

A Framework for Developing and Evaluating Comprehensive Urban Forest Management Plans:
An Analysis of Washington State Plans

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Abstract

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The urban forest is a diverse and dynamic resource that is inextricably linked to the surrounding community. A comprehensive urban forest management plan helps communities create a shared vision and develop a set of goals and actions that serve as a municipality's guide for management. Using content analysis and an evaluative framework, this study examined the comprehensiveness of 39 urban forest management plans in Washington State. Nearly all plans address the management of trees, but few plans specifically address the community's role in urban forest management. Public participation in the plan writing process significantly influenced the overall comprehensiveness of the plans, supporting the claim that urban forest management should be an inclusive, community-wide process. Most Washington plans lack detailed implementation guidelines and nearly all plans lack a written strategy for monitoring and measuring performance. Plan content varies depending on municipalities' unique management objectives, suggesting that a one-size-fits-all approach is not appropriate in the development of an urban forest management plan. However, the results suggest that an adaptable framework and set of criteria would be useful to municipalities as they plan for managing this diverse and complex resource.

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1. Introduction

1.1 Research Summary

The purpose of this thesis is to increase understanding of municipal urban forest management in Washington State by exploring municipal urban forest management plans. An urban forest management plan is a municipality's planning document that guides the management of its urban trees and urban forest. This thesis draws from the literature on urban forest management, environmental planning, and plan evaluation to create a framework for comprehensive urban forest management plans. The resulting framework is used to analyze the 39 urban forest management plans in Washington State. This thesis contributes valuable information about municipal urban forest planning and management efforts in Washington State, including identifying the importance of public involvement in the planning process and the current lack of monitoring and performance measurement in urban forest management plans. These observations should provide the Washington Department of Natural Resources' Urban and Community Forestry Program with useful information to share with municipalities that are working on developing or improving an urban forest management plan. The framework presented in this thesis may also serve as a resource for municipalities as they develop urban forest management plans in the future.

1.2 Urban Forest Management

The urban forest, sometimes referred to as the community forest, is the collection of street trees, park trees, residential trees, green spaces, and vegetated public lands in populated areas (Moll, 1995). Urban forests provide environmental, social, and economic benefits and are integral to urban living. Unlike a rural forest, an urban forest is inextricably tied to its human inhabitants and is populated by people, houses, businesses, and other infrastructure. Because of this, urban forests must be managed differently than rural forests (Dwyer, Nowak, & Noble, 2003). Since urban forests are diverse, connected, and dynamic, they require a comprehensive approach to planning and management (Dwyer et al., 2003). Comprehensive urban forest management considers all the trees in an urban area as well as the competing land uses, ownerships, and community values and is integral to shifting from reactive to proactive management of the urban forest (Nowak, Stein, & Randler, 2010).

Urban forest management plans help municipalities create a long-term vision for their urban forests, develop goals and objectives, and create action and implementation plans to achieve the desired vision. An urban forest management plan becomes a city's guiding document for urban forest management and provides a strategic direction and/or a set of operational guidelines for management. Developing a management plan gives a municipality the opportunity to create policies, define best management practices, and consider ways to involve the community in shaping the future of the urban forest. A *comprehensive* urban forest management plan addresses the components of sustainable urban forest management, as defined by Clark et al. (1997): the vegetation resource, community framework, and management approach. A comprehensive plan should also address the components of a strong resource management plan, including an assessment of the current state of the resource, a vision statement, management goals and objectives, specific action steps, an implementation plan, and a plan for monitoring and evaluating the success of the plan and programs (Miller, 1997).

1.3 Urban Forest Management in Washington

Over the last two decades, many Washington communities have made efforts to manage and plan for the future of their urban forests, including conducting tree inventories and developing management plans. These proactive steps require financial resources and technical expertise, which is often lacking at the municipal level, especially in smaller municipalities. In Washington, financial and technical urban forestry assistance is provided through the Washington State Department of Natural Resources (DNR) Urban and Community Forestry Program. The DNR Urban and Community Forestry Program's mission is to "educate citizens and decision-makers about the economic, environmental, psychological, and aesthetic benefits of trees and to assist local governments, citizen groups, and volunteers in planting and sustaining healthy trees where people live and work in Washington" (DNR, 2013).

The most common first step Washington municipalities have taken to more actively or visibly manage their urban forest is to gain Tree City USA recognition. As of April 2013, 82 Washington cities were recognized as Tree City USA communities, which provides evidence that Washington cities are recognizing the importance of trees in contributing to quality of life and a city's character. Tree City USA, a program created by the Arbor Day Foundation, is a national designation marking a municipality's effort to manage its tree resources with an ordinance, a tree board, and an annual budget. In Washington State, the Tree City USA program is administered by the DNR Urban and Community Forestry Program.

Beyond technical advice and administering the Tree City USA program, the DNR's Urban and Community Forestry Program partners with the USDA Forest Service Urban and Community Forestry Program to offer Community Forestry Assistance (CFA) grant opportunities to Washington municipalities. The DNR Urban and Community Forestry Program awards CFA grants to municipalities for a number of different urban forestry program improvement projects, including conducting tree inventories to get a baseline of a municipality's tree resources, creation of tree ordinances, and the development of urban forest management plans. From 2001 to 2011, DNR awarded over 140 grants to municipalities and community groups throughout Washington to support the development of inventories, management plans, and community education programs (DNR, 2012). Of those grants, approximately 23 funded the creation of an urban forest management plan or similar guiding urban forestry plan. The DNR Urban and Community Forestry Program recommends that any city considering the development of a management plan first have a thorough understanding of the tree resource, and additionally that the city has already shown commitment to proactive management of the urban forest. For this reason, DNR is currently considering making CFA grants available to only those municipalities recognized as a Tree City USA (Micki McNaughton, personal communication).

1.4 Research Objectives

Through assistance from the DNR Urban and Community Forestry program and supportive city leaders, at least 38 Washington municipalities have adopted urban forest management plans or similar guiding management documents in the past twenty years. Washington municipal urban forestry plans come in a variety of forms, from strategic, long-term plans to operational plans written with a single goal in mind, such as street tree planting or maintenance. Because of the diversity and complexity of the urban forest as well as unique community characteristics and values, a management plan should be both comprehensive and unique to a particular municipality. While plans should remain unique, all comprehensive management plans should contain certain elements, including addressing the components of a sustainable urban forest (i.e. vegetation resource, resource management approach, and community framework) and the components of a strong resource management plan (e.g. assessment of resource, vision statement, monitoring strategy). To date, no studies have analyzed the components of urban forest management plans or the success of plan implementation. It is unclear

whether most Washington State urban forest management plans are capturing the components of a *comprehensive* urban forest management plan.

The overarching research goal is to increase understanding of municipal urban forest management planning in Washington State. The two primary research objectives are to:

- 1. Characterize the comprehensiveness of Washington municipal urban forest management plans.**
 - a. Do plans address all three components of a sustainable urban forest, i.e. the trees, community involvement, and the municipality's management approach?
 - b. Do plans address the components of a strong resource management plan, including an assessment of the resource, a vision statement, goals and objectives, action steps, an implementation plan, and a strategy for monitoring and adaptive management?
- 2. Assess the influence of municipal and plan attributes on the comprehensiveness of a plan.**
 - a. Does a municipality's size or location influence the comprehensiveness of its plan?
 - b. Does a plan's author, funding source, or public input during plan development influence plan comprehensiveness?

Characterizing the comprehensiveness of urban forest management plans in Washington State provides valuable information about the themes and elements Washington municipalities have addressed and included in their plans and the specific pieces that most municipalities overlook. This analysis offers an answer to the question of whether Washington municipalities are addressing the three components of a sustainable urban forest as defined by Clark et al. (1997) in "A Model of Urban Forest Sustainability". Assessing the influence of municipal and plan attributes on the overall comprehensiveness of the plans within the State elucidates relationships that may provide valuable information to agencies like the DNR Urban and Community Forestry Program, which works to help municipalities better manage their urban forests. Municipality size and location east or west of the Cascade Mountains are logical municipal attributes to test for influence of plan comprehensiveness; two previous studies on urban forest management in Washington State have also used these municipal attributes to analyze findings related to urban forest management (Studer, 2003) and tree ordinances (Dugan, 2004). Additionally, assessing the influence of other attributes such as plan author, funding source, and public involvement during the plan development may lead to conclusions about ways the plan development process can lead to more comprehensive urban forest management plans.

1.5 Relevance of Research

Approximately 38 Washington municipalities have written an urban forest management plan to guide management of their urban forest, which can require extensive staff time, contractor time, and funding. Many Washington municipalities have relied on grant funding from the DNR Urban and Community Forestry Program to help fund the cost of plan development. To date, no studies have systematically reviewed these urban forest management plans or considered implementation success, including the plans funded through DNR grants. This work includes the first comprehensive list of municipal urban forest plans in Washington, the first analysis of these plans, and the first attempt to understand the municipal and plan attributes that influence the overall comprehensiveness of a plan. While work has been done to analyze tree ordinances (Dugan, 2004), community urban forest programs (Studer, 2003), and urban forestry governance structure, there has been little to no work to analyze urban forest management plans. This thesis presents the first analysis of urban forest management plans in the United States, following Ordonez's & Duinker's analysis of urban forest management plans in Canada in 2013.

This thesis also contributes a framework for developing and evaluating urban forest management plans. While few studies have evaluated plans or plan quality, the plan remains one of a city planner's primary tools (Baer, 1997). One way to evaluate a plan is by using a set of criteria, based on the contents that should be included in the plan. This thesis contributes a set of evaluative plan criteria that can be used and adopted by municipalities or state agencies preparing or evaluating urban forest management plans. While urban forest management plans have recently increased in popularity, there is currently no widely accepted framework for developing them. This thesis offers a framework to provide guidance for urban forest management planning efforts and offers a set of criteria for evaluating any urban forest management plan.

The results of this thesis should be useful to the DNR Urban and Community Forestry Program, as it has not yet developed a "model" urban forest management plan and guide, which was a requirement of the 2008 Evergreen Communities Act. The Evergreen Communities Act (RCW 35.105), which lost funding in early 2009, created the framework for a statewide municipal urban forestry recognition program. The Act created a 3-tiered awards system for urban forestry program recognition and provided access to a

wide range of State loan and grant opportunities for recognized communities. To receive recognition within the second and third tiers, municipalities would have been required to conduct an inventory of their trees and to create an urban forest management plan, which would have encouraged more municipalities to create and adopt an urban forest management plan. If funding for the Act is restored, understanding the elements Washington municipalities have included in their plans along with those they have overlooked will be useful information to DNR and to municipalities interested in taking additional steps towards comprehensive urban forest management. Should the Evergreen Communities Act's funding be reinstated, the most comprehensive plans identified in this thesis should prove useful for identifying and developing "model" urban forest management plans.

1.6 Thesis Overview

This thesis is divided into five chapters. The first chapter introduced the urban forest and urban forest management and outlined the two main research objectives. The second chapter provides a more detailed background and a literature review on the urban forest, urban forest management, and urban forest management plans. The components of a comprehensive urban forest management plan are presented and structured within a four-question planning process: 1) What do we have?; 2) What do we want?; 3) How do we get what we want?; and 4) Are we getting what we want? The literature is synthesized and presented as a framework for comprehensive urban forest management plans, which is later used to analyze Washington municipal urban forest management plans. The third chapter describes the study's methods of content analysis and the development of an index of plan comprehensiveness. Chapter four reports the results of the content analysis, the comprehensive scoring index, and the relationships between plan comprehensiveness and municipal and plan attributes. Finally, chapter five provides a discussion of the findings, management implications, and offers ideas for further research on plan implementation and effectiveness.

2. Background & Literature Review

This chapter provides background information on the urban forest and discusses the literature relating to urban forest management and urban forest management plans. The chapter begins with a brief introduction to plan evaluation, forming the basis for the study's methodology. Next, the chapter presents a broad overview of the urban forest and urban forestry, which is important for introducing the concept of urban forest management. While there is considerable literature about urban forest management, there is far less literature about the urban forest management plan. A discussion about urban forest management plans, including several frameworks that have been presented in the literature, follows. This chapter concludes with an overview of the components of comprehensive urban forest management plans, subsequently synthesized to develop a framework to analyze comprehensive urban forest management plans in Washington State.

2.1 Plan Quality Evaluation

This section provides a brief overview on the literature regarding plan quality evaluation, as one of the main purposes of this thesis is to evaluate Washington urban forest management plans. Exploring plans, including looking for the differences between plans, helps establish a system for evaluation that can shed light on opportunities to make improvements (McDonald et al., 2005). Much of the planning literature concludes that it is very difficult to distinguish a good plan from a bad one, however there are methods of distinguishing differences between plans. With the emphasis that is put on the creation of plans for the management of natural resources, surprisingly little research has been conducted regarding evaluating the quality or effectiveness of plans. Plan evaluations have been conducted in a wide variety of fields including environmental planning, sustainability, and natural hazard mitigation using evaluative criteria (Edwards & Haines, 2007). Several authors have written about evaluating comprehensive plans and have suggested criteria for determining plan quality. Some of the suggested criteria include the presence of a vision statement, assessment of current conditions, the quality of goals and objectives, and the presence and quality of plans for implementation and monitoring (Berke et al., 2006).

Criteria are necessary to evaluate what a plan should include and how its quality should be judged and according to Baer (1997), the “appropriate criteria to evaluate a plan are implicit in the concept that the plan embodies”. Plan evaluation criteria are usually derived from the regulations mandating the development of a plan or by guidelines presented by the supervisory agency. For example, an evaluation conducted on smart growth plans in Wisconsin developed evaluative criteria based on the goals and policies that promote smart growth in the state (Edwards & Haines, 2007). Developing criteria to evaluate a type of plan can help clarify the mission and purpose of a plan and help planners and urban foresters develop plans that are comprehensive and effective (McDonald, Allen, & O’Conner, 2005). Baer (1997) suggests that a set of “positive” criteria with a list of what an ideal plan should include are very helpful to planners beyond a list of what a plan should not include. A set of evaluative plan criteria is most useful at two stages of planning: (1) when developing a plan and (2) when evaluating a plan (Baer, 1997). Berke et al. (2006) suggest creating evaluative criteria and assessing both internal and external plan quality. Internal plan quality criteria relate to evaluating the vision statement, goals, implementation plan, and monitoring plan, while external plan quality criteria include revealing the participation of actors, interdependent actions, and how the plan encourages opportunities to actively use it (Berke et al., 2006).

Several different types of plan evaluation have been suggested in the literature including plan critiques, plan testing and evaluation, comparative plan research, and post-hoc plan evaluations. A plan critique is conducted by someone other than the plan author and is undertaken after the plan has been adopted, but usually before any measureable results have occurred. The critique is usually comprised of criteria that have been created by the evaluator and are usually not very explicit or reproducible (Baer, 1997). Plan testing and evaluation is the method of evaluating alternate ways to achieve a plan’s goal as a means to find better alternatives (Baer, 1997). This type of evaluation is typically conducted by the team preparing the plan. Comparative plan research and professional evaluation are conducted after plan adoption, either before outcomes can be evaluated or when outcomes are not meant to be part of the evaluation. The evaluation is undertaken by an outside researcher and multiple plans are compared systematically (Baer, 1997). The first example of such an evaluation was Gruft & Gutstein’s 1974 “An Analysis of Comprehensive Planning Reports,” in which they systematically applied a set of criteria that they developed. Finally, a post-hoc evaluation is conducted after a plan has been adopted and implemented as a way to understand the outcomes of a plan. The most common approach to post-hoc

evaluation is a blueprint approach of comparing a plan's intended outcomes with what actually happened on the ground (Baer, 1997).

2.2 The Urban Forest

The urban forest, the matrix of trees within an urban area, plays an essential role in maintaining healthy, livable communities and mitigating environmental impacts of urban development (Nowak, D.J & Dwyer, J.F., 2007). Robert Miller (1988) defined the urban forest as “the sum of all woody and associated vegetation in and around dense human settlements, ranging from small communities in rural settings to metropolitan regions”. Approximately 80% of the US population currently lives in areas classified as “urban” (Dwyer et al., 2003). Metropolitan areas support nearly one quarter of the nation's total canopy tree cover with over 74 billion trees (Dwyer et al., 2000). As urban areas continue to expand and the percentage of the US population residing in urban areas increases, urban forests will make a significant difference in quality of life for the majority of Americans (Dwyer et al., 2003). With expanding urban areas, the relationship between urban residents and urban trees becomes more pronounced, highlighting the need for active management of the urban forest.

It has been well established in the literature that trees provide environmental, social, and economic benefits to urban areas. Environmental benefits of urban trees include reducing stormwater runoff (Sanders, 1986), improving air quality, providing habitat for birds and mammals, noise reduction (Leonard & Parr, 1970), reducing temperature and the heat island effect, and conserving energy (Harris et al., 2004). Research on the social benefits of urban trees has shown that trees have a “restorative power” (Kaplan, 1992), reduce stress, decrease recovery times (Ulrich, 1984), help build a sense of community in neighborhoods (Kuo, Sullivan, Coley, & Brunson, 1998), slow down traffic (Wolf, 2006), and increase personal effectiveness (Kuo, 2001). Urban trees are also known to have economic benefits on communities. Studies have shown urban trees increase property values (Orland, Vining, & Ebreo, 1992), reduce heating and cooling costs by conserving energy (Mcpherson & Rowntree, 1993), and increase shopper spending in treed areas (Wolf, 2007).

Dwyer et al. (2003) writes about three key characteristics of the urban forest: diversity, connectedness, and dynamics. Urban forests are diverse because they are comprised of multiple land uses and competing land management goals. Urban forests also vary regionally between urban areas

and are comprised of diverse tree species, wildlife, people, climate, and infrastructure. Second, the urban forest is connected with many other elements in the urban environment including buildings, roads, people, and parks. Urban forests are also connected to people and their current management values, such as land protection, development, or protecting wildlife habitat. Finally, Dwyer et al. (2003) writes that urban forests are dynamic and change significantly over time. The urban forest changes as trees mature, land use patterns change, urban populations grow, and management objectives change. In this way, urban forests are much more dynamic than rural forests because of the influence of changing human values and management goals. With the presence of people, values can change and shift to new priorities, greatly influencing the urban forest around them.

2.2.1 Urban Forestry

Emerging in the 1970s, urban forestry is a relatively new field and profession. Recognition of the importance of urban trees and a growing interest in the urban environment led to the creation of a field of forestry in urban areas. Robert Miller (1997) identifies three main events that led to the creation of the field of urban forestry: 1) expansion of urban areas leading to a larger interface with rural woodlands; 2) changing social values related to managing rural land; and 3) the negative influence of urbanization on the vegetation within urban and rural areas. The destruction caused by Dutch elm disease in cities across the U.S. also served as a focusing event for many municipal managers, making them aware of the need to protect urban trees and leading to more proactive urban forest management choices (Schwab, 2009).

There is no authoritative definition of urban forestry, however, almost all definitions include the need for planning and managing the urban forest. The Dictionary of Forestry defines urban forestry as the “art, science, and technology of managing trees and forest resources in and around urban community ecosystems for the physiological, sociological, economic, and aesthetic benefits trees provide society” (Helms, 1988). The Cooperative Forestry Act of 1978, which authorized financial and technical assistance to state foresters, defined urban forestry as follows: “Urban Forestry means the planning, establishment, protection and management of trees and associated plants, individually, in small groups, or under forest conditions within cities, their suburbs, and towns” (Miller, 1997). The American Planning Association takes a planning focus in its definition, defining urban forestry as,

A planned and programmatic approach to the development and maintenance of the urban forest, including all elements of green infrastructure within the community, in an effort to

optimize the resulting benefits in social, environmental, public health, economic, and aesthetic terms, especially when resulting from a community visioning and goal-setting process (Schwab, 2009).

2.2.2 Sustainable Urban Forests

A sustainable urban forest has become the standard goal and vision of many municipalities. A “sustainable urban forest” was first defined by Clark et al. (1997) as “the naturally occurring and planted trees in cities, which are managed to provide the inhabitants with a continuing level of economic, social, environmental, and ecological benefits today and into the future”. Clark et al. (1997) introduced a “Model for Urban Forest Sustainability,” which created a theoretical model for municipal urban forest management and was based on three premises:

1. City trees provide a wide range of benefits,
2. Maintaining the benefits of urban tree requires human intervention, and
3. Sustainable urban forests exist within defined boundaries.

The Model for Urban Forest Sustainability is divided into three main components important to maintaining a sustainable urban forest: the vegetation resource, a community framework, and resource management.

The vegetation resource is the “engine that drives urban forests” and refers to the composition, extent, and distribution of the trees within the urban forest. Clark et al. (1997) writes that a sustainable urban forest should have a diversity of tree species, sizes, and age classes. The second component, community framework, refers to the importance of the community’s involvement in managing the urban forest and the creation of a shared community vision for the urban forest. The community framework includes the community’s cooperation in caring for trees within neighborhoods, on private property, and on public lands. It also includes the community’s understanding of the benefits of urban trees and engagement with the urban forest. The final component of a sustainable urban forest—the resource management approach—is the “philosophy of management” and relates to the management of the urban forest, including the programs, staff, and policies that direct management objectives. Management of the urban forest should be proactive and comprehensive and address the vegetation resource and the community’s role in managing a sustainable urban forest.

Dwyer (2003) also writes about sustainable urban forests, emphasizing the role of people who manage the urban forest in his definition. He writes that urban forest sustainability involves “maintaining healthy and functional vegetation and associated systems that provide long-term benefits desired by the community” (Dwyer et al., 2003). Because the attributes of a sustainable urban forest depend on the desired social and ecological benefits of the community, Dwyer et al. (2003) writes that managing urban forest sustainability really requires a community-wide effort. This mirrors the community framework of the Clark et al. (1997) model for urban forest sustainability.

2.3 Urban Forest Management

Urban forests are populated by people, houses, businesses, and other infrastructure and because of this, are managed differently than rural forests. Unlike rural forests, urban forests are inextricably tied to and shaped by the human inhabitants (Dwyer et al., 2003). Urban forests face a unique set of challenges including insect and disease outbreaks, air pollution, wildfires, natural storm events, invasive plants, climate change, and lack of adequate management and planning (Nowak et al., 2010). Urban trees face soil compaction, impervious surfaces, invasive plants and diseases, inadequate growing spaces, development threats, and a lack of necessary soil nutrients. As the urban forest cannot be separated from human activity, a city’s inhabitants must actively intervene to address challenges facing urban trees and the forest. Dwyer et al. (2003) writes that managing a sustainable urban forest requires municipal governments to not only maintain the urban forest structure and to protect the health of the individual trees, but also to involve the surrounding community in the process.

2.3.1 Why Plan the Urban Forest

Planning is critical for effective management of any resource, including the urban forest. Robert Miller (1997) writes that “planning is nothing more than thinking out a course of action in anticipation of the future”. Planning is often an interdisciplinary effort drawing from the knowledge of many individuals, especially in complex urban environments with multiple land owners and uses. The process of planning can help improve coordination of management activities within the local government as well as coordination with outside agencies, nonprofit organizations, and community groups (Escobedo, Northrop, & Zipperer, 2007). Planning helps avoid reactive management of the urban forest, which has been all too common in cities across the US. Cities that reactively manage the urban forest are not

prepared when a problem arises, such as a Dutch elm disease outbreak or a wind storm that causes street tree damage. The planning process is proactive and involves setting goals that help protect and improve the resource and helps create a framework for program implementation and consistent decision making.

Management plans are developed to help urban forest managers proactively plan the urban forest and establish a direction for future management efforts. A plan has several core purposes, which include: offering a community vision that inspires action; providing goals, action steps, and policies that help translate the vision into on-the-ground change; addressing long-term considerations into short-term actions; and finally to help present the “big picture,” relating the management objectives to the larger community and regional context (Berke, Godschalk, & Kaiser, 2006). A good plan serves as an important resource for city managers, documents agreement of the goals created through a community involvement process, and serves as a reference for public officials and residents (Berke et al., 2006).

2.3.2 Comprehensive Urban Forest Management

The diversity of land use types, urban populations, tree species, and land ownerships within an urban forest requires a comprehensive approach to its management. As the urban forest is diverse, dynamic, and connected, Dwyer et al. (2003) recommends that sustainable urban forest management and planning should be comprehensive. He writes that management planning should “recognize and embrace diversity and complexity” by drawing from multiple disciplines from political science to wildlife management. Larsen et al. (1990) writes that one of the principles of good planning is integrating and balancing resources because “good planning is truly interdisciplinary...it integrates consideration of all resources”. Sustainable urban forest management also recognizes that a one-size-fits-all approach does not work because of the diversity in the resource, community values, and land ownership between cities. Comprehensive urban forest management considers all of the trees in an urban area as well as the competing land uses, ownerships, and community values (Nowak et al., 2010). Comprehensive management considers the connection of all of the activities impacting the urban forest—like land use planning and residential development—to take a more holistic approach to management (Dwyer et al., 2003). A comprehensive approach also considers the desires and needs of the community, which requires periodically assessing and evaluating the community’s values (Dwyer et al., 2000).

Grey (1995) wrote that the concept of comprehensive management suggests “orchestration,” i.e. that someone is looking at the full picture and understands the complexities of location, ownership, and condition of the urban forest. He writes that comprehensive management has two parts: 1) direct management in which something is being done directly to the urban forest, and 2) indirect management, in which others are influenced to do something to the urban forest. While Grey (1995) suggests that comprehensive management should be centrally organized by a city department, he says that the central urban forestry department usually cannot influence all aspects of the urban forest. Comprehensive planning can address issues and management considerations that are traditionally out of the realm of government interest or control, such as trees at private residences.

A comprehensive management approach addresses the three components of the Clark et al. (1997) model of urban forest sustainability: the vegetation resource, the community framework, and the resource management approach. The three components address the interdisciplinary nature of urban forest management and the importance of proactive management and community involvement when managing the urban tree resource. This comprehensive approach can be applied to any size city in any location, as it is meant to serve as a framework for all urban forest management. As suggested by Grey (1995), comprehensive management is both direct and indirect. Direct management refers to the work being done to the urban tree resource, while the indirect management includes the involvement of the surrounding community in management decisions as well as internal municipal coordination.

Comprehensive management challenges managers to take a very wide approach to urban forest management and there are many barriers to successful implementation. Of these challenges, the most common and obvious is the lack of funding. In times of tightening budgets, proactive environmental programs are often cut first and a city may be forced to return to more reactive management of the urban forest, such as cutting, regular maintenance, and pruning cycles. Without sufficient funding or staffing, addressing the community framework can be nearly impossible. Another challenge is the lack of information about comprehensive urban forest management. As urban forestry is a relatively new field, city managers are sometimes unaware of the importance of and need for funding a comprehensive urban forest management program focusing not only on the tree resource, but also on the needs of the community. Without a proper understanding of urban forestry, arboriculture principles, the basics of urban forest management, and the importance of involving the community in management decisions, it is a serious challenge to develop a comprehensive urban forestry program. Because they lack an

understanding of urban forest management components and resources, many cities have not been able to complete the most basic inventory or urban forest management plan (Nowak et al., 2010).

2.3.3 Components of Urban Forest Management

A 2003 assessment of urban forest management in Washington municipalities found that highly-evolved urban forestry programs in the state had five components: a maintenance program, a tree ordinance, a written management strategy, a computerized inventory, and a tree board (Studer, 2003). These components share similarities with the four main components of urban forest planning that Robert Miller (1997) outlines: the inventory, the creation of management goals and objectives, a management plan, and a monitoring system for evaluating progress towards goals. Miller (1997) divides these four components into four major questions in his “urban forest planning model”, discussed below. Miller writes that the key to successful implementation of all of these components is strong public support and involvement of the community during the planning process.

2.3.3.1 Inventories

The first component of urban forest management answers the questions, “what do we have?” Once a community identifies a need to actively manage the urban forest, the first step a city should take is to conduct an inventory. A tree inventory is essentially the foundation of urban forest management, providing a basis for systematic management. Inventorying the urban forest should also include a review of past management activities to develop a strong baseline. Inventories should consider the community and include gathering information about the public’s attitudes and perception of urban trees. Vegetation inventory data usually includes species composition, age structure, tree condition, location, habitat, and management history (i.e. pruning and maintenance information). Inventories are useful for identifying locations where the city should direct resources for pruning or removing hazardous trees as well as locations for future plantings (Miller, 1997). Vegetation inventories can also uncover valuable trees, such as the presence of rare or heritage trees that might otherwise be overlooked (Van Wassenauer, Schaeffer, & Kenney, 2000). Conducting an inventory should come before developing goals and a management plan, as it is critical to first understand the resource before developing a plan of action.

2.3.3.2 Management Plans

Once a city has an understanding of its urban tree resource, it can tackle the next two questions, “what do we want?” and “how do we get what we want?” A city does this through developing a shared vision, identifying goals and objectives, and writing an urban forestry management plan with goals, action steps, and an implementation plan. Goals tend to be broad and objectives are narrower; both should be created based on an understanding of the tree resource, current and past management efforts, and the community’s attitudes and values related to urban forestry. A city develops a management plan with specific strategies or action steps to meet the goals and objectives they have identified. Management plans will be described in more detail later in this chapter.

2.3.3.3 Feedback & Monitoring

The final step of the urban forest planning model answers the question, “how are we doing?” This step is the feedback or monitoring step, in which the implementation of the management plan and associated urban forestry programs are evaluated. Monitoring is critical for making management of the urban forest an ongoing process that can be responsive to change. As the urban forest is an ever-changing dynamic resource, it is critical to check in on progress and reevaluate goals and strategies. Monitoring requires returning to the baseline data and assessing the progress made towards the original goals. Feedback and monitoring help make urban forest management more agile and sensitive to changes in the tree resource, community values, and new management techniques (Miller, 1997). Feedback and monitoring can be achieved through evaluating a set of criteria and indicators or through a detailed monitoring plan.

2.4 Urban Forest Management Plans

An urban forest management plan serves as a municipality's guiding document for urban forest management and provides a strategic direction and/or a set of operational guidelines for management. Urban forest management plans help municipalities create a unifying vision for the urban forest that will guide the development of goals and objectives (California Urban Forest Council, 2013). Urban forest management plans—ideally official municipal documents—provide an opportunity for the municipality to create policies for managing the urban forest, define best management practices, and outline ways to

involve the public in shaping its urban forest management goals (Steenberg et al. 2013). The Washington Department of Commerce's (2009) "A Guide to Community and Urban Forestry Programming" states that a management plan "conveys a vision for the resource in practical terms, based on the distinctive character and context of a community, and helps to establish consistency and coherence in long-range planning". This definition implies that a community has an understanding of the resource and of the character of the local community before developing a plan, i.e. the community has already completed an inventory.

Over the past decade, long-term urban forest planning has become a common practice for municipalities in North America. Across Canada, Ordonez & Duinker (2013) cite the improvement in municipal urban forest programs to the rise in the number of urban forest management plans that have been developed. Cities across the United States from Tampa, Florida to Pittsburgh, Pennsylvania to Palo Alto, California are investing in the creation of comprehensive plans to guide long-term management of the urban tree resource (ACTrees, 2013). Cities are motivated to write a plan because of a variety of concerns, which include increased urbanization and loss of tree canopy, declining street tree populations, lack of a cohesive vision, and a realization of the extensive environmental, health, and economic benefits trees can provide cities (Ordonez & Duinker, 2013). The components of an urban forestry management plan depend on the particular municipality's goals, current organizational structure, and its emerging urban forestry issues. Because of the diverse set of reasons municipalities choose to create an urban forest management plan, the results are also diverse, from purely operational plans to far-reaching, long-term strategic plans.

A one-size-fits-all approach for management planning does not work because of an urban forest's diverse composition, local land uses, and community values. Urban forest management plans should be written for a municipality's unique urban forest with locally specific strategies that meet the needs of the urban forest's residents (Dwyer et al., 2003). US cities of all sizes and geographic locations have written urban forest management plans. These plans have a variety of titles, from management plans to master plans to strategic plans. However, nearly all plans share a common goal of serving as the document that will help provide guidance for management of the urban forest. For example, the city of Pittsburgh, Pennsylvania (population 306,111) and the non-profit Tree Pittsburgh recently released its 2014 "Urban Forest Master Plan" with the following purpose:

An Urban Forest Master Plan is a road map, providing detailed information, recommendations, and resources needed to effectively and proactively manage and grow a city's tree canopy. More importantly it provides a shared vision for the future of the urban forest to inspire and engage stakeholders in the care and protection of trees.

Palo Alto, California (population 66,363) released a final version of its Master Plan in 2014 with the stated purpose “to identify challenges and direct the city towards strategies that will ensure that this legacy will continue to be a hallmark of Palo Alto” (City of Palo Alto, 2014). The small community of Bainbridge Island, Washington (population 23,263) developed a “Community Forest Management Plan” with the purpose “to provide tools that ensure we maintain forests that provide all possible functions and benefits, maintaining the forest cover in residential areas and integrating trees as green infrastructure into a developing urban landscape” (City of Bainbridge Island, 2009). Even though the plan titles and the goals and strategies differ between these cities, the underlying purpose is active management of the urban forest.

The majority of urban forest management plans address trees on public land only. While an urban forest management plan that does address trees on private property does not alone give a municipality the jurisdiction to tell private landowners what they can and cannot do with their trees, it does create a framework that considers the role of both private and public trees and may be translated into official policies, such as ordinances (Escobedo, Northcrop, & Zipperer, 2010). Because the urban forest is composed of all of the trees within an urban area, many cities have begun acknowledging the importance of addressing the entire urban forest in their urban forest management plans, versus a small segment of the overall tree population.

2.4.1 Types of Plans

Municipalities have adopted a large variety of urban forest plan types with varying names and titles, however this thesis refers to all plans broadly as urban forest management plans because there is currently no wide agreement on the definitions of the different plan types. While the plans will all be referred to as management plans, this research acknowledges the differences among the plans. Some of the management plans are more strategic, while others take a much more operational approach with a narrower view on the urban forest. This section presents a brief overview of each common plan type.

2.4.1.1 Strategic Plans

Strategic plans are commonly defined as plans with a longer-term planning horizon and an overall goal of attaining urban forest sustainability, focusing on all three components of a sustainable urban forest (van Wassenauer et al., 2012). Bryson (1988) writes that strategic plans involve broad-scale information gathering and an emphasis on future implications of the present decisions. The Evergreen Community Partnership Task Force and the Washington Department of Commerce (2009) define a strategic plan as a document that establishes

...long-term over-arching goals and objectives for a community's urban forestry efforts in order to provide a logical process for programmatic development, and may function as a framework for interagency cooperation toward the incorporation of urban forestry principles into general community planning and infrastructure maintenance.

Van Wassenauer et al. (2012) introduced a strategic framework for urban forest management planning which involves a 20-year strategic plan and a set of 5-year management plans (Figure 1). This framework has been used and adapted by a number of municipalities across North America. The strategic plan is high level and includes long-term goals, while the management plan connects the long-term goals to short-term operational goals. In this framework, the 5-year management plans are the link between the high-level strategic plan and the on-the-ground management activities (van Wassenauer et al., 2012). Strategic plans tend to address the community framework more so than any other plan type, considering the importance of involving the community in planning for the future of the urban forest.

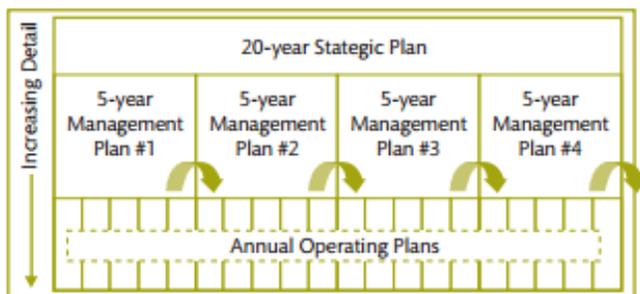


Figure 1. Temporal Framework for Strategic Urban Forest Management Plan (van Wassenauer et al., 2012)

2.4.1.2 Management Plans

Using the van Wassenauer et al. (2012) strategic framework for urban forest management planning, the management plan is a 5-year plan that is similar to an operational plan, connecting

strategic priorities with day-to-day management activities (Hubbard, 2012). The Washington State Department of Commerce (2009) defines a management plan in its “Guide to Community Forestry Programming” as follows:

A management plan conveys a vision for the resource in practical terms, based on the distinctive character and context of a community, and helps to establish consistency and coherence in long-range planning even should changes occur in local administration. A management plan is an expression of purpose that identifies how community and urban forests and other ecosystems may aid the community in achieving its broader planning goal.

Management plans are usually defined as plans that connect the field operations with municipal management, using detailed tree inventories to prioritize planting and maintenance and assigning responsibility to the appropriate department (Vermont Urban and Community Forestry Program, n.d.). Considering the Clark et al. (1997) model for urban forest sustainability, management plans typically cover the vegetation resource and resource management components.

2.4.1.3 Operational Plans

Operational plans are usually comprised of guidelines for the on-the-ground activities of an urban forestry program, such as tree planting, maintenance, or risk assessment. Operational plans typically focus on the tree resource without much consideration for municipal coordination and management or community involvement, the other two components of a sustainable urban forest. Operational plans are usually specific to one task such as pruning and maintenance, and contain pruning schedules and best management practices. Other examples include maintenance plans, planting plans, or storm response plans. Operational plans may be part of the action plan of a management plan or strategic plan and usually include activities with a timeline and responsible party (Hubbard, 2012).

2.4.1.4 Master Plans

Similar to the other plan types, the definition of a master plan varies. According to Hubbard (2012), a master plan is not as comprehensive as a strategic plan and includes more specific goals and objectives, such as plans for planting, maintenance, or budget considerations. Master street tree plans are common in Washington State and across the US, usually including both short- and long-term goals for tree planting and maintenance and establishing policies for removal and protection (Miller, 1997).

Baer (1997) writes that the title “master plan” usually implies a blueprint of sorts with considerable detail associated with each component. Many cities across the country, including Pittsburgh, Pennsylvania and Palo Alto, California, have titled their urban forestry plans, “Urban Forest Master Plans”. It is unclear whether these plans contain significant differences from a plan titled “Strategic Urban Forest Plan” or “Urban Forest Management Plan”.

As there are no firm definitions for any of these plan types, it is difficult to classify the Washington State urban forestry plans by type. Much of urban forest management planning is moving towards the incorporation of long-term strategies and operational goals, blurring the definitions of the individual plan types. It is common to find hybrid plans that incorporate the elements of multiple plan types, such as management plans with a strategic focus on building long-term community support for the urban forest (McDonald, Allen, Benedict, & Conner, 2005). Most plans are a combination of the plan types with strategic goals, management guidelines, and operational components related to best management practices for tree maintenance or planting. For this reason, it is not useful to create a detailed taxonomy of urban forestry plan types. However, it is still important to acknowledge the differences between plan elements and management approaches (McDonald et al., 2005). For these reasons, all plans in this thesis are referred to as urban forest management plans, while acknowledging the differences between the plans.

2.4.2 Urban Forest Management Plan Frameworks

There is no authoritative literature or framework on the components that should be included in an urban forest management plan, however, several frameworks have been presented in the literature that suggest a basic framework for plan development. Robert Miller’s (1997) “Urban Forest Planning Model” has been used by many cities in the development of urban forest management plans. The model provides a framework for planning and organizing the components of any management plan and asks four basic questions:

- 1) What do we have?
- 2) What do we want?
- 3) How do we get what we want?
- 4) Are we getting what we want?

The “Urban Forest Management Plan Toolkit” (Toolkit)—developed by California Urban Forest Council and the Inland Urban Forest Council—structures its guidelines around these four questions. The Toolkit acknowledges that each municipal urban forest management plan is unique and that this planning process can be used to create an individualized plan for a particular city and geographic location by walking through the four steps (UFMP Toolkit, 2014). Both the Wisconsin Department of Natural Resources and the Vermont Urban and Community Forestry Program use the Miller (1997) planning model in their technical guides for developing urban forest management plans. The Vermont plan acknowledges that planning is a continuous process with a sequence of steps and that the four questions from the urban forest planning model drive the process, regardless of the type of plan (Vermont Urban and Community Forestry Program, n.d.).

In 2013, Ordonez and Duinker published a paper titled, “An analysis of urban forest management plans in Canada: implications for urban forest management”, which was the first paper reviewing the quality and comprehensiveness of North American urban forest management plans. After conducting an extensive literature review on the elements commonly found in urban forest management plans, the authors created “a model of urban forest management plan elements”. The Ordonez & Duinker (2013) model presents a three-level planning process with a separate implementation process including monitoring and evaluation (Figure 2). The arrows on the right-hand side relate the plan’s specificity or abstraction with the assumption that plans with actions and schedules are more specific than plans with little more than a stated vision and purpose with vague objectives and targets. While the arrangement of this model differs slightly from the Miller (1997) framework, it includes the same elements.

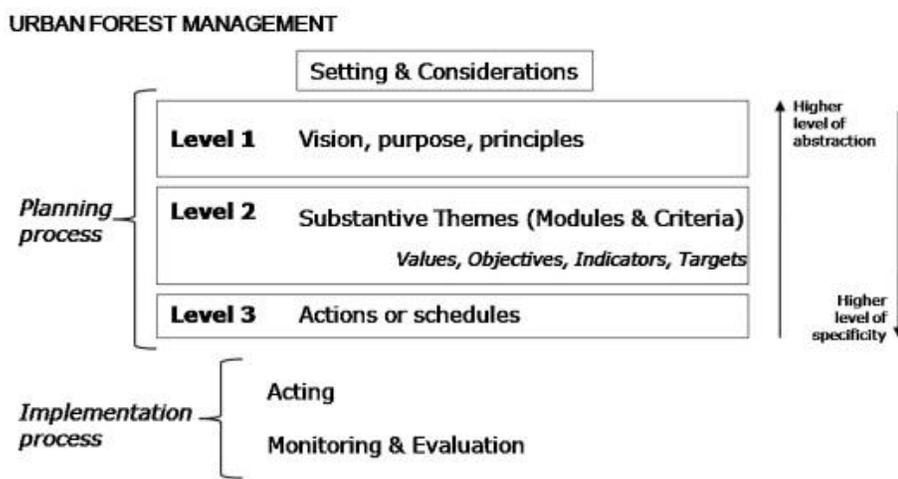


Figure 2. A Model of Urban Forest Management Plan Elements (Ordonez & Duinker, 2013)

2.5 Components of Comprehensive Urban Forest Management Plans

While an urban forest management plan should be unique to each municipality, all plans should contain some shared components. This section is organized by the four questions presented in Miller's (1997) urban forest planning model as a way to structure a management plan. While these components could be structured in another format, the urban forest planning model provides a cyclical planning model that is easily adapted to the concerns of any municipality. The following sub-sections (2.5.1-2.5.4) will review the components of comprehensive urban forest management plans, which are summarized from the urban forest management and environmental planning literature. These components will be later synthesized into a framework to analyze the urban forest management plans in Washington State in section 2.6.

2.5.1 What Do You Have?: Background & Assessment

The first step of the urban forest planning model provides background information and establishes baseline data on the community and urban forest, answering the question, "What do you have?". Conducting an inventory is the first step in managing the urban forest because understanding the current state of the forest and its current management is critical before undertaking goal formulation and action planning. This section of an urban forest management plan includes an assessment of the urban forest resource, a review of past management efforts, current management efforts (including current programs, policies, and department roles), and provides a community context (UFMP Toolkit, 2014). As urban forest management plans vary in scope, this assessment may focus on one or more areas of the urban forest, such as street trees, all public trees, or trees on private property.

2.5.1.1 Tree Inventory

The management plan should first include the outcomes of the tree inventory or canopy assessment that was completed prior to the development of the urban forest management plan. A tree inventory provides the basis for understanding a municipality's vegetation resource, which is critical for informing the identification of management gaps (Dwyer et al., 2000). The American Public Works Association recommends that tree inventories be conducted prior to plan creation so that the data can

inform plan goals, objectives, and actions (American Public Works Association, n.d.). The Washington Department of Commerce's "A Guide to Community and Urban Forestry Programming" recommends that maps be included in this section to highlight key information provided by the assessment, including changes from previous assessments. Any information gathered about the tree resource through inventories, surveys, or canopy cover analyses should be included to provide an overview of the current state of the urban forest. Without sufficient inventory data, it is impossible for a municipality to comprehensively plan for the future of the urban forest and create meaningful goals and objectives in the second planning phase (Larsen & Yonts-shepard, 1990). For this reason the Washington DNR Urban and Community Forestry Program recommends that any municipality looking to develop a management plan first complete a tree inventory, documenting the current state of the tree resource.

2.5.1.2 Review of Community Participation & Attitudes

In the past few decades, the importance of public participation in planning and decision-making has grown in importance and is recognized as a more democratic approach and a way to move beyond the technical expertise of a select few scientists and managers. The term "participation" infers active involvement in the process and more than top-down communication from government officials. Public participation can be defined as "procedures designed to consult, involve, and inform the public to allow those affected by a decision to have an input into that decision" (Rowe & Frewer, 2000). Urban forest management plans should reveal participation from the community—either formal or informal—through public meetings, focus groups, surveys, or public comment periods. A plan should be transparent in describing who was involved in writing the plan, who participated in the plan writing process, and how the participation influenced the process (Larsen & Yonts-shepard, 1990). Additionally, plans that explain how the writers accounted for the interests of stakeholders in defining the vision, goals, and strategies are more frequently used (Berke et al., 2006). Stakeholders include other government agencies with responsibility or authority to make decisions related to urban forestry, non-profits involved in the work, private companies such as developers and businesses with a stake in the management of the urban forest, and community members. In general, plans rarely account for the opinions of disadvantaged members of the community that may not be well organized and have political power (Berke et al., 2006).

Some urban forest management plans also include information about the community's interest in and knowledge of the urban forest as this can have an impact on urban forest management and planning. It also provides more context related to the community's values that may help inform the next phases of plan development. Municipalities have used online and mail-in surveys, telephone interviews, and focus groups to gauge community awareness of urban forest management and to help understand the community's perceptions and attitudes towards trees (UFMP Toolkit, 2014). This information can help form a community urban forestry vision and prioritize goals and strategies in the urban forest management plan.

2.5.1.3 Review of Existing Policies & Programs

This section of the management plan should also include a review of existing urban forestry programs and policies, such as tree planting programs, street tree ordinances, and the current internal management structure. This section provides local context for the plan by providing information about previous actions and existing activities and practices, including information from previous urban forest planning documents. This section also frequently includes a summary of the municipality's current urban forest work with the associated department, staff member, or community organization responsible for the program or policy (Washington Department of Commerce, 2009). This information provides additional local management context for the development of goals and action steps.

2.5.1.4 Performance Measurement: Assessing the Current State of the Urban Forest

Performance measurement is useful at two stages of the urban forest management planning process: to assess the current state before developing goals and action plans and after the plan has been implemented to evaluate success and identify where improvement is needed. Performance measurement is the ongoing monitoring and reporting of program accomplishments, usually in relation to pre-established goals (GAO, 2005). The purpose of performance measurement is to understand progress towards specific future outcomes and to review the current state of a program or policy to provide an overall assessment. Clark al. (1997) first introduced a criteria and indicators approach to urban forest performance measurement, providing a standardized set of qualitative and quantitative performance measures that can be used to assess the state of the urban forest (Kenney, Wassenaer, & Satel, 2011). Conducting a criteria and indicators assessment also helps identify gaps and guide future

management activities to improve the health of the tree resource and the effectiveness of the management approach (Kenney et al., 2011).

The Clark et al. (1997) Model of Urban Forest Sustainability introduced a set of 20 criteria with associated indicators to measure the performance of the urban forest in three categories: vegetation resource, community framework, and resource management. The criteria and indicators were introduced to help managers assess the current state of the urban forest at any given time and to assist managers in updating their management approach to meet their goals. In 2011, Kenney, van Wassenauer, & Satel refined the Clark et al. (1997) criteria and indicators and presented 25 criteria as a standardized assessment framework for the purpose of evaluating any urban forest. Each of the 25 Kenney et al. (2011) criterion has associated quantitative or qualitative indicators to measure current performance on a low to optimal scale. A criterion is defined as a “category of conditions by which sustainability can be assessed” and an indicator as a “qualitative or quantitative variable which can be measured and demonstrate trends” as a measure of a particular criterion (Kenney et al., 2011). For example, the criterion may be “relative canopy cover” with an associated set of quantitative indicators ranging from low (“the existing canopy cover equals 0-25% of the potential”) to optimal (“the existing canopy cover equals 65-100% of the potential”). Not all outcomes can be measured directly; instead some criteria act as surrogates, reflecting trends related to the desired outcome (Hatry, 1999).

A criteria and indicators assessment is first useful when undertaking a baseline assessment of the current status of the urban forest and as a way to help formulate goals and objectives. After the implementation of the urban forest management plan, returning to the same set of criteria and indicators is a useful way to monitor and track the successes and shortcomings of the plan (van Wassenauer et al., 2012). The baseline assessment of the criteria and indicators can either be completed internally by the urban forester or by an interdepartmental team or externally by a consultant with a more objective perspective. Involving outside stakeholders who are in positions to inform the initial assessment can help open the process up to the community and provide managers with additional insight (van Wassenauer et al., 2012). Once a baseline assessment has been completed, it can be used to look for gaps and formulate goals and objectives to improve performance. A comprehensive management plan incorporates these criteria and indicators into its management plan as a way to evaluate future performance.

Both the Clark et al. (1997) and the Kenney et al. (2011) criteria and indicators were meant to be applicable to any urban forest and as a standard set of performance indicators for evaluation. The Kenney et al. (2011) criteria and indicators were meant to be a planning tool for municipalities to use when creating urban forest management plans, similar to performing a gap analysis to look at the difference between the current state and the community's vision for the future state of the urban forest. Kenney (2010) also writes that a criteria and indicators assessment can help assess a municipality's strengths, weaknesses, opportunities, and threats (SWOT), provide a guideline for strategic planning, help communicate progress towards goals, and serve as a common set of indicators to compare municipal programs. Performance measurement is also important in the final phase of planning when tracking the successes and shortcomings after plan implementation to guide adaptive management.

2.5.2 What Do You Want?: Developing a Shared Vision & Setting Goals

The second phase of the planning process involves creating a shared community vision for the urban forest and setting goals and objectives based on the results of an urban forest assessment, answering the question, "what do you want?". The goals and objectives address substantive themes of urban forest management, which can be divided into the three categories from the Clark et al. (1997) Model of Urban Forest Sustainability: vegetation resource, resource management approach, and the community framework. Nearly all of the urban forest management literature strongly recommends that municipalities have a strong and thorough understanding of their urban forest resource before moving forward with vision and goal development. The baseline performance assessment should inform the development of goals, often focusing on moving the lowest assessed criteria to a more optimal range (van Wassanaer et al., 2012).

2.5.2.1 Vision Statement

The first step in defining the desired outcomes of the urban forest is the development of a clear vision statement. A vision statement is "a picture of the future with some implicit or explicit commentary on why people should strive to create that future" (Kotter, 1996). An urban forest management plan helps communities create a unifying vision for the future state of the urban forest; therefore, the vision statement should be created and accepted by the community (Escobedo, Northrop,

& Zipperer, 2007). A good vision statement serves three purposes: (1) clarifies the general direction for change, (2) motivates people to take action in the right direction, and (3) helps coordinate the actions of different people (Kotter, 1996). A good vision can help align people in the community by providing a shared sense of direction for urban forest management. Kotter (2012) writes that effective vision statements are imaginable, desirable, feasible, focused, flexible, and communicable. An effective urban forest management plan vision should clearly describe the desired future outcomes of the urban forest that the plan is working toward and provide a foundation for the plan's goals and action steps (Larsen & Yonts-shepard, 1990). The vision statement should also reflect the community values identified through the community assessment in the first planning step to ensure the vision statement is unique and oriented toward the particular community (Kenney, 2010). Some municipalities have created a working group or opened up the process to the public to create a community-wide visioning process. For example, during the development of their urban forest strategic plan, the city of Shoreline, Washington held an open house to get community input on the development of its vision statement.

2.5.2.2 Goals and Objectives

Goals and objectives are actual steps developed to achieve the stated vision. The goals should relate to the current resource assessment from the first step of the planning process and help fill any gaps that were identified between the current state of the urban forest and the community vision for the future of the urban forest. Miller (1997) defines goals as something a city hopes to achieve, or general outcomes. Goals are "general statements about what your community is trying to accomplish" (Escobedo, Northrup, & Zipperer, 2007). An objective provides a more specific desired outcome related to the overall goal (UFMP Toolkit, 2014). For example, if the overall goal is to plant more trees, an associated objective may be to plant 500 trees a year. A good goal should be measurable, specific and linked to targets and a good objective should be measurable, results-oriented, specific, and practical (Conservation Measures Partnership, 2013). In a comprehensive plan, the goals and objectives should address the three main components of a sustainable urban forest: the vegetation resource, community framework, and resource management approach. However, goals are not necessarily exclusive and independent of one another; goals are often linked to achieve multiple benefits (Escobedo, Northrup, & Zipperer, 2007). The goals and objectives identified will create the basis for action steps, implementation planning, and monitoring and evaluation in the next phases of planning.

2.5.2.3 Substantive Themes

The goals and objectives identified in a comprehensive urban forest management plan fit within three primary categories from the Clark et al. (1997) model of urban forest sustainability: the forest resource, community support, and resource management (Figure 3). Within each category, there are some key substantive themes that van Wassenaer et al. (2012) recommend be addressed in any comprehensive urban forest management plan. While the scope, overarching goals, and planning horizon of urban forest management plans vary, the following ten substantive themes should ideally be addressed in any comprehensive management plan. Many of the following themes overlap between the three Clark et al. (1997) categories and cannot definitively be placed within any one category.

<u>Vegetation Resource</u>	<u>Resource Management</u>	<u>Community Framework</u>
1. Tree inventory	6. Budget	9. Communication strategy
2. Tree establishment	7. Municipal coordination & management	10. Community partnerships
3. Tree maintenance		
4. Tree protection	8. Tree risk management	
5. Stewardship initiatives		

Figure 3. The 10 substantive themes fall within the 3 sustainable urban forest categories from Clark et al. (1997)

Vegetation Resource: The Clark et al. (1997) Model of Urban Forest Sustainability calls the vegetation resource—or trees—the “engine that drives urban forests”. The following five substantive themes and associated goals and objectives address the vegetation resource. Van Wassanaer et al. (2012) recommend that these five themes be addressed with goals and action steps in any urban forest management plan.

- 1) *Urban Forest / Tree Inventory:* Developing and maintaining an up-to-date tree inventory is key to active and accurate management of a city’s trees. Goals and objectives related to this theme include developing, maintaining, or using tree inventories, canopy cover assessments, or street tree assessments to guide management of the urban forest (van Wassenaer et al., 2012). Often tree inventory goals relate to timelines for updating inventories and ensuring inventory data remains up-to-date and in a usable format, such as Geographic Information Systems (GIS).
- 2) *Tree Establishment:* Planting suitable urban trees, with genetic diversity and uneven age structure, is important for the health and sustainability of any urban forest. This theme includes goals and objectives relating to tree planting priorities, species distribution, tree replacement policies, stocking specifications, habitat requirements, and using the inventory to find suitable

planting locations (Clark et al. 1997; van Wassenauer et al., 2012). Many cities include specific goals for increasing tree planting on private property, selecting tree species that are appropriate for planting location (i.e. right tree, right place), and diversifying the tree species used in planting projects.

- 3) *Tree Maintenance*: Regular tree maintenance helps reduce risk and conflicts with other urban infrastructure, such as overhead power lines. Tree maintenance goals and objectives include pruning standards and cycles, maintenance specifications, and tree risk inspection cycles. Goals and objectives might also include transitioning from reactive to proactive management, requiring that an International Society of Arboriculture (ISA)-certified arborist manage pruning crews, instituting regular tree inspections, or implementing best management practices to reduce the chance of pest and disease outbreaks (van Wassenauer et al., 2012).
- 4) *Tree Protection*: Protecting existing trees is vital to the health and sustainability of the urban forest and helps to ensure a diverse age composition. In this section, goals and objectives relate to tree protection standards, regulations, and specifications. Other goals include protecting trees during construction, large tree protection, and heritage tree protection (van Wassenauer et al., 2012).
- 5) *Stewardship Initiatives*: Active stewardship of trees and natural areas helps reduce the threats urban trees face, such as invasive species and inadequate water and nutrients. Invasive species in the urban forest have not permeated urban forest management to the extent that some of the other vegetation resource themes have, however, it is an important consideration when the overall goal is to steward the health of urban trees (Muller & Bornstein, 2010). The stewardship initiative theme includes goals related to creating or improving community stewardship programs for public or private trees, public-private partnerships for tree stewardship, community tree care programs, or goals to steward parks, such as invasive species removal and the use of native plants (Kenney et al., 2011). This theme could easily fit under the community framework category as many stewardship initiatives involve community participation.

Resource Management Approach: The resource management approach refers to the actual management of the urban forest and the components (e.g. policies, regulations, and personnel) needed for successful management of the vegetation resource and community framework. The following three themes address the resource management approach.

- 6) *Budget*: While most goals and objectives presented in an urban forest management plan should connect in some way to the budget, the goals within this theme include addressing future urban forest program funding, creating funding goals and priorities, and identifying sources of funding. Goals may also address the budget cycle and consider the long-term versus short-term funding horizons for urban forest programming (van Wassenauer et al., 2012). As funding is critical for the implementation success of the urban forest management plan and programs, the municipality's urban forestry budget should be explicitly discussed within the urban forest management plan.
- 7) *Municipal Coordination and Management*: Proactive municipal management is a critical component of comprehensive urban forest management. This resource management theme includes any goals or objective related to improvements to municipal coordination and management of the urban forest, such as staffing goals, ordinance improvements, or the creation of interdepartmental teams or citizen urban forestry commissions. This theme also includes goals related to interagency cooperation among city departments to ensure all city departments are operating with common goals and objectives (Clark, Matheny, Cross, & Wake, 1997).
- 8) *Tree Risk Management*: Actively managing tree risk ensures publicly-owned trees are safe, reducing the chance of dangerous interactions with the community. Goals and objectives within the tree risk management theme include the need for tree risk assessment and inventories, risk rating systems, risk mitigation strategies, and specific goals related to risk-prone species and planting locations (van Wassenauer et al., 2012). Tree risk management should be included in an urban forest assessment or inventory and include risk ratings along with risk abatement recommendations (Kenney et al., 2011). For this reason, this theme often overlaps with the tree inventory theme.

Community Framework: The community framework within the Clark et al. (1997) model of urban forest sustainability addresses the need for community awareness of and participation in urban forest management. The following two substantive themes address the importance of community action and awareness in urban forest management and planning.

- 9) *Communication & Education Strategy*: As the public's lack of awareness of trees and their associated benefits is a common obstacle to urban forest management, the communication and education strategy theme includes goals and objectives that relate to increasing the community's awareness of the urban forest and value of trees. Dwyer et al. (2000) write that

improving the dissemination of information is an important element of comprehensive urban forest management. This theme includes outreach and public education goals for programs that increase the visibility of urban forest benefits, such as public education campaigns and the creation of educational brochures, improving online materials, and hosting public workshops (van Wassenauer et al., 2012; Kenney et al., 2011). Residents who are aware of the benefits associated with the urban forest are more likely to participate in urban forest management efforts (Dwyer et al., 2000).

10) *Community Partnerships*: Partnerships between the local government and the surrounding community help build community awareness for urban forest management and involve more community members in developing and attaining the urban forest management plan's vision. Goals and objectives in this section relate to increasing or improving cooperation with the green industry (e.g. landscapers, arborists, nurseries), neighborhood groups, nonprofits, neighboring municipalities, and large private and institutional landowners such as universities and hospitals (van Wassenauer et al., 2012; Kenney et al., 2011).

2.5.3 How Do You Get What You Want?: Action Steps & Implementation Plans

Once a vision has been developed and specific goals and objectives have been formulated, the next step is to develop action steps and an implementation plan to achieve the identified goals, addressing the question, "How do you get what you want?"

2.5.3.1 Action Steps & Best Management Practices

In this phase, action steps and best management practices are identified that will achieve the identified goals and objectives. Each goal should be associated with specific actions or a set of best management practices. For example, a goal related to proper pruning technique may include a set of best management practices and an action step to work with identified green industry partners to ensure all tree care professionals working on public trees are supervised by a certified arborist. The level of detail included in each action step is an important consideration because it relates to the ease of implementation and to the level of flexibility in the plan. As a rule of thumb, the more precise and clear the action steps, the more likely the action step will be implemented by the appropriate agency or staff person (Sabatier & Mazmanian, 1980). It is also important to consider the planning timeline and how

frequently the plan will be updated as this influences the level of specificity included in the identified action steps. A plan with a short planning horizon likely includes action steps that are more specific than a plan with a 20-year planning horizon.

2.5.3.2 Implementation Plan

Implementation of the urban forest management plan is a continuous process. The implementation plan describes how the actions will be carried out to reach the plan's goals and objectives. An implementation plan should include the action that needs to be done, the department or staff person responsible for administering the action, the estimated cost and funding source, and a timeline of implementation (Hubbard, 2012; UFMP Toolkit, 2014). Assigning responsibility for each action helps ensure that the implementing staff member is aware of and committed to the task (Sabatier & Mazmanian, 1980). This information is also directly related to the estimated cost and funding considerations. The timeline will depend on the life of a plan and whether the plan includes long- or short-term goals. Many management plans are written with a five-year timeline and include action steps that will be implemented within the next five years. Estimating the cost of action steps and identifying secured or potential funding sources is essential for achieving objectives (Sabatier & Mazmanian, 1980). Including estimated budgets in the implementation plan is also important for developing annual work plans and ensuring that the desired implementation timeline is aligned with current and future funding levels (UFMP Toolkit, 2014).

2.5.4 Are You Getting What You Want?: Monitoring & Evaluation

The final phase of the planning cycle asks, "Are you getting what you want?" and addresses the need for feedback, monitoring, and adaptive management. This is the second stage where performance measurement is important. Creating a monitoring plan is important for assessing whether the actions implemented through the urban forest management plan are effective at reaching the goals and objectives. A monitoring plan should be written before the urban forest management plan is implemented and should be aligned with the baseline data collected during the assessment phase to provide information on the effectiveness of actions implemented through the plan. Because the urban forest is dynamic, a management plan should be viewed as a living document that is constantly

reassessed and updated to address changes to the tree resource and changes to management and community priorities.

2.5.4.1 Monitoring & Adaptive Management

Dwyer et al. (2003) write that because the urban forest is dynamic, it requires an adaptive approach to its management. An adaptive approach provides managers with flexibility, which gives them the ability to continually evaluate the success of management actions towards achieving goals. Adaptive management involves monitoring the effectiveness of program activities, identifying areas for improvement, and then modifying the management plans and actions to address shortcomings (Dwyer et al., 2003). Including adaptive management strategies within an urban forest management plan requires a well-thought-out monitoring plan. The monitoring section of the urban forest management plan should include a detailed plan for monitoring the implementation and effectiveness of the plan's recommendations.

Effectiveness monitoring is the process of determining if an activity achieved the stated goal or objective, i.e. answering the question, "Did it work?" Managers should use the indicators that were used to gather baseline data to assess the current state of the urban forest, or managers can choose to create a monitoring plan that links specific indicators with each goal or objective presented in the plan (Noss & Cooperrider, 1994). Using the baseline data collected during phase one of urban forest management plan development, managers can revisit the criteria and indicators to evaluate progress (van Wassenauer et al., 2012). Managers should strive to connect the indicators with the goals and objectives in the plans and try to avoid including every possible measure, which can waste time and resources (Escobedo, Northrup, & Zipperer, 2007). Van Wassenauer et al. (2012) recommend using a criteria- and indicators-based approach for monitoring at the end of every management plan cycle, tracking the overall performance of each criteria and identifying shortcoming and successes to inform the next management plan. Noss & Cooperrider (1994) recommend that monitoring and review of the criteria and indicators be separated from management, as it has the potential to introduce bias when managers create a monitoring plan to measure their own progress towards the goals. Monitoring can better be done by an interdepartmental team or outside contactor that can take a more complete and objective approach to monitoring and evaluation.

Adaptive management comes after monitoring performance, adjusting management practices to reflect the knowledge gained (Noss & Cooperrider, 1994). For this reason, it is important that plans remain flexible to account for the information learned through monitoring and evaluation. The planning process is a cycle and an urban forest management plan is not complete once it has been written and approved by local city officials. A comprehensive management plan becomes a living document that is constantly used, monitored, and updated as more is learned. The indicators from the monitoring plan should again be evaluated before the start of the next plan writing process and should be used to influence future plan goals, elements, and strategies.

2.6 Evaluating Urban Forest Management Plans

There is no authoritative framework or set of criteria by which to evaluate urban forest management plans. For the purpose of this thesis, a framework and associated set of evaluative criteria was developed synthesizing both the environmental planning and urban forest management literature presented above. As most urban forest management planning documents are similar and difficult to distinguish (e.g. master plans vs. management plans vs. strategic plans), a distinctive framework for each plan type is unnecessary. The framework was developed by starting inductively to get a sense for what was included in the Washington urban forest management plans and then looking to the literature introduced in this chapter, including Miller's (1997) "urban forest planning model" and Ordonez's & Duinker's (2013) "model of urban forest management plan elements".

The resulting framework for comprehensive urban forest management plans—which was influenced by Miller (1997), Ordonez & Duinker (2013), Clark et al. (1997), and Kenney et al. (2011)—has four distinct levels, increasing in level of specificity (Figure 4). The framework synthesizes both the planning and the urban forest management literature and is structured around the Miller (1997) urban forest planning model. Each level addresses one question of the urban forest planning model. The process is not meant to be linear, but continuous, represented by the arrow pointing back to level 1 (Figure 4). The framework was created to analyze all plans deductively as a way to characterize and evaluate plan comprehensiveness. This framework not only serves as a means for evaluating urban forest management plans, it can also serve as a guiding framework for plan development. The elements included in the framework are meant address comprehensive management of any urban forest, regardless of size or geographic location.

A Framework for Comprehensive Urban Forest Management Plans

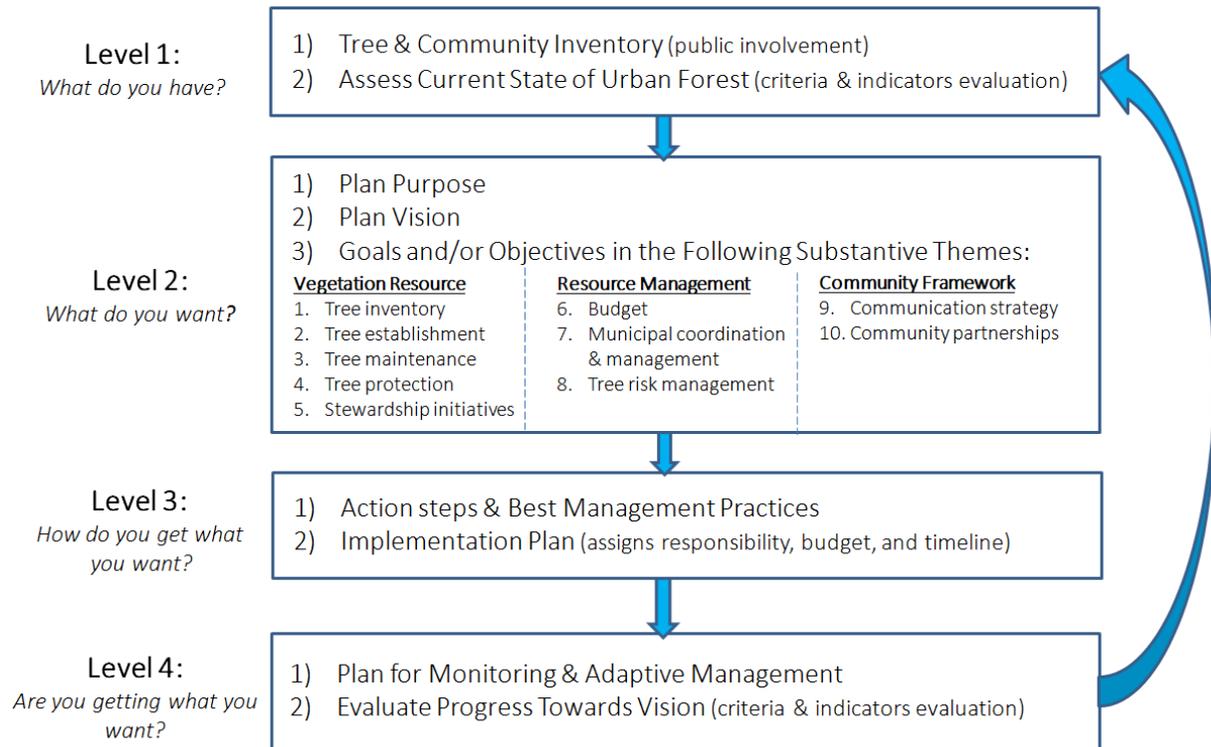


Figure 4. A Framework for Comprehensive Urban Forest Management Plans

Level 1 of the framework answers the question, “What do you have?” by providing information on the current state of a municipality’s urban forest. Level 2 answers the question, “What do you want?” and includes the plan’s vision, its purpose, and a list of the municipality’s goals and objectives related to ten substantive themes. As discussed in Chapter 2, the ten substantive themes are topics that van Wassenauer et al. (2012) recommend be addressed in any urban forest management planning document, bucketed into the three categories from the Clark et al. (1997) framework: vegetation resource, community, and resource management. Level 3 expands upon the goals and objectives and includes specific action steps and best management practices associated with each goal, adding specificity to the plan, which increases the likelihood of successful implementation. This level also includes the creation of an implementation plan with assigned responsibility for each task, budgetary considerations, and a timeline for implementation. The final level of the framework addresses the question, “Are we getting what we want?” and includes a plan for monitoring and the use indicators to evaluate progress towards overall vision. The use of this framework for the purpose of this thesis will be further discussed in Chapter 3.

2.7 Barriers to Plan Development & Implementation

While the literature suggests that an urban forest management plan as an essential component of comprehensive management of the urban forest, municipalities face many barriers to plan development and implementation. Noel Studer's 2003 thesis about municipal urban forest management in Washington State concluded that organizational, administrative, and technical capacity for managing trees was low across Washington State, preventing municipalities from proactively planning and managing the urban forest. Studer found that most communities lacked clear goals and objectives for tree care and the funding necessary to transition from reactive to proactive management of trees (Studer, 2003).

Besides the obvious lack of adequate funding, creating a high-quality management plan is not simple. Common barriers to creating high-quality, comprehensive plans include a lack of understanding for the current state of the resource, which makes it very difficult to create a strong rationale for identifying and prioritizing issues (Berke et al., 2006). An inventory is critical to the development of an urban forest management plan, yet many municipalities across Washington and beyond have not had the will nor the resources to take this important first step. Many municipalities that do have inventories do not regularly update the inventory or properly use it to inform decisions.

Management plans that are developed usually lack comprehensive components, including measurable objectives to assess whether the desired goal has been achieved (Berke et al., 2006). Another frequently overlooked component of management plans is action planning and identifying specific steps for achieving the desired goals and objectives (Hubbard, 2012). It is common to find plans containing vague goals, but lacking concrete action steps that will help the municipality achieve those goals. Finally, plans rarely contain provisions for monitoring to the degree to which the goals have been achieved or monitor indicators that track progress towards these goals (Berke et al., 2006). These plan shortcomings make successful plan implementation very difficult as specific action steps may not be sufficiently outlined and progress is nearly impossible to measure without a monitoring strategy.

3. Research Design & Methodology

This chapter presents the methods used for addressing the research objectives introduced in Chapter 1. The major goal of this thesis was to systematically explore municipal urban forest management plans in Washington State. As described in Chapter 2, urban forest management planning should be comprehensive in order to account for the diversity and complexity of the urban forest. After urban forest management plans were collected, content analysis was used to evaluate the comprehensiveness of the plans, based on a set of evaluative criteria constructed from the literature. Applying a set of evaluative criteria highlighted the variation between plans and revealed examples of more comprehensive plans in Washington State. This chapter will include an overview of the methods, including document collection, developing an evaluation tool, content analysis methodology, and indexing plans based on comprehensiveness. This chapter will conclude with a discussion of the limitations of the methodology.

3.1 Plan Selection & Collection

As little was known about the urban forest management plans that have been developed by Washington municipalities, this research was meant to both identify and evaluate existing plans in the State and characterize their comprehensiveness based on the planning and urban forest management literature. To address the overall research objective and increase understanding of municipal urban forest management planning in Washington, the first step was to identify urban forest management plans from around the state. An urban forest management plan was defined as any guiding urban forest management document with a focus beyond natural area planning, such as trees in public parks. Any plan with a sole focus on parks or natural lands was removed from the analysis. For example, both the Anacortes and Mercer Island plans were removed from the study because both are entirely focused on publicly-owned park lands and include only park management goals. This thesis only considered municipal plans; plans written by institutions—such as universities—were not considered.

Plans were identified with the help of the DNR Urban and Community Forestry Program, a 2010 Municipal Research Services Center (MRSC) study on Washington State’s urban forest management, communication with urban forestry plan writing consultants, and individual email and phone contacts

with municipal planners, arborists, and public works directors. Staff from the DNR Urban and Community Forestry Program helped identify municipalities who had been awarded funding through a Community Forestry Assistance grant to write a management plan. Individual contacts with at least half of these municipalities were required, as not all management plans were on file at the DNR office or available online. The Washington DNR Urban and Community Forestry Program also provided a list of municipalities that they suspected might have an urban forest management plan. Individual inquiries were made with municipalities thought to potentially have an urban forest management plan—including the top 20 largest municipalities in Washington—through email and phone. Results from a 2010 MRSC study, which was an email-distributed survey to municipal managers, helped to identify additional Washington municipalities with guiding urban forest management documents. Email communication with consultant Jim Flott of Community Forestry Associates revealed an additional list of plans he had written for Washington municipalities in the role of municipal consultant.

In total, 39 municipal plans were identified, ranging from strategic plans to purely operational tree maintenance plans (Table 1). The study includes two city of Covington plans. Instead of combining the two plans for the purpose of this evaluation, the plans were evaluated separately because both serve different purposes for the city and are both currently in use. Covington's 2006 Community Forestry Plan serves as an operational plan, while the 2013 Urban Forestry Strategic Plan for Publicly-Managed Trees creates a far-reaching strategic vision. The sample also includes two plans written for the City of Bonney Lake; however, the two plans were evaluated together because Bonney Lake's 2010 Street Tree Plan was meant to serve as an addendum to the City's 2005 Community Forestry Program Plan. All of the plans used for this thesis serve as the city's current guiding document for urban forest management. Email and phone communication with the majority of the municipalities confirmed that the plans included in the study serve as the municipality's most recent urban forest management plan. The search for plans, while comprehensive, likely did not yield every urban forest management plan in the state. However, we do know any plan that was not included in this thesis was not funded through a DNR CFA grant, was not identified in the MRSC study, and was not found through online searches. Therefore, this sample is considered a complete look at the urban forest management plans in Washington.

Table 1. Washington Municipal Urban Forest Management Plans

Municipality	Plan Date	Plan Name
Bainbridge Island	2006	Community Forest Management Plan
Bonney Lake	2005 & 2010	Community Forestry Program & Street Tree Plan
Bremerton	1997	Master Urban Tree Plan
Chelan	2004	A Comprehensive Community Forestry Management Plan
Clyde Hill	2003	A Citizen's Guide to Urban Forest Management
Coulee Dam	2004	A Comprehensive Community Forestry Management Plan
Covington	2013	Urban Forestry Strategic Plan for Publicly-Managed Trees
Covington	2006	Community Forestry Plan
Edmonds	2002	Street Tree Plan (2010 update)
Entiat	2006	Urban Forest Management Plan
Fife	2012	Urban Forest Management Plan
Hoquiam	2012	Tree Inventory and Community Urban Forest Management Plan
Kenmore	2004	Street Tree Plan
Kirkland	2013	Urban Forestry Strategic Management Plan
Lacey	2005	Urban Forest Management Plan
Lake Forest Park	2010	Community Forest Management Plan
Longview	2010	Urban Forest Maintenance Management Plan
North Bend	2011	Urban Forestry Plan
Olympia	2001	Master Street Tree Plan
Pasco	2008	Urban Forestry Management Report
Poulsbo	2003	Master Public Tree Plan
Renton	2009	Urban and Community Forestry Development Plan
Richland	2011	Urban Forest Management Plan
Royal City	2004	Arboricultural Specifications and standards of Practice for the City of Royal City
SeaTac	2010	Comprehensive Public Tree Maintenance Program
Seattle	2014	Urban Forest Stewardship Plan
Shoreline	2003	Urban Forest Management Plan
Snoqualmie	2010	City Tree Plan
Spokane	2002	Vegetation Management Plan
Sumner	2003	Urban Forestry Strategy Update
Tacoma	2011	Strategic Urban Forest Management Plan
Tumwater	2013	Comprehensive Street Tree Plan Update
Twisp	2004	Community Forestry Management Plan
Vancouver	2007	Urban Forestry Management Plan
Walla Walla	2003	Urban Forestry Management Plan
Wenatchee	2009	Community Forestry Plan
Woodinville	1998	Community Urban Forestry Plan
Yarrow Point	2011	Urban Forest Management Plan DRAFT
Yelm	2008	5-Year Urban Forestry Strategic Plan

3.2 Evaluating Urban Forest Management Plans

The first research objective is to characterize the comprehensiveness of urban forest management plans. To characterize the comprehensiveness of the 39 plans, an evaluation tool was created using the framework for comprehensive management plans, which was presented in Chapter 2. According to Baer (1997), criteria are necessary to evaluate what a plan should include and how its quality should be judged. A comparative plan research method was used to evaluate the 39 plans. A comparative plan research evaluation is undertaken by an outside researcher after a plan has been adopted, but before the outcomes can be evaluated or when outcomes are not meant to be part of the evaluation (Baer, 1997). This was the appropriate approach because the outcomes of plan implementation, i.e. on-the-ground urban forestry programming and policies, were not considered for this thesis.

3.2.1 Construction of a Plan Evaluation Tool

To create a comprehensive evaluation tool for this thesis, the urban forest management literature was first consulted for existing models, which were reviewed in Chapter 2. Evaluative criteria were also derived from the planning literature to identify the common components of strong resource management plans (e.g. vision statement, goals, action steps, implementation plans, and plan for monitoring). The synthesis of the urban forest management models and planning literature was presented as a “framework for comprehensive urban forest management plans” in Chapter 2 (Appendix A). While it is important to note that there is no one-size-fits-all blueprint for all urban forest management plans, this framework serves as a tool to more objectively evaluate the comprehensiveness of each plan and the presence or absence of particular components. The framework presents a list of “positive” criteria, which help model what an ideal plan should include, instead of what a plan should not include (Baer, 1997).

3.2.2 Content Analysis

Content analysis was used to characterize the comprehensiveness of Washington municipal urban forest management plans and is an appropriate method for systematically analyzing documents. Content analysis is a qualitative method to analyze text with the goal of taking a volume of qualitative material and identifying themes and meaning (Patton, 2002). Patton (1987) writes that “organizing and simplifying the complexity of data into some meaningful and manageable themes or categories is the basic purpose of content analysis”. Deductive content analysis is the process of analyzing data based on

an existing framework and set of criteria. Following the principles of content analysis described by Patton (2002), a set of evaluative criteria was developed based on the framework for comprehensive urban forest management plans to classify the components included in 39 plans. Table 2 outlines the specific evaluative criteria associated with each of the four levels of the framework (Appendix A). Other plan attributes were also recorded to address the second research objective of assessing the influence of a municipality’s attributes on the comprehensiveness of its plan (Table 3). Each criterion was assessed for presence or absence using a binary scale of 1 or 0; 0 indicating the element is not present and 1 indicating the element is present.

Table 2. Comprehensive Urban Forest Management Plan Evaluative Criteria

Framework Level	Evaluative Criteria
1	Was an inventory undertaken before writing the plan?
1	Does the plan include the results of a forest assessment/inventory?
1	Does the plan mention the use of public input in the writing process?
1	Does the municipality evaluate the current state of the urban forest using Clark or Kenney criteria and indicators?
1	Does the plan address public, private, parks, or street trees?
2	Does the plan include a vision?
2	Is there a stated purpose for writing the plan?
2	Does the plan address the following substantive themes with a goal or objective? <ul style="list-style-type: none"> • Urban forest/ tree inventory • Tree establishment • Tree maintenance • Tree protection • Tree risk management • Communication strategy • Community partnerships • Stewardship initiatives • Budget • Municipal coordination and management
3	If the plan addresses a substantive theme with a goal or objective, does it also include an associated action step or set of best management practices (BMPs)?
3	Does the plan have an implementation plan? If so, does it assign responsibility, address the budget, and include a timeline?
4	Does the plan address monitoring or adaptive management?

Table 3. Plan Attribute Data Collected During Coding

Attribute
Plan Name
Municipal Population
Was plan publicly available online?
Was plan funded by DNR?
Plan Authors (City staff or consultant)

Using NVivo 9, the components of each management plan were manually coded based on the evaluative criteria in Tables 2 and 3. Nvivo 9 is a qualitative analysis software package that assists qualitative researchers in analyzing large volumes of text through content analysis. NVivo allows the researcher to code each text file by developing “nodes” representing key themes or criteria and organize all text by node, which helps elucidate patterns and relationships in the text files. Following the recommendations of Krippendorff (2013), a coding dictionary was created to define each evaluative criterion to assist with objective coding (Appendix B). Each substantive theme was coded first for presence or absence of a goal or objective and then for an associated action step or set of best management practices (BMPs). Action steps were defined as any accompanying details related to how the goal will be reached. Action steps might provide strategies for reaching goals, description of how the goal would be reached, or simply a diagram or illustration (e.g. municipal coordination maps illustrating how municipal departments would work together). BMPs were defined as “best available, industry-recognized courses of action in consideration of the benefits and limitations based on scientific research and current knowledge” (Lilly, 2010). In evaluating each plan, the presence or absence of goals addressing each of the substantive themes was coded. The presence or absence of accompanying action steps, best management practices, or strategies was also coded.

Some of the consultant-written plans read more like consultancy documents than municipal-generated plans, comprised of sets of recommendations instead of specific action steps. Recommendations for actions were coded as action steps, as it implied that an action was to be taken to reach the overall objective. Plans that addressed a specific substantive theme with a goal or objective *and* a related action step or set of BMPs were coded as a level 3 plan, based on the framework. This differentiated the plans between level 2 and level 3 components based on the specificity of the substantive themes (See Appendix A for framework diagram). It should be noted that many of these substantive themes do overlap and are not mutually exclusive. In some cases, one goal or set of action steps could be coded under two to three separate substantive theme categories. For example, a goal for removing hazard branches along street corridors might be coded both under the tree maintenance and the tree risk management themes. Often themes were addressed with multiple goals and objectives within a plan; however, a plan only had to include one goal or objective for the substantive theme to be coded as “present”.

The coding results within Nvivo 9 were transferred to an Excel spreadsheet and each code was reviewed for stability. Stability is one of the three types of reliability, and can be determined when the same content is coded more than once by the same coder (Weber, 1990). Testing stability was especially important for coding the substantive themes as either being addressed with a goal or objective or with the addition of an associated action step or BMP because this could be interpreted with some subjectivity. The resulting table summarized the attribute data and the presence/absence of each evaluative criterion.

3.3 Indexing Plan Comprehensiveness

The next phase of the analysis of the urban forest management plans was meant to address the second research objective of assessing the influence of municipal and plan attributes on the comprehensiveness of a municipality's plan. To accomplish this, each plan was given a quantitative score of comprehensiveness to better understand how it compared to the other plans. An index of plan comprehensiveness was developed based on the framework and associated plan evaluative criteria (Table 2). The purpose of the index is not to assess the quality of plans or to reveal the "best" plans; the purpose of the index is to provide a score based on the evaluative criteria presented in the comprehensive urban forest management framework. Each criterion has an associated point score of 0 or 1 based on presence or absence. The criteria are divided into sections based on the associated level in the framework for comprehensive urban forest management plans; the highest possible point score is 31 (Table 4). The index serves a second purpose of providing a comprehensive checklist for plan development efforts and a method for evaluating urban forest management plans (McDonald et al., 2005).

Plans with higher scores are considered more comprehensive, based on the 31 criteria included in the index. Each element of the framework was weighed equally to avoid making judgments about the importance of one element over another. Similar methods have been used in a number of plan evaluation studies (Ricklin et al., 2012; Edwards & Haines, 2007). Municipal plans vary in their comprehensiveness and scope based on the priorities and values of a particular municipality, which is why such an index cannot substitute as a measure of plan quality. This index was created to provide a comprehensiveness score for each municipal plan to illustrate the variety of plans throughout Washington State and can be used to quantitatively test the influence of municipal attributes such as

population, geographic location, and plan funding source on the comprehensiveness of the resulting plan.

Table 4. Plan Comprehensiveness Index

Level	Components	Point Score
LEVEL 1: BACKGROUND/INVENTORY		
1	Included review of existing policies & programs	1
1	Conducted evaluation of current state of urban forest	1
1	Community involvement: plan mentioned involving the community in plan creation	1
1	Conducted tree inventory/canopy assessment before writing plan	1
LEVEL 2: VISION, GOALS & OBJECTIVES		
2	Presence of a vision statement	1
2	Budget	1
2	Communication and education	1
2	Community partnership	1
2	Stewardship initiatives	1
2	Municipal coordination	1
2	Tree establishment	1
2	Tree maintenance	1
2	Tree risk management	1
2	Tree inventory	1
2	Tree protection	1
LEVEL 3: ASSOCIATED ACTION STEPS (W/ GOAL) & IMPLEMENTATION PLAN		
3	Budget	1
3	Communication and education	1
3	Community partnership	1
3	Stewardship initiatives	1
3	Municipal coordination	1
3	Tree establishment	1
3	Tree maintenance	1
3	Tree risk management	1
3	Tree inventory	1
3	Tree protection	1
3	Includes an implementation plan	1
3	Implementation plan w/ assigned responsibility	1
3	Implementation plan w/ budgetary considerations	1
3	Implementation plan w/ timeline	1
LEVEL 4: MONITORING & EVALUATION		
4	Address monitoring or addresses adaptive management	1
4	Includes specific time to update plan	1
TOTAL		31

3.4 Data Analysis

The results of the content analysis were transferred from NVivo to Excel, including all plan attributes. A variety of graphical representations were created to display the results of the analysis using descriptive statistics to summarize the percentage of plans that included each of the criteria. Examples of how municipalities incorporated each of the elements were selected from the NVivo codes to help illustrate the different ways municipalities addressed the elements, particularly the 10 substantive themes from levels 2 and 3 of the framework.

The plan comprehensiveness index scores were transferred to SPSS, a statistical software package. The relative influence of city and plan attributes were explored using descriptive statistics and box and whisker plots. The relationships between study variables and the plan index scores were analyzed using SPSS, including independent t-tests to explore the relationship between municipality geographic location, DNR funding, and plan author. Analysis of variance (ANOVA) was used to explore relationships between the three municipal size categories. As the sample only included 39 plans and the plan index included 31 criteria, any analysis of the influence of specific criterion on the overall comprehensiveness lacked power. For this reason, it was not possible to use regression analysis to predict the power of individual plan criterion on the comprehensiveness score. Instead, this analysis relied heavily on descriptive statistics.

3.5 Research Limitations

The primary limitation of this thesis is the subjectivity inherent in analyzing plans because the analysis relies on human interpretation, which is subject to human error. A coding dictionary was developed and used with the goal of reducing the subjectivity of this analysis while coding the management plans using NVivo. Substantive themes were defined with all possible words and subjects that could be classified under a particular theme or code (Appendix B). The codes were systematically applied to reduce subjectivity. Each code was reviewed twice; once when originally coded in NVivo and the again when transferring the coded presence/absence data into Excel. The quality of individual elements was not evaluated, as this is a subjective judgment, and there are few examples of successful evaluations of plan quality in the literature. Instead, this analysis focused entirely on the presence or absence of plan elements. Substantive theme categories are broad and do not necessarily summarize

the particular goals included within the theme. Instead, examples of goals are provided with the results in Chapter 4. The categories and code definitions were intentionally broad to account for the variation between municipalities; since municipalities have different community values and management objectives, they do not address each theme in the same way.

Another limitation of the study is the fact that each urban forest management plan is a snapshot in time and may have been written by a few individuals or in some cases, even a sole contractor. Plans rarely reflect the entirety of a municipality's urban forest management program and all of the on-the-ground activities relating to urban forest management. Neither interviews nor surveys with municipal staff related to plan development and content were included in this thesis. This limits the known context of many of the plans, as the reasons for writing the plan and guiding principles may not always be explicit in the document. It is important to note that just because a certain substantive theme or element was not included in the management plan, does not mean that it was not considered in the planning process or currently is addressed elsewhere in the city's planning or programming. A 2010 study of California urban forestry programs found that while a high percentage of survey respondents indicated that their city was addressing a certain issue or goal within their programming, only about half of the cities had actually codified these elements in their actual urban forest management plan (Muller & Bornstein, 2010). Baer (1997) also cautions that an outside evaluator cannot discern whether a plan's technical inadequacies were deliberate to satisfy political demands or were mistakenly left out of the plan. A municipality may default to vague goals and objectives without detailed action steps in order to see a plan survive through a political approval process with the mayor or city council. It is impossible to know whether a municipality intentionally left out detail for this purpose because the analysis was based on the plan alone, without any interviews with municipal staff or plan authors.

While some communication was made with municipal staff and consultants about the existence of plans, no questions were asked about the elements the municipality ultimately included. Exploring the reasons why certain elements were included in the plans could be informative, particularly understanding the relationship between certain plan elements and common barriers such as limited funding or technical knowledge. The next step in evaluating urban forest management plans is to conduct an implementation evaluation of the plans, using the plan contents as a baseline or comparison to the actual on-the-ground management decisions and activities. An implementation evaluation will help paint a fuller picture of urban forestry management activities within these

municipalities and provide a deeper understanding of how these plans are being used. Ideas for future research will be discussed in greater detail in Chapter 5.

4. Results

This chapter presents the findings and results relating to the overarching research goal of increasing understanding of municipal urban forest management planning in Washington and the two research objectives to:

1. Characterize the comprehensiveness of Washington municipal urban forest management plans; and
2. Assess the influence of a municipality's attributes on the comprehensiveness of its plan.

First, this chapter provides an overview of the 39 plans and the attributes of the 38 municipalities with urban forest management plans as a way to provide context for the subsequent results. Key results of this initial analysis reveal that 46% of the 38 municipalities are classified as medium-sized cities, 85% of small municipalities received CFA funding through the DNR Urban and Community Forestry Program to write a management plan, and 59% of all plans were written with the help of an outside consultant.

Next, this chapter presents the findings of the document analysis sequentially by the four levels of the framework for comprehensive urban forest management plans. Level 1 of the framework asks, "What do you have?" and includes the review and assessment of the current urban forest resource. While the majority of plans included the results of a tree inventory, very few conducted a comprehensive assessment of the current state of the urban forest, using a criteria and indicators approach as suggested in the literature. Level 2 of the framework asks, "What do you want?" and involves creating a shared community vision for the urban forest and setting goals and objectives based on the results of an urban forest assessment. Only 38% of the plans included a vision for the future state of the urban forest, setting the direction for the plan and informing goal development. While many of the plans did address the ten substantive themes, the vegetation resource themes of tree maintenance, tree establishment, and tree protection were addressed most frequently. Level 3 of the framework asks, "How do you get what you want?" and addresses the ten substantive themes with specific action steps and best management practices and includes a strategy for implementation. The majority of plans included detailed action steps for implementing goals related to tree maintenance and tree establishment. Only 26% of the plans included an implementation plan. Level 4 asks, "Are you getting what you want?" and addresses the need for feedback, monitoring, and adaptive management.

Only three out of the 39 plans addressed monitoring and adaptive management; no plan included a detailed strategy for monitoring the implementation of the plan.

Finally, the quantitative results of the comprehensive plan index are presented and the relationships between plan comprehensiveness index scores and municipal and plan attributes are explored. The analysis results reveal that municipality size and public participation during the plan writing process were the most influential attributes in predicting the comprehensiveness of a management plan. A discussion of the results is presented in Chapter 5 along with conclusions and recommendations for future research.

4.1 Overview of Plans

In total, 39 plans were identified across Washington State, ranging from purely operational plans to strategic plans. Municipalities within the sample were located across the state, from large to small, and with varying levels of DNR funding support. Of the 39 plans, 19 used the word “management” in its title, four plans used the term “strategic”, and three plans were titled “master” plans. “Community Forestry Plan” was another common plan title. Covington has two plans represented in the sample, which means that in total, there are actually 38 municipalities represented. As stated in Chapter 3, Covington’s two plans are both included in the sample because Covington currently uses the two plans separately to manage its urban forest. While one plan serves as more of an operational plan, the other provides a more long-term strategic vision for the urban forest and addresses the community framework. See Appendix C for a complete list of urban forest management plans and associated municipal attributes.

4.1.1 Municipal Attributes

This section summarizes the attributes of municipalities who have invested in the development of a management plan. Of the 39 plans, 33% were written by municipalities classified as small with populations between 100-9,999 residents, according to 2011 census numbers (Figure 5). Of the total 281 municipalities in Washington, 203 or 72% are classified as small. Of these 203 small municipalities, only 6% have written an urban forest management plan. Medium-sized municipalities with a population between 10,000 and 49,999 residents wrote 46% of the plans; 31% of all medium-sized municipalities

have written an urban forest management plan. Large Washington municipalities—municipalities with over 50,000 residents—have written eight plans, or 20% of the total plans. In total, there are 21 cities in Washington classified as large, which means that 38% of all large Washington cities have written an urban forest management plan. Approximately 90% of the municipalities with urban forest management plans are currently designated as a Tree City USA (Figure 5). By definition, Tree City USA municipalities have an active tree board, a tree care ordinance, and have an urban forestry program with an annual budget greater than \$2 per capita. It is unclear how many municipalities were active Tree Cities at the time of their management plans were written.

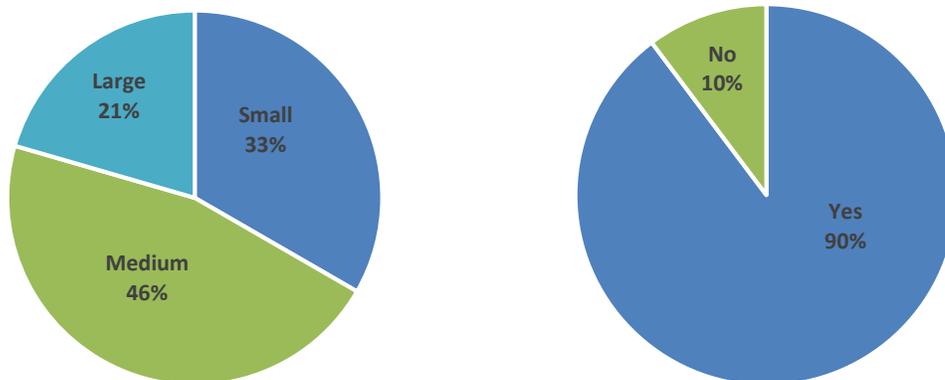


Figure 5. Size of Municipalities with Plans

Tree City USA Status of Municipalities with Plans

Of the 38 municipalities with urban forest management plans, 13, or 33% are located east of the Cascade Mountains, while 26, or 66%, are located west of the Cascades (Table 5). The small and large municipalities with management plans are relatively evenly split between the eastern and western sides of the Cascades, while 83% of the medium-sized municipalities with management plans are located west of the Cascades. This is compatible with the overall geography of medium-sized Washington municipalities, as the majority are located in Pierce, King, and Snohomish counties. In total, 54% of municipalities with management plans are located in the Puget Sound Region of Washington (Figure 6).

Table 5. Municipality Size and Location

Municipality Population Category	East or West of Cascades		Total
	East	West	
Small	7	6	13
Medium	3	15	18
Large	3	5	8
Total	13 (33%)	26 (67%)	39

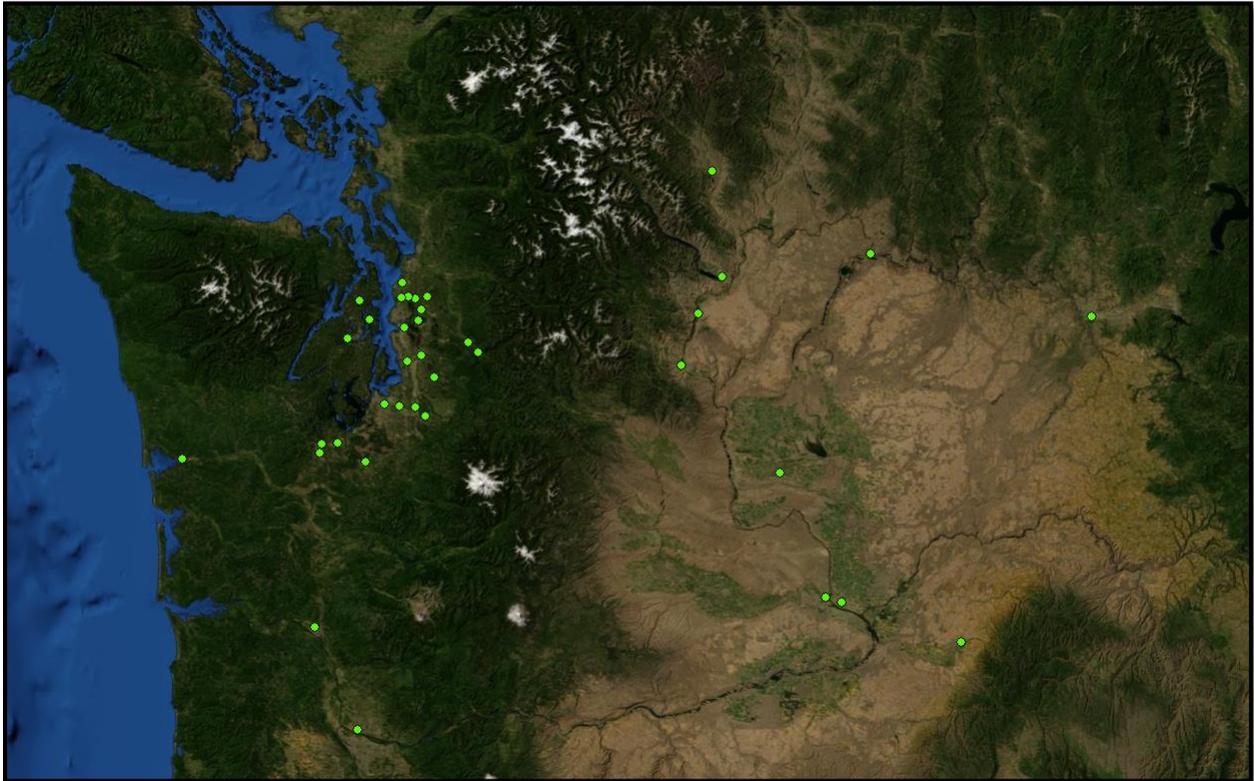


Figure 6. Geographic Locations of Washington Municipalities with Urban Forest Management Plans

4.1.2 Plan Attributes

Plan attributes were recorded during data collection, including the plan author, the year the plan was written, the plan’s availability to the public (i.e. whether it was publicly available online), and whether the municipality had received funding from the DNR Urban and Community Forestry program in the form of a Community Forestry Assistance (CFA) grant. In total, 56% of all urban forest management plans were funded partly or entirely through a CFA grant, administered through the Washington DNR (Table 6). Of the small municipalities with plans, 85% received CFA grant funding, while

44% of medium-sized municipalities received funding for plan creation. Large municipalities were evenly split on funding, with four receiving funding and four without. Most of the large municipalities that received DNR grant funding also mentioned receiving funding from other sources, meaning that the DNR Urban and Community Forestry Program CFA funding was not their only source. Unlike large municipalities, many of the small municipality plans did not mention any other funding sources for plan development.

Table 6. Urban Forest Management Plan Funding by Municipal Size

Population Category	CFA Grant Funding		Total
	No	Yes	
Small	2 (15%)	11 (85%)	13
Medium	10 (56%)	8 (44%)	18
Large	4 (50%)	4 (50%)	8
Total	16 (44%)	23 (56%)	39

The average age of urban forest management plans in Washington is seven years (written in 2007); all plans were written between 1997 and 2013 with all but two of the plans written after 2000. All plans included in this study represent the municipality’s most recent plan. In theory, the plans included in this thesis are currently in use. Municipal representatives from the two cities with plans written before 2000 responded via email that the city’s plan was currently in use and had not yet been updated. It is unknown how many of the 39 plans have been officially adopted; this should be an important question to consider if designing an implementation evaluation.

The majority of plans (59%) were publicly available online through the municipality’s website. Procuring a plan from the other 41% of municipalities proved somewhat difficult and required emails and phone calls with municipal managers, city clerks, and program directors. A few plans that had been funded through a CFA grant and were known to exist were especially difficult to find. Several municipalities had to search for the document and locate a staff person who had formerly been in charge of the project. In multiple cases, DNR records indicated they had awarded CFA funding for a master plan or similar management plan, however, the city reported that the project had not been completed. In one case, the municipality had received a grant through DNR Urban and Community Forestry and instead of writing an urban forest management plan, had created a vegetation management plan for several of its public parks. This plan was removed from the sample.

Consultants wrote or assisted in writing 59% of urban forest management plans in Washington, while only 30% were written entirely by municipal staff (Figure 9). Of the consultant-written plans, Jim Flott of Community Forestry Consultants wrote 7 of the 23 consultant-written plans; 6 of which were funded through a CFA grant. Davey Resources, Kevin McFarland of Sound Urban Forestry, and Elizabeth Walker all wrote two or more plans. In total, 19 out of the 23 consultant-written plans were funded through CFA grant, or 83%. For a full list of plan authors, see Appendix C.

4.2 Plan Elements

This section presents the results of the content analysis of the 39 urban forest management plans in Washington and is divided into four subsections based on the four levels in the framework presented in Chapter 3 (Appendix A). This section will also provide examples of how particular plans addressed each framework element; additional examples of the ten substantive themes can be found in Appendix E. These examples are provided to both illustrate how municipalities addressed each component, but also to highlight the diversity among plans. Additional examples are provided in Appendix E.

4.2.1 Level 1: Background & Assessment of Urban Forest

The first level of the framework for comprehensive urban forest management plans answers the question, “What do you have?” and provides background information to establish baseline data on the state of the urban forest and the community’s values towards trees. Urban forest management plans address this question by including the results of a tree inventory, evaluating the current state of the urban forest through a review of current policies and programs, a comprehensive assessment of the current state of the urban forest and community, and by involving the community in the plan development process.

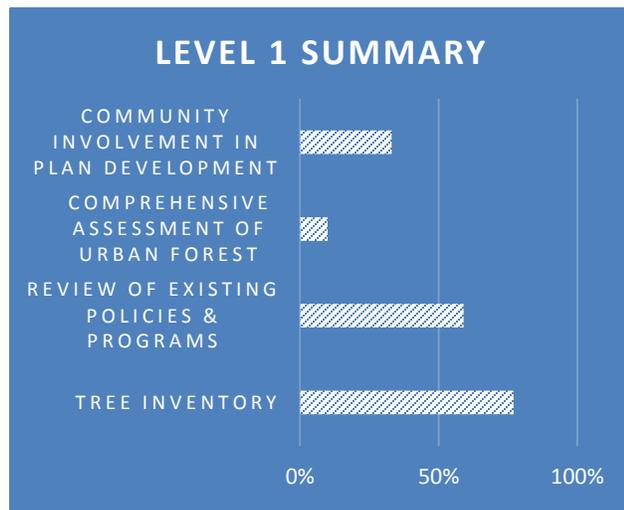


Figure 7. Summary of Plans Addressing Level 1 Criteria

Figure 7 summarizes the number of plans addressing each of the criteria in level 1 of the framework. The

majority of urban forest management plans also included a section listing the benefits of urban trees and the urban forest in the introduction of the plan, providing justification for its management.

4.2.1.1 Inventories

In total, 30 of the 39 plans explicitly state that an inventory was conducted before writing the plan; several of the municipalities conducted inventories as a result of plan development. The urban forest management literature states that inventories should be conducted prior to the development of a management plan to inform the plan's goals, objectives, and actions. The DNR Urban and Community Forestry Program recommends that any municipality undertaking the development of a management plan already have completed an inventory. It is important to note that not all inventories were conducted with the same methods or level of rigor. Municipal tree inventories and assessments ranged from comprehensive UFORE (Urban Forest Effects) type inventories, such as i-Tree inventories, to windshield street tree surveys. The comprehensiveness of the inventory in relationship to the comprehensiveness of the plan was not studied, however it may be an interesting consideration for future studies.

The majority—if not all—tree inventories focused on trees on public lands and along right-of-ways. Several of the medium-sized and larger municipalities had completed a city-wide canopy assessment, including Covington, Vancouver, and Seattle. Many of the smaller municipalities on the eastern side of the Cascades claimed to have inventoried all public trees within their jurisdiction. Several municipalities hired the same consultant to conduct a tree inventory and to write their urban forest management plan. It is unclear how many municipalities gathered spatial data or manage their tree data through a computer-based data management system. Municipalities reviewed the results of inventories and canopy assessments by including maps of canopy cover, canopy cover percentages, a summary of the most commonly planted species, and identifying available planting locations. It was unclear how many of the municipal tree inventories are up-to-date. In a 2010 study of California municipality urban forest management, the researchers found that many of municipalities' inventories were long out of date and that the average update period was between 10-20 years (Muller & Bornstein, 2010). This suggests that not all of the data used to develop some of the urban forest management plans in Washington State was up-to-date.

4.2.1.2 Review of Current Policies and Practices

Reviewing the municipality's current urban forestry policies and programs helps provide context for the urban forest management plan and orient readers. This section should review current tree ordinances, tree planting programs, and the internal management structure. Of the 39 urban forest management plans analyzed, 20 included a review of the municipality's current policies and practices, providing context for the plan. The 51% of plans that addressed current policies and practices varied in the amount of detail and history. Some plans included an extensive background of the history of urban forestry in the municipality and a comprehensive list of decisions, policies, and departments involved in planning, while others provided only a brief history to add context to the plan.

4.2.1.3 Public Participation in Plan Writing Process

Public participation is an important component of planning and plan development. An urban forest management plan benefits from public participation by ensuring the plan is sensitive to community values and management objectives. The plan should be transparent in describing who participated during the plan writing process and how the process was influenced by public participation (Larsen & Yonts-Shepard, 1990). Of the 39 plans, 13 plans (33%) explicitly address public participation during the plan writing process. Municipalities used a number of methods to involve the community during plan development. For example, Bainbridge Island, Sumner, and Lake Forest Park conducted community values surveys online or through a community newsletter to better understand each community's interest and knowledge of the urban forest. The cities of Covington and Seattle both held open houses to receive feedback on the key objectives and opened the process to public comment before finalizing the draft. The city of Seattle also held six meetings with community groups to solicit comments from groups assumed to have an interest in the outcomes of their 2013 Urban Forest Stewardship Plan.

The city of Kirkland conducted an online survey to gauge the community's interest in the urban forest and their priorities for urban forest management; the city received over 650 responses. The city of Kirkland also conducted focus groups, inviting residents, tree care professionals, and developers to participate and share their views and opinions about urban forest management. In the focus groups, participants were asked questions such as, "What are the opportunities/threats around urban forest

management on private lands in Kirkland?” and “What are the strengths and weaknesses in the draft management plan?” The results of Kirkland’s survey and focus groups helped inform the direction of the city’s final Urban Forestry Strategic Management Plan.

Tacoma’s “Strategic Urban Forest Management Plan for Neighborhood Business Districts” focused on Tacoma business districts, therefore the city reached out to the neighborhood business districts during plan development. Tacoma gathered stakeholder input during public meetings and used the information to identify opportunities, elements to include in the plan, and goals. It cannot be assumed that the municipalities that did not include information about a public process did not involve the public during the development of the plan. However, the planning literature does state that a plan should be transparent in describing how participation influenced the process (Larsen & Yonts-Shepard, 1990).

4.2.1.4 Assessing the Current State of the Urban Forest

As mentioned in Chapter 2, an assessment of the current state of the urban forest is useful at two stages of the urban forest management planning process. The urban forest management literature recommends conducting a criteria and indicators evaluations before developing the plan to create a benchmark of the current state of the urban forest (Clark et al., 1997; Kenney et al., 2011; van Wassenauer et al., 2012). Criteria and indicators provide a standardized set of performance measures that can be used to assess the state of the urban forest to inform the planning process (Kenney, van Wassenauer & Satel, 2011). In total, only four out of the 39 plans included the results from an assessment of the current state of urban forest within their urban forest management plan (10% of total plans). Both the 2013 Covington and the 2013 Kirkland strategic plans included a criteria and indicators evaluation using the Clark et al. (1997) and Kenney et al. (2011) frameworks. Both of these plans are more strategic in nature and offer a thorough assessment of the current state of the urban forest along with long-term goals and objectives.

The Kirkland criteria and indicators evaluation was accomplished by interviewing staff from all city departments to gain an understanding of the current state of urban forest operations, including the state of the urban forest; feedback from Kirkland residents gathered through a survey was also used. Each criterion was assessed for its current level of performance and given a score from low to optimal,

based on the current status and risk. For example, the assessment included a criterion for the “management of trees & vegetation in public natural areas” and is given a performance level of “good” with an explanation of the current status (Figure 8). The Kirkland plan is later divided into sections based on the Clark et al. (1997) model for urban forest sustainability, addressing the vegetation resource, community framework, and resource management approach. The Kirkland plan includes a goal to continue to track data and performance measures using the performance measures included within the plan

Previously, urban forest efforts have not been well-coordinated or tracked using meaningful performance measures. The intent of this plan is to lay the foundation for cohesive, efficient and sustainable forest management on a daily, annual, and long-term basis.

Kirkland’s criteria and indicators performance measures are based on the Clark et al. (1997) model for urban forest sustainability, but updated to reflect Kirkland’s unique characteristics. The plan states, “...the performance measures and criteria indicators below can be used for subsequent analysis and goal-setting”.

Criteria: Management of Trees & Vegetation in Public Natural Areas	
<i>Performance</i>	Good
<i>Current Status</i>	The 20-Year Forest Restoration Plan outlines the structure & function of forested parkland. It does not include the extensive acreage of natural areas in the annexation areas. The ecological structure and function of all publicly-owned natural areas is not documented in the citywide GIS system.
<i>Risk</i>	If services are not tracked, the value of the asset is unknown and preservation and maintenance is more difficult to rationalize.
<i>Benefit</i>	Healthier, more resilient and sustainable natural areas.

Figure 8. Excerpt from the Criteria & Indicators Evaluation in Kirkland’s Urban Forestry Strategic Management Plan (2013)

The Covington plan also included the results of a criteria and indicators evaluation that the city conducted before developing its goals and actions. The 2013 Covington plan was written with the help of an outside contractor who helped the city with the criteria and indicators evaluation by having each member of the city’s “Tree Team” fill out a matrix and rank each indicator and select a key objective for each criterion (Figure 9). The results of this evaluation were all included within the plan. In response to the evaluation of criteria and indicators, the Tree Team used the results to set key objectives for the plan development process. Key objectives resulting in this initial criteria and indicators evaluation

included, “The public recognizes the urban forest as vital to the community’s environmental, social, and economic well-being” and “Ensure all city departments cooperate with common goals and objectives for urban forest management”.

APPENDIX C.1

Vegetative Resource Criteria and Indicators

C = Current Level; D = Desired Level

PR= Parks; PW = Public Works; CD = Community Development Team; ET = Engineering; CA = City Arborist

Criteria	Performance Indicator Spectrum				Key Objective
	Low	Moderate	Good	Optimal	
1. Relative Canopy Cover	The existing canopy cover equals 0-25% of the potential.	The existing canopy cover equals 25-50% of the potential. <i>Desired by CD, CA</i>	The existing canopy cover equals 50-75% of the potential. <i>Desired by PW, ET, PR</i>	The existing canopy cover equals 75-100% of the potential.	* Achieve climate-appropriate degree of tree cover, community-wide
2. Age distribution of trees in the community	Any Relative DBH (RDBH) class (0-25% RDBH, 26-50% RDBH, etc.) represents more than 75% of the tree population.	Any RDBH class represents between 50% and 75% of the tree population. <i>Desired by CD, CA</i>	No RDBH class represents more than 50% of the tree population. <i>Desired by ET, PR</i>	25% of the tree population is in each of four RDBH classes.	* Provide for uneven-aged distribution city-wide as well as at the neighborhood/HOA level.
3. Species suitability	Less than 50% of trees are of species considered suitable for the area.	50% to 75% of trees are of species considered suitable for the area. <i>Desired by PW</i>	More than 75% of trees are of species considered suitable for the area. <i>Desired by CD, CA, PR, ET</i>	All trees are of species considered suitable for the area.	* Establish a tree population suitable for the urban environment and adapted to the regional environment.
4. Species distribution	Fewer than 5 species dominate the entire tree population city-wide.	No species represents more than 20% of the entire tree population city-wide. <i>Desired by PW, PR, CD, CA</i>	No species represents more than 10% of the entire tree population city-wide. <i>Desired by ET</i>	No species represents more than 10% of the entire tree population at the neighbourhood level.	Establish a genetically diverse tree population city-wide as well as at the neighborhood level.
5. Condition of Publicly-managed Trees (including ROW trees)	No tree maintenance or risk assessment. Request based/reactive system. The condition of the urban forest is unknown	Sample-based inventory indicating tree condition and risk level is in place.	Complete tree inventory which includes detailed tree condition ratings.	Complete tree inventory which includes detailed tree condition and risk ratings.	* Detailed understanding of the condition and risk potential of all publicly-managed trees

Figure 9. Excerpt of the Criteria and Indicators Evaluation of the Vegetation Resource from Covington’s 2013 Urban Forestry Strategic Plan

The cities of Vancouver and Bainbridge Island both conducted a similar evaluation, but used a different model. Instead of using the Clark et al. (1997) criteria and indicators model to look for gaps in its current programs and policies, the city of Vancouver conducted a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis and the city of Bainbridge Island conducted a gap analysis. The city of Vancouver conducted its SWOT analysis “as a means to organize input and comments provided by the public, agency, and local organization staff, and Urban Forestry commissioners and staff”. This activity provided the Vancouver Urban Forestry Commission a way to evaluate the current state of the urban forest—including public perception—before writing a detailed plan moving forward. The city of Bainbridge Island conducted a gap analysis before developing its goals and objectives. The plan includes a brief analysis of gaps in its current policies and resources, completed by the Community Forestry Commission, which was used to inform plan development.

4.2.2 Level 2: Vision and Goals

The second level of the framework for comprehensive urban forest management plans asks the question, “what do you want?” and includes a summary of the reasons why a municipality writes a plan, the vision for the future state of the urban forest and the municipality’s goals and objectives related to ten substantive themes. Level 2 includes 11 evaluative criteria, which include the presence of a vision statement and the presence of a goal addressing each of the ten substantive themes. Figure 10 provides a summary of the number of plans that address each of the 11 criteria from level 2 of the plan comprehensiveness index, which was presented in Chapter 2 (Appendix D).

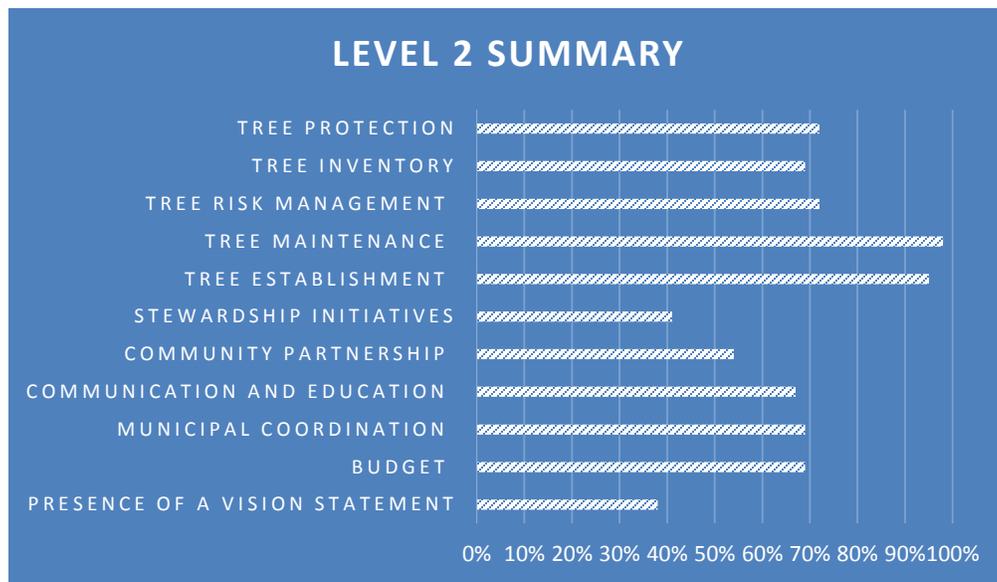


Figure 10. Summary of Plans Addressing Level 2 Criteria from the Plan Comprehensiveness Index

4.2.2.1 Reasons for Writing a Management Plan

A municipality’s reasons for writing an urban forest management plan influence the municipality’s vision statement, goals, and actions. During document analysis, codes were assigned to the reasons municipalities decided to write an urban forest management plan. The most commonly identified reason for writing a plan was to provide direction for the management of the municipality’s trees, with 57% of plans making this statement. The enhancement and preservation of trees was stated as a reason in 54% of plans. Nearly 49% of the plans included a statement that the document served as the municipality’s first step in managing the urban forest or providing a guiding framework for management. Other reasons for writing an urban forest management plan included: a response to

changes in land use and urbanization, concerns over an ageing tree population, improving the community’s quality of life, a desire to shift from reactionary to proactive management of the urban forest, and view preservation. Two of the municipalities located on the coast include a goal to preserve views. Notably, nine plans mention the importance of the urban forest management plan in its relationship to the municipality’s comprehensive plan under the Growth Management Act. As planning is not done in a vacuum, these municipalities noted the relevance and connectedness of their comprehensive plans in guiding the development of an urban forest management plan. Also notable are the 12 plans that mention the chance to involve the public and increase the community’s support and awareness for urban forest management as one of the reasons behind the creation of a management plan (Figure 11).

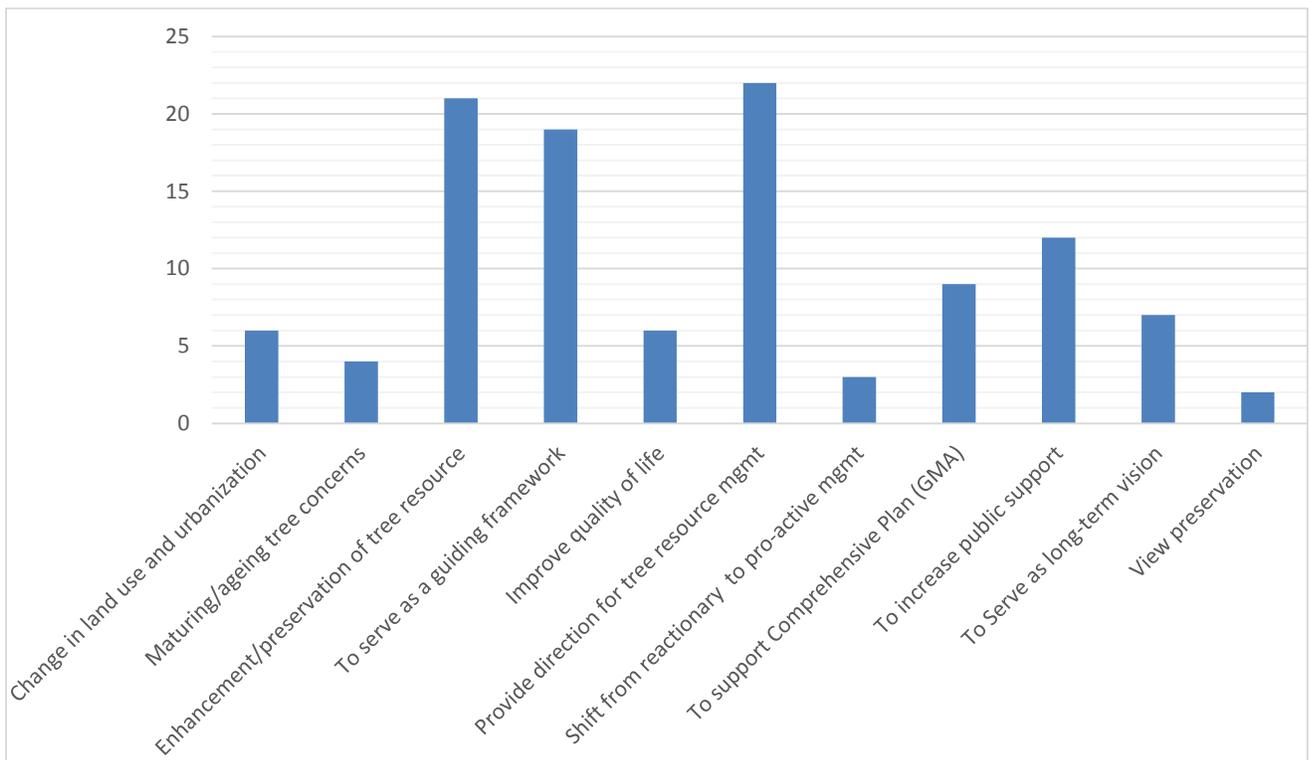


Figure 11. Washington Municipalities’ Stated Reasons for Writing an Urban Forest Management Plan

4.2.2.2 Vision Statement

The planning literature states that all planning documents should include a vision statement that helps align people, creating a shared sense of direction. Effective vision statements are imaginable, desirable, feasible, focused, flexible, and communicable (Kotter, 2012). Vision statements should clearly

describe the future outcomes and provide a foundation for the plan's goals and action steps. Finally, vision statements should be unique and oriented to the needs of a particular community. Out of the 39 plans, 15 plans included a vision statement, or 38% of all plans. While the quality of the vision statements was not analyzed, several will be highlighted below for how they address the elements of an effective vision statement, as defined by Kotter (2012).

Seattle's vision statement is a good example of one that clearly describes the desired future outcomes and is unique to the character of the city:

Seattle's urban forest is a thriving and sustainable mix of tree and understory species and ages that creates a contiguous and healthy ecosystem that is valued and cared for by the City and all of its residents as an essential environmental, economic, and shared community asset that reinforces Seattle's identity and legacy as a forested, livable city.

The city of Yelm's vision statement provides a solid example of statement that clearly describes future outcomes, is imaginable, feasible, and focused. This vision statement also communicates with a broad audience addressing volunteers, youth, and "people of all ages", which can help align the whole community towards a shared vision of urban forestry:

Trees and vegetation grace our City streets and parks, and provide habitat for wildlife, soften our city structures, clean our air, connect us with the past, protect our water resources and ensure that every resident experiences daily close contact with nature. Our vegetation is treasured for its aesthetic value as well as for the positive influence it provides the residents and business community. Within our City, there exist threads of diverse and well-maintained trees that reflect past community efforts and the commitment to the future. Our community's urban forest is planted and maintained by youth, volunteers, and the community, creating a patchwork of nature and people in balance. People of all ages and backgrounds have formed lasting partnerships to participate actively in the stewardship and care-taking of our precious tree resource.

Renton's vision statement is notable because it addresses the three components of a sustainable urban forest from the Clark et al. (1997) model. Renton's vision statement is also forward-thinking and imaginable: "Renton's urban and community forest is healthy, diverse, and sustainable, contributing to Renton's identity in the region." Covington's vision statement from its 2013 strategic plan reads similar to a mission statement instead of a vision because it lacks a clear picture of the desired future state of the urban forest and instead states the purpose of managing the urban forest: "Covington is dedicated to protect and manage the urban forest in order to preserve and enhance its benefit to the environment and the livability of the community."

The municipalities that did not include a vision statement in their plans likely did not go through a visioning exercise, which can help cities create a shared sense of direction that aligns city staff and community members toward a common future state. The lack of a vision statement does not indicate the plan lacked quality, but does indicate that there may have been less community involvement in the plan development process.

4.2.3 Substantive Themes

After completing an assessment of the current state of the urban forest and identifying management gaps, the next step is to identify goals and objectives to reach the overall vision. A high quality goal is measurable, specific, and linked to targets (Conservation Measures Partnerships, 2013). A comprehensive plan should address the three main components of an urban forest from the Clark et al. (1997) model of urban forest sustainability: the vegetation resource, the community framework, and the resource management approach. In Chapter 3, ten substantive themes were introduced within the three categories from the Clark model. The themes were presented as topics that any comprehensive urban forest management plan should include. During content analysis, each of the 39 plans was coded for presence or absence of the ten substantive themes and whether the plan addressed the theme with a goal or objective or with a goal and associated action steps, strategies, or set of best management practices. Best management practices were defined as, “best available, industry-recognized courses of action, in consideration of the benefits and limitations, based on scientific research and current knowledge” (Lilly, 2010).

Goals were often vague without measurable targets or objectives. Plans addressing a theme with both a goal and an associated action step provided more specificity. According to the implementation literature, goals and action steps with more specificity increase the likelihood of implementation (Sabatier & Mazmanian, 1980). Figure 12 summarizes the number of plans addressing each substantive theme with a goal and associated set of action steps or best management practices. The following sections will explore each of the ten substantive themes, provide a summary of the percentage of plans that included each theme, and include example of how plans addressed the themes. Examples illustrate how some municipalities have incorporated the themes to highlight the variation

between plans and to provide ideas for municipalities interested in incorporating the theme into their own urban forest management plan.

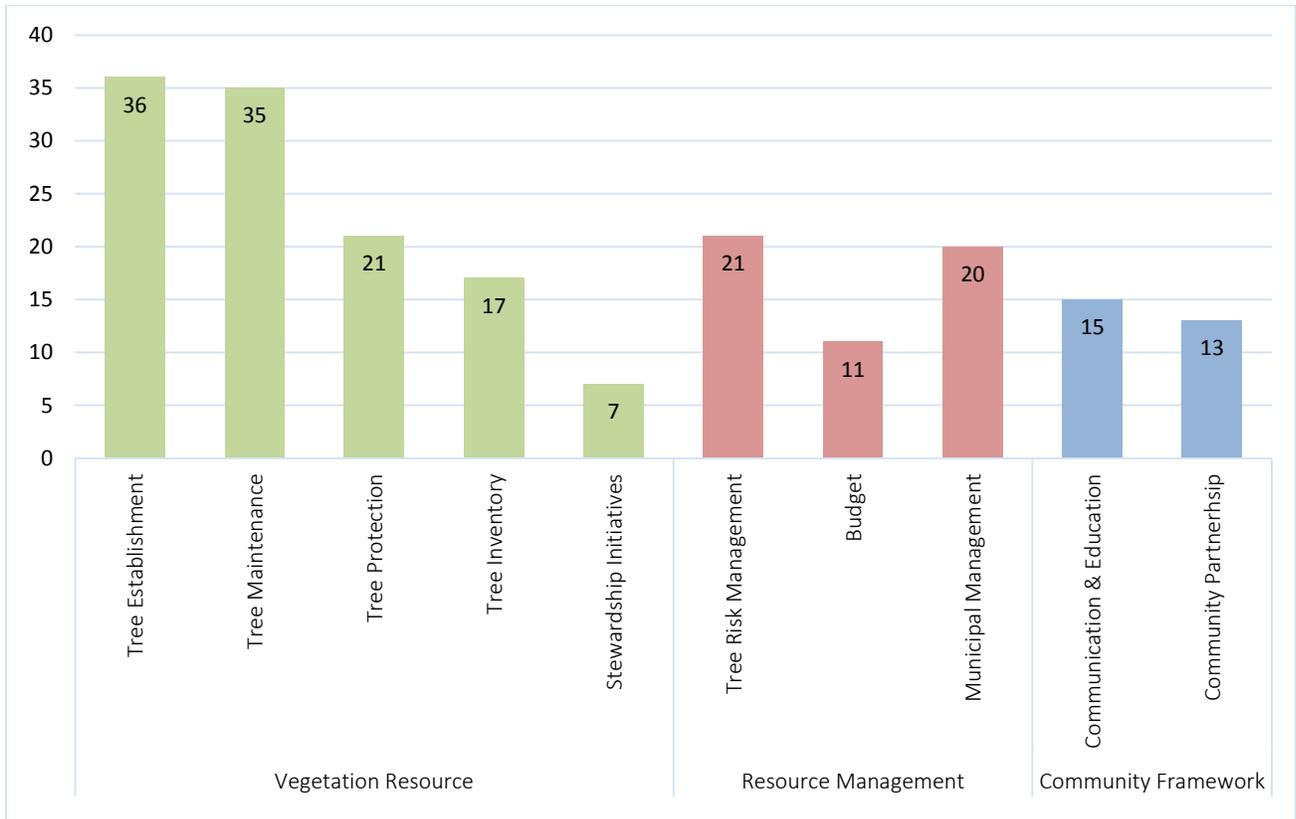


Figure 12. Frequency of Plans Addressing Substantive Themes with Goals and Action Steps.

4.2.4 Vegetation Resource

The vegetation resource component addresses the trees and vegetation within an urban forest. The framework for comprehensive urban forest management plans includes five substantive themes within the vegetation resource component: tree establishment, tree maintenance, tree inventory, tree protection, and stewardship initiatives. Vegetation resource themes were the most commonly addressed out of the three categories, particularly tree establishment and tree maintenance. The following subsections will provide a summary of the number of plans that addressed each theme within vegetation resource and offer examples from the plans.

4.2.4.1 Tree Establishment

Tree establishment was the most frequently mentioned substantive theme in the 39 urban forest management plans; 95% of the plans include goals and objectives relating to tree establishment (Figure 13). Tree establishment goals relate to planting suitable trees, maintaining genetic diversity and uneven age structure, and other considerations such as tree replacement, distribution, and locating suitable planting locations. While “tree establishment” is a broad theme, addressing this theme in some way suggests that the municipality is considering the

health and importance of growing its tree population. Of the 39 plans, 92% include a goal with an associated action step or set of best management practices related to tree establishment, which was the highest among all substantive themes. The action steps included in the plans ranged from purely operational—such as best management practices for species selection—to strategic long-term goals related to shifting planting palette to address changing climatic conditions. For example, the city of Fife (2013) included the following goal addressing tree establishment—specifically tree selection—with a list of associated best management practices to achieve the stated goal:



Figure 13. Tree Establishment Theme Summary

Tree Selection: Trees appropriate to conditions in Fife should be chosen bearing in mind the following guidelines:

- Appropriate to climate—in addition to commonly available tree cultivars, it may be useful to investigate trees native to areas around the world that have similar climate and/or soil conditions to broaden the diversity of Fife’s urban forest.
- Appropriate to location (frontage, parking lot, park, etc.)—Tree selection may involve design aesthetics in addition to tolerance to micro-climate conditions.
- Hardiness—Tree species and cultivars selected must be tolerant of the temperatures and precipitation levels that obtain in the Pacific Northwest, planning forward to potential climate change alterations as well.
- Do no harm tree cultivars (seedless, thornless, etc.)—public safety as well as lessened maintenance may be important considerations for certain tree planting locations.
- Tree species restricted for use as street trees due to invasive root systems, weak and/or brittle wood, or tendency to spread via root suckering. Among these are the following genera: Willow, poplar, aspen, and Swedish aspen.

See Appendix E for more specific examples of how plans incorporated goals, objectives, and action steps relating to the tree establishment theme. These examples are not exhaustive and do not illustrate the wide variety of action goals, actions steps, and best management practices included within the 39 plans. These examples are meant only to help illustrate how some municipalities addressed tree establishment within their urban forest management plans.

4.2.4.2 Tree Maintenance

Of the 39 plans, 98% include a goal with an associated action step or set of best management practices related to tree maintenance (Figure 14). The tree maintenance theme includes goals relating to pruning, inspection cycles, the reduction of pests and diseases, and proper maintenance of newly planted trees. Many of the plans address this theme with both action steps and a set of best management practices relating to tree selection, pruning timing, and the use of certain standards when maintaining public trees. Only one out of 39 plans did not include any goal or objective related to tree maintenance. The action steps and best management practices associated with goals about tree maintenance ranged from pruning specifications for street trees to guidelines for municipal arborists for removing diseased trees threatening public safety. One of the most common goals was related to pruning trees in accordance with ANSI A300 standards and using International Society of Arboriculture best management practices for tree pruning. The following example is excerpted from Walla Walla’s Urban Forest Management Plan and addresses the need for pruning specifications with both a goal and a set of best management practices:

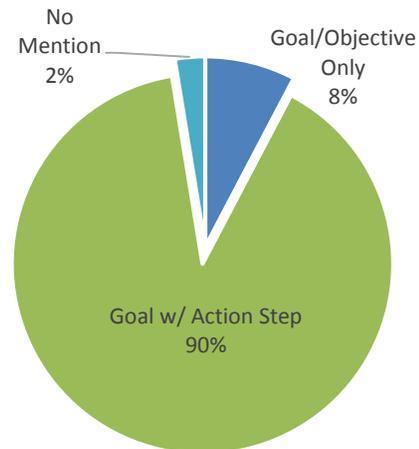


Figure 14. Tree Maintenance Theme Summary

All pruning shall be done in accordance with the following industry standards: ANSI A300, ISA BMPs

- Prune properly. Bad pruning cuts can cause long-term damage.
- Prune carefully. Bad pruning cuts won’t grow back and can cause long-term damage.
- Don’t prune branches clean of twigs leaving a tuft of leaves at the end; this “lion’s tailing” creates weak branches and may cause branch failure.
- Stay on top of pruning tasks in order to keep branch removals as small as possible.

- Prune branches just outside of branch collar to allow for faster wood closure and less exposure to disease pathogens.

While this example provides simple best management practices, the inclusion of this extra detail gives this plan more specificity and provides staff more information about the Walla Walla’s urban forestry policies. Appendix E includes several additional examples of how plans incorporated goals, action steps, and best management practices related to tree maintenance.

4.2.4.3 Tree Inventories

An updated tree inventory is critical to proactive management of the urban forest. It provides the data necessary to plan for tree establishment, maintenance, and for managing risk. Goals related to tree inventories—including goals to update and maintain tree inventories—are found in 69% of all urban forest management plans, with 43% of the plans addressing tree inventories with goals and associated action steps (Figure 15). Tree inventory goals are important to comprehensive urban forest management because a tree inventory should be a living inventory of the urban forest that is frequently updated and reviewed to not only ensure accurate information, but to constantly use the information as a tool for management. Tree inventory action steps ranged from the specific data collection variables to detailed schedules for updating tree inventories and incorporating the data into GIS or a database management system. The city of North Bend (2011) addresses the tree inventory theme with a goal and action steps about proper maintenance of its tree inventory:



Figure 15. Tree Inventory Theme Summary

The City shall maintain its public tree inventory, including the species, size, condition, and associated maintenance or replacement needs of all street trees in parks and other public places. Maintenance of the City’s tree inventory shall consist of the following activities:

- The City’s GIS Technician shall maintain the tree inventory database by inputting data resulting from new development projects that add street trees, as well as data collected by the City’s Tree Steward, other applicable staff, or consultants.
- The City’s Tree Steward shall inspect the City’s public trees at least every other year, and shall report changes in the inventory to the City’s GIS Technician.

This excerpt from North Bend’s plan provides an overall goal for maintaining the City’s tree inventory, details specific steps that should be taken to reach this goal, and assigns responsibility for who will be undertaking these efforts. This level of details provides specificity to the plan, increasing the likelihood of successful implementation. See Appendix E for more specific examples excerpted from urban forest management plans across Washington.

4.2.4.4 Tree Protection

Tree protection is a common theme in Washington urban forest management plans; 72% of the plans address tree protection in some way (Figure 16). Tree protection goals found within the plans include protecting trees during construction, encouraging the protection of large trees, protecting native trees, protecting mature street trees, creating a memorial tree program, and preserving trees located within city lots. The creation of heritage tree programs, or similar tree protection programs, is also a common goal among the plans. Of the total plans, 54% include a tree protection goal with an

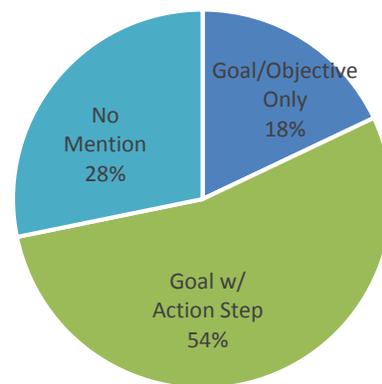


Figure 16. Tree Protection Theme Summary

associated set of action steps or best management practices, adding specificity to the plan. The city of Lacey addresses tree protection with a goal to establish a heritage tree program and includes a set of action steps, which add specificity to the plan and increase its likelihood of implementation:

- Create a heritage and specimen tree program that recognizes special trees worthy of extra attention, notoriety and protection.
 - A. Develop definitions of heritage and specimen trees that emphasize the special distinctions that lead to such characterization, in context with Lacey’s history.
 - B. Hold contests annually on Arbor Day for identification and qualification of these special trees.
 - C. Develop standards for protection of such trees and methodology for registering trees so that new landowner are notified of what they are purchasing and expectations associated with the distinction, including the tree’s health and expected life cycle.
 - D. A new section should be added to the tree ordinance that recognizes heritage and specimen trees. Sample language will be developed for the City of Lacey and will be provided to the City under separate cover.

Not only does this plan offer a goal to create a heritage tree program, it also provides specific action steps describing how the city of Lacey will achieve this goal. Appendix E provides several additional examples of how plans addressed the tree protection theme with goals, best management practices and action steps.

4.2.4.5 Stewardship Initiatives

Stewardship initiatives make up the final substantive theme under the vegetation resource category and was also the most infrequently addressed theme. The stewardship initiative theme refers to goals relating to active stewardship of trees and natural areas to reduce the threats urban trees face, such as invasive species and inadequate nutrients and water. Goals include creating or improving community stewardship programs for public or

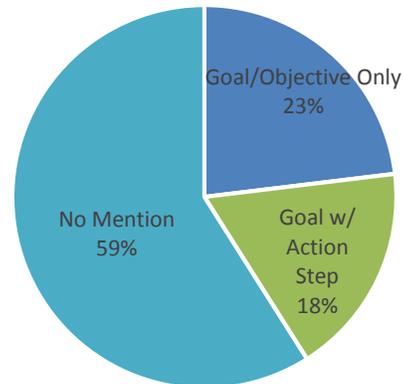


Figure 17. Stewardship Initiatives Theme Summary

private trees, community tree care programs, or removing invasive species and replacing them with native plants in forested natural areas. Stewardship initiative goals differ from tree maintenance goals because they are commonly city-wide initiatives related to public trees and often include public involvement. This theme could easily be situated under the “community framework” category as many of the stewardship initiative examples in the plans involve volunteers, such as tree steward programs (e.g. the city of Pasco’s Stewards for Young Trees) or volunteer programs to remove invasive species in parks (e.g. city of Seattle’s Green Seattle Partnership).

Approximately 41% of all the plans address stewardship with a goal, some of which are vague. Only 18% of all the plans address stewardship with an associated action step or set of best management practices (Figure 17). Plans that include goals relating to stewarding natural parks by removing invasive species and planting natives were all coded as addressing the stewardship initiative theme. For example, any city with a Green Cities partnership program addresses this theme with programming to steward public parks and involve the community in restoration. Other examples include plans with goals to initiate public campaigns encouraging residents to remove invasive species, such as English ivy, from their backyards to reduce the threat to the urban forest. Several plans—including Fife’s—provide

detailed lists of invasive species with associated best management practices for their removal. Plans including goals to engage local residents in stewarding trees in private or public lands were also coded as addressing the stewardship initiative theme. For example, the city of Vancouver addresses the stewardship initiative theme with a goal to “Promote stewardship of native plant communities on private and public property. Provide education about the benefits of native plants and the negative effects of invasive and non-native species.” Vancouver’s Urban Forest Management Plan also includes a list of three action steps meant to help achieve its stewardship goal:

1. Implement a comprehensive and creative ‘No Ivy’ campaign, centered on ‘No Ivy Day’ in early May, to increase awareness, inspire removal efforts, and promote landscape alternatives.
2. Encourage planting of native trees and shrubs, where appropriate, through outreach materials, trainings, events and other media exposure.
3. Work with volunteers to remove and control invasive species, such as English ivy and Himalayan blackberry, which threaten native plant communities on public lands.

Appendix E provides several examples of how municipalities incorporated goals and action steps related to stewardship in their plans.

4.2.5 Resource Management Approach

The resource management approach component of Clark’s (1997) model of urban forest sustainability refers to the actual management of the urban forest and the components needed for successful management. The framework for comprehensive urban forest management plans includes three substantive themes related to the resource management approach: budget, municipal coordination and management, and tree risk management. The following section will reveal how many of the urban forest management plans address these three themes and provide examples to illustrate the variety among Washington plans.

4.2.5.1 Budget

A sufficient budget is critical for successful plan implementation and should be discussed within an urban forest management plan. Management plans that explicitly address this theme discuss the role of the budget in the future of the municipality’s urban forestry programming. Budgetary goals in the Washington plans include securing funding for an urban forest program, creating funding goals and management priorities, locating sources for funding, and addressing the role of the budget cycle in the short- and long-term funding



Figure 18. Budget Theme Summary

horizons. Of the 39 plans, 69% address the theme of budget with at least one goal or objective (Figure 18). About 28% of the plans address the budget theme with a goal and associated set of action steps. For example, the city of Seattle address budgetary needs with a goal relating to securing adequate funding for urban forestry efforts and include an associated set of action steps detailing methods for increasing urban forestry funding in their 2013 Urban Forest Stewardship Plan:

In order to establish adequate and sustainable funding for urban forestry efforts, the City will consider the following:

- Develop tools for measuring and monetizing the comprehensive benefits provided by a healthy urban forest in Seattle.
- Use asset management and triple bottom-line cost-benefit analysis in assessing urban forest related projects.
- Explore options for dedicated funding sources for street trees. Explore creative financing mechanisms to ensure alternative funding to supplement general fund revenues.
- Develop a coordinated approach to seek funding from sources such as local and regional foundations, industry, and corporations.
- Work with the business and non-profit communities (e.g. Seattle Parks Foundation) to create a tree donation account or other funding strategies.
- Explore funding opportunities with the business community and with regional donors, particularly for special projects identified in a management plan.
- Explore creative financing mechanisms to obtain funding for City urban forestry program.

Of the plans that do address budgets with a goal, but lack specific action steps, most include a goal relating to the need for more funding or the importance of securing long-term funding. Examples include goals such as, “Increase funds spent on community trees” or “Institute appropriate public and

private funding mechanism to achieve goals and implement recommended actions.” While the presence of these goals indicates that these municipalities acknowledge the importance of adequate funding levels to implement the goals within their plan, they do not volunteer any specific action steps. The 28% of plans that do include more specific action steps offer specific ideas and strategies for increasing funding, goals to implement more sophisticated accounting systems, and detailed lists of potential funding sources to pursue. For additional examples of how Washington urban forest management plans address the budget theme, see Appendix E.

4.2.5.2 Municipal Coordination & Management

The second resource management theme present in 69% of the management plans is municipal coordination and management (Figure 19). As discussed in Chapter 2, proactive management is a critical component of comprehensive urban forest management and requires active planning by the municipality. Plans address this theme with goals to improve municipal coordination and management through staffing, ordinance improvements, or the creation of an interdepartmental urban forestry team. Some cities include goals to create a citizen tree board or urban forestry commission to involve the community in the municipal decision-making process. Improving coordination and collaboration across municipal departments is a common goal in many of the plans. A number of plans recognize the need for cooperation across city departments to ensure an integrated and coordinated approach to management across the city.

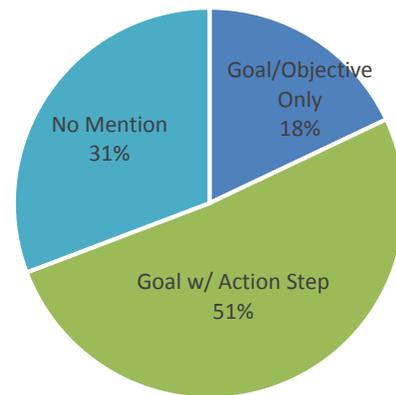


Figure 19. Municipal Coordination Theme Summary

Walla Walla’s plan explicitly states that “an interdisciplinary approach to management is necessary to preempt complications and allow for mitigation of negative impacts before they occur.”

Interdepartmental coordination was a main goal of most of the strategic plans including Seattle, Kirkland, and Covington; Seattle called coordination one the plan’s five overarching strategies. One way many plans proposed addressing the need for cooperation was through the creation of or by maintaining an interdepartmental urban forestry team to discuss city-wide urban forestry goals and work. The following example is excerpted from Renton’s Urban and Community Forestry Development Plan:

Goal: Continued interdepartmental cooperation and involvement in the urban forestry program.

The Task Force recognized the urgent need to provide the highest value and control service costs utilizing existing City crews and resources. The Task Force agreed to work as an Interdepartmental Team to discuss departments' staffing options further. The Task Force agreed that the certified arborist crew would be best located within the Community Services Department, with interdepartmental support from City departments, Mayor and City Council, Commissions, and the public.

Of the total plans, 51% include a goal with an associated action step or steps. Common action steps relate to securing or maintaining Tree City USA status, improving coordination across departments, integration of city standards, staffing needs, updating codes and ordinances, and improving the training available to municipal staff. See Appendix E for more specific examples of how plans incorporated goals and action steps related to improving municipal coordination.

4.2.5.3 Tree Risk Management

Managing the liability of trees is a large concern of many urban forest managers (van Wassenauer, Satel, & Kenney, 2012). Tree risk management goals relate to tree risk assessment, tree risk inventories of street trees, implementing tree risk rating systems, risk mitigation, tree risk evaluation, and goal to improve public safety. This theme also includes any response related to storms, such as cleanup and public safety after a large storm where trees have fallen or are impairing power infrastructure. In total, 72% of the plans address tree risk management with 54% of plans addressing tree risk management with a goal and more detailed actions steps (Figure 20). Tree risk management goals were often vague. For example, the following goal is vague and was not accompanied by any action steps, "Reduce the number of hazardous street trees to acceptable levels through a pro-active approach to their management". Many plans contain similar goals and action steps about how to identify hazardous trees and what to do once the trees are identified. For example, the city of Entiat's plan states, "The primary management priority for the city in the short term is the reduction of high risk

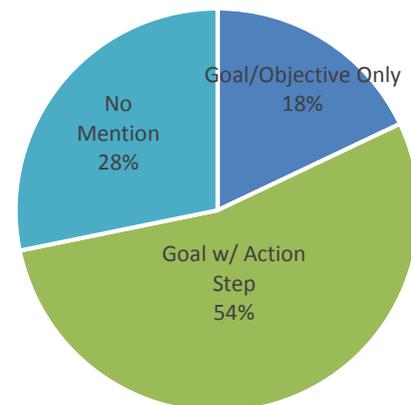


Figure 20. Tree Risk Management Theme Summary

trees in public areas.” Entiat’s urban forest management plan provides specific action steps and recommendations to reduce the risk of trees in public areas:

- Risk reductions are best accomplished by reducing the number of poor quality species and eliminating high risk features such as trunk splits, trunk and basal decay and included bark crotches. By removing these species when the opportunity arises, the town minimizes expenses by avoiding the greater cost of removal once the trees are in an advanced stage of structural decline.
- A town should develop specific guidelines for when and under what conditions trees may be removed. An ISA publication entitled “A Photographic guide to the Evaluation of Hazard Tree in Urban Areas” by Matheny and Clark is a source of information for risk management guidelines.
- The town may wish to follow the criteria below for tree removals. The four situations in which tree removal are appropriate are:
 - if the tree is dead
 - if the tree is irreversibly diseased (particularly epidemic diseases such as Dutch elm disease) or in significant decline
 - if the tree or tree parts represents a risk to fail
 - or if there is unavoidable conflict between tree(s) and construction.

Many of Entiat’s urban forest management plan’s action steps read more like a set of recommendations than specific action steps, especially when referring to Entiat as “a town”. Entiat’s plan was written by an outside consultant, supporting this observation. Appendix E provides additional examples of how municipalities incorporated goals and action steps related to tree risk management into urban forest management plans.

4.2.6 Community Framework

The community framework is the final component of the Clark et al. (1997) model of urban forest sustainability and addresses the need for community awareness of and participation in the management of the urban forest. Generally, the urban forest management plans with a more operational approach did not address the community framework as frequently as the plans with a more strategic, long-term approach. The framework for comprehensive urban forest management plans includes two substantive themes relating to the community framework: communication and education strategy, and community partnerships. The following section will reveal how many of the urban forest management plans address the community framework themes and provide examples from the plans.

4.2.6.1 Communication and Education

The community's lack of awareness of trees and the urban forest has been a common obstacle for effective urban forest management. A sustainable urban forest requires a shared community vision in which residents acknowledge the importance of trees within their community (Clark et al., 1997). The communication and education theme includes goals and objectives that relate to increasing the community's awareness of the urban forest and the value of trees. Examples of goals within this theme include outreach and public education goals to increase residents' knowledge and understanding of trees through brochures, online materials, and public meetings. This theme also includes goals to communicate the value of trees to city employees and agency and nonprofit partners. In total, 67% of the urban forest management plans include goals for improving communication and education and 39% of plans included a goal with associated strategies or action steps (Figure 21). A number of cities reference the educational power of gaining Tree City USA status and set goals to either become a Tree City or remain a Tree City USA. For example, the city of Lacey's 2005 Urban Forest Management Plan includes the following goal:

Develop a public education program that promotes Lacey's distinction as a Tree City USA and provides support to individual citizens and home owners associations concerning tree issues.

Action steps associated with communication and education goals include improving the city's urban forestry web presence, creating educational opportunities for residents to learn about trees, celebrating Arbor Day, publishing an annual report to highlight progress, and creating a training and education program for city staff to learn more about urban forestry. For example, one of the goals in the city of Fife's Urban Forest Management Plan is to "Promote urban forestry awareness and citizen activism". The plan includes the following action steps to achieve this overall goal:

- a. Incorporate urban forestry principles and guidelines into the Green Factor program. This popular program provides an excellent venue to bring basic urban forestry information to the citizens of Fife.
- b. Develop public education and outreach programming.
 - i. Investigate existing educational materials that may be suitable for Fife. Examples include: Alliance for Community Trees, The Arbor Day Foundation,

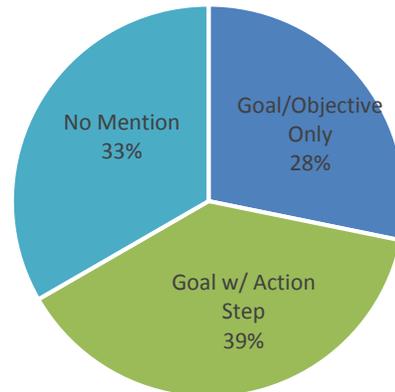


Figure 21. Communication & Education Theme Summary

- DNR Community Forestry Assistance Grant products, urban forestry educational materials developed in local Washington jurisdictions and other regions of the United States.
 - ii. Research citizen volunteer programs in other cities for ideas to engage the citizens of Fife. Example of such programs are NeighborWoods (City of Olympia), Friends of Trees, and 'Friends of' parks groups (City of Seattle).
- c. Make urban forestry information available via the City's website.
 - i. Post educational materials on the City's website.
 - ii. Post City regulations applicable to trees so that they are easy for citizens to find.
 - iii. Provide details of tree-related issues so that citizens have a central location to find the latest developments.

The city of Fife's plan provides extensive detail in its action steps, which outline specific steps managers can take to achieve the goal of increasing urban forest awareness. Appendix E provides more specific examples of how Washington municipalities incorporated communication and education goals into their management plan.

4.2.6.2 Community Partnership

The community partnership theme addresses all goals to improve relationships between the local government and the surrounding community to help build community awareness for urban forest management. Goals and objectives include increasing and improving cooperation with the business community, especially the green industry (e.g. landscapers, arborists, and local nurseries). Goals relate to building partnerships with other organizations and neighborhood groups to partner on projects to improve the urban forest. This theme also includes goals for improving relationships with large private landowners, such as universities and hospitals, to assist in reaching the municipality's urban forestry goals.

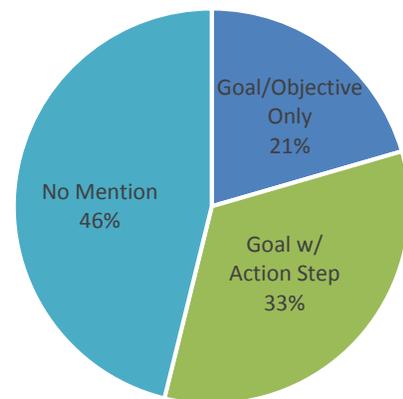


Figure 22. Community Partnership Theme Summary

In total, 54% of Washington management plans include goals or objectives related to building community partnerships, with 33% of the plans also including specific action steps (Figure 22). Many of plan goals that address community partnership acknowledge the importance of partnerships with local business, nonprofits, and utility companies for management of the urban forest. Several plans gave

examples from other municipalities that had done a good job of creating community partnerships, such as the NeighborWoods program in Olympia and the city of Seattle’s reLeaf program. Kirkland’s plan includes a section listing specific ways the city would partner with agencies and community groups, including improving its collaboration with utility companies for tree maintenance. Other examples of goals include partnering with the local school district or local colleges to develop school curriculum, working more closely with the construction industry to protect trees during construction, and working more closely with realtors. For example, the city of Spokane includes a goal to “Coordinate all construction activities affecting trees and shrubs with the urban forestry program” in their 2002 Vegetation Management Plan. The plan lists the following action steps to achieve this goal:

- a. Encourage developers to conserve as many trees as possible on new development and to consider power line/tree conflicts.
- b. Establish guidelines for business area landscaping.
- c. Coordinate plantings with urban forester.
- d. Educate the development community about the species of trees best suited to their site.

This particular goal encourages a partnership between the city of Spokane and private developers, with the overall goal of protecting tree health during development and encouraging tree planting. Appendix E provides several additional examples of how plans incorporated both goals and action steps related to improving community partnerships.

4.2.7 Level 3: Action Steps and Implementation Plans

Level 3 of the framework asks, “how do you get what you want?” and includes action steps and best management practices that explain how the municipality will achieve the goals identified in level 2 of the framework (Appendix A). The plan comprehensiveness index includes 14 criteria for level 3 (Appendix D). Ten of the criteria address the presence of action steps and best management practices associated with goals addressing each of the ten substantive themes. The four other criteria relate to the presence of an implementation plan. An implementation plan also helps answer the question, “how do you get what you want?” by describing how the plan’s goals and action will be carried out, including assigning responsibility, a timeframe, and budgetary considerations for each plan action. Figure 23 summarizes the results of the content analysis, showing the percentage of plans that address each of the 14 criteria. Action steps relating to the themes of tree establishment and tree maintenance were included most frequently, which was highlighted in the previous section.

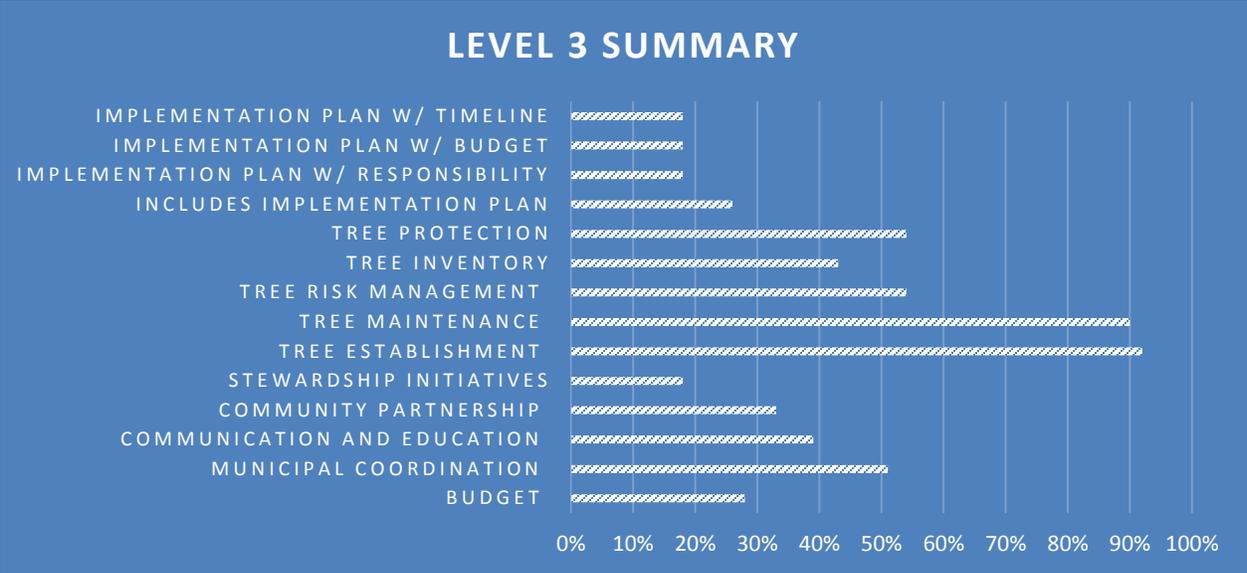


Figure 23. Summary of Plans Addressing Level 3 Criteria from the Plan Comprehensiveness Index

4.2.7.1 Implementation Plans

The planning literature suggests that an implementation plan should assign responsibility, provide an estimate of the cost and potential funding source, and a timeline for implementation of each action step included in the plan. First, the plans were coded for the presence or absence of an implementation plan. Urban forest management plans that did include an implementation plan were then coded for the three components of a robust implementation plan: assigned responsibility, budget, and timeline for implementation for each action step. Out of the 39 plans analyzed, ten, or 26% of the total, include an implementation plan. Each of the three implementation plan elements were present in a total of seven plans. Only one out of the ten urban forest management plans includes an implementation plan without any of the three elements. Out of the ten management plans that did include an implementation plan, Bainbridge Island, Renton, and Yelm were the only three that include all three elements. The other six plans include two of the three components (Figure 24). Two of the ten plans with implementation plans were written by the city of Covington.

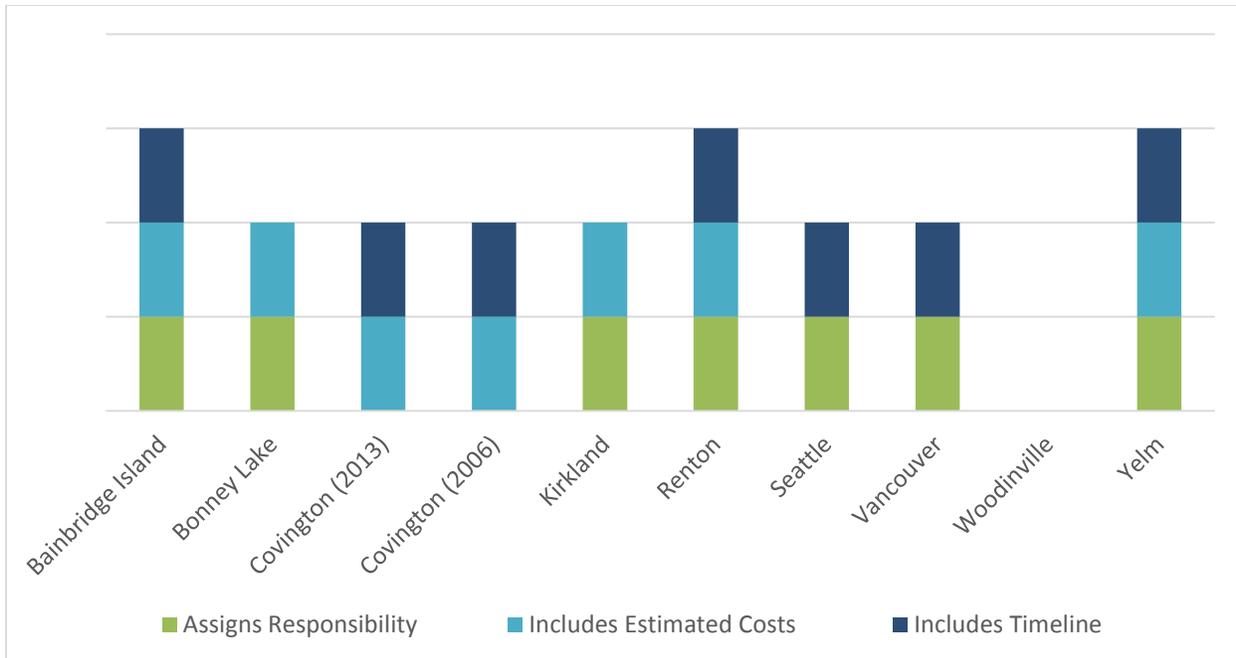


Figure 24. Urban Forest Management Plans Addressing Components of a Robust Implementation Plan

The Bainbridge Island Community Forest Management Plan (2006) calls its implementation plan a “Community Forest Workplan” and includes the following information for each action included within the plan: lead staff/department, partner departments/agencies, timeframe, and budget (Figure 25). The result is a cohesive document connecting all of the policy goals and actions presented within Bainbridge Island’s plan to a schedule with assigned responsibility and estimated budget. Bainbridge Island’s plan is currently out of date; the plan was supposed to serve as the city’s 5-year-plan and be updated in 2010.

Action	Lead Staff/ Department	Partner Departments/ Agencies	Timeframe	Budget	Evaluation Tools
Policy I: Protect, restore and improve existing vegetation that has environmental, wildlife habitat and aesthetic qualities, including tree groves, significant tree stands, and forested hillsides and vegetation associated with wetlands, stream corridors and riparian areas.					
Identify priority areas for forest preservation	CFC	Open Space Commission, BI Land Trust	2005-2010		
Develop educational materials to inform landowners about the benefits of tree canopy and management approaches that can be applied to private property.	Staff Forester/ CFC		2006	\$5,000	
Develop site-based management plans for properties purchased by the Open Space Commission.	Staff Forester	Open Space Commission or BI Land Trust	2006-2007		
Develop a long-term tree management plan for Waterfront Park.	Staff Forester				

Figure 25. Implementation Plan Excerpted from Bainbridge Island’s Community Forestry Plan (2006)

Renton’s Urban and Community Forestry Development Plan (2009) serves as the city’s ten-year strategic plan and includes an implementation schedule with actions to be taken that extend to 2020, which is when the plan will be updated. Renton’s implementation plan includes estimated budget needs

and the proposed source of the funds. Each action step is also assigned a specific year or timeframe for implementation. The city of Yelm’s 5-Year Urban Forestry Strategic Plan (2009) also includes a thorough implementation plan with assigned responsibility, an estimated starting and ending date, and an estimated cost for each project or action included within the strategic plan. The city of Yelm chose to break up their implementation plan by year with a list of projects and associated planning attributes (Figure 26).

PROJECT	SCHEDULE Start & End Date	RESPONSIBLE PARTY	COST ESTIMATE
1. -Continue to implement regular Street Tree Maintenance schedule.	1/10-08/10	City Staff Tree Board Consultant Contractor	\$3,500
2. -Seasonal Newspaper Articles -AAT/Memorial Tree -Arbor Day Community Events -Create Recognition Program -Tree Grant Program	Annual	City Staff Tree Board Citizens High School Businesses	\$500
3. -Coordinate with Homeowners Associations of Proper Tree Care and Maintenance. -Staff Certified Arborist Training -Research Ideas to promote AAT & MT Programs	5/10-12-10	City Staff Tree Board Consultant	\$TBD
4. Review Ordinances	07/10-12/10	City Staff Tree Board Consultant	\$250
5. Research Funding	Annual	City Staff Tree Board Consultant	\$100

Figure 26. Implementation Plan Excerpted from the City of Yelm’s 5-Year Urban Forestry Strategic Plan (2009)

Another notable implementation plan is found in Kirkland’s 2013 Urban Forestry Strategic Management Plan. The city of Kirkland’s plan was written as a long-term plan for a 24-year period. The implementation plan is based on the framework developed by van Wassenauer et al. (2012) in which the city creates one long-term strategic plan, a series of 5-6 year management plans, and annual work plans. Kirkland uses this method because it aligns with the city’s budget cycle. The goal of Kirkland’s implementation plan framework is for the interdepartmental urban forest team (Tree Team) to prioritize urban forest objectives in six-year increments. Based on the priorities for each six-year management plan, individual departments would be required to develop an annual operating work plan to ensure that the goals and action steps are addressed. The goal of this process is to “...lay the foundation for cohesive, efficient and sustainable urban forest management on a daily, annual, and long-term basis” (City of Kirkland, 2013).

4.2.8 Level 4: Monitoring & Evaluation

The final level of the framework for comprehensive urban forest management plans includes a strategy for plan monitoring and evaluation to help answer the question, “Are you getting what you want?” (Appendix A). This level is associated with two criteria in the plan comprehensiveness index (Appendix D): whether the plan addresses monitoring or adaptive management and whether the plan includes a specific time for updates and evaluation. Figure 27 summarizes the content analysis results for the two criteria in level 4.

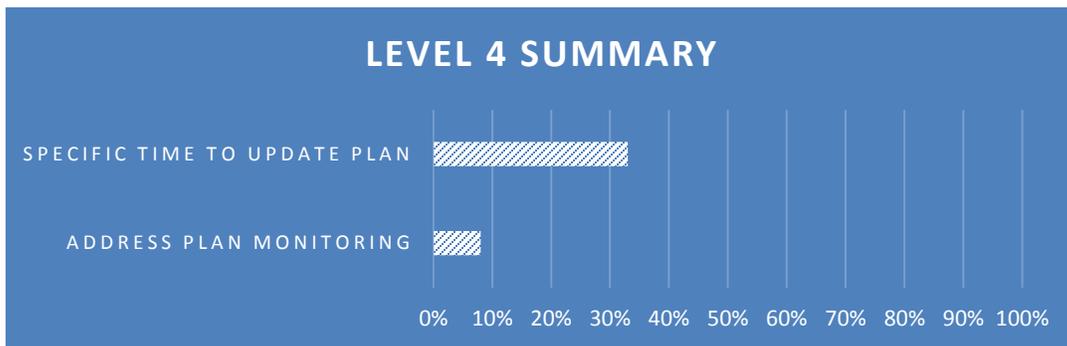


Figure 27. Summary of Plans Addressing Level 4 Criteria from the Plan Comprehensiveness Index

A strategy for monitoring and evaluating the progress of the management plan should be written before the urban forest management plan is implemented and should be aligned with the baseline data collected during the assessment phase. Dwyer et al. (2003) recommend an adaptive approach to management of the urban forest with flexibility and feedback built into the management plan. An adaptive management approach allows managers to adjust management practices to reflect the knowledge gained through monitoring the plan (Noss & Cooperrider, 1994). Each plan was coded for whether it addressed monitoring, evaluation, or adaptive management in any way.

Out of the 39 plans, only three plans mention or address monitoring in some way, which is less than 8% of all plans. Not one of the plans includes a detailed plan for monitoring the implementation, effectiveness, or performance of the urban forest management plan. Kirkland’s Urban Forestry Strategic Plan (2013) states that the criteria and indicators used for the baseline analysis will be used in subsequent analysis and evaluation of program success and for future goal-setting. However, the plan does not explicitly state how monitoring will take place or include a timeline for evaluation. The city of Kirkland’s plan also includes a final section titled “Monitoring & Revision” with a goal to review the

progress in the final year of each planning cycle. The monitoring section includes the following language: “Operational and management priorities should be reviewed on an annual basis and the annual report should be appended to the strategic plan document”.

Seattle’s Urban Forest Stewardship Plan (2013) includes a brief section on monitoring with a goal to work on developing a monitoring framework “based on the Plan’s integrated approach” with indicators related to forest health, forest function, and canopy cover. The plan also states that “monitoring will be used to evaluate Seattle’s urban forest efforts and update the Plan to make actions even more effective over time.” The Seattle plan states that the monitoring framework will also include measures of effectiveness and performance to better understand how each program and action is helping the city achieve its goals. Finally, the Bainbridge Island Community Forest Management Plan (2006) includes a brief mention of the importance of stable funding for the Community Forestry Commission as their role is critical in implementing and monitoring the effectiveness of the plans. None of the remaining 36 plans mentioned the need for monitoring the plan or the importance of adaptive management in plan implementation and evaluation.

Out of the 39 plans, 13 (33%) include a specific year or time to update the current plan. The other plans did not include a clear timeline for the life of the plan or include any goal related to plan updates. The majority of the plans that did give a specific a time for updating the plan did so vaguely, and it was not an explicit goal. For example, some plans included the document’s active dates in the plan title or included an action schedule or implementation plan extending out to a certain year with the assumption that the plan would be updated that time. Including a specific date to update the plan indicates that the municipality is considering the importance of a plan update.

4.3 Plan Comprehensiveness Score

To further address the first research objective of characterizing the comprehensiveness of Washington municipal urban forest management plans, results from the content analysis were used to assign each plan a comprehensiveness score based on the criteria presented in Chapter 3 (Appendix D). Plans were awarded a point for including each of the 31 criteria from the index; one point was awarded if the element was present and zero if absent. See Appendix F and G for detailed summary results of each criterion and the overall plan comprehensiveness score for each of the 39 urban forest

management plans. A plan that addressed a substantive theme, such as tree maintenance, with a goal or objective received one point; an additional point was received if the plan addressed the tree maintenance goal with an associated set of action steps or best management practices. The comprehensiveness index was not meant to identify the plans of highest quality, but to identify the most comprehensive plans according to the framework. Plans with the highest scores address more of the elements included in the framework for comprehensive urban forest management plans. The average index score of the 39 plans was 15.33 with a range between 5 and 29 (Figure 28). Figure 29 graphs the frequency of plan scores; 19 was the mode. Appendix F provides a detailed comprehensiveness score summary for each municipal management plan and Appendix G graphically summarizes the 39 plans scores by municipality.

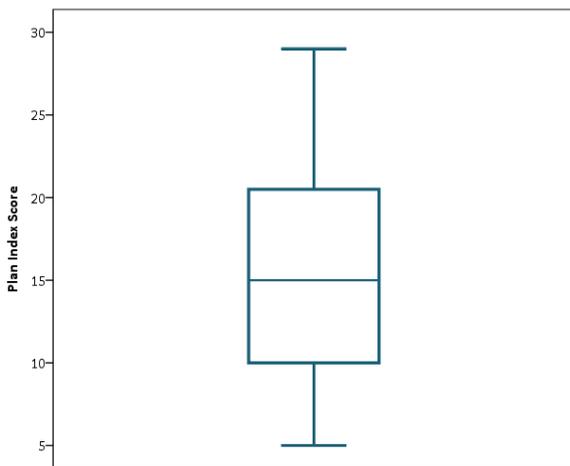


Figure 28. Plan Comprehensiveness Index Spread

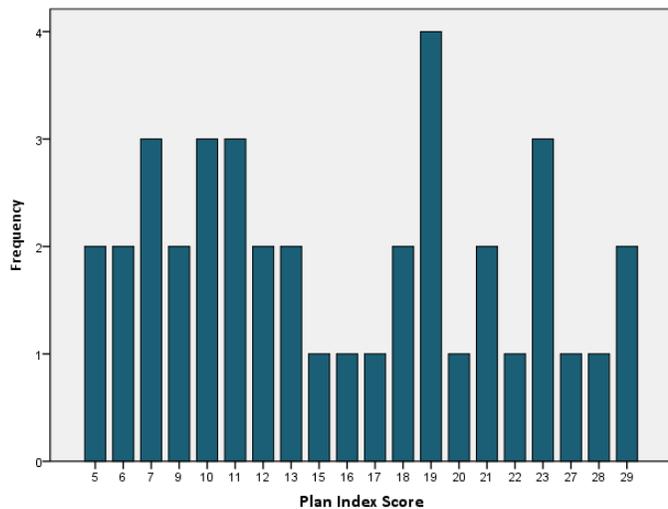


Figure 29. Plan Comprehensiveness Index Score Frequency

4.4 Influence of Municipal & Plan Attributes on Plan Score

To address the second research objective of assessing the influence of a municipal and plan attributes on the comprehensiveness of each management plan, municipal and plan attributes were analyzed in relation to the comprehensive index plan scores. This study analyzed the following attributes: the municipality’s location east or west of the Cascades, its size, whether it received financial support from the DNR Urban and Community Forestry Program to write its management plan, public involvement during plan development, and the plan author (i.e. city staff or outside consultant). The

following sections will review the results of this analysis, starting with the influence of municipality size and location on overall urban forest management plan comprehensiveness.

4.4.1 Municipality Size & Location Influence

Assuming that municipality size would have a strong influence over the overall plan comprehensiveness score, a one-way analysis of variance (ANOVA) test was run to identify differences among the three categories of municipality size (i.e. small, medium, large). The plan comprehensiveness score differed significantly across the three municipality sizes, $F(2,26)=3.69$, $p=.035$. Figure 30 graphs the median plan scores for municipalities in different size categories, illustrating a relationship between the size of municipality and the

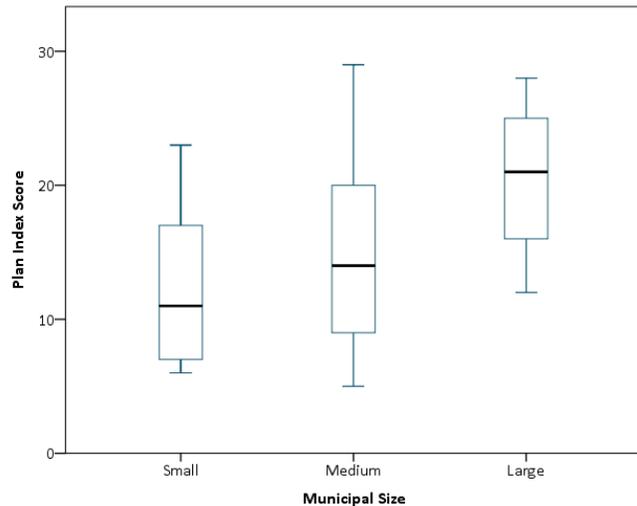


Figure 30. Influence of Municipality Size on Plan Comprehensiveness Score

comprehensiveness of its plan. Large cities have the highest mean plan score with 20.5 (SD=5.9), while the small municipal plans have the lowest mean, with a score of 12.8 (SD=5.9). The medium-sized municipality plans have a mean score of approximately 15, which was the overall mean for all Washington State plans. Medium-sized municipalities have the largest range in plan scores, but also have the greatest number of plans within the municipal size category (18 total). These results reveal a relationship between urban forest management plan comprehensiveness and municipality size, suggesting that larger municipalities may have more developed urban forestry programs with more resources for planning and management.

A municipality's location east or west of the Cascades was found to have no significant influence on overall plan comprehensiveness score. The 26 municipalities located west of the Cascades, had an average plan score of 15.7, while the 13 municipalities located east of the Cascades had an average score of 14.7. Results of an independent group t-test confirmed that there is no significant difference between the plan comprehensiveness scores of municipalities located on the east or west side of the Cascades ($t(37)=-.428$, $p=.67$).

In total, 21 of the 39 cities with urban forest management plans are located within the Puget Sound region, which includes the Seattle-Bellevue-Everett metropolitan area, Tacoma metropolitan area, Olympia, and the Bremerton-Silverdale metropolitan area. An independent sample t-test was conducted to compare the comprehensiveness plan score between municipalities located within or outside of the Puget Sound region. A municipality's location within or outside of the Puget Sound region was not found to have a significant effect on plan score ($t(37)=-.091, p=.928$). However, 3 of the cities with the highest comprehensiveness plan scores were located in the Puget Sound region: Kirkland, Seattle, and Bainbridge Island. Figure 31 displays the location and the comprehensiveness plan scores of municipalities located within the Puget Sound region and beyond.

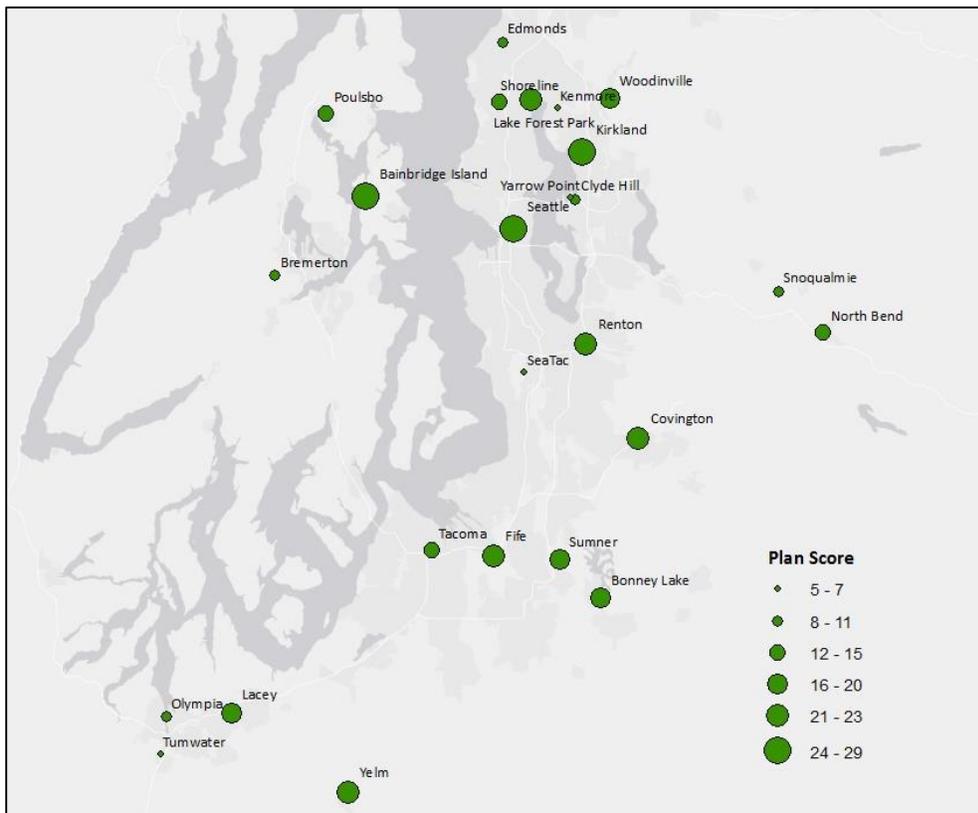


Figure 31. Puget Sound Region Municipality Location and Urban Forest Management Plan Index Score

4.4.2 Influence of Urban Forest Management Plan Attributes

This section assesses the influence of urban forest management plan attributes on the overall plan comprehensiveness scores. Attributes include public participation during plan development, plan

author, and whether the municipality received a CFA grant from the Washington DNR Urban and Community Forestry Program. Out of the 39 total plans, 13 explicitly mention the role of public input in the development of the urban forest management plan in the form of public comments, meetings, or survey results. Plans that did not explicitly mention public participation as part of the plan development process had an average plan score of 12.5 (SD=5.7), while plans with public input had an average plan score of 21.8 (SD=6.1) (Figure 32). An independent sample t-test revealed a significant difference in the plan scores between plans that explicitly mention the role of public input and plans that did not mention the role of public input ($t(37)=4.3$; $p<.01$). This suggests that that community involvement and participation in the plan development process influences the overall comprehensiveness of the resulting urban forest management plan.

This thesis assessed the influence of plan author on overall plan comprehensiveness by comparing the means between plans written entirely by city staff and plans written entirely by or with the help of an outside consultant (Figure 33). In total, 59% of the plans were written by or with the help of outside consultants. An independent sample t-test revealed that there was not a significant difference in the plan comprehensiveness scores between plans written with the help of outside consultants ($M=15.6$, $SD=6.7$) and plans written by city staff only ($M=15$, $SD=7.5$); $t(37)=-.246$, $p=.807$).

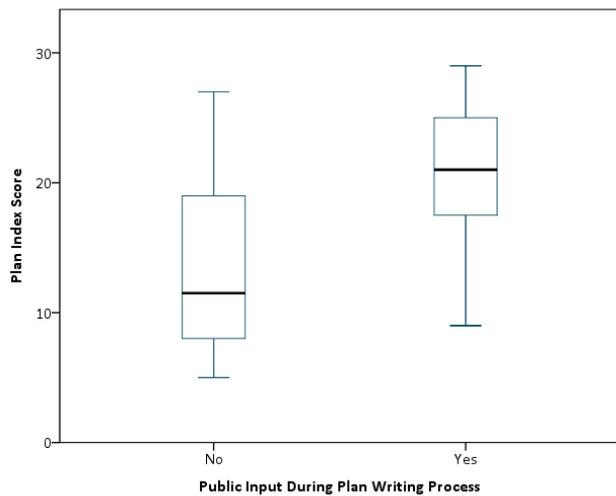


Figure 332. Influence of Public Input on Plan Comprehensiveness

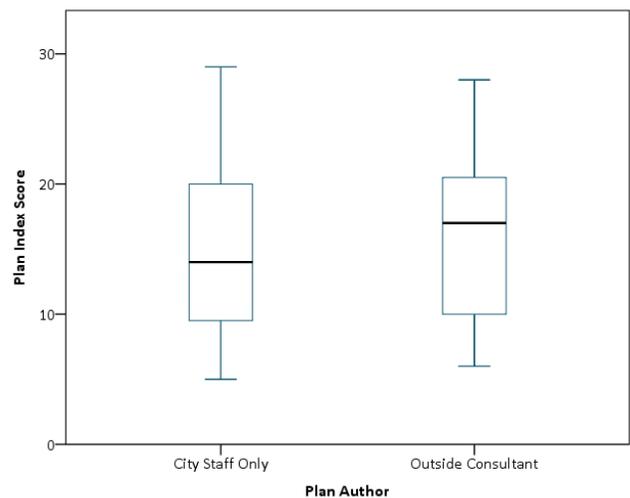


Figure 33. Influence of Plan Author on Plan Comprehensiveness

Using an independent sample t-test, this study analyzed the influence of receiving a CFA grant from the DNR Urban and Community Forestry Program on overall plan comprehensiveness score.

Receiving CFA grant funding for the development of a plan was found to have no significant influence on plan comprehensiveness ($t(37)=-.54$; $p=.59$). Plans funded completely or partly by a CFA grant have a mean comprehensiveness score of 14.9 (SD=7.0), while plans without funding have a mean score of 16.0 (SD=7.4). In its current form, Washington DNR Urban and Community Forestry does not provide municipalities with a template for urban forest management plans or a list of elements that must be included. If DNR required municipalities that receive a CFA grant to include certain elements within its urban forest management plan, it is likely that the CFA-funded plans would be more comprehensive and the plans would look more similar to one another.

Comparing both municipality size and CFA grant funding, there were some noticeable differences between total plan scores (Figure 34). Large municipalities that did not receive funding had the highest overall mean plan score ($M=19$, $SD=7.9$), while small municipalities that received CFA grant funding to write a plan had the lowest overall plan scores ($M=11.8$, $SD=5.5$). These results suggest that large municipalities have more resources to devote to plan development than smaller municipalities. Small municipalities that received CFA grant funding had a lower median score than small municipalities that did not receive CFA funding, while the plans of medium-sized municipalities receiving funding had a higher median score. Appendix H provides a summary table of the interaction between population category and CFA funding on overall urban forest management plan comprehensiveness score.

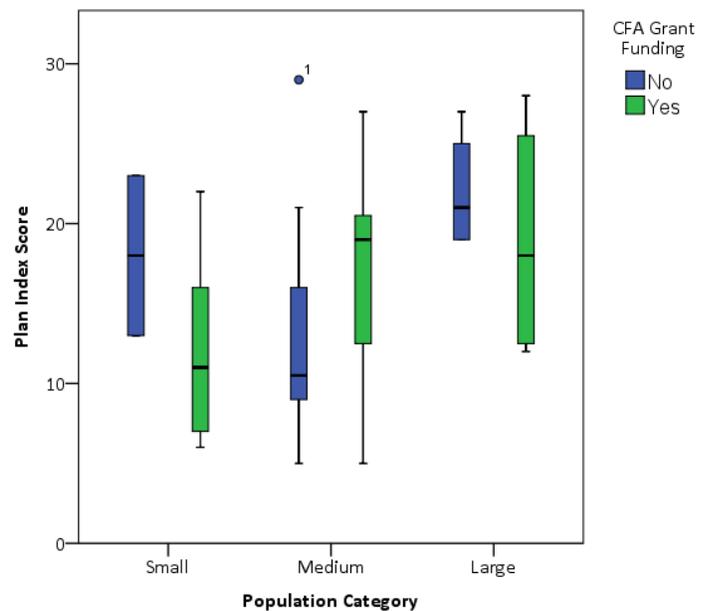


Figure 34. Interaction between Population Category and CFA Funding on Plan Comprehensiveness Score

4.5 Summary of Plan Comprehensiveness by Framework Level

Figure 35 summarizes the number of Washington urban forest management plans that addressed the 31 criteria in the four levels of the framework for comprehensive management plans (Appendix A). Level 1 addresses the question, “What do you have”; Level 2 addresses the question,

“What do you want?”; Level 3 addresses the question, “How do you get what you want?”; and Level 4 addresses the question, “Are you getting what you want?”

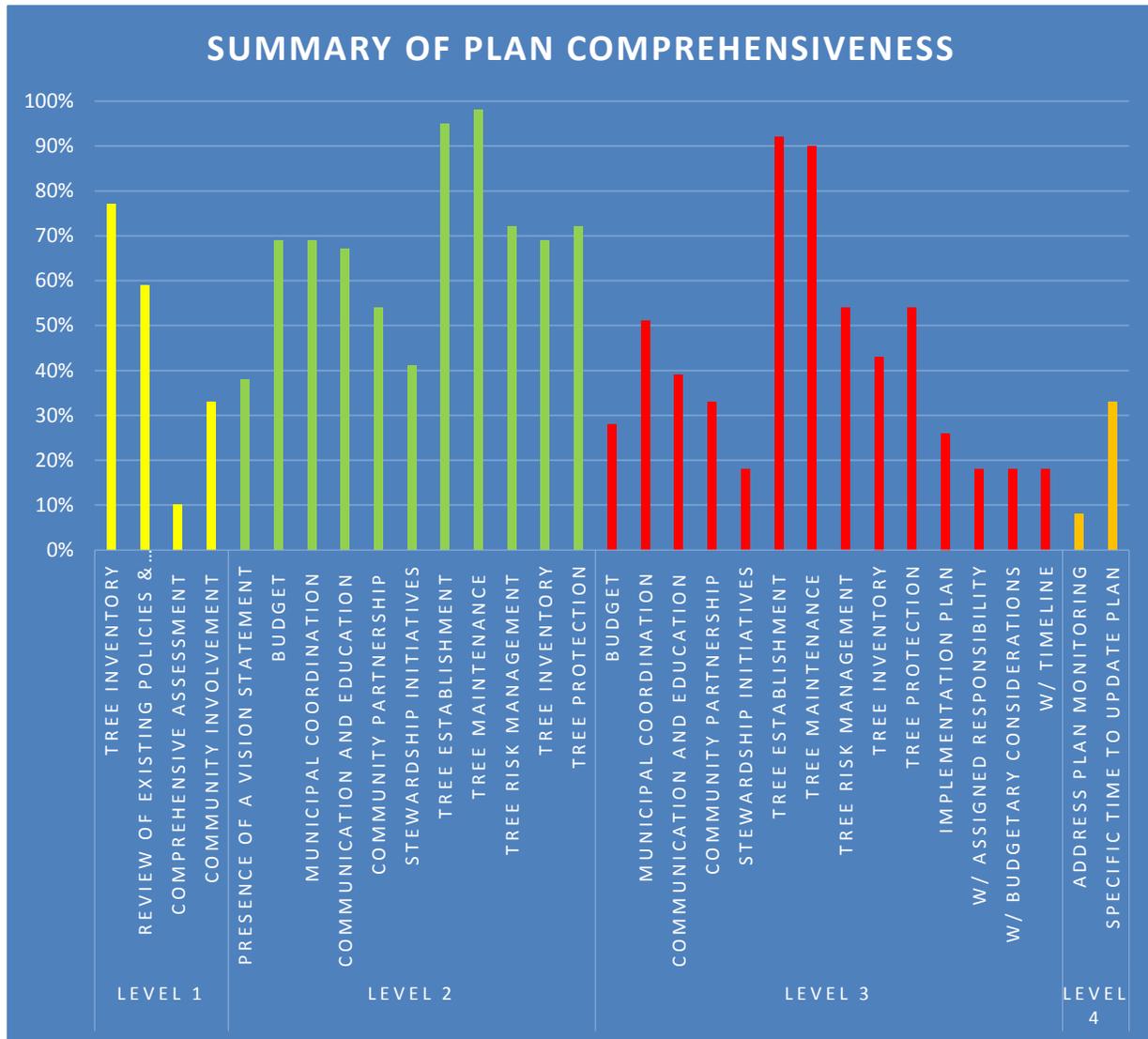


Figure 35. Summary of Plan comprehensiveness Criteria in Washington Plans

Level 1 of the framework includes background information relating to the current urban forest resource, addressing the trees, current management programs and policies, and the community’s involvement. While over 75% of municipalities included the results of a tree inventory in their management plans, only four municipalities conducted a comprehensive assessment of the urban forest that addressed the current management levels and the community. Levels 2 and 3 of the framework have the most criteria because these levels address the ten substantive themes of a sustainable urban forest (Clark et al., 1997) with goals (Level 2) and action steps or best management practices (Level 3).

Tree establishment and tree maintenance were addressed with goals and associated action steps most frequently, while stewardship initiatives were addressed with a goal and detailed action steps in the fewest number of plans. Just 38% of municipalities included a vision statement for the future of the urban forest (Level 2) and just 26% of municipalities included a plan for implementation (Level 3). Level 4 criteria were addressed by the fewest number of management plans; only 3 municipalities addressed the need for plan monitoring or adaptive management and just 33% of municipalities included some indication of when they plan to update or review their urban forest management plan. These findings will be discussed in greater detail in Chapter 5.

4.5.1.1 Relationship between Plan Components and Overall Comprehensiveness Score

To understand which plan elements were indicative of a more comprehensive urban forest management plan, the plans were divided into four quartiles based on their overall comprehensiveness score (Figure 36). There are nine plans in the “low” score category with comprehensiveness scores between 0 and 9. The “low-medium” group includes ten plans with scores between 9 and 14. The “medium” group includes eight plans with comprehensiveness scores between 15 and 19 and the “high” group includes 12 plans with scores ranging between 20 and 31.

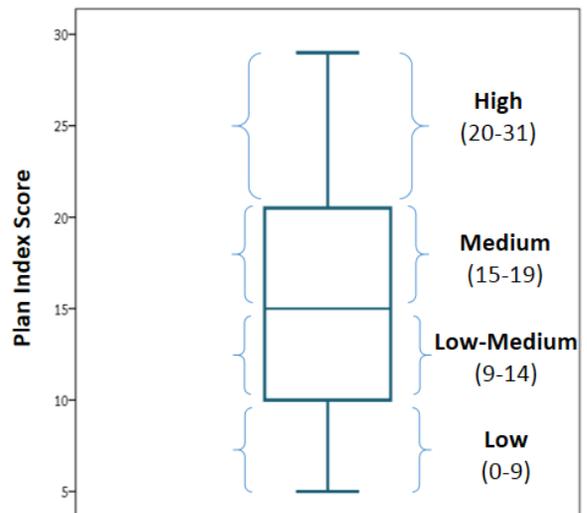


Figure 36. Plan Comprehensiveness Quartiles

Considering each of the components in relationship to the overall plan comprehensiveness score, no plan with a score less than ten (low) includes implementation guidelines, a written strategy for monitoring or adaptive management, addresses the stewardship initiative theme, or includes an assessment of the current state of the urban forest with a criteria and indicators evaluation. Only plans with scores greater than 15 (medium and high) address the communication and education and community partnership themes with goals and action steps; no plan with a score under 15 addresses communication and education or community partnerships with goals and associated action steps. No plan with an overall score less than 10 addresses budgets or municipal coordination with goals and

action steps. Approximately 75% of plans with scores greater than 20 include an explicit account of public participation, while approximately 20% of plans with scores ranging from 15-19 include information about public involvement in the plan development process.

Nearly all of the 39 plans address most of the vegetation resource themes (particularly tree establishment, maintenance, and protection). Plans in the low-medium and medium quartiles start addressing resource management approach themes, and the plans in the highest quartile address the community framework themes (i.e. communication and education and community partnerships). This suggests the community framework themes may be indicators of more comprehensive urban forest management plans. It also suggests that municipalities—regardless of overall plan comprehensiveness—address themes related to the vegetation resource first, specifically tree maintenance, tree establishment, and tree protection. This trend, along with the results from this chapter, will be discussed in further detail in Chapter 5. Appendix I provides detailed summaries for each group of plans ranging from low to high comprehensiveness scores, highlighting the components that plans include in each of the four quartiles.

5. Discussion

This final chapter discusses the findings and how the results help address the overarching research goal of increasing understanding of municipal urban forest management planning in Washington State. The analysis revealed variety and differences among the 39 plans across Washington State, which ranged from purely operational plans addressing only tree maintenance to comprehensive plans that consider the community's role in urban forest management. This chapter will first address the two research objectives by discussing and drawing conclusions based on the results from the content analysis and plan comprehensiveness analysis. Next, the key takeaways and recommendations are summarized. The chapter continues by presenting Washington State management implications, providing a plan to apply the findings and recommendations of this thesis to improve urban forest management plans in Washington State. Finally, ideas for future research are presented, including conducting an implementation evaluation of urban forest management plans to better understand the barriers to successful implementation and whether comprehensive plans are more likely to be fully implemented.

5.1 Research Objective 1: Characterizing the Comprehensiveness of Urban Forest Management Plans

Using content analysis and an evaluative framework, this study examined the comprehensiveness of 39 urban forest management plans in the State of Washington to address the first research objective of characterizing the comprehensiveness of Washington urban forest management plans. The first sub-question asked whether plans address all three components of a sustainable urban forest as defined by Jim Clark (1997), i.e. the trees, community involvement, and the municipality's management approach. This question was addressed by coding the presence or absence of the ten substantive themes and whether plans address each theme with a goal alone or with a goal and a set of associated action steps. The second sub-question asked whether the plans address the components of a comprehensive management plan, which include a vision statement, goals and objectives, actions steps, an implementation plan, and a strategy for monitoring and evaluation. The following sections will discuss the results of the content analysis presented in Chapter 4, providing the foundation for the recommendations presented later in the chapter.

5.1.1 Sustainable Urban Forest Components

The first sub-question asked whether the plans address all three components of a sustainable urban forest, i.e. the vegetation resource, community framework, and management approach. As mentioned in Chapter 4, the vegetation resource themes of tree establishment, tree maintenance, and tree protection were the most frequently mentioned in Washington urban forest management plans. This aligns with the findings from Ordonez & Duinker (2013), who found that maintenance and planting/establishment were the two most common and specific themes across the sample of Canadian urban forest management plans they analyzed. While themes related to the vegetation resource component were most common, the stewardship initiative theme was the least common theme included in the 39 plans. This theme could have easily been grouped with the community framework as most stewardship initiative goals and actions included partnerships with community groups and the inclusion of volunteers. Resource management approach themes were the second most commonly addressed group, however many lacked specificity with associated action steps and strategies. While many plans with plan comprehensiveness scores ranging from 15 to 20 do address the budget theme with a goal, very few include specific action steps or strategies related to implementing this goal. Themes in the community framework category were addressed by the fewest number of plans; only the most comprehensive plans address these themes with both goals and specific action steps.

The results illuminate high variability between plans, specifically how the plans address the ten substantive themes. For example, 27 urban forest management plans include a goal related to municipal coordination and management, however the substance of these 27 goals varies greatly. This variation can be attributed to the particular needs of the individual municipality and may also be related to the current stage of development of a municipality's urban forestry program (i.e. the goals of young programs tend to differ from the goals of more developed programs). For example, while one city may address the municipal coordination and management theme with a goal of remaining a Tree City USA, another city may address this theme with a goal of expanding its urban forestry department and adding additional staff. The variability among these goals should not serve as an indicator of plan quality and only as an indicator of the current status of the city's urban forestry program. The framework presented in Chapter 2 was not meant to provide a rigid set of requirements for every management plan, but provide an outline of themes that a comprehensive plan should include. The variability between the plan

goals illustrates the importance of a flexible framework as each municipality's plan should address its specific values and needs.

5.1.2 Urban Forest Management Plan Specificity

As discussed in Chapter 2, the more specificity a plan provides with precise and clear action steps and a detailed plan for implementation, the greater the chance of successful implementation (Sabatier & Mazmanian, 1980). Overall, many of the plans in this study lack specificity. Most plans address themes with vague goals that lack detailed action steps or indicators of success for monitoring; the action steps that are provided often lack specificity. For example, one municipality's plan recommends the creation of a list of "species to avoid" in planting projects, however the management plan does not actually provide this list. Another common example was a general action step to "raise funds for tree planting" without identifying specific ways these funds would be raised. In total, only 26% of Washington State municipal plans actually include an implementation plan, fewer plans assign responsibility for actions, consider the budgetary implications, and relate actions to a timeline. The lack of specificity can be attributed to three factors. Ordonez & Duinker (2013) attributed that lack of specificity in Canadian urban forest management plans to a municipality's lack of information about the resource and to consultants not being "tuned in" to the need for specific action steps, implementation plans, and performance indicators. The third factor in plan specificity is the general nature of the plan, e.g. a 20-year strategic plan will likely have less detail than a street tree maintenance plan.

A municipality's lack of information, particularly a thorough tree inventory and baseline assessment of the state of the urban forest, is likely a strong factor in the specificity of the plans in Washington State. Only four out of the 39 plans in this study included the results of a thorough assessment of the urban forest. Municipalities that have very specific, detailed data from a thorough assessment of the urban forest are able to address more of the management themes with greater level of specificity, possibly even having the ability to develop quantitative or qualitative indicators. Many municipalities include specific goals about the need to develop or strengthen a comprehensive tree inventory. This may imply that some municipalities lacked a lot of formal knowledge about their urban trees, which is likely a reason attributing to a lack of plan specificity. Ordonez & Duinker (2013) found a slight relationship between the specificity of a municipality's inventory and the specificity of their plan in their analysis of Canadian urban forest management plans.

Ordóñez & Duinker (2013) also found that plan specificity was related to the plan author. Similar to the Ordóñez & Duinker study, some of the plans written by outside consultants in this study read more like a consultancy document, lacking the character of a management plan that involved city staff in the development process. Often, the best management practices or action steps appear cut-and-pasted from another management plan or document, which raises the question of whether specificity in these cases would still increase chances of implementation success. In some cases, the same wording was used in multiple documents, particularly those plans written by the same consultant. The plans that read more like consultancy documents contain many recommendations directed at the municipality suggesting ways to change their management techniques, e.g. updating specific ordinances or implementing programs modeled off of other established programs throughout the state. Consultant-directed plans were also less likely to have incorporated a thorough public participation process into the plan development process. Finally, nearly all of the plans that read more like consultancy documents lacked detailed implementation plans that assigned responsibility, estimated the costs, and included a timeline. Staff-driven plans are more likely to include a detailed implementation plan, as staff have more knowledge about the internal workings of the program, such as the budget process and staff resources.

Plan specificity is also related to the nature of the plan. By nature, an operational plan should provide more detailed best management practices and action steps. However, a strategic plan with a long-term planning horizon may provide fewer specifics. For example, the city of Renton's 2009 Urban and Community Forestry Development Plan serves as the City's 20-year strategic plan and lacks some detail in its action steps. The plan's introduction acknowledges this, stating:

The Plan does not provide specific information on the components of each program or strategy. These details will be developed as each program is initiated, some with direct public involvement. For example, the Task Force recognized the need for a forestry ordinance. This plan proposes a sequence of actions to accomplish the ordinances, but it does not suggest policies to be included in the ordinance. Ordinance development is left to an ordinance development team whose composition is yet to be determined.

While few plans include a direct reference to the lack of specificity, it is likely that many of the strategic plans lack some specificity because they plan to later develop annual work plans or action plans that will address specific action steps or strategies for the included goals. It is unclear how much detail is included in subsequent planning documents related to specific plans and programs, or if these documents exist. Van Wassanaer et al. (2012) suggest that while a long-term planning horizon is actually

necessary to achieve urban forest sustainability, there is a need for shorter-term objectives and “implementable directives” with more specificity to direct day-to-day operations.

5.1.3 Assessment of the Current State of the Urban Forest

The second sub-question asked whether plans address the components of a strong resource management plan, including sharing the results of an assessment of the current state of the urban forest. While about 77% of all of the plans include the results of a tree inventory conducted prior to plan development and 51% of the plans include a review of the current programs and policies, only four out of the 39 plans include the results of a thorough assessment of the current conditions of the urban forest. A criteria and indicators assessment is one approach for thoroughly assessing all three components of a sustainable urban forest. Only two Washington municipalities conducted a thorough criteria and indicators assessment; both Kirkland and Covington used the Kenney et al. (2011) model. Looking outside of Washington, nearly all of the other cities that have conducted a criteria and indicators assessment as part of the development of their urban forest management plan used the Kenney et al. (2011) criteria and indicators as their primary model. This suggests that the cities whose plans were written before 2011 may not have conducted an assessment as part of their management plan development process because they lacked a strong model.

5.1.4 Plan Monitoring & Adaptation

Monitoring is an important component of a comprehensive management plan because it is a means for assessing whether the actions implemented through the urban forest management plan are effective at reaching the goals. The lack of monitoring plans in Washington urban forest management plans is notable; of the 39 plans, only three plans even mention the importance of monitoring the management plan’s implementation and effectiveness. No plan includes a thorough monitoring strategy or includes a detailed list of performance metrics to evaluate effectiveness, both of which are strongly recommended in the literature. A monitoring plan is important for assessing the shortcomings and successes of a management plan and learning from management decisions, which is essential for adaptive management. Van Wassanaer et al. (2012) recommend that a monitoring plan include an indicators-based approach that links to the baseline assessment, which sets a benchmark. One of the major strengths of using a criteria and indicators approach to plan monitoring is that it allows for a

thorough assessment of the three components of a sustainable urban forest (i.e. vegetation resource, resource management approach, and community framework), while assessing progress of management efforts. Such an approach is also a great way to highlight the program's strengths and weaknesses, providing managers a tool for assessing the best use of resources.

The lack of monitoring plans in Washington urban forest management plans is not surprising. Research has shown that most management plans do not include a plan for monitoring, especially for monitoring the degree to which goals have been achieved (Berke et al., 2006). It is also rare to find plans that include measurable objectives that reflect the desired goals within the plans. Additionally, Berke et al. (2006) find that management plans often fail to include indicators to track progress towards goal achievement. Washington urban forest management plans are no exception to these general observations. Few municipalities across North America have included detailed monitoring plans, however there are a few good examples from more recently adopted urban forest management plans in Tampa, Florida and Toronto, Canada, among others.

5.2 Research Objective 2: Assessing the Influence of Municipal and Plan Attributes on the Comprehensiveness of its Plan

The second research objective was to assess the influence of municipal and plan attributes on the plan comprehensiveness score, specifically the municipality's size and location and the plan's author, funding source, and public process. The purpose of the comprehensiveness scoring index was not meant to rate the quality of plan goals and objectives; instead it was meant to be a tool to analyze the presence or absence of plan elements. The plan comprehensiveness scores proved to be a useful way to compare the plans and look at particular municipal and plan attributes. Municipal size was found to influence the overall plan comprehensiveness score, with the largest cities having higher scores and the smallest cities having lower scores on average. This finding is likely influenced by resources; large municipalities tend to have more financial and administrative resources that could be directed towards writing a comprehensive plan. While the age of each municipality's urban forestry program was not considered for the purpose of this thesis, it is likely that the larger municipalities have more developed urban forestry programs than the smaller municipalities. If this is the case, larger municipalities' plans were likely also influenced by the maturity of their urban forestry programs.

Public input and participation in plan development was also found to have a significant influence on overall plan comprehensiveness. This suggests that involving the community from the beginning of the plan development process—including during the assessment of the urban forest, vision statement creation, and development of goals—may lead to a more comprehensive plan. The importance of public participation in planning and decision-making has come to the forefront of public administration in the last few decades, recognizing the importance of a democratic approach that moves beyond the technocrats and scientists. By definition an urban forest management plan is a community document that creates a plan for the future of the urban forest, therefore it is important that municipalities recognize the importance of public input throughout the plan development process beyond the goal of community buy-in. This thesis suggests that public participation may help strengthen an urban forest management plan, making it more comprehensive.

5.3 Key Findings & Recommendations

This section provides a list of this study's eight key findings and presents some targeted recommendations for the DNR Urban and Community Forestry Program and Washington State municipalities that have developed or are thinking of developing an urban forest management plans.

1. Nearly all plans address the management of trees, but few plans specifically address the community's role in urban forest management.

Regardless of plan type, all Washington urban forest management plans addressed the core component of urban forest management, the trees. Tree maintenance and tree establishment goals and action steps were the most commonly addressed themes in Washington State plans. Plans address tree management in a variety of ways, ranging from very specific best management practices for tree care to long-term goals for adapting a city's species palette for climate change. Planting and caring for trees remains the key component of nearly all urban forest management plans in Washington State. Most plans failed to fully address the two additional components of the Clark et al. model: the community framework and the resource management approach. Only the most comprehensive plans addressed strategies for communication and education and building community partnerships in the community.

Recommendation: *Washington municipalities should continue to fully address the vegetation resource in their management plans, while also addressing the importance of community involvement through goals and action steps to build partnerships and raise awareness for the benefits of trees.*

- 2. While approximately 70% of plans address the themes relating to resource management (i.e. budget, tree risk management, and municipal coordination), the majority of these plans lacked specific action steps and strategies for implementation.**

Goals recognizing the importance of sustaining adequate funding for an urban forest program and increasing coordination among departments were common in plans across Washington State, yet many of the plans lacked specifics related to how municipalities would actually achieve these goals.

Recommendation: *Develop case studies highlighting robust Washington municipal urban forestry programs to provide examples of how other municipalities have translated these resource management goals into actionable strategies. This should provide municipalities with clear examples for developing and implementing goals to strengthen their resource management approach.*

- 3. Washington municipal urban forest management plans are diverse, with goals and strategies relating to the particular needs of the individual municipality and the current state of the resource.**

While the ten substantive themes identified in the framework for comprehensive urban forest management plans should be addressed in any plan, the goals and action steps vary greatly between the plans. Each urban forest is complex, with diverse tree species, different management objectives, and a unique relationship to its residents; therefore, a one-size-fits-all approach is not appropriate for urban forest management. Goals should be unique and individualized for the needs of the particular urban forest. Boilerplate urban forest management plan language is not appropriate to manage this diverse resource.

Recommendation: *Encourage municipalities to use the framework for comprehensive urban forest management plans as a guide to plan development (Appendix A). The framework is meant*

to be adaptable, allowing municipalities the freedom to address each component as it suits their community and management objectives. This framework is applicable to a municipality of any size and any geographic location; the framework is not limited to Washington State.

4. Washington municipal urban forest management plans lack specificity, especially detailed action steps and implementation plans.

Many of the plans lack detailed goals, specific action steps, and implementation plans that identify the responsible party, estimate costs, and include a timeframe for implementation. The lack of specificity can be attributed to the lack of baseline information about the urban forest, consultant-written plans with boilerplate language, and the big-picture nature of the strategic plans in the study.

Recommendation: *Municipalities and the DNR should dissuade consultants from using boilerplate language to address each of the ten substantive themes in municipal plans. Goals, action steps, and implementation plans should be unique to a municipality, relying on urban forest assessment data to inform goal development. A copy and paste approach to management plan development does not work.*

Recommendation: *Municipal staff should be involved in plan development to ensure action steps are realistic. Each action step should be linked to the budget, have a timeline, and be assigned to a staff person or department for implementation.*

5. Nearly all Washington municipal urban forest management plans lack a thorough assessment of the urban forest.

Comprehensive baseline data for the current state of a municipality's urban forest is critical in developing a comprehensive plan with realistic goals and actions that help meet current management gaps. The lack of baseline data for the resource management approach and the community framework categories is evident in the lack of specificity in plans' goals and action steps. The criteria and indicators for sustainable urban forest management presented by Clark et al. (1997) and updated by Kenney et al. (2011) offer a standardized set of performance measures that can be used to assess the current state of any urban forest.

Recommendation: Encourage municipalities to spend more time and resources answering the question, “What do we have?” before developing a management plan. A thorough assessment of the urban forest will help municipalities develop quantifiable action steps and indicators of performance. The performance indicators developed by Clark et al. (1997) and Kenney et al. (2011) can be easily adapted by any Washington municipality. A framework for comprehensive urban forest management plans, such as the one presented in this thesis, will help guide municipalities to thoroughly answer the question, “What do we have?” before developing goals and actions.

6. Nearly all Washington municipal urban forest management plans lack a monitoring strategy and plan for adaptively managing the urban forest.

Performance measurement is critical for evaluating the progress towards the plan’s goal after implementation. A monitoring strategy helps municipalities answer the question, “Did it work?” and consider the effectiveness of the plan’s actions steps in achieving the goals and overall vision. Without a plan for monitoring, adaptive management is nearly impossible. A set of measurable indicators is one method for assessing the current state of the urban forest and monitoring progress over time.

Recommendation: Municipalities should use performance measures to inform the development of a robust monitoring strategy prior to plan implementation. The performance measures developed by Clark et al. (1997) and Kenney et al. (2011) can be adapted by any municipality and can be monitored over time. Municipalities should also create a monitoring schedule that addresses the need for evaluation and adaptive management over time.

7. A municipality’s size influences the overall plan comprehensiveness of urban forest management plans in Washington State.

On average, the largest Washington cities in this study had the most comprehensive plans, while the smallest cities and towns had the least comprehensive plans. This can likely be attributed to resources; larger cities typically have more resources than smaller towns and cities and thus have more staff and financial resources at their disposal. This finding suggests that grant resources may be better spent when targeted to the smaller Washington municipalities. (See Appendix H for summary table of historic grant distributions by municipal size.)

Recommendation: The DNR Urban and Community Forestry Program should consider the impact of CFR grants awarded to small versus large municipalities in Washington State. On average, small municipalities stand to gain more for the supplemental funding provided through a CFA grant than a large municipality with a full-time urban forestry staff.

8. Public input and participation in the plan development process has a significant influence on overall plan comprehensiveness.

As the urban forest is inextricably linked to the surrounding community, the development of an urban forest management plan should involve the public and strive to be an open, community-wide process. The results of this study suggest that involving the public in the development of a management plan (e.g. community meetings, public comment periods) leads to the development of a more comprehensive plan.

Recommendation: Municipalities should take the time to develop an open and transparent public process for the development of their urban forest management plan, including the formation of a shared community vision. Municipalities without the resources to undertake a public process should consider hiring a consultant with experience engaging the public in plan development.

5.4 Washington State Management Implications

This thesis presents the first analysis of urban forest management plans in Washington State and proposes a framework for the development and evaluation of comprehensive urban forest management plans. As urban forests are diverse, a one-size-fits-all approach does not work for the development of urban forest management plans. The proposed framework suggests a structure and a list of themes comprehensive plan should address, but does not suggest specific goals or objectives that must be included in every plan. A plan should be unique to the particular urban forest, community values, and management objectives. Thus, the framework presented here is meant to provide a guide to urban forest management plan development. This analysis provides Washington municipalities a way to compare their plans to others across the state. Examples of how municipalities incorporated certain elements into a plan can also be useful to other municipalities, highlighting the variety of ways plans have addressed plan elements and providing ideas for future plan updates.

The results from this analysis offer the Washington DNR Urban and Community Forestry Program information to consider when awarding CFA grants in the future. The discussion of the components commonly missing from Washington plans provides useful information to guide the DNR Urban and Community Forestry Program's message to municipalities considering developing or updating an urban forest management plan. The comprehensiveness plan index scoring tool can be used to select comprehensive plans that may be used as model plans for municipalities to consult when developing an urban forest management plans, as was first directed under the 2009 Evergreen Communities Act. DNR already requires that cities complete an inventory prior to the creation of a management plan; however the DNR has not developed guidelines for developing a comprehensive plan. DNR might consider adopting an urban forest management plan framework with a set of criteria, requiring that each urban forest management plan funded through a CFA grant address each criterion. This would serve as a way to ratchet up the comprehensiveness of Washington management plans. The framework for comprehensive urban forest management plans, which is presented within this thesis, can serve this purpose (Appendix A).

This thesis should also provide useful information to municipalities outside of Washington State. Municipalities across North America are recognizing the importance of proactive planning and management, shifting from the reactive management approach that has been so typical in urban forest management. Municipalities could benefit from an adaptable framework that provides a basic structure for a management plan, yet gives municipalities the freedom to individualize a plan based on community values and management objectives. This thesis also highlights the important components of a robust resource management plan, including the components that are found to influence overall comprehensiveness. This work has conclusions that likely extend beyond Washington State, including the lack of thorough baseline assessment of the urban forest and the lack of monitoring strategies in the majority of management plans. While the findings of this thesis cannot necessarily be applied to each state and province, the key findings are likely to transcend these geographic boundaries.

5.5 Future Research

Following this work, the next clear research question is whether Washington urban forest management plans are being implemented successfully and what successful implementation looks like

on the ground. Case studies on implementation of management plans in different-sized communities across the state would provide valuable information on which elements of management plans are working and which elements are not working. An implementation evaluation assesses “the extent to which a program is operating as intended” (GAO, 1998). An implementation evaluation—or post-hoc evaluation—would evaluate if management plans are implemented and if so, how they are performing (i.e. its effectiveness). This type of evaluation usually uses a “blueprint” model in which the plan’s intended outcomes are compared against what actually happened (Baer, 1997). While departures from the urban forest management plan are important to note, it is just one part of the overall story of implementation. Such an evaluation would help identify barriers to successful implementation and assist municipalities in avoiding common pitfalls when developing and implementing their urban forest management plan.

An implementation evaluation would help answer a number of questions, including whether a strong urban forest advocate is necessary for successful implementation of a management plan. It would be especially revealing to look at the implementation of consultant-written plans versus plans written in-house. Do municipalities that wrote the plan in-house with help of an interdepartmental team tend to have more buy-in during implementation? Similarly, the relationship between public participation during plan development and implementation success would be interesting to explore. An implementation evaluation would also help to further explore the specificity of plans and lead to a better understanding of the relationship between plan specificity and implementation success.

The framework for comprehensive urban forest management plans is theoretical and it is unknown how the components of a comprehensive plan translate to on-the-ground implementation. It would be interesting to know whether the municipalities with plans that scored high on the plan comprehensiveness index are actually exhibiting comprehensive management of the urban forest on the ground. It is possible that there are factors and municipal attributes that were overlooked in this analysis that would not become clear until conducting an implementation evaluation. A more detailed case study approach is the most appropriate method for evaluating on-the-ground implementation of a management plan. Such an approach could incorporate interviews with key staff to understand the success of putting these more theoretical framework components into practice.

Finally, it would also be useful to gain a better understanding of what compels municipal managers to shift from reactive to proactive management and develop an urban forest management plan. For example, do grant funding opportunities from Washington DNR encourage smaller, cash-strapped municipalities to write a plan more than these opportunities influence large municipalities to do so? It would also be useful to know more about the resources and plan examples that urban forest managers are using when developing their city's urban forest management plan. Having a better understanding of the initial reasons municipalities choose to write a management plan and of the resources they are currently using to develop their plan can inform the methods that state urban and community forestry agencies use when encouraging municipalities to write management plans. A more thorough understanding of how urban forest managers filter information and select which information to use to inform plan creation can also help the DNR Urban and Community Forestry Program be more targeted with their outreach and education materials.

The research topics described above would all help further this thesis' primary research goal of increasing understanding of municipal urban forest management planning in Washington State. With greater understanding of urban forest management plan implementation and effectiveness, a framework for comprehensive urban forest management plans can be strengthened to be more useful to municipalities. Identifying barriers to successful implementation will help municipalities avoid common pitfalls and provide the DNR Urban and Community Forestry Program information they can use to help municipalities overcome barriers to successful on-the-ground implementation. Additional research on municipal urban forest management will also draw more attention to the importance of proactive management of the urban forest, with the potential to convince additional municipalities to develop a comprehensive urban forest management plan and program.

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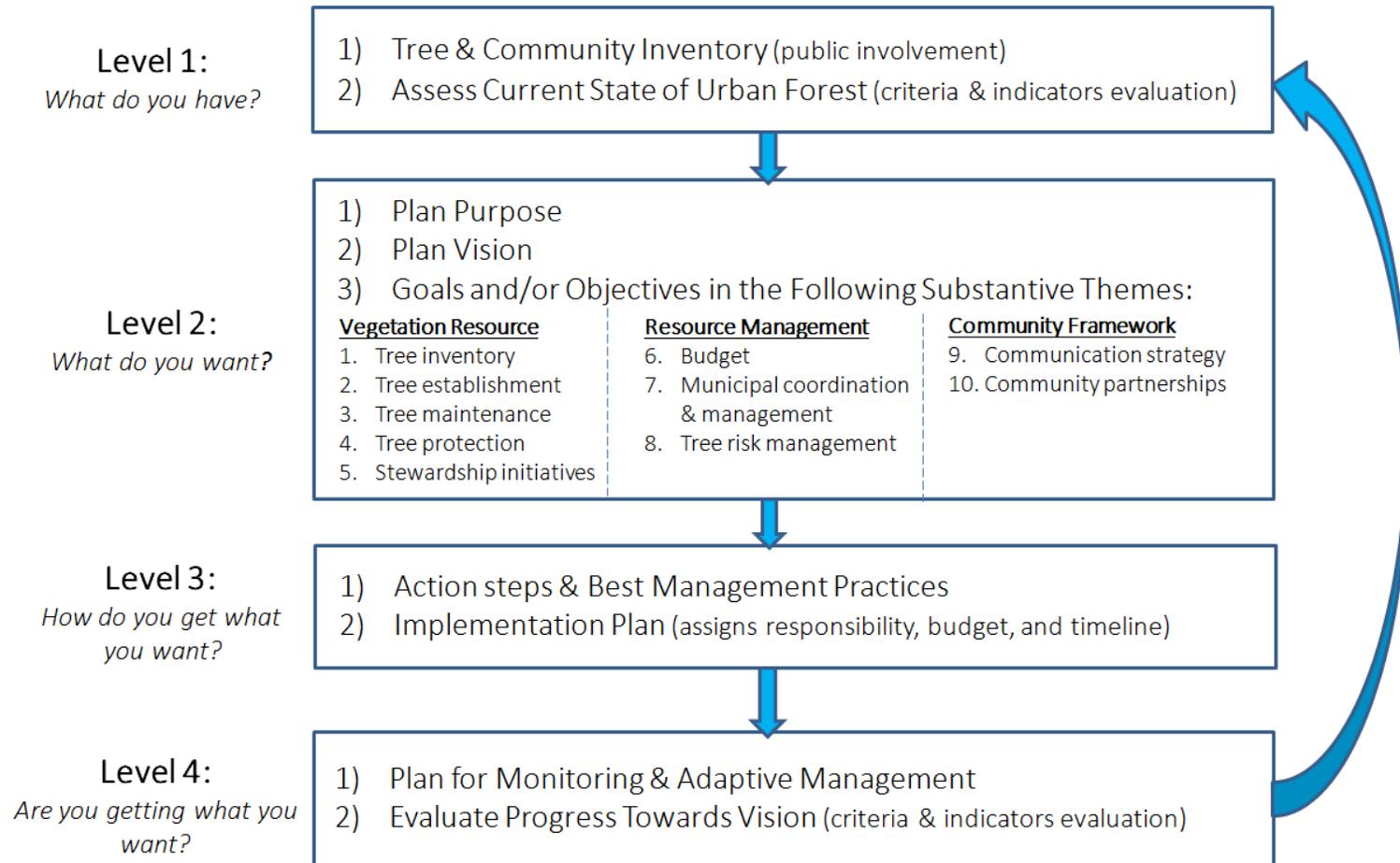
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Appendix A. Framework for Comprehensive Urban Forest Management Plans

A Framework for Comprehensive Urban Forest Management Plans



Appendix B. Plan Analysis Checklist & Coding Dictionary

- 1. Record municipal and plan attributes:**
 - a. Municipality population
 - b. Year plan was written (if stated)
 - c. Plan name (UFMP or other)
 - d. Whether plan is publicly available online
 - e. Whether plan indicates funding from DNR
 - f. Plan authors (contractor or city staff only)
 - g. Is the City a Tree City USA?
 - h. Geographic locations: Is the city located east or west of the Cascades?
- 2. Vision statement:** Does plan include a stated vision statement?
- 3. Review of current programs & policies:** Does the plan review the current urban forest practices within the municipality? This includes policies, programs, current staff responsibilities, and current works plans.
- 4. Public input in writing process:** Does the plan explicitly mention the public's involvement or input in the writing process? While a public process might be implied, a plan must explicitly state the way the public was involved to be coded.
- 5. Reasons for writing plan/concerns/plan purpose.** Check all that apply or add additional reasons. All of these reasons should appear in the first few sections of the plan (e.g. executive summary, introduction, plan purpose). Use NVivo to highlight these key reasons.
 - a. Achievement of prior urban forest goals
 - b. Enhancement and preservation of tree resource
 - c. Tree disease and pest concerns
 - d. To develop a long-term plan for urban forest
 - e. Tree loss due to development
 - f. Increase tree diversity
 - g. To serve as a guiding framework for city's urban forestry work
 - h. To serve as a guide to tree care and maintenance (more operational)
 - i. Ageing trees
 - j. Address tree maintenance issues
 - k. Threat of urbanizations
 - l. To develop a public education/involvement program
 - m. View preservation
 - n. Support municipality's comprehensive plan
- 6. Urban Forest Inventory & Assessment--** Does the plan mention urban forest inventory results? If so, specify what kind of inventory/survey/assessment the municipality undertook.
 - a. Does the plan include the results of a forest assessment such as a street tree inventory or canopy cover analysis?
 - b. Does the plan provide a summary of the assessment? (in the form of tree data, canopy cover, tree species, "current state of the urban forest")?

- 7. Public or private trees?** (choose all that apply)
- Does the plan address public trees only?
 - Does the plan address public and private trees?
 - Does the plan address street trees only?
 - Does the plan address parklands?
- 8. Does the plan address the following substantive themes with A) a goal or objective (possibly vague) or B) and goal or objectives and action steps, strategies, or set of best management practices¹?**
- Urban forest/tree inventory:* goals and objectives related to the urban forest tree inventory, future data collection, keeping inventory current, maintaining GIS layers, overall goals about cover related to current canopy cover data.
 - Tree establishment:* tree planting priorities; goals related to canopy cover; species distribution; tree replacement policies; stock specifications; habitat requirements; planting guides; requirements for staff training related to tree planting; recommendations for specific tree species to plant.
 - Tree maintenance:* Overall goals for tree maintenance; pruning guidelines; reactive vs. proactive tree maintenance; minimum maintenance standards; inspection cycles; specific areas where tree maintenance will take place; goals related to reduction of pests and disease.
 - Tree protection:* Current practices and goals related to tree protection; proposed tree protection by-laws; guidelines for protecting tree during construction; policies to protect large trees, heritage trees, or trees on public/private property.
 - Tree risk management:* Goals related to tree risk assessment, tree risk inventories, risk rating systems, risk mitigation, tree risk mitigation practices; any goals related to addressing certain trees (species, age class, geographic group, etc).
 - Communication Strategy:* Any goal related to increasing the public's awareness of the urban forest and value of trees; goals related to communicating the value of trees to the public/city employees/other agencies;; include interagency and interdepartmental communication goals; includes all community education goals; goals related to interagency communication.
 - Community Partnerships:* Any goal related to cooperating with the green industry (landscapers, arborists, nurseries), neighborhood groups, other municipalities; goals related to initiating neighborhood action (neighborhood tree plantings).
 - Stewardship Initiatives:* Goals related to improving/creating community stewardship programs of public and street trees; public-private partnerships for tree stewardship; natural area stewards; community tree care programs; goals related to park land stewardship and planning, including invasive species control work.
 - Budget:* Goals related to or addressing urban forest program funding; funding goals; funding priorities; long-term urban forestry funding; community budget cycle timing (is there wording about timing phases of work with the budget cycle?).
 - Municipal coordination & management:* Any goal or action steps related to municipal management of the urban forest; includes staffing goals; ordinance planning and creation; creation of interdepartmental teams or citizen forestry commissions; goals related to

¹ Best management practice is defined as “best available, industry-recognized courses of action in consideration of the benefits and limitations based on scientific research and current knowledge” (Lilly, 2010).

improving agency cooperation within the city.

- 9. Implementation:** Does the plan include an implementation plan? (implementation plan includes any section of plan specifically called “implementation plan” or with similar name)
- a. If so, does the implementation plan assign responsibility for specific action items?
 - b. Is the implementation plan linked to an associated budget?
 - c. Does the implementation plan include a timeline for actions?

10. Monitoring/Evaluation

- a. Does the plan include a specified time to update the plan or specify how long the plan should be used for planning/management purposes?
- b. Does the plan include a plan for evaluating, monitoring, and modifying the plan elements (essentially an adaptive approach to management)? In order to receive this code, plan must explicitly include a section titled “monitoring plan” or “evaluation” and list specific ways the plan’s progress will be monitored, evaluated, or adapted after implementation.
- c. Does the plan acknowledge “adaptive management”?
- d. Does the plan use any other performance measurement tools? (e.g. SWOT, gap analysis)

Other elements to code:

- Does the plan explicitly or implicitly draw from any urban forest management frameworks (e.g. Clark, Kenney, or Dwyer)?

Appendix C. Municipal and Urban Forest Management Plan Attributes

Municipality Name	Population	Size Category	East or West	Year	Plan Title	Publicly available online?	Tree City USA (2013)	DNR Funded	Plan Author	Consultant Name (if applicable)
Bainbridge Island	23,025	Medium	West	2006	Community Forest Management Plan	Yes	Yes	No	City staff	-
Bonney Lake	17,374	Medium	West	2005	Community Forestry Program & 2010 Street Tree Plan (addition)	Yes	Yes	Yes	Consultant	Davey Resources Group
Bremerton	39,051	Medium	West	1997	Master Urban Tree Plan	No	Yes	No	Consultant	Sound Urban Forestry, Kevin McFarland
Chelan	3,890	Small	East	2004	A Comprehensive Community Forestry Management Plan	No	Yes	Yes	Consultant	Community Forestry Consultants, Jim Flott
Clyde Hill	2,984	Small	West	2003	A Citizen's Guide to Urban Forest Management	Yes	Yes	Yes	Consultant	Elizabeth Walker (UW CFR MS Thesis)
Coulee Dam	1,107	Small	East	2004	A Comprehensive Community Forestry Management Plan	No	No	Yes	Consultant	Community Forestry Consultants, Jim Flott
Covington (2013)	17,575	Medium	West	2013	Urban Forestry Strategic Plan for Publicly-Managed Trees	Yes	Yes	Yes	Consultant	Terra Firma Consulting, Elizabeth Walker
Covington (2006)	17,575	Medium	West	2006	Community Forestry Plan	Yes	Yes	Yes	City Staff	-
Edmonds	40,400	Medium	West	2010	Street Tree Plan	Yes	Yes	No	Consultant	Mackleod Reckord LLC
Entiat	1,112	Small	East	2006	Urban Forest Management Plan	No	Yes	Yes	Consultant	Community Forestry Consultants, Jim Flott

Municipality Name	Population	Size Category	East or West	Year	Plan Title	Publicly available online?	Tree City USA (2013)	DNR Funded	Plan Author	Consultant Name (if applicable)
Fife	9,173	Small	West	2012	Urban Forest Management Plan	No	Yes	Yes	Consultant	Arborea LLC, Micki McNaughton
Hoquiam	8,696	Small	West	2012	Tree Inventory and Community Urban Forest Management Plan	Yes	Yes	Yes	Consultant	ArborPro Urban Forest Management
Kenmore	20,870	Medium	West	2004	Street Tree Plan	No	No	Yes	Unspecified	-
Kirkland	49,755	Medium	West	2013	Urban Forestry Strategic Management Plan	Yes	Yes	Yes	Consultant	Davey Resource Group, Forterra & Kirkland's Tree Team
Lacey	43,860	Medium	West	2005	Urban Forest Management Plan	Yes	Yes	Yes	Consultant	Washington Forestry Consultants, Galen Wright
Lake Forest Park	12,972	Medium	West	2010	Community Forest Management Plan	Yes	Yes	No	City Staff	-
Longview	36,672	Medium	West	2010	Urban Forest Maintenance Management Plan	Yes	Yes	No	Unspecified	-
North Bend	5,947	Small	West	2011	Urban Forestry Plan	Yes	Yes	Yes	City Staff	-
Olympia	47,698	Medium	West	2001	Master Street Tree Plan	Yes	Yes	No	City Staff	-
Pasco	65,398	Large	East	2008	Urban Forestry Management Report	Yes	Yes	No	Consultant	Community Forestry Associates, Jim Flott
Poulsbo	9,336	Small	West	2003	Poulsbo Master Public Tree Plan	No	Yes	No	City Staff	-
Renton	92,812	Large	West	2009	Urban and Community Forestry Development Plan	Yes	Yes	No	Consultant	Worthey & Associates, Sound Tree Solutions (Elizabeth Walker), MAKERS Architecture and Urban Design

Municipality Name	Population	Size Category	East or West	Year	Plan Title	Publicly available online?	Tree City USA (2013)	DNR Funded	Plan Author	Consultant Name (if applicable)
Richland	51,440	Large	East	2011	Urban Forest Management Plan	No	Yes	Yes	Consultant	Community Forestry Associates, Jim Flott
Royal City	2,193	Small	East	2004	Arboricultural specifications and standards of practice for the city of Royal City	No	No	Yes	City Staff	-
SeaTac	27,667	Medium	West	2010	Comprehensive Public Tree Maintenance Program for the City of SeaTac	No	Yes	No	City Staff	-
Seattle	620,778	Large	West	2013	Urban Forest Stewardship Plan	Yes	Yes	No	City Staff	-
Shoreline	54,044	Large	West	2003	Urban Forest Management Plan	Yes	Yes	Yes	Consultant	ACRT, Ralph Nevill
Snoqualmie	10,884	Medium	West	2010	City Tree Plan	No	Yes	No	City Staff	-
Spokane	210,103	Large	East	2002	Vegetation Management Plan for the City of Spokane	Yes	Yes	No	City Staff	-
Sumner	9,562	Small	West	2005	Urban Forestry Strategy Plan & Update	No	No	Yes	Consultant	Urban Forestry Services, James Barborinas
Tacoma	202,010	Large	West	2011	Strategic Urban Forest Management Plan Neighborhood Business District	Yes	Yes	Yes	Consultant	Community Forestry Consultants, Jim Flott
Tumwater	17,671	Medium	West	2013	comprehensive street tree plan (DRAFT)	No	Yes	Yes	Consultant	Sound Urban Forestry , Kevin McFarland
Twisp	926	Small	East	2004	Community Forestry Management Plan	No	Yes	Yes	Consultant	Community Forestry Consultants, Jim Flott

Municipality Name	Population	Size Category	East or West	Year	Plan Title	Publicly available online?	Tree City USA (2013)	DNR Funded	Plan Author	Consultant Name (if applicable)
Vancouver	164,759	Large	West	2007	Urban Forestry Management Plan	Yes	Yes	Yes	Consultant	Conservation Techni1, Steve Duh
Walla Walla	32,148	Medium	East	2003	Urban Forest Management Plan	Yes	Yes	No	Unspecified	-
Wenatchee	32,373	Medium	East	2009	Community Forest Plan	Yes	Yes	No	Unspecified	-
Woodinville	11,157	Medium	East	1998	Community Urban Forestry Plan	Yes	Yes	Yes	Consultant	Sound Urban Forestry, Kevin McFarland
Yarrow Point	1,022	Small	East	2011	Urban Forest Management Plan (DRAFT)	No	Yes	Yes	Consultant	Tree Solutions
Yelm	6,965	Small	East	2008	5-Year Urban Forestry Strategic Plan 2009-2013	No	Yes	No	City Staff	-

Appendix D. Plan Comprehensiveness Index Criteria

Level	Components	Point Score
LEVEL 1: BACKGROUND/INVENTORY		
1	Included review of existing policies & programs	1
1	Conducted evaluation of current state of urban forest	1
1	Community involvement: plan mentioned involving the community in plan creation	1
1	Conducted tree inventory/canopy assessment before writing plan	1
LEVEL 2: VISION, GOALS & OBJECTIVES		
2	Presence of a vision statement	1
2	Budget	1
2	Communication and education	1
2	Community partnership	1
2	Stewardship initiatives	1
2	Municipal coordination	1
2	Tree establishment	1
2	Tree maintenance	1
2	Tree risk management	1
2	Tree inventory	1
2	Tree protection	1
LEVEL 3: ASSOCIATED ACTION STEPS (W/ GOAL) & IMPLEMENTATION PLAN		
3	Budget	1
3	Communication and education	1
3	Community partnership	1
3	Stewardship initiatives	1
3	Municipal coordination	1
3	Tree establishment	1
3	Tree maintenance	1
3	Tree risk management	1
3	Tree inventory	1
3	Tree protection	1
3	Includes an implementation plan	1
3	Implementation plan w/ assigned responsibility	1
3	Implementation plan w/ budgetary considerations	1
3	Implementation plan w/ timeline	1
LEVEL 4: MONITORING & EVALUATION		
4	Address monitoring or adaptive management	1
4	Includes specific time to update plan	1
TOTAL		31

Appendix E. Examples of how Washington Urban Forest Management Plans Addressed the 10 Substantive Themes with Goals and Action Steps

TREE ESTABLISHMENT	
Goal, Objective, Action Step, BMP	Examples from Coded Management Plans
Goal	<p><i>Excerpted from Chelan’s Comprehensive Community Forestry Management Plan</i></p> <p><i>“The city should emphasize diversity of species in the planting program. Many species should be avoided that have high maintenance costs, high storm damage potential or a history of failure. The key to maintaining a healthy, sustainable community forest is the implementation of regular, annual tree plantings, regardless of grant money or catastrophic events. A large number of trees do not to be planted, but a consistent annual addition of trees to the community forest is critical to maintain a perpetual canopy.”</i></p>
Goals and Action Steps	<p><i>Excerpted from Seattle’s Urban Forest Stewardship Plan:</i></p> <p><u>Goal:</u> <i>“Preserve, restore, and enhance the urban forest on City property.”</i></p> <p><u>Action Steps:</u> <i>“-Develop metrics for soil volume, soil compaction, soil type, species diversity, and hydrologic information to help create sustainable forests requiring less maintenance. (OSE, IDT)</i> <i>-Encourage understory plantings in tree planting projects. (SDOT, DPD, Parks, Seattle Center FAS, SPU)</i> <i>- Explore opportunities to maximize available planting space by using existing and new technologies such as root barriers, Silva Cells, and/or specialized soil mixes. (SDOT, DPD, Parks, Seattle Center FAS, SPU)</i> <i>- Expand the use of tree planting strips rather than tree pits with grates to provide greater rooting area and enhanced storm water mitigation. (SDOT, DPD, Parks, Seattle Center, FAS, SPU)</i> <i>-Plant a minimum of two trees for each tree removed across all departments. (OSE, IDT)</i> <i>-Explore feasibility of increasing fruit and nut tree planting and/or establishment of community orchards on Seattle public lands. (OSE, Parks, FAS)”</i></p>
Goal with Best Management Practices (BMPs)	<p><i>Excerpted from Fife’s Urban Forest Management Plan:</i></p> <p><u>Goal:</u> <i>“Tree Selection: Trees appropriate to conditions in Fife should be chosen bearing in mind the following guidelines:”</i></p> <p><u>BMPs:</u> <i>“-Appropriate to climate—in addition to commonly available tree cultivars, it may be useful to investigate trees native to areas around the world that have similar climate and/or soil conditions to broaden the diversity of Fife’s urban forest.</i> <i>-Appropriate to location (frontage, parking lot, park, etc.)—Tree selection may involve design aesthetics in addition to tolerance to micro-climate conditions.</i> <i>-Hardiness—Tree species and cultivars selected must be tolerant of the temperatures and precipitation levels that obtain in the Pacific Northwest, planning forward to potential climate change alterations as well.</i> <i>-Do no harm tree cultivars (seedless, thornless, etc.)—public safety as well as lessened maintenance may be important considerations for certain tree-planting locations.</i> <i>-Tree species restricted for use as street trees due to invasive root systems, weak and/or brittle wood, or tendency to spread via root suckering. Among these are the following genera: Willow, poplar, aspen, and Swedish aspen.”</i></p>

TREE MAINTENANCE	
Goal, Objective, Action Step, BMP	Examples from Coded Management Plans
Goal	<p><i>Excerpted from Walla Walla's Urban Forest Management Plan</i></p> <p><u>Goal:</u> <i>"It is recommended that the City of Walla Walla maintain a five to seven-year cyclic pruning program."</i></p>
Goal with BMPs	<p><i>Excerpted from Walla Walla's Urban Forest Management Plan</i></p> <p><u>Goal:</u> <i>"All pruning shall be done in accordance with the following industry standards: ANSI A300, ISA BMPs"</i></p> <p><u>Action Steps:</u> <i>"-Prune properly. Bad pruning cuts can cause long-term damage. -Prune carefully. Bad pruning cuts won't grow back and can cause long-term damage. -Don't prune branches clean of twigs leaving a tuft of leaves at the end; this "lion's tailing" creates weak branches and may cause branch failure. -Stay on top of pruning tasks in order to keep branch removals as small as possible. -Prune branches just outside of branch color to allow for faster wound closure and less exposure to disease pathogens."</i></p>
Goal with BMPs	<p><i>Excerpted from Bonney Lake's Community Forestry Program:</i></p> <p><u>Goal:</u> <i>"Manual watering of newly established street trees during the first two growing seasons after planting Use 'tree canteens' where appropriate:"</i></p> <p><u>BMPs:</u> <i>"1. Water twice weekly during the first month after planting. Then water weekly through the remaining summer months. Water at least once a month during the second summer. Use 5 gallons per inch of diameter for each tree"</i></p>

TREE INVENTORY	
Goal, Objective, Action Step, BMP	Examples from Coded Management Plans
Goal	<p><i>Excerpted from Fifes Urban Forest Management Plan</i></p> <p><u>Goal:</u> <i>“Complete Fife’s public tree inventory.”</i></p>
Goal with Action Steps	<p><i>Excerpted from Bremerton’s Master Urban Tree Plan</i></p> <p><u>Goal:</u> <i>“Inventory of the street and park trees (analysis of species, health, size class, maintenance, location, comments).”</i></p> <p><u>Action Steps:</u> <i>“Determine what areas other than the Central Business District (CBD) and Parks should be inventoried.</i></p> <ul style="list-style-type: none"> <i>a. Facilitate meeting(s) to focus on priorities</i> <i>b. Review and possibly update existing inventories</i> <i>c. Consider important areas within the sectors of East, Central, & West Bremerton</i> <ul style="list-style-type: none"> <i>1. Principal arterials</i> <i>2. Parks</i> <i>3. Minor arterials</i> <p><i>Compile inventory information into a database program (data management).”</i></p>
Goal with Action Steps	<p><i>Excerpted from North Bend’s Urban Forestry Plan</i></p> <p><u>Goal:</u> <i>“The City shall maintain its public tree inventory, including the species, size, condition, and associated maintenance or replacement needs of all street trees in parks and other public places.”</i></p> <p><u>Action Steps:</u> <i>“Maintenance of the City’s tree inventory shall consist of the following activities:</i></p> <ul style="list-style-type: none"> <i>a. The City’s GIS Technician shall maintain the tree inventory database by inputting data resulting from new development projects that add street trees, as well as data collected by the City’s Tree Steward, other applicable staff, or consultants.</i> <i>b. The City’s Tree Steward shall inspect the City’s public trees at least every other year, and shall report changes in the inventory to the City’s GIS Technician.”</i>

TREE PROTECTION	
Goal, Objective, Action Step, BMP	Examples from Coded Management Plans
Goal	<p><i>Excerpted from Bainbridge Island’s Community Forest Management Plan</i></p> <p><u>Goal:</u> <i>“Develop best management practices that protect existing mature trees in the urban area.”</i></p>
Goal with Action Steps	<p><i>Excerpted from Lacey’s Urban Forest Management Plan</i></p> <p><u>Goal:</u> <i>“Create a heritage and specimen tree program that recognizes special trees worthy of extra attention, notoriety and protection.”</i></p> <p><u>Action Steps:</u> <i>“A. Develop definitions of heritage and specimen trees that emphasize the special distinctions that lead to such characterization, in context with Lacey’s history.</i> <i>B. Hold contests annually on Arbor Day for identification and qualification of these special trees.</i> <i>C. Develop standards for protection of such trees and methodology for registering trees so that new landowner are notified of what they are purchasing and expectations associated with the distinction, including the tree’s health and expected life cycle.</i> <i>D. A new section should be added to the tree ordinance that recognizes heritage and specimen trees. Sample language will be developed for the City of Lacey and will be provided to the City under separate cover.”</i></p>
Goal with Best Management Practices (BMPs)	<p><i>Excerpted from Covington’s 2006 Community Forestry Plan:</i></p> <p><u>Goal:</u> <i>“Reduce impacts during construction.”</i></p> <p><u>BMPs:</u> <i>“-Explain tree protection efforts to the project manager</i> <i>-Remove unwanted trees carefully</i> <i>-Fence critical root zone of the trees to be preserved with 1 foot for every diameter of the tree at 4 ½ feet.</i> <i>-Install tree protection signage and explain tree protection plan to contractors and sub-contractors</i> <i>-Do not allow any storage, parking, dumping, or excavating within the critical root zone</i> <i>-Disturbance within the critical root zone should be evaluated by the arborist</i> <i>-Carefully prune limbs or roots properly before they are broken and damaged</i> <i>-Monitor the site to maintain tree protection efforts</i> <i>-After construction is complete, make a final inspection for any needed follow up care.”</i></p>

STEWARDSHIP INITIATIVE	
Goal, Objective, Action Step, BMP	Examples from Coded Management Plans
Goal	<p><i>Excerpted from Pasco's Urban Forest Management Plan</i></p> <p><u>Goal:</u> <i>"Encourage stewardship. Promote a Stewards for Young Trees program within the community, setting up regular workshops for steward training and allowing civic or school groups to 'adopt' newly planted trees."</i></p>
Goal with Action Steps	<p><i>Excerpted from Vancouver's Urban Forest Management Plan</i></p> <p><u>Goal:</u> <i>"Promote stewardships of native plant communities on private and public property. Provide education about the benefits of native plants and the negative effects of invasive and non-native species."</i></p> <p><u>Action Steps:</u> <i>"-Implement a comprehensive and creative 'No Ivy' campaign, centered on 'No Ivy Day' in early May, to increase awareness, inspire removal efforts, and promote landscape alternatives.</i> <i>-Encourage planting of native trees and shrubs, where appropriate, through outreach materials, trainings, events and other media exposure.</i> <i>-Work with volunteers to remove and control invasive species, such as English ivy and Himalayan blackberry, which threaten native plant communities on public lands."</i></p>
Goal with Action Steps	<p><i>Excerpted from Bainbridge Island's Community Forest Management Plan</i></p> <p><u>Goal:</u> <i>"Effectively manage publicly owned forest lands."</i></p> <p><u>Action Steps:</u> <i>"a. Develop site-based management plans for properties purchased by the Open Space Commission.</i> <i>b. Identify costs for long-term management of Open Space properties and allocate appropriate funds.</i> <i>c. Develop a long-term management plan for waterfront Park.</i> <i>d. Work with the Parks and recreation District to implement Best Management Practices for trees and forests on lands managed by the Parks District.</i> <i>e. Prevent unnecessary forest loss on public lands from any private or public activities, including public works and utilities projects."</i></p>

BUDGET	
Goal, Objective, Action Step, BMP	Examples from Coded Management Plans
Goal	<p><i>Excerpted from Lacey’s Urban Forest Management Plan</i></p> <p><u>Goal:</u> <i>“Budget adequate annual funding (\$65,000+) to complete basic maintenance tasks for city trees and some replanting.”</i></p>
Goal with Action Steps	<p><i>Excerpted from Vancouver’s Urban Forest Management Plan</i></p> <p><u>Goal:</u> <i>“Strategize funding sources for sustainable urban forestry programming.”</i></p> <p><u>Action Steps:</u></p> <p><i>a. Establish a Tree Fund to receive urban forest/tree-related fines, fees, fees-in-lieu, etc. Accumulated funds may be used to pay for staff training, tree-related contracting costs, or other urban forestry needs as identified by City staff and approved by City Council.</i></p> <ul style="list-style-type: none"> <i>i. Investigate a permit fee structure to support city-wide tree care and maintenance on public property.</i> <i>ii. Investigate an urban forestry plan review fee for plans that incorporate trees.</i> <i>iii. Investigate permit and/or licensing options for tree care contractors working in the City.</i> <p><i>b. Research grant opportunities for program development. Grants can be a valuable resource for developing urban forestry tools and advancing programmatic development at the local level. The Washington State Dept. of Natural Resources Urban and Community Forestry Program offers Community Forestry Assistance Grants annually for this purpose. Other grant opportunities for program development may be available as well.</i></p> <p><i>c. Research grant opportunities for special projects. By shifting to a view of the urban forest as an infrastructure element, a variety of grant opportunities opens for specific projects that incorporate trees. Public works-related grants may feature trees as traffic-calming or pedestrian protection devices or as stormwater management tools, for example. Grants for economic development may focus on trees as an attractant to bring customers into retail zones. Health and welfare grants may focus on the health benefits of trees to children and the elderly through improved air quality and pedestrian safety. Wellness and Walkable Communities programs easily incorporate trees into planning for more pleasant and healthful community trails and sidewalks that invite citizens to walk more often.”</i></p>
Goal with Action Steps	<p><i>Excerpted from Seattle’s Urban Forest Stewardship Plan</i></p> <p><u>Goal:</u> <i>“Implementation of the action agenda will require policy, program, and budget coordination, as well as long-term and stable funding.”</i></p> <p><u>Action Steps:</u> <i>“In order to establish adequate and sustainable funding for urban forestry efforts, the City will consider the following:</i></p> <ul style="list-style-type: none"> <i>• Develop tools for measuring and monetizing the comprehensive benefits provided by a healthy urban forest in Seattle.</i> <i>• Use asset management and triple bottom-line cost-benefit analysis in assessing urban forest related projects.</i> <i>• Explore options for dedicated funding sources for street trees. Explore creative financing mechanisms to ensure alternative funding to supplement general fund revenues.</i> <i>• Develop a coordinated approach to seek funding from sources such as local and regional foundations, industry, and corporations.</i> <i>• Work with the business and non-profit communities (e.g. Seattle Parks Foundation) to create a tree donation account or other funding strategies.</i>

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|--|--|
| | <ul style="list-style-type: none">• <i>Explore funding opportunities with the business community and with regional donors, particularly for special projects identified in a management plan.</i>• <i>Explore creative financing mechanisms to obtain funding for City urban forestry program.”</i> |
|--|--|

MUNICIPAL COORDINATION AND MANAGEMENT	
Goal, Objective, Action Step, BMP	Examples from Coded Management Plans
Goal	<p><i>Excerpted from Kirkland’s Urban Forestry Strategic Management Plan</i></p> <p><u>Goal:</u> <i>“Establish a formal urban forestry program for greater accountability, cooperation and resource-sharing. It is important to distinguish the urban forestry program as an entity within the organization and for the community.”</i></p>
Goal with Action Steps	<p><i>Excerpted from Lacey’s Urban Forest Management Plan</i></p> <p><u>Goal:</u> <i>“Updating ordinances.”</i></p> <p><u>Action Steps:</u> <i>–Modify the tree and vegetation protection ordinance to require review of all commercial and industrial projects with one or more trees. This is important in cases when as an example, only a few Oregon white oaks occur on the site.</i> <i>–Also consider a minimum percentage area for tree tracts in all types of developments. Language regarding tree removal on private property should be clarified.</i> <i>–Consider modifying the landscape ordinance to prevent improper pruning of required landscape trees. A procedure for inspection of required landscaping for compliance 3 plus years after the bond has been released needs to be established.</i> <i>–Consider modifying the landscape ordinance to require that all trees and shrubs planted on projects within the City of Lacey meet the ANSI standard for size and that plants are healthy and show evidence of cultural pruning and care from the nursery.”</i></p>
Goal with Action Steps	<p><i>Excerpted from Renton’s Urban and Community Forestry Development Plan</i></p> <p><u>Goal:</u> <i>“Continued interdepartmental cooperation and involvement in the urban forestry program.”</i></p> <p><u>Action Steps:</u> <i>“The Task Force recognized the urgent need to provide the highest value and control service costs utilizing existing City crews and resources. The Task Force agreed to work as an Interdepartmental Team to discuss departments’ staffing options further. The Task Force agreed that the certified arborist crew would be best located within the Community Services Department, with interdepartmental support from City departments, Mayor and City Council, Commissions, and the public. “</i></p> <p>Program Coordination</p> <pre> graph TD UFP((URBAN FORESTRY PROGRAM)) <--> CS[COMMUNITY SERVICES Environment] UFP <--> PW[PUBLIC WORKS Transportation Utilities Maintenance] UFP <--> POLICE UFP <--> FES[FIRE AND EMERGENCY SERVICES] UFP <--> HRM[HUMAN RESOURCES AND RISK MANAGEMENT] UFP <--> CED[COMMUNITY AND ECONOMIC DEVELOPMENT Economic Development Services Planning] </pre>

TREE RISK MANAGEMENT	
Goal, Objective, Action Step, BMP	Examples from Coded Management Plans
Goal with Action Steps & BMPS	<p><i>Excerpted from Covington’s 2013 Urban Forestry Strategic Plan for Publicly-Managed Trees</i></p> <p><u>Goal:</u> <i>“Detailed understanding of the condition and risk potential of the condition and risk potential of all publicly-managed trees in order to be more responsive.”</i></p> <p><u>Action Steps:</u> <i>“-Complete inventory includes a failure risk rating as a basis for a more proactive risk management</i> <i>-Inventory includes tree condition to guide tree establishment/renewal and management decisions for tree health and optimal condition to ensure maximum longevity</i> <i>-Risk assessment must be done by a qualified professionals (Tree Risk Assessment training)</i> <i>-Must be part of the inventory program to generate priority reports,</i> <i>-Condition rating is collected as part of complete inventory”</i></p>
Goal with Action Steps/ Recommendations	<p><i>Excerpted from Entiat’s Urban Forest Management Plan</i></p> <p><u>Goal:</u> <i>“The primary management priority for the city in the short term is the reduction of high risk trees in public areas.”</i></p> <p><u>Action Steps/Recommendations:</u> <i>“Risk reductions are best accomplished by reducing the number of poor quality species and eliminating high risk features such as trunk splits, trunk and basal decay and included bark crotches. By removing these species when the opportunity arises, the town minimizes expenses by avoiding the greater cost of removal once the trees are in an advanced stage of structural decline.</i></p> <p><i>A town should develop specific guidelines for when and under what conditions trees may be removed. An ISA publication entitled “A Photographic guide to the Evaluation of Hazard Tree in Urban Areas” by Matheny and Clark is a source of information for risk management guidelines.</i></p> <p><i>The town may wish to follow the criteria below for tree removals. The four situations in which tree removal are appropriate are:</i> <i>-if the tree is dead</i> <i>-if the tree is irreversibly diseased (particularly epidemic diseases such as Dutch elm disease) or in significant decline</i> <i>-if the tree or tree parts represents a risk to fail</i> <i>-or if there is unavoidable conflict between tree(s) and construction.”</i></p>
Goal with Action Steps	<p><i>Excerpted from Covington’s Urban Forestry Strategic Plan</i></p> <p><u>Goal:</u> <i>“Assessment of tree condition and hazard. Detailed understanding of the condition and risk potential of all publicly-managed trees in order to be more responsive.”</i></p> <p><u>Action Steps:</u></p> <ul style="list-style-type: none"> • <i>“Complete inventory includes failure risk rating as a basis for a more proactive risk management (publicly-owned trees are managed as a high priority)</i> • <i>Inventory includes tree condition to guide tree establishment/renewal and management decisions for tree health and optimal condition to ensure maximum longevity</i> • <i>Risk assessment must be done by a qualified professional (tree risk assessment training)</i> • <i>Must be part of the inventory program to generate priority reports, etc.”</i>

COMMUNICATION & EDUCATION	
Goal, Objective, Action Step, BMP	Examples from Coded Management Plans
Goal with Action Steps	<p><i>Excerpted from Fife’s Urban Forest Management Plan</i></p> <p><u>Goal:</u> <i>“Promote urban forestry awareness and citizen activism.</i></p> <p><u>Action Steps:</u> <i>“a. Incorporate urban forestry principles and guidelines into the Green Factor program. This popular program provides an excellent venue to bring basic urban forestry information to the citizens of Fife.</i> <i>b. Develop public education and outreach programming.</i> <i>i. Investigate existing educational materials that may be suitable for Fife. Examples include: Alliance for Community Trees, The Arbor Day Foundation, DNR Community Forestry Assistance Grant products, Urban forestry educational materials developed in local Washington jurisdictions and other regions of the United States.</i> <i>ii. Research citizen volunteer programs in other cities for ideas to engage the citizens of Fife. Example of such programs are NeighborWoods (City of Olympia), Friends of Trees, and ‘Friends of’ parks groups (City of Seattle).</i> <i>c. Make urban forestry information available via the City’s website.</i> <i>i. Post educational materials on the City’s website.</i> <i>ii. Post City regulations applicable to trees so that they are easy for citizens to find.</i> <i>iii. Provide details of tree-related issues so that citizens have a central location to find the latest developments.”</i></p>
Goals with Action Steps	<p><i>Excerpted from Vancouver’s Urban Forestry Management Plan</i></p> <p><u>Goals:</u> <i>“1. Maintain, update, and develop promotional and technical information about urban forestry and the Urban Forestry Division.</i> <i>2. Host events and festivals to promote the benefits of trees and recognize forestry advocates.”</i></p> <p><u>Action Steps:</u> <i>“-Highlight Urban Forestry program accomplishment in Annual Report and provide quarterly updates to City Council and City managers.</i> <i>-Maintain Urban Forestry website as a comprehensive and dynamic source for urban forestry information.</i> <i>-Release periodic media advisories to promote continued media coverage; explore option of weekly or monthly urban forestry column in the Columbian.</i> <i>-Utilize available free and low-cost media such as Clark-Vancouver Television, public service announcements, and newsletter articles to deliver marketing messages and promote Urban Forestry activities.</i> <i>-Develop simplified promotional materials to tell the story of the urban forest, its benefits, and how residents can help.</i> <i>-Promote financial benefits of trees, such as real estate value increase and energy conservation.</i> <i>-Amend existing marketing strategy to deliver key messages to priority audiences on a seasonally appropriate timeframe.</i> <i>-Increase visibility of Urban Forestry by attending local community events, such as the Home and Garden Idea Fair, and offering presentations to various civic, service, or community organizations.”</i></p>

COMMUNITY PARTNERSHIPS	
Goal, Objective, Action Step, BMP	Examples from Coded Management Plans
Goal	<p><i>Excerpted from Walla Walla's Urban Forest Management Plan</i></p> <p><u>Goal:</u> <i>"Expanded partnerships will continue to be integral to the success of Walla Walla's UFMP. Current partnerships with Pacific Power & Light and the Rotary Club of Walla Walla must be strengthened, maintained and expanded, and new partnerships established. Pacific Power & Light should be encouraged to continue working with the City to educate citizens on planting the right tree in the right place."</i></p>
Goal with Action Steps	<p><i>Excerpted from Spokane's "Vegetation Management Plan for the City of Spokane"</i></p> <p><u>Goal:</u> <i>"Coordinate all construction activities affecting trees /shrubs with urban forestry program."</i></p> <p><u>Action Steps:</u> <i>"a. Encourage developers to conserve as many trees as possible on new development and to consider power line/tree conflicts. b. Establish guidelines for business area landscaping. c. Coordinate plantings with urban forester. Educate the development community about the species of trees best suited to their site."</i></p>
Goals with Action Steps	<p><i>Excerpted from Vancouver's Urban Forestry Management Plan</i></p> <p><u>Goals:</u> <i>"Coordinate with neighborhood associations, schools and other organizations to develop urban forestry related project and programs and distribute relevant materials."</i></p> <p><u>Action Steps:</u> <i>"-Encourage neighborhood associations to incorporate urban forestry elements and planting projects in Neighborhood Action Plans; assist neighborhoods with development and implementation of urban forestry projects. -Partner with the school districts or local college program to develop a school curriculum for young children to teach, explore and experience the benefits of the urban forest. Use and build on existing programs (e.g. Project Learning Tree, City Among the Trees). -Encourage neighborhoods to apply for grants and seek sponsors to implement urban forestry projects; provide assistance if necessary. -Seek opportunities for Urban Forestry staff to speak at regional and national arboriculture events and submit articles for publication in industry magazines and journals."</i></p>

Appendix F: Comprehensiveness Plan Index Score Summary for Washington State Plans

Bainbridge Island—Kirkland

Municipalities		Bainbridge Island	Bozney Lake	Bremerton	Chelan	Clyde Hill	Coulee Dam	Covington (2013)	Covington (2006)	Edmonds	Entiat	Fife	Hoquiam	Kenmore	Kirkland
Vision									1	1					1
Reviews Existing Programs & Policies		1	1			1		1	1	1		1			1
Criteria & Indicators Evaluation		1						1							1
Inventory Conducted Before Plan		1		1	1	1	1	1			1	1	1	1	1
Community Involvement in Plan		1						1	1						1
Budget	Level 2	1	1				1	1	1	1	1	1			1
	Level 3	1							1			1			1
Communication & Education	Level 2	1	1	1	1		1	1	1		1	1			1
	Level 3	1	1					1			1	1			1
Community Partnership	Level 2	1	1	1				1			1	1			1
	Level 3	1	1					1				1			1
Municipality Coordination	Level 2	1		1	1		1	1	1		1	1	1	1	1
	Level 3	1					1	1	1			1			1
Stewardship Initiatives	Level 2	1						1			1	1			1
	Level 3	1						1			1	1			1
Tree Establishment	Level 2	1	1	1	1	1	1		1	1	1	1	1	1	1
	Level 3	1	1	1		1	1		1	1	1	1	1	1	1
Tree Maintenance	Level 2	1	1	1	1	1	1	1	1	1	1	1	1		1
	Level 3		1	1	1	1	1		1	1	1	1	1		1
Tree Protection	Level 2	1	1			1			1	1	1	1			1
	Level 3	1	1			1			1	1	1	1			1
Tree Risk Management	Level 2	1	1			1	1	1	1		1	1	1		1
	Level 3	1	1			1		1	1		1	1			1
Tree Inventory	Level 2	1	1	1	1		1	1	1		1	1			1
	Level 3	1	1	1				1			1	1			1
Includes an Implementation Plan		1	1					1	1						1
Implementation Plan Assigns Responsibility		1	1												1
Implementation Plan Includes Budget		1	1					1	1						1
Implementation Plan Includes Timeline		1						1	1						1
Addresses Plan Monitoring		1													1
Time to Update Plan		1												1	1
TOTAL SCORE		29	19	10	7	10	11	21	20	9	18	22	7	5	27

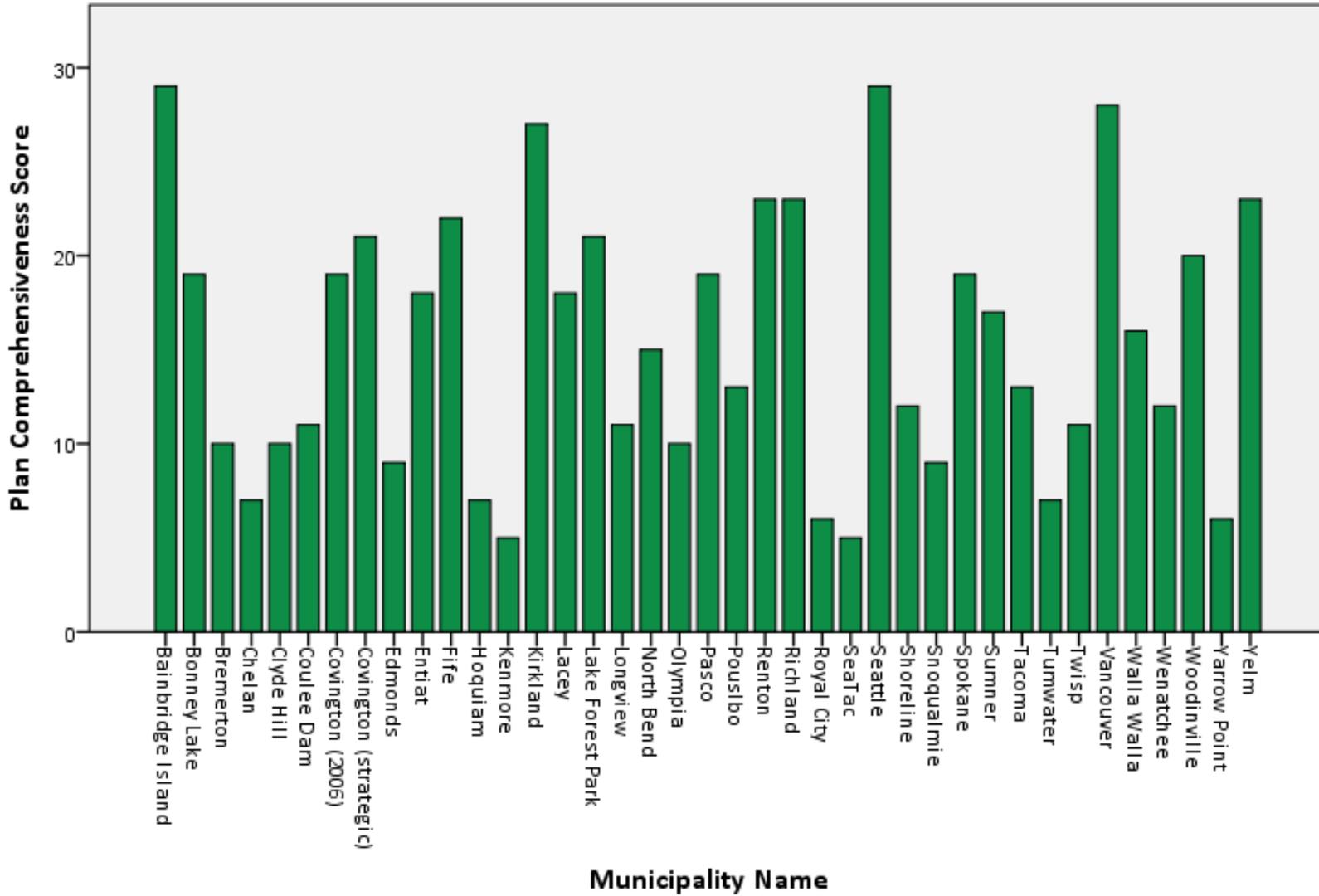
Lacey--Snoqualmie

Municipalities		Lacey	Lake Forest Park	Longview	North Bend	Olympia	Pasco	Poulsbo	Remon	Richland	Royal City	SeaTac	Seattle	Shoreline	Snoqualmie
Vision			1		1	1		1	1	1			1		
Reviews Existing Programs & Policies		1	1	1	1	1	1		1	1			1		
Criteria & Indicators Evaluation															
Inventory Conducted Before Plan		1		1	1	1	1		1	1			1	1	
Community Involvement in Plan		1	1							1			1		1
Budget	Level 2	1			1		1	1	1	1			1	1	
	Level 3				1					1			1	1	
Communication & Education	Level 2	1	1		1		1		1	1			1	1	
	Level 3		1				1		1	1			1		
Community Partnership	Level 2	1	1				1		1	1			1	1	1
	Level 3		1						1				1		
Municipality Coordination	Level 2	1	1		1		1	1	1	1			1	1	
	Level 3	1	1		1		1		1	1			1		
Stewardship Initiatives	Level 2	1	1				1			1			1	1	
	Level 3												1		
Tree Establishment	Level 2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Level 3	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tree Maintenance	Level 2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Level 3	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tree Protection	Level 2	1	1	1	1		1	1	1	1	1		1		1
	Level 3	1	1	1			1	1	1	1	1		1		
Tree Risk Management	Level 2	1	1	1		1	1	1	1	1		1	1	1	1
	Level 3	1	1	1			1	1	1	1			1		
Tree Inventory	Level 2		1	1	1	1	1	1	1	1		1	1		1
	Level 3		1		1	1		1	1	1			1		
Includes an Implementation Plan									1				1		
Implementation Plan Assigns Responsibility									1				1		
Implementation Plan Includes Budget									1						
Implementation Plan Includes Timeline									1				1		
Addresses Plan Monitoring													1		
Time to Update Plan		1	1				1		1	1			1		
TOTAL SCORE		18	21	11	15	10	19	13	23	23	6	5	29	12	9

Spokane—Yelm

Municipalities		Spokane	Sumner	Tacoma	Tumwater	Twisp	Vancouver	Walla Walla	Wenatchee	Woodinville	Yarrow Point	Yelm
Vision			1	1			1			1		1
Reviews Existing Programs & Policies			1	1			1					
Criteria & Indicators Evaluation							1					
Inventory Conducted Before Plan		1	1	1	1	1	1	1	1		1	1
Community Involvement in Plan			1	1			1			1		
Budget	Level 2	1	1			1	1	1	1	1	1	1
	Level 3								1	1		1
Communication & Education	Level 2	1	1	1		1	1	1	1	1		1
	Level 3	1					1			1		1
Community Partnership	Level 2	1	1				1	1		1		1
	Level 3	1	1				1			1		1
Municipality Coordination	Level 2	1	1			1	1	1		1		1
	Level 3	1	1			1	1	1		1		1
Stewardship Initiatives	Level 2		1				1	1		1		1
	Level 3						1					
Tree Establishment	Level 2	1	1	1	1	1	1	1	1	1		1
	Level 3	1	1	1	1	1	1	1	1	1		1
Tree Maintenance	Level 2	1	1	1	1	1	1	1	1	1	1	1
	Level 3	1	1	1	1	1	1	1	1	1	1	1
Tree Protection	Level 2	1	1	1	1		1	1	1	1		1
	Level 3	1		1	1		1		1			
Tree Risk Management	Level 2	1		1		1	1	1	1	1	1	
	Level 3	1				1	1	1	1	1	1	
Tree Inventory	Level 2	1	1				1	1		1		1
	Level 3	1					1					1
Includes an Implementation Plan							1			1		1
Implementation Plan Assigns Responsibility							1					1
Implementation Plan Includes Budget												1
Implementation Plan Includes Timeline							1					1
Addresses Plan Monitoring												
Time to Update Plan		1		1			1	1				1
TOTAL SCORE		19	17	13	7	11	28	16	12	20	6	23

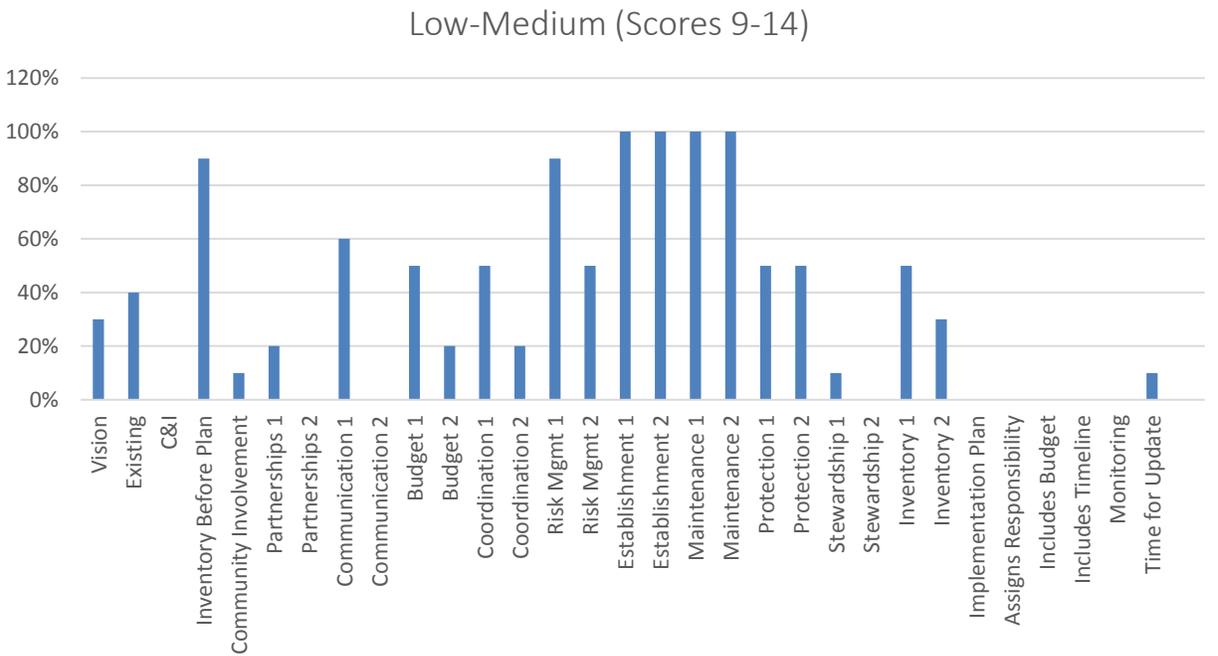
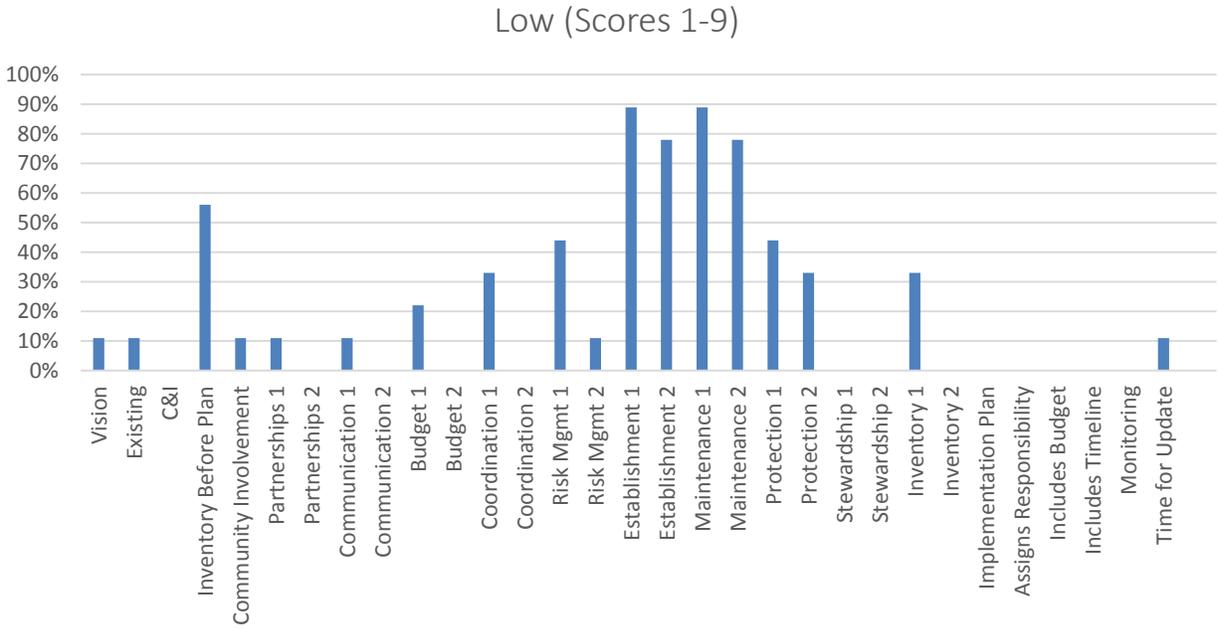
Appendix G. Graphical Display of Comprehensiveness Scores from the 39 Washington Urban Forest Management Plans



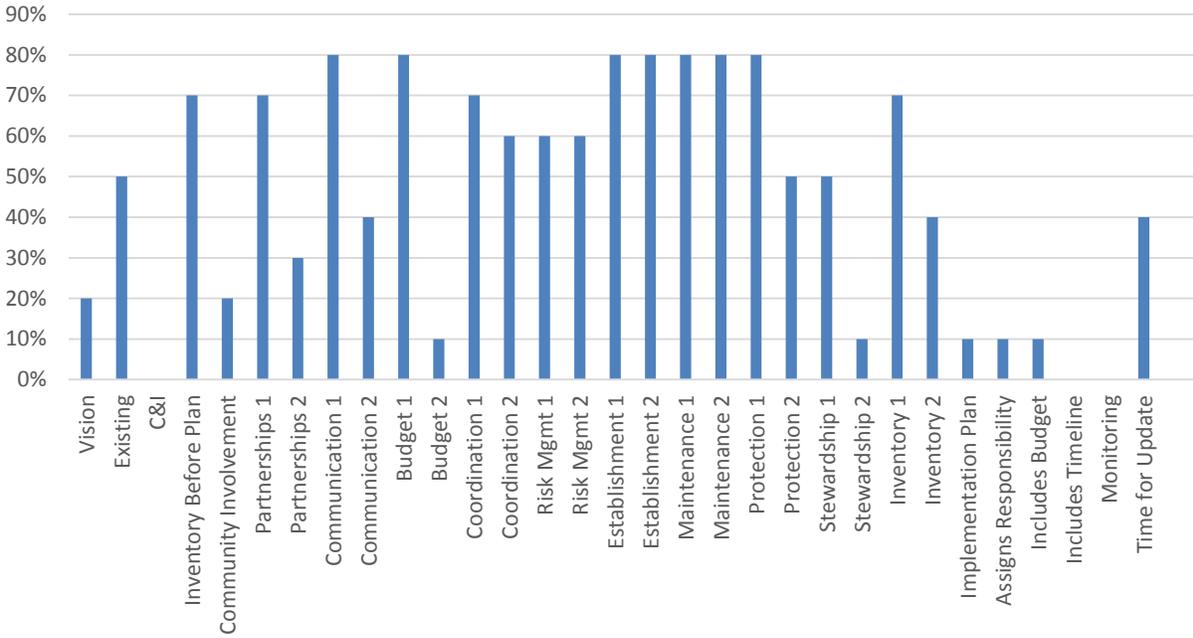
Appendix H. Influence of Municipality Size and CFA Funding on Overall Plan Comprehensiveness Score

Population Category	CFA Funding?	Mean	Std. Deviation	N
<i>Small</i>	No	18.0	7.1	2
	Yes	11.8	5.5	11
	Total	12.8	5.9	13
<i>Medium</i>	No	13.2	7.1	10
	Yes	17.0	7.3	8
	Total	14.9	7.2	18
<i>Large</i>	No	22.0	3.8	4
	Yes	19.0	7.8	4
	Total	20.5	5.9	8
Total	No	16.0	7.2	16
	Yes	14.9	7.0	23
	Total	15.3	7.0	39

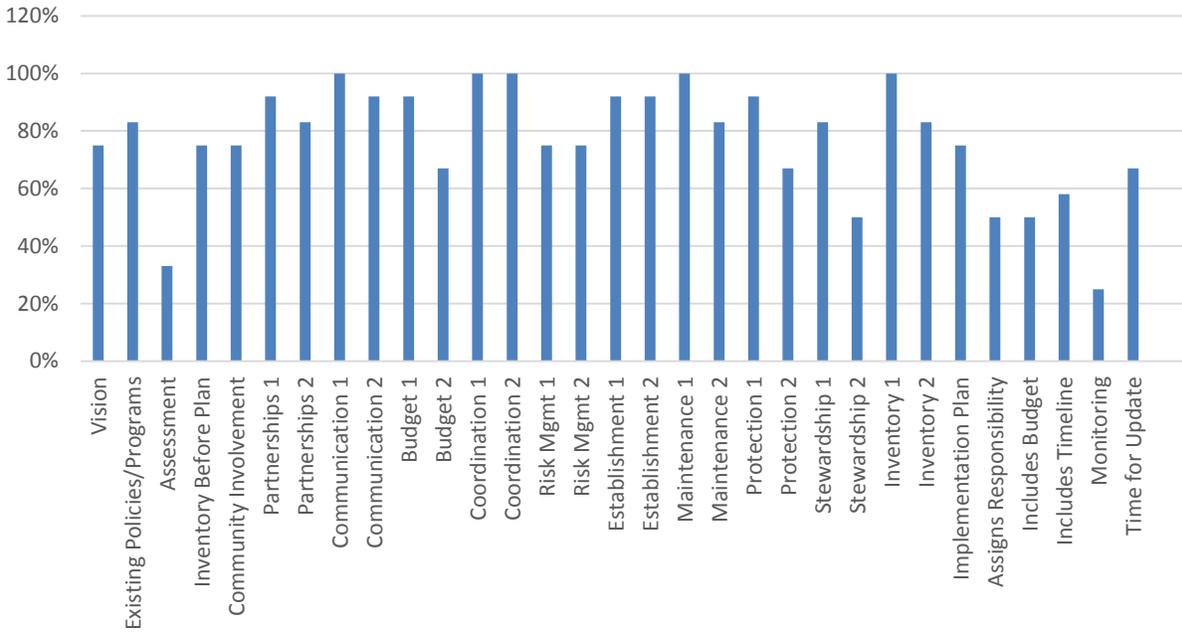
Appendix I. Percentage of Plans with Comprehensiveness Scores from Low to High Addressing Criteria



Medium (Scores 15-19)



High (Scores 20-31)



* 1= goal, 2=goal + action stepsy