual tree-related emergencies, such as tree failures and large limb failures, are usually isolated events that can be effectively handled by having an emergency protocol for hazardous trees.

Efficient tree emergency response should proceed in an organized manner to maximize safety and minimize costs. For large-scale storm events that result in substantial amounts of damage and debris from trees, a formal tree emergency protocol should be in place, outlining emergency response steps, safety standards, debris removal plans, public communication means, and contact lists. These steps are outlined in the *Tree Emergency Manual for Public Officials*, included in Appendix E.

Storm events, such as ice storms, high winds, and destructive pest infestations, can result in overwhelming amounts of hazardous trees and debris that have immediate implications to public safety. Storm events often cannot be accurately predicted, and the post-storm management of the resulting hazards and debris can go from challenging to chaotic without an emergency response standard in place.

Communities manage such catastrophes with varying degrees of efficiency and often rely on aid from state and federal government agencies to fund hazard reduction and debris removal. That aid depends significantly on the ability to estimate storm damage accurately and quickly. The newly developed software “i-Tree Storm” (Appendix F) creates a new standard for assessing widespread storm damage in a simple, credible, and efficient manner immediately after a severe storm. This assessment method is adaptable to various community types and sizes, and it provides information on the time and funds needed to mitigate storm damage. Paramount to an efficient and accurate damage assessment is the establishment of a pre-storm survey and the training of observers who will be called upon to perform the field assessments as the Town mobilizes after a disaster.

## **Recommendations**

1. Continually update the Towns' tree emergency response and recovery plan.
2. Establish a method to assess the costs of damage to trees after a storm event.

## **6.7 Tree Preservation**

The following recommendations are suggestions for action-items to protect and enhance the existing public and private urban forest and to establish new forest cover where it is needed. The recommendations range from a variety of planning and management tools to simple public education. They are suggested as realistic and practical goals for the Town and citizens to achieve.

### **6.7.1 Legislation**

Various types of legislation can be particularly effective in protecting natural resources, since the very nature and location of these resources often cross public and private lines, and the presence or absence of them in a community can greatly affect the community and surrounding area as well.

### **6.7.2 Tree Preservation Ordinances**

Tree preservation ordinances expand on the general principles and goals of the simple tree ordinances by addressing larger issues, such as protection of trees on private property, protection of trees in critical areas (*e.g.*, streambanks and steep slopes), and protection of unique forest ecosystem areas.

Several approaches can be used to define the preservation of trees within a development. Examples include:

- Using a minimum basal area to ensure a minimum canopy cover for all land within the Town.
- Establishing a maximum percentage of trees that can be lost due to development.
- Requiring that the post-development forest be proportionally similar to the pre-development forest. For example, if 50% of the pre-development forest is mature trees and 50% is saplings, then the post development forest should also consist of 50% mature trees and 50% saplings.

#### **Goals of Tree Preservation Ordinances**

-  Reducing tree loss during development.
-  Reducing damage to standing trees during construction.
-  Providing for replacement of trees lost during construction.
-  Planting trees where none occurred previously.
-  Maintaining preserved trees after construction is completed.

Tree replacement guidelines may also be included in the ordinance. For example, some ordinances permit replacing 15, 2-inch diameter trees for the removal of 1, 30-inch diameter tree. This can become a complex procedure and may fail to mitigate the loss of a mature forest if there is not a mechanism to ensure the survival of these newly planted trees. In addition, it may be challenging to locate appropriate planting sites for large numbers of small trees.

### **6.7.3 Riparian Setbacks and Easements**

Article XIII, Section 224, *Buffer Areas Required*, of the Boone Unified Development Ordinance establishes a mechanism to preserve and protect riparian buffers. In addition, the *2007 Boone Smart Growth Audit* further identifies the Town's desire to protect the riparian corridor. These existing rules support the objectives of this Plan and should be enforced.

Retaining undisturbed, forested land along sensitive resources, such as streams and rivers, provides additional measures of protection. Undisturbed vegetation along streams and rivers filters pollutants, abates flooding, moderates peak flows, allows for groundwater infiltration of stormwater, reduces erosion and sedimentation, stabilizes banks, and provides habitat benefits. These areas may be protected by setbacks from the resource area similar to lot-line setbacks. Setbacks protect property owners by preventing construction too close to flood- or erosion-prone areas that widen due to upstream development.

Requiring riparian setbacks and easements prevents development of the most sensitive lands and promotes a reduction in flooding, erosion, and water quality problems while creating more attractive, livable communities.

### **6.7.4 Conservation Development**

Conventional development carves the landscape into a patchwork of disturbed (*i.e.*, mowed, graded, and paved) land. Conservation development or open space subdivisions are designed to create the same overall density while preserving 50% or more of the site in open space by grouping buildings together on smaller lots than would ordinarily be allowed under standard zoning or by having flexible side, rear, and front yard setbacks. Critical areas of Boone's urban forest can be preserved and protected within the open spaces in conservation developments.

Boone provides a mechanism for alternative residential developments, such as cluster development in Article XIII, Section 223, *Cluster Development*. The *2007 Boone Smart Growth Audit* reinforces the policy of cluster development.

To further promote conservation development, the Town should consider the following:

- Educate local officials and the development community as to the value, public health and safety benefits, and mechanics of conservation development.
- Educate the public as to the benefits of and need for conservation development.
- Identify linked systems of resources to protect the areas for relatively dense development by comprehensive planning.

### **6.7.5 Conservation Easements and Donations**

Often, property owners will willingly donate all or portions of their property to governments or non-profit organizations for forest and farmland preservation. Other than the outright donation of property, owners can also allow and approve conservation easements to be placed on their property. A conservation easement is a voluntary agreement that allows a landowner to permanently limit the type and amount of development on their property while retaining private ownership.

All parties concerned in transactions relating to conservation easements and land donations generally regard these actions positively. There is no taking by the government; the community benefits from the additional protected greenspace; and the property owner can receive financial as well as non-financial benefits from the donation or easement transaction. The Town should work cooperatively with local organizations to educate and encourage landowners to consider donating or placing conservation easements on their land to protect critical urban forests.

### **6.7.6 Create a Tree Mitigation Site**

Use of a tree mitigation site would be an asset to the Town. A tree mitigation site is a specific piece of land, or multiple sites, where tree plantings can occur to replace trees that have been removed or damaged due to development elsewhere in the Town. Typically, a mitigation site is on publicly owned land or land protected in perpetuity, generally with a conservation easement. The mitigation site would likely be managed by the Town or other entity knowledgeable in forest management, urban forestry issues, and tree care. The party responsible for tree removal or damage funds the purchase, planting, and long-term maintenance of the trees that are planted at the mitigation site property. Plantings along some of Boone's waterways would be ideal sites.

### **6.7.7 Historic Tree Designation**

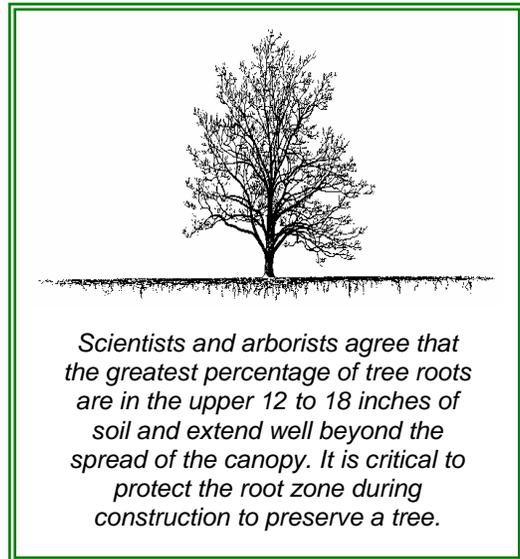
It seems to be human nature to want to know about the largest and oldest of trees. In addition to sheer beauty and majesty, the engineering challenges to maintain a large, complex tree structure is truly awesome. To attain great age and size requires the capture of huge amounts of much water, essential elements, food, as well as plenty of good luck. Society honors large specimen trees through state champion programs native tree societies, and advocacy groups. Although large and old trees seem to be the answer to tree preservation, preservation should be geared toward the "normal" range of size and age for the area. The species of a tree should also be considered. For Boone, trees such as *white pine (Pinus strobes)*, *black locust (Robinia pseudoacacia)*, are subject to the harsh winter conditions, issues with saturated soils and other issues that classify them more of a hazard in an urban environment. Historic should be designated based on appropriate species, native versus non-native, and useful life directly related to the size and species. *i.e. a 8" flowering dogwood (Cornus florida) based on size and age is more historic and useful than a 40" white pine (Pinus strobes).*

### 6.7.7 Construction Damage and Tree Preservation

Trees are valuable assets. They clean the air, provide shade and wind protection, add aesthetic benefits, decrease cooling and heating costs, provide pollution control, provide stormwater management benefits, and increase property value.

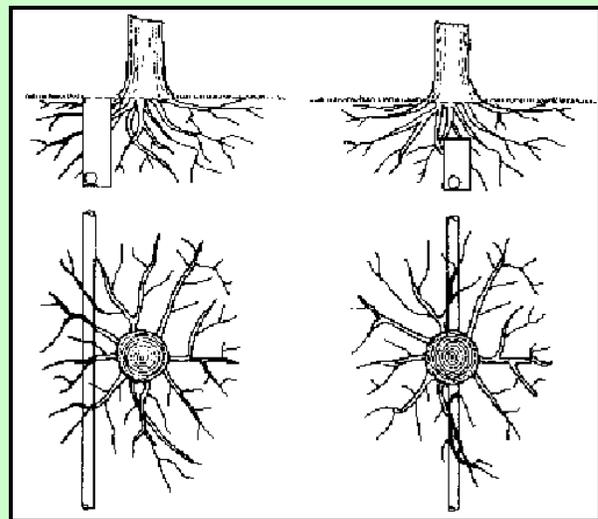
Unfortunately, when expansion occurs in the name of progress, trees are often compromised in the process. Attempts to save trees during the construction process are often doomed unless protective measures are carefully implemented prior to and strictly enforced during construction.

Trees are adversely affected both above and below ground by construction activities. To preserve trees during construction activities, every possible preservation technique must be implemented to minimize damage. The following information addresses the activities that damage trees during construction—trenching, soil compaction, and soil clearing and grading.



#### **Trenching**

*A trench dug without consideration can effectively and immediately sever a tree's root system by 50 percent or more. Construction equipment can injure a tree by tearing or breaking limbs and/or roots and by damaging the bark and wounding the trunk. Wounds created from these actions are permanent and can be fatal if extensive.*



#### **Tunneling and Directional Boring**

*Whenever possible, trenching should be restricted to areas that will disturb the least amount of root systems. Where this cannot be achieved because of other site restrictions, tunneling or directional boring should be considered. These practices minimize tree damage by keeping root injury to a minimum.*

## Soil Compaction



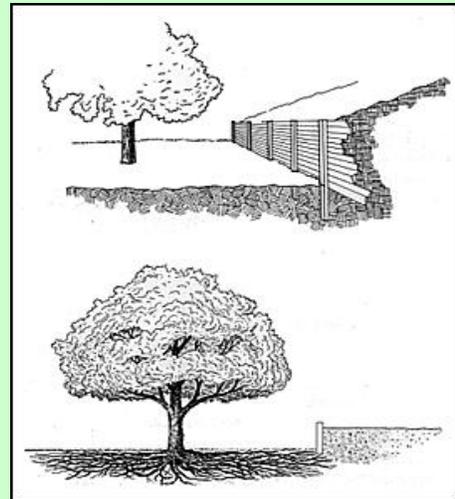
The most damaging effect of construction activity is soil compaction. Species tolerance to compaction varies, but most trees will suffer when the surrounding soil is compacted extensively.

Soil compaction during construction is usually due to equipment and vehicles continually driving over the root zone and from construction supplies and materials being stored for long periods of time near trees. Compaction happens quickly and is difficult, if not impossible, to correct. Only seven passes of a small tractor over the same area is enough to change a porous soil consistency to one similar to concrete.

To remedy this, fencing and off-limits areas should be established. If this cannot be accomplished, then a thick layer of unrefined (coarse) wood chips (12 to 18 inches deep) or sturdy geotextile materials can be temporarily laid over the driving area to reduce compaction.

## Soil Clearing and Grading

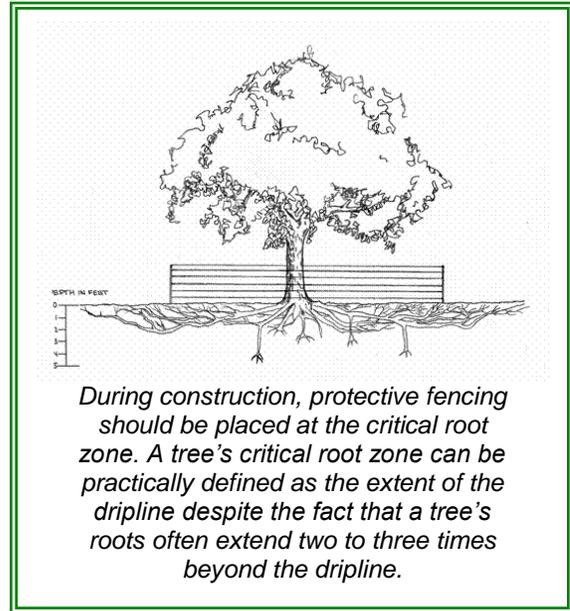
Soil grading and clearing can cause root loss, mechanical damage, soil compaction, and stripping of soil nutrients. These detrimental effects of grading and clearing can be avoided by preserving a tree's root zone. Restricting construction activity in and near the root zone by erecting metal, plastic, or wood fencing is the most effective means of avoiding damage to roots, trunks, and crowns.



### Site Design Solutions

Site design solutions are available to achieve required grade changes and to retain trees as depicted in the above illustration. The project architect and/or engineer, working in conjunction with a qualified arborist, can help develop innovative solutions to construction activities and tree preservation.

Ultimately, a Tree Preservation Plan should be developed specifically for all construction projects in the Town that will affect desirable trees and forest tracts. A preservation plan must note that protective tree fencing shall be installed prior to any site work and that it be placed at or outside of the dripline to ensure survivability of existing trees. It must also state that no site disturbing activities (e.g., cut, fill, parking, or material storage) shall take place inside the fenced area. Signs should be posted on the fencing to display all pertinent information, such as potential penalties, Town urban forester contact information, and other useful facts.



Trees that are only slightly damaged may be restored to a healthy condition by pruning, watering, fertilizing, core aeration, and/or radial trenching. Branches directly interfering with construction work should be properly pruned back. If a tree is severely injured, it should be removed.

While trees that have been disrupted by construction activities may not be showing signs of damage or stress now, they may show signs of decline in the near future. Trees in construction zones can be damaged or killed by root severance, soil compaction, soil grading, and/or construction materials (e.g., toxic leaks and spills).

Tables 5 and 6 list symptoms of construction damage and methods to minimize damage to trees.

**Table 5. Symptoms and Signs of Construction Activity Damage**

Tree Part	Symptoms and Signs of Damage
Crown	Slow growth rate, staghorns, and/or dieback
Leaves	Wilted, scorched, sparse, undersized, distorted, chlorotic, browning margins, premature autumn color, and/or premature drop
Trunk	Wounds, absent bark, crown rot, absence of buttress (root) flares, adventitious sprouting, suckering, and/or severe insect damage and disease
Branches	Dieback, slow growth rate, wounds, adventitious sprouting, and/or suckering
Fruits and flowers	Abnormally large crop, absence of fruit, and/or flowering out of season

**Table 6. Major Construction Impacts and Methods to Minimize Damage**

Impact to Tree	Construction Activity	Methods and Treatments to Minimize Damage
<b>Root Loss</b>	Stripping site of organic surface soil during mass grading	Restrict stripping of topsoil around trees. Any woody vegetation slated for removal and adjacent to preserved trees should be cut at ground level and <u>not</u> pulled out by equipment. This will prevent tree root injury.
	Lowering grade, scarifying, preparing subgrade for fills and/or structures	Use retaining walls with discontinuous footings to maintain natural grade as far as possible from trees. Excavate to finish grade by hand and cut exposed roots with a saw to avoid root wrenching and shattering by equipment, or cut with root pruning equipment. Spoil beyond cut face can be removed by equipment sitting outside the dripline of the tree.
	Subgrade preparation for pavement	Use paving materials requiring a minimum amount of excavation (e.g., reinforced concrete instead of asphalt). Design traffic patterns to avoid heavy loads adjacent to trees (i.e., heavy load bearing pavement requires thicker base material and subgrade compaction). Specify minimum subgrade compaction under pavement within dripline (i.e., extra reinforcement in concrete or geotextile under asphalt may be needed).
	Excavation for footings, walls, and/or foundations	Design walls/structures with discontinuous footings/pier foundations. Excavate by hand. Avoid slab foundations/post and beam footings.
	Trenching for utilities and/or drainage	Coordinate utility trench locations with installation contractors. Consolidate utility trenches. Excavate trenches by hand in areas with roots larger than 2 inches in diameter. Tunnel under woody roots rather than cutting them.
<b>Wounding Top of Tree</b>	Injury from equipment	Fence trees to enclose low branches and protect trunk. Report all damage promptly so arborists can treat appropriately.
	Pruning for vertical clearance for buildings, traffic, and/or construction equipment	Prune to minimum height required prior to construction. Consider minimum height requirements of construction equipment and emergency vehicles over roads. An arborist, not construction personnel, should perform all pruning.
<b>Unfavorable Conditions for Root Growth and/or Chronic Stress from Reduced Root Systems</b>	Compacted soils	Fence off trees to keep traffic and storage out of root area. In areas of engineered fills, specify minimum compaction (usually 85%) if fill will not support a structure. Provide a storage yard and traffic areas for construction activity well away from trees. Protect soil surface from traffic compaction with thick mulch. Following construction, vertical mulch compacted areas. Install aeration vents.
	Spills and/or waste disposal (e.g., paint, oil, fuel)	Post notices on fences prohibiting dumping and disposal of waste around trees. Require immediate cleanup of accidental spills.
	Soil sterilants (herbicides) applied under pavement	Use herbicides safe for use around existing vegetation and follow label directions.
	Impervious pavement over soil surface	Utilize pervious paving materials (e.g., interlocking blocks set on sand). Install aeration vents in impervious paving.

**Table 6. Major Construction Impacts and Methods to Minimize Damage (Continued)**

Impact to Tree	Construction Activity	Methods and Treatments to Minimize Damage
Inadequate Soil Moisture	Rechannelization of stream flow, redirecting runoff, lowering water table, and/or lowering grade	In some cases, it may be possible to design systems to allow low flows through normal stream alignments and provide bypass into storm drains for peak flow conditions. Usually flood control and engineering specifications are not flexible where the possibility of flooding occurs. Provide supplemental irrigation in similar volumes and seasonal distribution as would normally occur.
Excess Soil Moisture	Underground flow backup, raising water table	Fills placed across drainage courses must have culverts placed at the bottom of the low flow so that water is not backed up before rising to the elevation of the culvert. Study the geotechnical report for groundwater characteristics to see that walls and fills will not intercept underground flow.
	Lack of surface drainage away from tree	Where surface grades are to be modified, make sure that water will flow away from the trunk ( <i>i.e.</i> , that the trunk is not at the lowest point). If the tree is placed in a well, drainage must be provided from the bottom of the well.
	Compacted soils, irrigation of exotic landscapes	Compacted soils have few macropores and many micropores. Core vent to improve drainage. Some species cannot tolerate frequent irrigation required to maintain lawns, flowers, and other shallow-rooted plants. Avoid landscaping under those trees, or utilize plants that do not require irrigation.
Increased Exposure	Thinning stands, removal of undergrowth	Preserve species that perform poorly in single stands as groups or clusters of trees. Maintain the natural undergrowth.
	Reflected heat from surrounding hard surfaces	Minimize use of hard surfaces around trees. Monitor soil moisture needs where water use is expected to increase.
	Pruning	Avoid severe pruning where previously shaded bark would be exposed to sun. Where pruning is unavoidable, provide protection to bark from sun.

**Recommendations**

1. *Update the current Tree Preservation Ordinance language.*
2. *Enforce riparian setbacks and require riparian easements.*
3. *Promote conservation development.*
4. *Promote and establish conservation easements and land donations.*
5. *Locate and prioritize potential reforestation areas.*
6. *Create a Tree Mitigation Site.*
7. *Implement an educational program with the Tree Commission taking the leadership role.*
8. *Require Tree Preservation Plans for all construction projects in the Town that will affect desirable trees and forest tracts.*
9. *Redefine what truly defines a Historic and Significant Tree based on the appropriate species for the area and size in accordance with the species useful life.*
10. *Consider providing a Champion Tree designation for the community that truly defines a majestic tree and consider more extensive preservation standards for this type of designated tree.*

## 6.8 Educational Tools

An important element of any successful urban forestry program in any community is education. Governments and non-profits alike can work together to educate and inform property owners on how to maintain their trees and forests, plant trees, and engage in development projects in ways that protect existing forest tracts.

The educational tools discussed in this section are proven approaches to protect urban and community forests. Implementing any of the recommendations previously described will require a substantial effort, and education and information dissemination are critical to the success of these efforts.

Implementing resource protection measures will require educating public officials and developers in designing, implementing, and complying with the new requirements in a way that appropriately protects the resources while allowing use of the land. The measures discussed involve changing perceptions about many issues, including:

1. Natural resources provide public and private health and safety benefits and are natural mechanisms to reduce many problems.
2. Trees and forests are not just attractive areas for people and places for animals to live, they are Boone's natural heritage.
3. Natural resources can be protected through both regulation and guidance. Not all forest protection strategies have to be legislated. Incentives and education can greatly promote proper forest stewardship throughout the Town and across Watauga County.
4. All activities have some level of impact on our natural resources, and Boone's residents have a personal responsibility to help protect their resources.

The Tree Board should take a leadership role in the educational efforts in Boone. The Board, as a non-partisan organization with its access to current and comprehensive forest data, is the natural and neutral agency to affect change.

Education topics should range from the scientific data gathered on Boone's urban forest to more basic, consumer-oriented tree care, planting, and benefits information. The educational efforts should be offered to the following persons and groups:

- Town Planners
- Engineers
- Building Inspectors
- Town Advisory Commissions
- Contractors/Subcontractors
- Home/Property Owners
- Homeowner Associations
- Foresters
- Citizen Groups
- Town Council
- Utility Companies
- Realtors
- Developers
- Landscape Architects

Educational tools may include:

- *Workshops and training seminars* with community leaders, advisory groups, contractors, homebuilders, and county and municipal staff.
- *Publications*, including direct mailings, newsletters, forestry and arboricultural handouts, landmark, unique and historic tree brochures, special publications, and articles for the local print media. All publications should be available in electronic format and included on the Town's website.
- *Awards and events* to recognize contractors and governments who excel at tree preservation and reforestation, and a Big Tree Contest and Arbor Day events and programs.

## 7.0 Funding Sources

---

Urban forest management is a recognized function of the Town of Boone and receives some dedicated funding. Although no dedicated urban forestry budgetary line items, various departmental funds are available and used for emergency tree maintenance, brush removal, landscape design work, and limited tree planting.

With greater funding levels, the Town could move from a reactive to a proactive management approach, provide greater services, and increase tree canopy coverage if the security of funds to sustain all activities, programs, and initiatives are available.

There are various funding mechanisms and sources the Town can consider to support increasing staff levels, public education efforts, tree protection, maintenance, planting activities, and other components of a truly progressive, comprehensive urban forest management program.

### 7.1 Establish a Boone Tree Bank

A special account could be created to deposit funds from various sources, which are restricted for use by the urban forestry program. The funds in this account are managed by the Town, subject to the annual budget process, and expenditures follow normal purchasing policies and procedures.

This innovative funding mechanism does not rely on Town general funds but, instead, on the collection and deposit of monies from various sources. Suggested sources included, but are not limited to, the following:

**Damage Compensation.** This source may not generate a great deal of money, but it is a legitimate and often under-pursued source of funds. When an automobile damages a public tree or when construction equipment destroys a group of public trees, the Town should seek compensation for the landscape value of that tree(s). The Town can rightly seek compensation for the total damages, including: the value of the tree(s); the cost of repair or clean-up; and the cost of the administrative time used during the resolution of the situation. The receipt of \$500 from a minor car accident to \$5,000 for a major damage claim can add up over time. Generally, the compensation is collected from the insurance company of the person responsible for the damage or directly from the business that caused the damage to public trees. The compensation funds can be used to remedy the specific damage, or be used for other legitimate urban forestry functions throughout the Town.

**Permit and Plan Review and Inspection Fees.** It is not uncommon for municipalities to require private developers and businesses to support the administrative time needed for proper and professional plan review and site inspection tasks. In light of the Town's goal to protect and enhance the urban forest, charging specifically for the time and arboricultural expertise needed to

approve permit applications, review plans, and make site inspections might be a viable option to support the salary and benefits of additional full- or part-time urban forestry positions. The Town may need to perform a job analysis to determine the time spent performing review and inspection tasks, and could investigate what other cities in the region, or of a similar size, are charging for such a task.

**Developers Fees.** In lieu of or in addition to new tree-related plan and inspection fees, and previously mentioned currently required expenses for tree preservation compliance, landscape installation, and other zoning/subdivision regulation activities, developers could be required to pay a set amount to support Boone's overall urban forestry program. In effect, it would be a cost of doing business within the Town limits. The fee could be a percentage of the total project cost, based on the number of housing units built, or based on the area of land being developed. The Town's Planning Department may have better information upon which to base this fee. It is suggested that this fee would be paid and deposited in the Tree Bank before the project is approved.

**Utility Company Fees.** Non-municipal utility companies perform new construction, maintenance, and repair work on an annual basis in the Town. This work may affect the aboveground and belowground portions of public trees. It is prudent and reasonable to assess a fee to such utility companies when their work affects municipal trees. Utility companies with aerial facilities might be required to provide the Town an anticipated annual work plan and maps with an appropriate fee attached to provide for inspection and monitoring. Any compensation for documented damage to public trees during utility work would be collected separately on a case-by-case basis, and the utility company should be responsible for the costs for any remediation necessary (*e.g.*, pruning, fertilization, or temporary irrigation) above and beyond the fees and compensatory payment. The same conditions would apply for companies installing or maintaining underground utilities.

**Private Donations/Corporate Sponsorships.** Boone is fortunate to have generous citizens who care about the quality of life in the Town. The Tree Board could solicit citizens for private donations to support tree planting, tree care, and public education activities. A major source of donations could be from businesses and corporations who wish to sponsor non-profit, environmental activities. All potential contributors should be reminded that any donations might be tax-deductible when they file their federal income tax return if their financial situation allows.

**Fund-Raising Activities.** With the support of volunteers, the Town can hold various fund-raising events throughout the year. Popular large events include competitive and social runs and walks. Volunteers can staff food and drink booths at local fairs and festivals. Tree and Boone-related merchandise could be commissioned and sold. Restaurants can have special Tree Nights where a small percentage of the patrons' bills is donated back to the Town for tree planting. Even small efforts, such as school and church bake sales and yard sales, can be encouraged to raise funds for trees in the community.

**Firewood/Mulch/Wood Sales.** If Town property can be sold, the wood waste from tree maintenance and storm damage repairs can be a source of funds for the Tree Bank. Other cities have been successful in selling split and un-split firewood, hardwood timber, and rough wood chips to the general public and commercial businesses. Rather than pay for proper removal and disposal, cities sell these excess wood products. A new trend is when a significant or historic public tree must be removed, the logs and useable wood are given to local craftsmen who then create furniture, sculpture, and other collectibles from the wood. These are sold and all or portions of the proceeds are returned to the Town.

### **Memorial and Honor Trees**

Boone's tree planting program can be partially funded and enhanced by creating and advertising a Memorial and Honor Tree Planting Program. Citizens at times of loss and at times of celebration often choose to plant a tree to remember special people and mark a special achievement. Cities across the country successfully use this funding technique not only for program support but also for generating good public relations for the urban forestry program.

A prudent approach to implementing such a program is to set a level of funding that will not only purchase and plant a tree of a certain size, but that will also collect funds to pay for maintenance for three years.

### **Utility Bill Donations**

The Town bills property owners directly for water and sewer services. These municipal invoices could be a source for needed funds for the urban forestry program. A small fixed amount from \$0.25 to \$1.00 could be automatically added to each bill; the property owner would then have the option to voluntarily include it with their utility payment. Another option is to ask the bill payers to round the invoice amount up to a higher figure of their choice.

Using this voluntary and "painless" funding mechanism can potentially raise thousands of dollars. It will require the cooperation of the Utility Department, and coordination with Finance Department to implement this program.

## **7.2 Other Funding Tools**

The following sources of revenue are not appropriate for inclusion in Boone's Tree Bank, but are each viable sources of funding for the comprehensive urban forestry program.

**Increase the General Fund Allocation to the Urban Forestry Program.** During future budgeting cycles, the Town should consider increasing the financial resources available for urban forestry staff and functions and making a separate budget line-item for the urban forestry program.

**Obtain Grants.** As a municipality and a non-profit with existing support structures and staff, Boone is in a good position to apply for and receive grants to support urban forestry activities. The Town has previously received grants for urban forestry projects, but with the investment in time and a person skilled in grant writing, there are likely multitudes of grant opportunities for Boone. These opportunities can be found with the State and Federal governments, non-profit organizations, large corporate and private business foundations, and private charitable foundations. If Boone establishes a Tree Bank, there will be a ready source of matching funds to leverage even more grant dollars.

**Promote the Federal Tax Incentive to Citizens.** As a non-profit, the Town is in a unique position to encourage citizens to directly pay for desired tree planting and tree maintenance on public property. The Town should inform property owners abutting the public rights-of-way, parks, or other Town properties that if they pay for Town-approved, proper public tree planting or tree maintenance, then that effort and any related expenditures may qualify as a charitable deduction on their federal income tax return. Until the Town's urban forestry program is fully staffed, equipped, and funded, this mechanism is a good public relations tool as well as a way to accomplish needed work.

## 8.0 Management Goals

---

The overarching goals of Boone's *Urban Forestry Master Management Plan* is to guide the Town's efforts to recover the loss of tree canopy and enhance all tree-related benefits by recommending strategies and actions to improve the Town's urban forest management in an equitable, economic, and sustainable manner. The *Urban Forestry Master Management Plan* seeks to be used along with the Land Use Master Plan and will achieve its goals by recommending strategies, goals, policies, standards and actions to protect, enhance, expand, and preserve the tree canopy for the benefit of the community.

Through public participation, input from Town staff, and a detailed analysis of urban forestry conditions, five management goal areas emerged as priorities for Boone:

1. Tree Planting and Increased Forest Canopy Cover
2. Improved Tree Planting/Protection Legislation and Policies
3. Expanded Education and Public Relations
4. Improved Funding
5. Improved Urban Forest Maintenance

### 8.1 Major Goal Areas, Statements, and Objectives

Achieving progress and success in the five major goal areas should be the Town's priority in the next ten years. These major goals are summarized below. Specific action steps are found in Table 7, *Goals, Objectives, and Recommendations*, at the end of this chapter.

#### **Goal Area 1 — Tree Planting and Increased Forest Canopy Cover**

**Statement:** Boone's canopy cover has been estimated at 34.7%, and it is rapidly disappearing due to forest removal on private property and lack of new and replacement tree planting on public and private properties. Without an adequate forest canopy cover, Boone will not realize the many tangible and intangible benefits trees provide, and the character of the Town will suffer.

- Objectives:**
1. Achieve an overall tree canopy cover of 40%.
  2. Update the *Master Tree Plan* with prioritized areas, including, but not limited to, these public areas: streets, parks, pathways/trails, public buildings, greenways and waterways.
  3. Ensure that all new tree planting is monitored to ensure species diversity and is performed using current arboricultural standards.
  4. Seek to establish an adequate level of funding for tree planting through increased allocations from the general fund, grants, donations, fees, and other sources.
  5. Plant trees only if there is a maintenance program and adequate resources available to care for the trees.

## **Goal Area 2—Improved Tree Planting/Protection Legislation and Policies**

**Statement:** The Town should review and improve ordinances, guidelines, and policies regarding tree planting and tree and forest protection, and create or enact new legislation and policies as needed. These policies will serve as an official statement by the Town regarding the importance and value of trees in the community.

- Objectives:**
1. Review and revise the Boone Unified Development Ordinance to require a higher degree of accountability for developers to preserve existing forests and plant new trees. Consider changing the fee structure to support more professional arboricultural review, inspection, and emphasize the need for developers to replace trees or make significant payments to a newly established Tree Bank.
  2. Revise Section 99, Trees and Shrubs of the Town Code that references trees on public property. Include language that provides for a full accounting of tree value by collecting the appraised value of public trees that are damaged or removed without a permit. Require permits for any work on public trees that may damage trees (including roots). Require all work on public trees to follow accepted industry standards.
  3. Create a document, separate from ordinances, that serves as a technical guide to tree preservation and other arboricultural activities to ensure all current arboricultural and horticultural standards and practices are referenced and used.

## **Goal Area 3—Expanded Education and Public Relations**

**Statement:** Citizens, businesses, Town staff and leaders, and developers need continued education and marketing targeted to increase their awareness of the benefits of trees. They need to be aware of the availability of Town resources and the various ways they can become more involved in the urban forest management program and be a part of the solution.

- Objectives:**
1. Continue public and citizen urban forestry outreach efforts through a wide variety of media outlets, special events, and publications to instill a sense of civic pride and gain more financial and political support for the urban forestry program.
  2. Create a standardized educational program for orienting newly elected public officials to the Town's urban forestry program, efforts, and goals.
  3. Promote internal educational opportunities by increasing professional interaction, coordination, and communication between departments and staff regarding tree planting and maintenance principles and practices.
  4. Market the urban forestry program and its successes outside of the Town to the County, state, region, and the country. A widespread and heightened awareness of the quality of the urban forest and life in Boone promotes economic development, which, in turn, enhances the visibility and political stature of the program.

### **Goal Area 4—Improved Funding**

**Statement:** Critical to the program’s success is adequate funding.

**Objectives:** 1. Seek new and reallocated funding sources to support a comprehensive urban forestry program. A national average sets the minimum annual budget at \$5 per capita.

### **Goal Area 5—Improved Urban Forest Maintenance**

**Statement:** Proper and timely tree maintenance is required to maximize tree benefits, increase service life, improve aesthetics, and ensure public safety. Maintenance programs are critical to the survival, vitality, and growth of existing trees and of newly planted trees.

**Objectives:**

1. Implement four tree maintenance programs—preventive maintenance on a 5-year cycle, routine maintenance on an as-needed or request basis, young or small tree maintenance, and an emergency response program.
2. Conduct a town-wide street tree and park tree inventory and complete a full update every ten years. Use a quality tree management software program to store the data, document maintenance work and costs, and create annual work plans.
3. Mandate the use of current and accepted best management practices and arboricultural work standards in all maintenance activities.
4. Adequately train Town employees performing maintenance, encourage Town staff to become *Certified Arborists*, and hire contractors who perform work to the highest industry standards (Appendix G has information about contracting tree work).

8.2 Goals, Objectives, and Recommendations

Table 7. Goals, Objectives, and Recommendations

Goals	Objective	Recommendations	Chapter Reference	Priority	Timeframe
1. Tree Planting and Increased Forest Canopy Cover	1A. Achieve an overall tree canopy cover of 40% in the Town of Boone.	1A.i. Set minimum percent canopy cover per land use and slope category.	3.1.2, 5.2	High	Short-term
		1A.ii. Achieve at least a 90% stocking level for street trees.	3.1.2	High	Optimum—2015 Moderate—2020 Minimum—2025
		1A.iii. Expand protection of trees on development sites.	3.1.1, 3.1.4, 3.2.1,	High	Mid-term
	1B. Update the <i>Master Tree Plan</i> with prioritized areas.	1B.i. Identify and prioritize areas to plant on public land (waterways, greenways, newly constructed roads, main arterials).	3.1.2	High	Mid-term
		1B.ii. Perform a complete public tree inventory.	3.1.2, 3.1.3, 5.3	Low	Bi-annually, short-term
	1C. Ensure that all new tree planting is monitored to ensure species diversity.	1C.i. Achieve a species mix where no single genus or species comprises more than 20% and 10%, respectively, of the total tree population.	6.4.2	High	On-going, short-term
		1C.ii. Favor large canopy tree species.	6.4.3	High	On-going, short-term
		1C.iii. Plant urban-tolerant species.	6.4.3	High	On-going, short-term
	1D. Seek to establish an adequate level of funding for tree planting and maintenance.	1D.i. Establish a Boone Tree Bank for the deposit of tree related fees and fines and dedicated for urban forestry activities	3.2.1, 7.1	High	Long-term
		1D.ii. Initiate a system of fees and fines (required and voluntary) that generate urban forestry funds.	7.1	Medium	Long-term
		1D.iii. Increase budgeted funds for tree planting .	7.2	High	Annually adjusted, mid-term
	1E. Plant trees only if there is a maintenance program and adequate resources available to care for trees.	1E.i. Develop a thorough and adequately funded tree maintenance program.	3.1.2, 3.1.3, 3.2.2, 4.3,	High	Short-term
	2. Improved Tree Planting/ Protection Legislation and Policies (continued on next page)	2A. Review and revise the Boone Unified Development Ordinance.	2A.i. Require protection of canopy coverage on steep slopes based on amount of slope.	3.2.1, 5.2	High
2A.ii. Combine and re-write Sections 365 and 370 of Unified Development Ordinance to include delineation and preservation of woodlands and delete the exemption of trees within footprints.			3.1.4, 3.2.3	High	Short-term
2A.iii. Delete references in ordinances that only preserve trees outside of proposed footprints.			3.2.1	High	Short-term
2B. Revise Section 99 "Trees and Shrubs" of the Town Code		2B.i. Include language that provides fines that reflect appraised values of trees using accepted appraisal methodology.	3.2.2	Medium	Short-term
		2B.ii. Require permits for any work near public trees that may cause damage (including roots).	3.2.2	High	Short-term
		2B.iii. Require all work on public trees to follow ANSI standard references.	3.2.2	High	Short-term
		2B.iv. Clearly define the roles and authority of each Town department for urban tree management.	3.2.2	High	Short-term Short-term
2C. Create a new technical standards manual as a document separate from ordinance.		2C.i. Create a "Tree and Landscape Manual" that contains detailed specifications separate from ordinances.	3.2.1	Medium	Short-term
2D. Create a new Public Tree Ordinance that clearly states the Town's responsibility for public trees.		2D.i. Clearly state the Town's responsibility for public trees and which Department has authority and describes the Tree Board's role.	3.2.1	High	Mid-term
		2D.ii. Designate one position as having authority for public trees. Clearly define relationship with other departments.	3.2.1	High	On-going, short-term
	2D.iii. Allow for collection of compensatory payments for public tree damage.	3.2.2	Medium	On-going, short-term	

**Table 7. Goals, Objectives, and Recommendations (Continued)**

Goals	Objective	Recommendations	Chapter Reference	Priority	Timeframe
3. Expanded Education and Public Relations	3A. Continue public and citizen urban forestry outreach efforts.	3A.i. Arrange or participate in local events to promote trees and the urban forestry program.	6.8	High	Annually, short-term
		3A.ii. Encourage individual citizen interactions with the <i>Urban Design Specialist</i> and Tree Board members.	6.8	Medium	Annually, short-term
		3A.iii. Establish a printed or electronic urban forestry newsletter.	6.8	Medium	Annually, short-term
	3B. Create an educational program for elected public officials.	3B.i. The Tree Board and <i>Urban Design Specialist</i> should inform and educate elected Town leaders.	6.8	High	Annually, short-term
		3C. Promote internal educational opportunities.	3C.i. The <i>Urban Design Specialist</i> should regularly host tree benefits and planting and maintenance education sessions with Town staff.	6.8	High
	3D. Market the urban forestry program.	3C.ii. Daily, routine interaction of the <i>Urban Design Specialist</i> and other Town staff should be viewed as educational opportunities.	6.8	Medium	Annually, short-term
		3D.i. Seek regional and national conference presentations and publication of articles.	6.8	Low	Annually, short-term
			3D.ii. <i>Urban Design Specialist</i> should work with the business and tourism communities to include the benefits of trees into their outreach efforts and projects.	6.8	Low
4. Improved Funding	4A. Seek new and reallocated public and private funding sources	4A.i. Create a Tree Bank to collect, manage, and disperse monies from various sources.	3.2.1, 7.1	High	Short-term
		4A.ii. Increase and/or reallocate General Fund support of urban forestry program.	4.2.1, 7.2	Medium	Short-term
		4A.iii. Seek corporate and private grants.	7.1	High	On-going, short-term
		4A.iv. Use tax incentives to increase citizen and business participation in the urban forestry program.	7.2	High	On-going, short-term
		4A.v. Authorize the collection of compensatory payments for public tree damage.	3.2.2	Medium	Short-Term
5. Improved Urban Forest Maintenance	5A. Implement various tree maintenance programs for all public trees.	5A.i. Establish a preventive maintenance program.	6.0	Medium	100% rotation every 10 years, short-term
		5A.ii. Implement an insect and disease monitoring program.	6.2.6	High	Annually, or as needed, short-term
		5A.iii. Establish a routine, mature tree care program.	6.2	Medium	As needed or requested, short-term
		5A.iv. Establish a new or small tree maintenance program.	6.3	High	100% rotation every 3 years, short-term
		5A.v. Establish an emergency response and risk tree management program.	6.6.1, 6.6.2	High	Short-term
		5A.vi. Create and properly equip a Town tree maintenance crew(s), or contract for the service.	3.3.1, 4.3	Medium	On-going, short-term
	5B. Conduct a complete public tree inventory.	5B.i. Perform a complete public tree inventory.	3.1.2, 3.1.3, 5.3	Medium	10-year intervals, long-term
		5B.ii. Commit to regular, routine inventory data entry and updating.	5.3	High	On-going, short-term
		5B.iii. Use GPS and GIS technologies to help manage the urban forest.	5.3	Low	At time of next inventory, mid-term
	5C. Use current and accepted best management practices and arboricultural work standards.	5C.i. Use all appropriate and current versions of the ANSI standards in tree maintenance operations.	3.1.2, 3.1.3, 3.2.2	High	On-going, short-term
	5D. Train Town employees.	5D.i. Use all best management practices promoted by arboricultural industry leaders.	3.1.2, 3.1.3	High	On-going, short-term
		5D.ii. Review <i>Urban Design Specialist's</i> tree planting, protection, and removal and replacement specifications annually and revise as needed.	6.4.9	Medium	On-going, short-term
		5D.iii. Encourage key staff to become <i>Certified Arborists</i> and/or <i>Certified Tree Workers</i> .	6.3.5	Medium	On-going, short-term
		5D.iv. Provide frequent in-house and professional training for all tree planting and maintenance tasks, safety, and equipment and tool use.	6.3.5	High	On-going, short-term

## 9.0 Conclusion

Historically, Boone has boasted about its beautiful natural setting, and abundant natural resources found in the forested hillsides, fields, and waterways that characterize the Town. These natural resources contributed greatly to the charm, ambiance, and character for which Boone is widely known.

Recently, however, changing demographics, renewed interest and activity in attracting business and increasing residential development, and new research on the benefits urban forests provide cities all pointed to the need for an evaluation of the current urban forest resources and management in Boone and creating a plan of action. The *Urban Forest Master Management Plan* is the resulting action plan and is based on major goals that collectively lead to creating a sustainable urban forestry program.

### 9.1 Management Goal Areas and Key Recommendations

The overarching goal of Boone's *Urban Forestry Master Management Plan* is to guide the Town's efforts to recover the loss of tree canopy and enhance all tree-related benefits by recommending strategies and actions to improve the Town's urban forest management in an equitable, economic, and sustainable manner. The five *Management Goal Areas* are presented below with the key recommendations. A detailed list of the recommendations to achieve each goal is presented in Table 7 located in Chapter 8.2, *Goals, Objective, and Recommendations*.

#### 1. Tree Planting and Increased Forest Canopy Cover

Boone's canopy cover is been estimated at 34.77%, and it is rapidly disappearing due to forest removal on private property and lack of new and replacement tree planting on public and private properties. Without an adequate forest canopy cover, Boone will not realize the many tangible and intangible benefits trees provide, and the character of the Town will suffer.

**Key Recommendations:** Achieve an overall tree canopy cover of 40% by a combination of creating and updating the Town *Master Tree Plan*, revising current legislation, enacting new legislation, creating incentives for private property owners to plant trees on private properties, and ensuring there is adequate funding for tree planting and maintenance.

#### 2. Improved Tree Planting/Protection Legislation and Policies

The Town should review and improve ordinances, guidelines, and policies regarding tree planting and tree and forest protection, and create or enact new legislation and policies as needed. These policies will serve as an official statement by the Town regarding the importance and value of trees in the community.

**Key Recommendations:** Improve Town legislation by reviewing and amending, as needed, the Unified Development Ordinance, as well as updating and adopting a defensible Public Tree Ordinance; and incorporate urban forestry goals, programs and tasks with all other Town plans.

3. **Expanded Education and Public Relations**

Citizens, businesses, Town staff and leaders, and developers need continued education and marketing targeted to increase their awareness of the benefits of trees. They need to be aware of the availability of Town resources and the various ways they can become more involved in the urban forest management program and be a part of the solution.

**Key Recommendations:** Continue public and citizen urban forestry outreach efforts, and educate elected officials and Town employees on a regular basis.

4. **Improved Funding**

Critical to the program’s success is adequate funding.

**Key Recommendations:** Seek new and reallocated funding sources to support a comprehensive urban forestry program.

5. **Improved Urban Forest Maintenance**

Proper and timely tree maintenance is required to maximize tree benefits, increase service life, improve aesthetics, and ensure public safety. Maintenance programs are critical to the survival, vitality, and growth of existing trees and of newly planted trees.

**Key Recommendations:** Implement and expand various tree maintenance programs, and conduct a complete public tree inventory every ten years using a tree data software program to manage the data.

**9.2 Plan Implementation**

It is hoped that Boone’s *Urban Forestry Master Management Plan* will be a working document that can be used by the Town and the Tree Board as a guide and reference source to achieve not only short- and long-term urban forestry goals, but Town goals as well.

With this Plan, Boone has an important and critical tool to help form, grow, and sustain an effective, progressive, and comprehensive urban forestry program. The Plan will allow the Tree Board, Town staff and leaders, and the citizens to examine a number of urban forestry issues in terms of what is technically correct, organizationally feasible, and aesthetically complementary, as well as what is economically expedient.

*“People in cities need to have living things around them. The most common biblical metaphor for the spirit is the wind; and trees show us the wind. The state of a city’s trees is what tells us if the special spirit of a city is alive and blowing.”*

*Sara Ebenrect, “Measuring the Value of Trees,”  
American Forests, July/August 1988*

The importance of comprehensive urban forestry management in Boone transcends the daily, operational maintenance routines and responsibilities; it stands to demonstrate the Town's leadership and commitment to improving the environmental quality of life for its citizens. It demonstrates that owning and managing land not only grants privileges but also entails obligations.

Boone's urban forest is a municipal amenity that will appreciate over time because trees are alive and growing. They provide tangible and intangible benefits to the Town and its citizens. Because of their significance to the environmental, social, and economic well-being of the Town, the urban forest should be professionally managed and protected to preserve them for all citizens and the future.