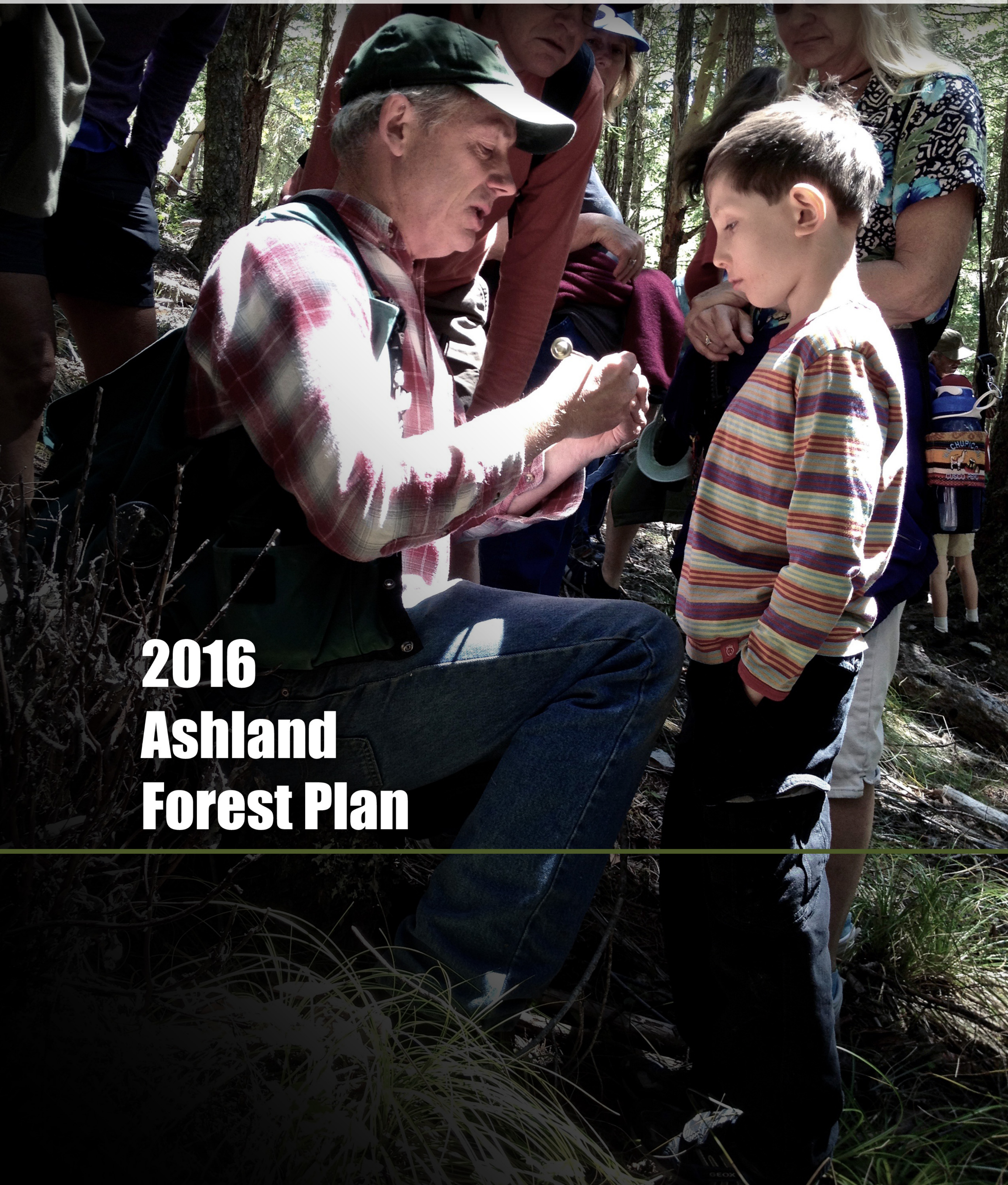
CITY OF ASHLAND



2016 Ashland Forest Plan

CITY OF
ASHLAND

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Executive Summary

Since Abel Helman built a small sawmill on the banks of Ashland Creek in 1852, the surrounding Ashland Creek Watershed has been cherished due to its essential water producing potential as well as other social and economic values. As settlement proceeded, the lack of frequent, low-intensity fires that had maintained low fuel content across the landscape had resulted in a forest susceptible to high-intensity wildfires and other forest health issues. Several early 20th century catastrophic fires in the Ashland Watershed catalyzed the City toward intensified management of their water supply. In May of 1992, the City of Ashland adopted the first Ashland Forest Plan (AFP). It placed the City forestlands under a management regime with the primary emphasis "to emulate the historical role of fire in the ecosystem utilizing a carefully applied program of tree salvage, thinning and prescribed fire". The lead organization charged with implementation of the AFP was the Ashland Forest Lands Commission (AFLC), a citizens' advisory group that provided recommendations for City forest management activities while fostering engagement and valuable feedback from the Ashland community.

During the first ten years of the AFP (1992-2002), citizens of Ashland were made more aware of the issues involving protection of their water supply and the ecological complexity of the surrounding Ashland Watershed. Through the careful thinning of brush and small trees plus use of prescribed fire, initial restorative work proceeded and trust was established within the community. In October 2003, the City adopted the City Forest Lands Restoration Project Phase II, commonly known as "Restoration II". This project instituted a community-vetted strategy that included non-commercial thinning, dead tree salvage, and harvest of commercially viable, yet primarily small diameter trees.

The AFLC is currently updating the 1992 AFP to better reflect current science and our experiences with active forest management. The 2016 AFP is guided by the mounting volume of credible data emerging from the monitoring protocols enacted on the City forestlands in 1995. A new element in the 2016 AFP is the inclusion of forestlands administered by the Ashland Parks and Recreation Commission including Siskiyou Mountain Park and Oredson-Todd Woods and nine additional parcels totaling 172 acres including undeveloped portions of upper Lithia Park. This brings all undeveloped City forestlands under one management umbrella resulting in improved budgeting, planning, and on-the-ground implementation. Through the 2016 Ashland Forest Plan, the Ashland Forest Lands Commission is committed to the care and further restoration of the City forestlands and collaborative work within the broader Ashland Watershed employing ecologically responsible stewardship principles within an open and transparent community decision-making process.

Chapter 1

Social, Educational, and Political Status

Early History of Wildfire and Forest Management in the Ashland Watershed

Abel Helman built a small lumber mill on the banks of Ashland Creek in 1852. The water-powered sawmill became the nucleus of the city of Ashland, but even before our small town was established, humans manipulated the forest environment in the Ashland Watershed. Native American tribes frequently used low-intensity fire as a tool to herd deer and gather grasshoppers (Holt, 1946). These frequent low-intensity fires periodically reduced the fuel loading with the result that high-intensity, stand-destroying fire was the exception. Native American fire influence on the landscape diminished significantly beginning with the arrival of early settlers (Lalande, 2010).

Several sawmills were built on Ashland Creek, upstream from the original Abel Helman operation in the 1860s. These were small operations, utilizing minor amounts of easily harvested timber from the lower reaches of Ashland Creek to supply the wooden buildings for the new town of Ashland (Williams, 1952). During the period of 1850-1880, the Ashland Watershed was a much more open forest due to the early indigenous fire regimes, "…denuded of forest growth and covered with grass or brush." (McCormick, et al. 1992).

In 1892, the Ashland Board of Trade (now Chamber of Commerce) petitioned the federal government to protect the City's water supply. The request was honored on September 23, 1893, by President Cleveland (City of Ashland, 2014a). The Ashland Forest Reserve, which consisted mostly of the Ashland Creek Watershed, was formally designated by executive proclamation. Grazing of sheep or other livestock, a very common practice within the area, was forbidden. There were no Federal employees available to oversee protection of the Reserve until the U.S. Department of Interior began to hire rangers in 1899. Systematic fire suppression efforts began soon after (McCormick, et al. 1992). W. G. Kroepke started duty on the Ashland Reserve in spring of 1899 and remained as ranger until after the area's administrative transfer to the newly-formed Forest Service in 1906.

In 1899, John Lieberg documented logging in all of the forested areas he surveyed, including the East and West Forks of Ashland Creek (City of Ashland, 2004). Areas lower in the watershed near Ashland (T39, R1E) had been logged more heavily due to the proximity of the Ashland Creek sawmills as noted in Table 1.1.

Table 1-1 — 1899 Forest Characteristics of the Ashland Watershed

Township	Forested Acres	Non Forest Acres	Logged Acres	% culled	Forested Stand Composition (% of trees > 4") by species						
					Ponderosa pine	Sugar pine	Douglas-fir	Madrone and Oak	Incense Cedar	White fir	Noble fir
T39S, R1E	8,040	15,000	8,040	50	60	15	20	5	0	0	0
T40S, R1E	18,540	4,500	500	0	23	10	30	5	2	5	30

Note: Original document has tree stocking in T40S, R1E at 105%. The meaning of the term "culled" used in this table is somewhat unclear. Its meaning can be inferred from the following sentence: Originally of good proportion, the forest has been culled during many years and stripped of its best timber, only a trace remaining (City of Ashland, 2004).

In 1907, President Theodore Roosevelt created the Ashland National Forest which added most of the Upper Applegate area into the Ashland Forest Reserve. The Ashland National Forest was absorbed almost immediately into the Crater National Forest, with headquarters in Medford, Oregon (Lalande, 1980). The early Forest Service built a number of roads, both in the original Ashland section and in the larger addition to the west. One of the main purposes of road and trail construction was to provide firefighting crews with access into the remote portions of the unit. Due to this increased focus on suppression of fire in the National Forests, the ensuing fuels buildup had set the stage for high-severity wildfires that had previously been unlikely.

One of the worst years for wildfire in the western United States was 1910. The summer was extremely hot, dry and windy throughout the region. During August and September of 1910, Ashland Creek experienced two fires totaling about 1,280 acres. These conflagrations were doubly serious because of the threat to community watershed values. Crews composed of both local civilians and U.S. Army troops helped to control the two burns, but "the high winds prevailing...and the inexperience of the men in handling the fires resulted in large areas being burned over." Fires occurred again in 1917 and 1924 but both of these were much smaller in size (Lalande, 1980).

The first national fire policy was introduced after several decades of severe fires throughout the western United States between 1910 and 1935. In the context of the forest management theory of the time, fire exclusion was believed to promote ecological stability. In addition, fire exclusion could also reduce commodity damages and the resulting community economic losses. In 1935, the Forest Service instituted the "10 AM Policy," wherein the objective was to prevent all human-caused fires and contain any fire by 10 a.m. the following day (USDA FS and USDI BLM, 2001).

The Forest Service was particularly apprehensive regarding the Ashland Watershed, with its valuable multi-purpose forestland and large number of recreational users: "...it is important to give the Ashland watershed special fire protection...campers are quite numerous in the headwaters of streams, and some of them need careful watching in order to see that carelessness is not exercised" (Erickson, 1913).

The issue of the Ashland Watershed's protection continued in 1928 when Hosler Dam was constructed and the resulting Reeder Reservoir, a new water impoundment facility, was filled. This resulted in a Cooperative Agreement between the City of Ashland and the United States Department of Agriculture (USDA). The Cooperative Agreement gave the City of Ashland standing as a partner in all aspects of Ashland Watershed management even on federally administered lands and has been amended many times since. This legal foundation has allowed for City involvement over the years that otherwise may not have been possible.

In August of 1959, the Ashland Watershed Fire engulfed nearly 5,000 acres of timber and brush from Jackson Hot Springs to the slopes overlooking Lithia Park. The human-caused blaze threatened to spread through the Ashland Watershed but was contained. The Forest Service immediately began a program of grass seeding, tree planting, and construction of erosion control ditches and check dams to mitigate the damage (Lalande, 1980).

The earliest Forest Service timber sale occurred in 1928 when Arthur Coggins purchased ten million board feet in the upper Tolman Creek drainage. After the Depression struck in 1929, Coggins' operation limped along for a few years, but by 1933 only one million board feet had been cut and the sale was cancelled (Mason, 1934). During the boom building period immediately after World War II, the town of Ashland supported over a dozen small sawmills. The attrition rate of these family-owned operations soared in the mid-1950s, following the arrival of the large, diversified wood products manufacturers in Jackson County (Tedrow, 1954).

Between the years of 1965 and 1968, approximately 2,795 acres were logged (Table 1-2) and about 45 miles of roads were built in the Ashland Watershed (Acklin, 2015 personal communication).

Table 1-2: Forest Service Harvest Types in the Ashland Watershed 1965-68

Harvest Type	Acres	Timber Volume (Board feet)
Partial Cut	2,300	17,390,000
Clearcut	495	16,170,000
Total	2,795	33,560,000

The Initiation of Ashland Forestland Management 1990 - 1995

In 1990, the controversial sale of forestland immediately adjacent to the City of Ashland by Southern Oregon University to Superior Lumber Company initiated a vigorous community conversation focusing on how to protect forest values in the vicinity of town. To protect important scenic values on what has now become known as Siskiyou Mountain Park, the City of Ashland developed a plan to trade timber harvested on its ownership in exchange for a lighter removal of timber on the Superior parcel and the post-harvest sale of the Superior parcel to the City. This exchange opened the door for a closer examination of how the City should positively interact with adjacent forestland owners. The outcome included promoting active forest management on privately owned lands as well as laying a foundation for the 1992 Ashland Forest Plan to be implemented on City owned lands within the Ashland Watershed and the wildland urban interface (WUI).

In that same year, a Coordinated Resource Management Plan was initiated in the Hamilton Creek watershed that included properties owned by the City, the Forest Service, the Southern Oregon Land Conservancy (SOLC), and five private landowners. This more collaborative approach to forest management across ownership boundaries with project oversight from the USDA Soil Conservation Service, was the first of its kind for forest-land in southern Oregon. This process resulted in a number of important developments, including a plan for trail use in the area (excluding private owners who did not want trails), watershed-level fire management, planning across multiple ownerships, coordinating a timber sale with several owners, and a watershed-level assessment of soil erosion and sediment transport into the hydrologic network. Outgrowths of the project included the following:

- an innovative three-year program through the Job Council and Phoenix High School where at-risk students worked on forest and land management projects in the watershed, for 20 hours per week;

- a community-wide fundraising effort that led to the purchase of 120 acres that was added to Siskiyou Mountain Park resulting in a conservation easement held by the SOLC in 1992 with an additional easement for the adjacent Oredson-Todd Woods completed in 1999; and

- a more educated and knowledgeable City staff in tune with the need for, and methods of, implementing sensitive forest and resource management, particularly given the emerging understanding of the high potential for wildfire in the Ashland WUI.

In 1992, Ashland Public Works put out a request for the preparation of an Ashland Forest Plan (AFP) to provide specific management guidance for City forestlands. Ron McCormick and Associates were hired and completed the plan for the City. In the AFP, the Ashland community was described as environmentally aware, and sharing a similar environmental goals. Some of these shared goals include the following:

- preservation of the scenic beauty and mountain backdrop to the City;

- protection of the watershed from catastrophic wildfire, especially originating from within the urban interface (developed area); and

- protection of residents and property from wildfire.

Keith Woodley, hired in 1990 as the new City of Ashland Fire Chief, was handed the duties of overseeing the management of City of Ashland forestlands and administering the new AFP.

The AFP recommended that the City Council establish a Forest Lands Commission to oversee City forest management direction. Chief Woodley began initial implementation of forest and resource management activities on City-owned lands by hiring Small Woodland Services, Inc. in 1995 to provide consulting and contracting services. It has been a highly successful management relationship for over twenty years with invaluable professional forest management services applied to the City forest ownership. Simultaneously, the Ashland Department of Parks and Recreation began more active forest, fuel, and trail management activities on City park lands through efforts led by Jeff McFarland (Central Division Manager, Ashland Department of Parks and Recreation). This active management was initiated first in response to the widespread, insect-related demise of large Douglas-fir in the upland portions of Lithia Park causing a significant increase in wildfire potential as the trees died and fell to the ground. Additional forest management on Ashland Parks and Recreation forestland throughout the City also began, most notably in Siskiyou Mountain Park.

The City of Ashland continued to be innovative in developing ecologically sound strategies for managing forestlands and increasing public acceptance for active forest management throughout the early 1990s. This approach was not yet common in southern Oregon because, during the 1980s and 1990s, loggers and conservationists squared off on opposite sides of the "timber wars" that erupted across the Pacific Northwest over efforts to save the northern spotted owl under the Endangered Species Act and the creation of the Northwest Forest Plan on federal agency land in 1994.

The Active Management of Ashland Watershed Forestlands 1995 - 2015

Beginning in 1995 with the hiring of Small Woodland Services Inc. and the advisory oversight of the Ashland Forest Lands Commission, the City of Ashland began active management of their forestlands with three primary objectives:

- Protection and promotion of the City's water supply
- Maintenance and promotion of forest health
- Reduction in the fire-prone nature of the forestland through active management of vegetation and fuels

The City ownership was divided into working management units based on existing stand conditions, past management history, and the management objectives as outlined by the City. Silvicultural prescriptions were developed for key areas in the ownership and non-commercial work was begun to achieve those management objectives. Over two-hundred permanent plots were installed that provided baseline data for existing conditions including stand exam and tree data, stocking survey, canopy closure, snags, coarse woody material, soils, fuels, and vegetation composition. The entire ownership was mapped for slope stability and geologic sensitivity. These comprehensive data sets provided an ongoing source for project implementation and effectiveness monitoring. The use of a recognized scientific methodology with the support of actual data was beginning to build citizen acceptance of active forest management.

The 1990s also ushered in the beginnings of collaboration across property boundaries on public and private ownerships. In 1997, the coordinated cross-boundary prescribed burn between the Forest Service and the City was believed to be the first project undertaken using the newly-created Wyden Amendment which allowed the Forest Service to conduct needed management activities on adjacent private lands. This initial collaboration between the two primary owners in the Ashland Watershed has blossomed into the positive outcomes currently being produced under the Ashland Forest Resiliency project (AFR).

In 1994, Fire Chief Keith Woodley and civic supporters created a funding source for City forestland management from the Water Fund, which is derived from the sale of water to citizens. These dedicated funds have allowed for active vegetation management projects and focused on non-commercial thinning, brushing, as well as piling and burning as recommended in the silvicultural prescriptions. Approximately 300 acres were successfully managed on the City of Ashland ownership, reducing wildfire risk. Other work included

- conifer planting in select locations to shift long term species composition,
- native grass seeding in specific locations,
- invasive plants inventory and management/eradication plans, and
- trail maintenance and recreation management.

Due to insect-related conifer mortality and trees that were threatening the pipeline from Reeder Reservoir, tree removal projects took place and a small volume of logs was sold to local mills. Additional hazard trees were removed along trails.

The growing public acceptance for comprehensive forest management strategies resulted in the 2003 Restoration II project designed by the Ashland Forest Lands Commission. This project, involving a timber sale, used helicopter harvest systems and was completed in 2004 removing 450,000 board feet (approximately 125 log truck loads) of merchantable timber. It was primarily thinning-from-below of overstocked stands and included the harvest of fire-prone, dead Douglas-fir (approximately 30% of the total volume). The sale was completed at essentially breakeven costs to the City, and provided a model showing how removal of merchantable trees could be undertaken in a program with clear objectives, especially those related to fire management.

The Restoration II project expanded the possibilities for developing break-even helicopter projects by demonstrating that carefully planned and implemented helicopter sales could occur at low volumes per acre. Previously the minimum viable break-even harvest volume per acre was considered to be about 5,000 board feet per acre. Restoration II removed approximately 2,400 board feet per acre within budget.

This work on City lands progressively began to provide the citizens and local resource professionals with examples of how key forest management goals could be achieved in the Ashland Watershed area while simultaneously protecting both ecological and important community values.

A prominent organization in this process continued to be the Ashland Forest Lands Commission, the citizens' advisory group established in 1992 that provided a steady influx of able and active residents who gave input to City staff and provided oversight for City forest management activities. In the process, the City was able to gain direct input guiding its activities while educating the public about the complex issues of forest and resource management in the Ashland Watershed. Over the years, the list of volunteer commissioners on the Ashland Forest Lands Commission has included an impressive list of forestry and natural resource professionals. In addition, the list of non-professionals who became well versed in forest and resource management is as impressive as the list of professionals involved. They provided a much needed laymen's perspective on forest and resource management issues and brought thoughtful strategies and community-based values to the table. All meetings were open to the public, allowing additional avenues for transparent and creative citizen involvement.

In contrast to the work being completed on City forestlands, there was an ongoing Forest Service stalemate and lack of pro-active management activity on adjacent agency lands in the Ashland Watershed. A proposed timber sale in 1997, locally known as HazRed, received stiff opposition from local residents, including a vocal march on the local ranger station. Eventually, the sale was withdrawn and a new collaborative planning process was initiated by the district ranger, Linda Duffy, with a greater effort to incorporate local input. An ad-hoc group of citizens formed the Ashland Watershed Stewardship Alliance (AWSA) which began meeting regularly. This active group included a technical team of local professionals who provided recommendations to the Forest Service for management of the Ashland Watershed (Ashland Watershed Stewardship Alliance, 1999).

Eventually, a second proposal for management activity in the Ashland Watershed was offered by the Forest Service (the Ashland Watershed Protection Project) which incorporated more of the citizens' input in its design, including a proposed 17-inch diameter limit on trees to be harvested in the watershed. Interestingly, the necessity of a diameter cap was strongly opposed by a vote of group members in one of the last meetings of the AWSA, largely because of the improved understanding of the complex issues surrounding ecologically sound management in the Ashland Watershed.

The Record of Decision for the Ashland Watershed Protection Project authorized 145 acres of logging, 1,141 acres of manual treatments, 263 acres of prescribed underburning and follow up maintenance underburning on 1,152 acres (USDA – FS, 2001).

Throughout this period, as the citizens of Ashland became more aware of the complex issues surrounding protection of their water supply and the various critical resources of the entire Ashland Watershed, it was increasingly understood that the choice to do nothing was unacceptable, and that the continued likelihood of a devastating high-severity fire would threaten all of the values prioritized by Ashland residents.

A handful of important factors were key to developing public awareness and acceptance:

- Ongoing management on City forestlands, including a helicopter thinning timber sale, in 2004, provided an example of how ecologically and socially acceptable forest management could be conducted.

- Numerous public and professional tours were conducted to view City management activities, exploring the management actions in context, with extensive discussion of the merits of the project. A similar situation was also occurring on Ashland Park lands, where members of the public observed management activities designed to reduce fire danger.

- A collaborative management style was developing on private, non-industrial lands in the Ashland WUI that allowed for inclusion of ecologically sensitive forest and resource management strategies by citizens who were more poignantly aware of the potential impacts from large-scale, high severity fire.

- The ongoing role of the Ashland Forest Lands Commission encouraged citizen input while increasing public awareness and education in the process.

- Beginning in 2000, the initiation of a series of fuels reduction grants through the National Fire Plan administered by the City of Ashland for homeowners and landowners in the Ashland WUI helped citizens to directly participate and understand the importance of vegetation management activities in the larger landscape.

- Ongoing changes within the Forest Service recognized the importance of productive interaction with the local community in the development of proposed forest and resource management activities. (Of special note, Linda Duffy was temporarily removed from her position as district ranger only to be subsequently re-instated, at least in part, due to citizen protest over her removal.)

One outgrowth of this process was the designation by the Forest Service of a single, on-point individual to oversee a new developing project in the Ashland Watershed within federal ownership which ultimately became the Ashland Forest Resiliency project (AFR). This encouraged more trusting and effective community involvement in agency planning and decision making.

Through careful and persistent education, citizen distrust of active intervention in forest management was slowly replaced by the general public's ability to understand and address important issues if given adequate information and valued as participants.

This framework of knowledge and trust provided a solid foundation with which to embark on a much larger project in the Ashland Watershed in 2003-2004. Designed under the Healthy Forest Restoration Act, this project allowed for consideration by the Forest Service of a community alternative incorporated within a Community Wildfire Protection Plan. Through an extraordinary effort by a number of key players, the City of Ashland was able to design such an alternative. This community alternative was submitted to the Forest Service for consideration in 2004 and was found to be consistent with agency goals. It was then largely adopted and blended into the 2009 Record of Decision (ROD) for AFR. The acceptance of a community alternative as the foundation of the ROD was precedent setting and further cemented the viability of the collaborative process developed in Ashland and was the first of its kind under the 2003 Healthy Forest Restoration Act (Sturtevant, 2007 personal communication).

Understanding the unique relationship of the City of Ashland with the Ashland Watershed, the supervisor of the Rogue River – Siskiyou National Forest, Scott Conroy, chose to appoint two other organizations to help plan for and implement the Ashland Forest Resiliency project ROD under a Master Stewardship Agreement (MSA). Stewardship Agreements are a federal authority that allows non-federal entities to partner in implementation of federal forest land management.

The City of Ashland brought expertise to the AFR Project, including technical ability (silvicultural prescription writing, tree marking, and operational oversight), community engagement and information sharing, and advocacy for additional funding.

The Nature Conservancy, which had been instrumental in helping develop the community alternative in 2009, was added as a partner to bring scientific and environmental credibility to the project, as well as both a local and national constituency.

The Lomakatsi Restoration Project brought established contracting capabilities, a workforce training component, and good local acceptance for their ecologically sensitive approach to implementation of forest management activities.

These four organizations, with the Forest Service as both the lead and an equal partner, embarked on a collaboration strategy using the MSA to help implement this much-needed project on Forest Service administered lands. In effect, the direct grass-roots citizen involvement evolved into an operational project typical of professional management practices as conducted by the agency. Connection with the local community was maintained through active participation of the other three partners, who brought skills and community credibility to the project that might otherwise not have been available within the agency.

In 2014, a larger landscape surrounding AFR was identified for treatments to reduce wildfire potential on adjacent ownerships in a 53,000-acre footprint. In its sixth year of activity in 2015, the partnership continued to retain broad public support for its work. The partnership successfully implemented major treatments in the Ashland Watershed and continued to find a variety of funding sources, including a City of Ashland utility bill surcharge, which began in July, 2015. It has become a regional and national example of incorporating local social concerns and expertise in the development of a federal agency project.

Community Education and Outreach

An important piece of the evolution of community attitudes toward forest management is ongoing education and outreach. Proactive engagement has allowed community members to understand the ecological, political and public safety components of forestland management. Community outreach fostered by the Ashland Forest Lands Commission and the Ashland Parks and Recreation Commission along with City staff have played a significant role toward increasing the public understanding and acceptance of forest stewardship.

Figure 1-2: Forestry Division Chief Chris Chambers speaking during an AFR Public Tour
April 12, 2014

Photo courtesy of City of Ashland

Ashland Parks and Recreation Commission
The Ashland Parks and Recreation Commission has provided a variety of nature programs through the North Mountain Park Nature Center. These programs teach monitoring skills, stewardship, and interaction with the environment. Courses include bird, animal and plant identification, water quality monitoring, bird counts, geology park/field study and Native American cultural study.

Specific programs and class offerings can be viewed on the Ashland Parks and Recreation website and in the recreation guides available to all Ashland residents and visitors. There are a growing number of volunteer groups that assist with trail restoration and construction and control of invasive species. One public school program of note is the adoption of Ashland Ponds by the students at Helman Elementary School in partnership with the Lomakatsi Restoration Project and the Rogue River Watershed Council, both of which are local non-profit organizations. Students have spent many hours in study, research, and restoration of this area.

Table 1-3: Organizations / School Groups that have Participated in Forestry, Trails, and Ashland Ponds Projects with the Ashland Parks and Recreation Department; 1993 to 2015

Americorps
Ashland Court Referred Community Service Program
Ashland High School
Ashland Mountain Adventures
Ashland Parks and Recreation Commission Volunteer Program
Ashland Parks and Recreation Commission Trail Host Program
Ashland Parks and Recreation Commission Youth Conserv. Corps Program
Ashland Rotary Club
Ashland Wilderness Charter School
Ashland Woodlands and Trails Association
Boy Scouts of America
Bainbridge Island School
College of the Siskiyous
Hassell Family
Helman Elementary School
International Mountain Bike Association
Jackson County Fuel Committee
Jackson County Juvenile Restorative Community Justice
Job Council
John Muir School
Klamath Bird Observatory
Klamath Tribe
Lithia Boys Home and Girls Home
Lomakatsi Restoration Project
Medford High School
Northwest Youth Corps
National Park Service
Oregon Department of Fish and Wildlife
Oregon Department of Forestry
Oregon Parks and Recreation Department
Oregon State University Spring Break Alternative Group
Oregon State University Extension Service
Phoenix High School
RealCorps
Recreational Equipment Inc. (REI)
Rogue River Watershed Council
Rogue Valley Mountain Bike Association
Saint Mary's School
Southern Oregon Land Conservancy
Southern Oregon University Mountain Bike Club
Southern Oregon University Outdoor Education Program
The Nature Conservancy
U.S. Forest Service
U. S. Geological Survey

Figure 1-3: Lomakatsi High School Trail Crew on the Bandersnatch Trail

July, 2015

Photo Courtesy of Jeffrey McFarland, City of Ashland

Ashland Forest Lands Commission

The Forest Lands Commission's mandate incorporates elements of public education and outreach, including:

- To ensure that plans integrate diverse opinions of citizens and private land owners.

- To promote public knowledge and acceptance of the Ashland Forest Plan programs.

Specific examples include public meetings, interpretive hikes, staffing at community events, brochures and a watershed poster contest.

Table 1-4: Forest Lands Commission Outreach Activities

Activity	Timeline
Staffing Earth Day Booth	2009 to 2014
Bear Creek Salmon Festival Participation	2009 to 2014
Ashland Watershed Map Contest	2011
Forestry Interpretive Hikes and Field Reviews	1995 to present

Ashland Fire & Rescue
Ashland Fire & Rescue has implemented numerous educational initiatives on private lands through the Fire Adapted Communities Program and precursor efforts. Since its inception, there has been an increase in community wildfire awareness and acceptance of personal responsibility for mitigation, forest stewardship and knowledge of the importance of the City's forestlands.

The 2009 Siskiyou Fire and 2010 Oak Knoll Fire unfortunately demonstrated the continued potential for high-severity fire to impact the community. The Siskiyou Fire ignited on September 21, 2009 during an unusually strong east wind. Through a combination of fortunate factors, the fire was controlled before it crossed Tolman Creek Road, where it would have threatened many more homes and advanced toward the Ashland Watershed.

On August 24, 2010 a grass fire near exit 14 on Interstate 5 spread over the freeway and into the adjacent neighborhood, destroying 11 homes and damaging three more. Ashland Fire and Rescue's new *Firewise Communities* Program grew rapidly due to the community awareness created by these two wildfires.

Figure 1-4: Retardant Drop on the Siskiyou Fire

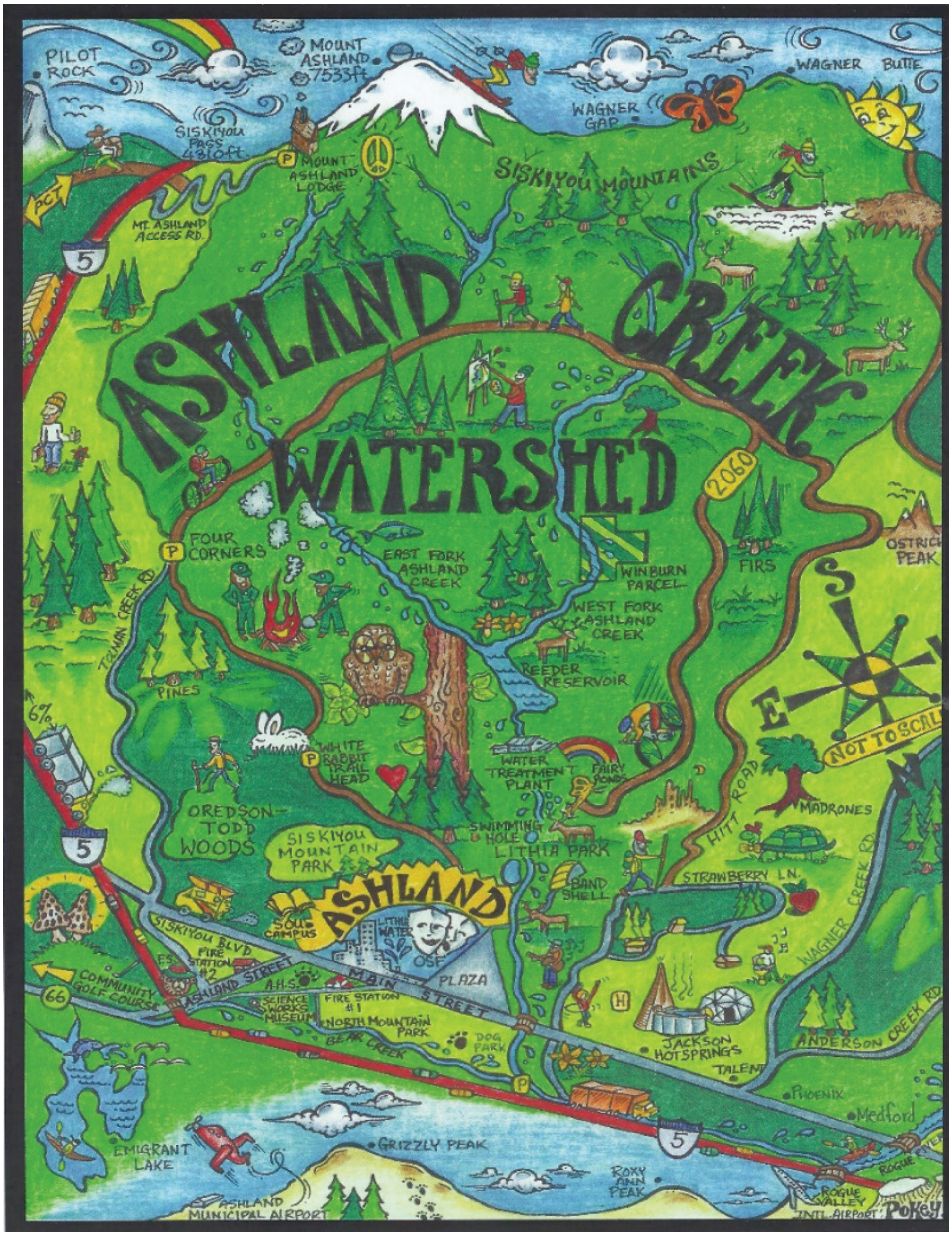
Photo Courtesy of Jeffrey McFarland, City of Ashland

Future Educational Needs
Continuation of programs that connect youth to the environment in active ways is important to their development and wellbeing, future watershed management, and the financing of programs to protect the watershed. Efforts under the AFR project brought over 2,000 students from Ashland Schools into watershed activities and education between 2010 and 2014 and will continue with additional funding in 2015. Additional efforts to integrate forest and watershed education into the Ashland School District curriculum are still under consideration, but have not been fully developed as of 2015. The City will continue to promote public knowledge and acceptance of Ashland Forest Plan (AFP) programs.

Examples of Expanding Community Involvement
Efforts to involve a broader spectrum of the Ashland community have resulted in valuable engagement of the arts and business communities.

In January, 2010, the Ashland Forest Lands Commission sponsored an Ashland Watershed Map Contest. The Commission offered a $500 prize in a competition to design a cartoon-like map of the Ashland Watershed and city. The map was intended to function as a tourist map of Ashland highlighting key features of the city and surrounding area. The contest was advertised in several local publications including two articles in the Ashland Daily Tidings. The winner was selected in April, 2010.

Figure 1-5: Winner of the Ashland Watershed Map Contest



Map courtesy of City of Ashland, artist and winner: Pokey McFarland

In 2014 the Ashland Chamber of Commerce produced a fold out map to satisfy the need for a comprehensive trail map for visitors and locals alike, and to help raise funds for the Ashland Forest Resiliency project.

The “Ashland Map” accomplished both goals and also became an effective platform for education and outreach:

> *The mission of our educational map is to create awareness, expand public understanding and foster stewardship of Ashland's outdoors and resources. With the map you will learn of the value and history of Ashland's watershed, from fire to water to a community settled because of its alluring source. While showcasing the work done by the Ashland Forest Resiliency project - past, present and future – the AFR initiative provides crucial forest management for fire protection and better access to AFR project areas to ensure the Ashland watershed is healthy and continues to provide Ashland's unsurpassed livability for decades to come. The map is produced by the Ashland Chamber of Commerce.*
>
> -Ashland Chamber of Commerce, 2014

In July 2014, the Watershed Art Group received a $3,000 grant from the Haines Philanthropic Foundation. The Watershed Art Group is a community collaborative aiming to use art to inspire, educate and involve community members of all ages in the stewardship of Ashland's forests. This funding was awarded to a local artist who created the mosaic sculpture of the Pacific fisher pictured below. The Pacific fisher, a member of the weasel family, was once thought to be rare in the Ashland area, but now AFR multi-party monitoring efforts have located over 25 of these forest carnivores in the vicinity of town. The increased understanding of the fisher's biology demonstrates an interdependent mix of community awareness of forest ecosystem values in a social and scientific context.

Figure 1-5: Watershed Art: Pacific Fisher Sculpture

Photos courtesy of City of Ashland

In April 2016, the Ashland Visitor and Convention Bureau produced the "Ashland Map Guide" which is a robust and picturesque guide to Ashland streets, parks, watershed, and trails, as well as information on Crater Lake, Table Rocks, Cascade-Siskiyou Bikeway and Sky Lakes Wilderness.

Surveys of Public Opinion, 2011 - 2015

Three separate surveys of public opinion were completed that specifically assessed the perceptions of Ashland residents regarding the importance of adjacent forestlands, the potential impacts of wildfire, the need for active management to accomplish important objectives, the effectiveness of the AFR project, and other issues. Two of these surveys were multi-year. Each survey used slightly different styles of assessment and areas of emphasis.

2011 and 2012 Shaffer et al. Surveys of Wildfire Public Opinion

In 2011, a Wildfire Public Opinion Survey (Shaffer et.al., 2011) was commissioned by the Rogue Valley Fire Prevention Cooperative (RVFPC) and the results were administered, analyzed, and published by the Southern Oregon University Research Center. A Phase Two Final Report was completed in 2012 (Shaffer et al. 2012). The intent of the project was to measure the regional public's knowledge, attitudes, and behavior with respect to wildfire prevention and preparedness. The results suggest that outreach efforts of the RVFPC and partners have been successful in raising public awareness of wildfire risk.

2011 Preister Discovery Project

Another survey of Ashland residents, The Ashland Discovery Project: Citizen Issues and Opportunities Regarding the Ashland Forest Resiliency Stewardship Project (AFR), was completed in May, 2011 by Kevin Preister, PhD., of the Center of Social Ecology and Public Policy (Preister, 2015). On behalf of AFR partners, the City of Ashland requested that the Center for Social Ecology and Public Policy use its Discovery Process™ to train and supervise a team of volunteers to engage the citizens of Ashland in conversations about their watershed. Input was provided by 213 local people through discussions with team members (139 as individuals and 74 in group settings). Preister's somewhat more personal and direct approach to community assessment through direct individual contact allowed for production of other community perspectives that might otherwise not have been obtained.

2012 and 2014 Shibley et al. AFR Public Perception Surveys

In 2012, an Opinion Survey of Ashland residents was conducted by the Southern Oregon University Research Center (Shibley et al., 2012).The study population was adult residents of Ashland, Oregon and the surrounding area. The sampling frame was registered voters in October 2011. The survey results were included in the 2012 report titled *Public Perceptions of AFR (Ashland Forest Resiliency) and Forest Restoration-Results from an Opinion Survey of Ashland Residents* and was part of a multiparty monitoring effort to track public support for this project. The report summarized results from a public opinion survey measuring beliefs and attitudes about forest conditions and management practices in the Ashland Watershed. Based on a random sample of residents in Ashland and the surrounding area, this study is part of the multiparty monitoring effort to track public opinion of the AFR project.

Summary of All Public Surveys

The three separate surveys of public opinion conducted between 2011 and 2014 present a good composite view of social opinion and public perceptions about forest and resource management in general and the work within the Ashland Watershed and interface in particular. In general, the surveys arrived at a number of very similar conclusions, with a few noticeable differences:

- The importance of the forestlands around the City of Ashland in general and the Ashland Watershed in particular as a place of special connection and high value to respondents was evident in all of the surveys, with the possible exception of the Shaffer surveys that did not address that particular issue. It was described as an important part of why people lived in Ashland, and in Shibley's first report, natural beauty and recreational use even superseded the value of the water produced from that watershed.

- All surveys reported a general and broad scale of agreement on the need to, and acceptance of, conducting active forest and resource management to accomplish important goals and objectives. All of the surveys indicated a concern for the negative effects of wildfire upon resources and other public values, and emphasized individuals' sense of vulnerability to fire. The 2014 Shibley survey found an increasing acceptance for active management and restoration in general, both locally and regionally.

- In both Preister's survey and Shibley's 2012 survey, there was a considerable lack of knowledge and understanding about the AFR project. However, Shibley's 2014 survey seemed to suggest that knowledge about AFR and its goals was increasing, although he also reported a decreased approval of AFR goals, with strong approval decreasing from 85 to 50%.

Another key finding that may be somewhat unusual regionally and/or nationally was the particularly high sense of trust amongst individual respondents for the primary organizations in the AFR project, ranging from 70-90% in the 2014 Shibley survey. Additionally, strong support for the two governmental organizations (Forest Service, City of Ashland) in both Shibley surveys (80% or greater of full trust or some trust) is suspected to be well outside of the ordinary for most of the country. Preister did not measure differences in levels of perceived trust of organizations, although he does suggest generally broad areas of trust for the project.

Conclusion

Ashland has a long history of active citizen involvement in a wide range of issues, not the least of which is interest in the natural environment. The close juxtaposition of the wildland urban interface, Ashland Watershed and the City of Ashland itself has long been a source of concern for Ashland residents. Protection of these water-producing forestland resources and the many other valuable natural assets contained in the Ashland Watershed has been of paramount importance for many decades.

However, the lack of frequent disturbance within the forest ecosystem, either natural (frequent low-severity fire, endemic levels of insect and disease, wind, landslides, etc.) or planned (thinning, prescribed fire, etc.) has resulted in an over-burdened system that is increasingly due for an uncharacteristic, large-scale, high-intensity disturbance that would be both socially and economically unacceptable. Years of social resistance to active intervention in forest ecosystems, as exemplified by the "timber wars" of the 1980s and 1990s, only further limited the potential for more ecologically appropriate management, making the area increasingly susceptible to unintended negative outcomes.

Through thoughtful and persistent education and active engagement of the Ashland community over a 25-year period, a more careful and reasoned approach to forest and land management has been implemented, first on private and municipal lands in the area, and ultimately on Forest Service land that encompasses most of the Ashland Watershed. The transition of the community from one commonly opposed to active intervention to one supportive of careful stewardship of the forest took place in a relatively short timeframe. This change is a clear example of how integrating ecological and social values can provide a unique and timely response to issues of critical importance to a forestland community. This 2016 Ashland Forest Plan hopes to move our community further in the direction of long-term, sustainable stewardship of the priceless social and ecological values that we are charged with managing.

Chapter 2

Water: Primacy and Practice

City forestlands within the Ashland Watershed are managed for the following values: preservation of municipal water quality and quantity, maintenance and promotion of forest and ecosystem health, and reduction in wildfire hazard and risk (City of Ashland, 2009).

Ashland Creek, which drains much of the northern flank of Mt. Ashland and flows through the center of the downtown area, is the primary source of municipal water. Several smaller, named creeks flow through Ashland including Clay, Hamilton, and Paradise creeks. Above Reeder Reservoir, the West Fork of Ashland Creek and Weasel Creek also flow through the City's Winburn Parcel. A wide variety of aquatic macro-invertebrates are found in the Ashland Watershed. Forest Service and Bureau of Land Management surveys have noted 25 rare or unusual taxonomy classifications in this area (Bear Creek Watershed Council, 2007).

Figure 2-1: Ashland Creek with rhododendrons in late spring

Photo courtesy of Jeffrey McFarland

Water Supply

City of Ashland customers consume a daily potable water total ranging from 2 to 7 million gallons (MG), depending on the season and weather. Hosler Dam was constructed in 1928 and the resulting Reeder Reservoir, a new water impoundment facility, was filled. Reeder Reservoir, provides 280 MG of untreated water storage, and the City maintains four tank reservoirs of treated water totaling 7.1 MG (City of Ashland, 2012). This treated water storage capacity results in approximately one day of potable water for city-wide use during the high-use season. City planners generally view Reeder Reservoir as storing approximately 40 days of water for the City. The City is also traversed by one large lateral from the Talent Irrigation District (TID), providing additional water supply in dry years.

The City's single water treatment plant, approximately one mile below Reeder Reservoir on Ashland Creek, was built in 1948 next to the City's original hydroelectric plant. This location, at the bottom of several converging canyons, is at significant risk from wildfire, floods and rock slides. The City continuously monitors the water system for over 100 contaminants including coliform bacteria, micro-organisms, herbicides, organics, inorganics, and pesticides (Bear Creek Watershed Council, 2007).

Geology and Natural Processes in the Ashland Watershed

The primary geologic formations in the Ashland Watershed are the igneous Mount Ashland batholith on the slopes of Mt. Ashland, and the sedimentary Hornbrook Formation lower down toward the Bear Creek valley floor. The batholith contains granite and other igneous rocks which readily decompose into the rounded pebbles, course sands, and granitic soils common in the upper watershed. The silty sand of the surface soil ranges from a depth of a few inches to about one foot, and is easily eroded. Landslide potentials are high, especially on slopes greater than 50% or those exposed to the elements due to natural or anthropogenic disturbance (Bear Creek Watershed Council, 2007). The bedrock of the Hornbrook Formation is mostly sandstone, shale and conglomerate, and does not erode as easily as the upland granitic soils.

Erosion and the resulting sedimentation are natural processes in the Ashland Watershed, but human activity, which may cause flooding and high-severity wildfire can accelerate these processes. Natural erosion of the Mt. Ashland granite results in the rounded stream cobbles and course sand seen in the Ashland Creek watershed. Excessive sediment in streams adversely affects aquatic habitats and the water quality needed for human uses.

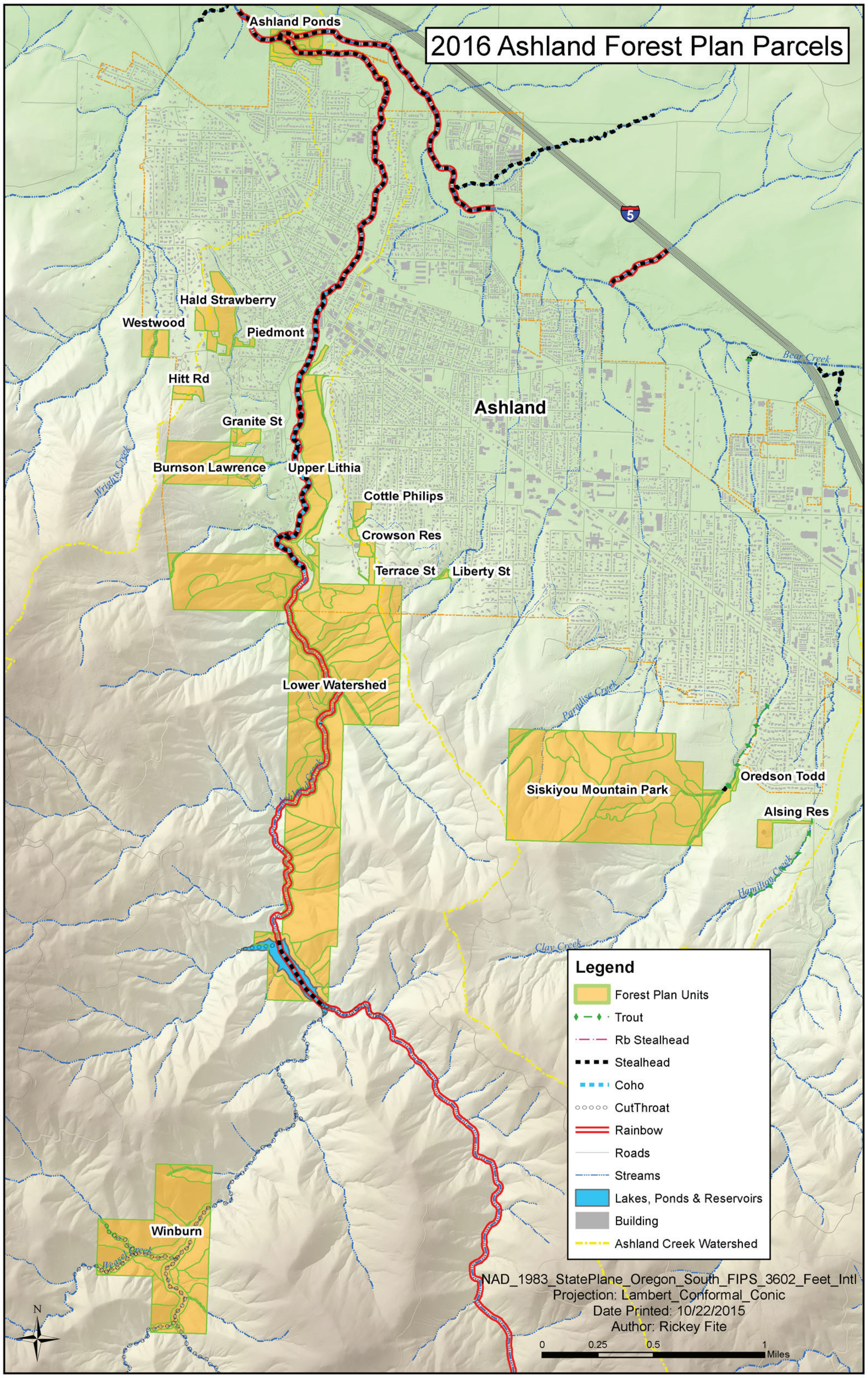
Ashland has experienced large floods every 20 to 30 years since European settlement, including 1853, 1861, 1890, 1927, 1948, 1955, 1964 (the largest), 1974, and most recently, 1997. Recent floods have overwhelmed or damaged the water and sewage systems, roads, parks, and city property, causing millions of dollars of damage to Ashland city property alone (Bear Creek Watershed Council, 2007).

The Ashland Watershed is heavily influenced by climate, with high summer temperatures and low annual precipitation. Precipitation levels increase sharply with elevation, providing an average 60 inches at the top of Mt. Ashland (7500 feet) and only 19 inches in town (1800 feet). The Ashland Water Advisory Committee commissioned a 30-year climate model for the Ashland Watershed in 2010, which predicted a modest increase in precipitation over that period, along with a 2°C increase in average temperature (City of Ashland, 2010a). Rain-on-snow events, primarily at the 3500-4000 feet elevations, are significant contributors to potential flood-stage creek flows.

Fisheries

Historical accounts indicate that Bear Creek was once “teeming with salmon” (Bear Creek Watershed Council, 2007). Bear Creek is considered a sensitive aquatic habitat by the Oregon Department of Fish and Wildlife (ODFW), and historically an important spawning tributary to the Rogue River for fall-run Chinook and winter Coho salmon, sea-run cutthroat trout, and summer and winter steelhead. The Forest Service estimates that steelhead were plentiful all the way up Ashland Creek, including the first mile of West Fork and East Fork, and within the first mile or so of Hamilton, Tolman, and Clayton creeks (USDA - FS, 1995). Current steelhead distribution on Ashland Creek is blocked by the Granite Street Dam which is well below the confluence of the East and West forks. A general overview of the creeks and fish distribution as well as City-owned parcels in the Ashland Watershed is shown in Figure 2-2.

Figure 2-2: General overview of the creeks and fish distribution on lands covered under the 2016 Ashland Forest Plan



Fisheries in the Ashland Watershed have historically supported five native salmonids:

- Coho salmon (*Oncorhynchus kisutch*)
- Chinook salmon (O. *tshawytscha*)
- Steelhead (*O. mykiss*)
- Rainbow trout (also *O. mykiss*)
- Cutthroat trout (*O. clarki*)

Coho salmon within Ashland Creek were listed as threatened under the Endangered Species Act in May, 1997. Steelhead are the anadromous (ocean-going) variety of rainbow trout. Other fish native to Bear Creek and its tributaries include Lamprey (*Lampetra tridentata*), Klamath smallscale suckers (*Catostomus rimiculus*), speckled dace (*Rhinichthys osculus*), and reticulate sculpin (*Cottus perplexus*). Fish distribution in perennial streams passing through City forestlands are listed below (table 2-1). The same information for streams managed under the Oregon Forest Practices Act is shown in table 2-2.

Table 2-1: Perennial Stream Segments with Fish Managed under the City Riparian Ordinance

(0.79 miles / 13.53 acres)

Creek Name	Miles Perennial Stream with Fish	Miles Perennial Stream	Miles Intermittent Stream	Total Stream Miles	Riparian Management Acres	Riparian Management Area
Ashland Creek AP	0.23	0.00	0.00	0.23	4.73	APR-2
Ashland Creek LW in City	0.31	0.00	0.00	0.31	2.93	LWR-1
Bear Creek	0.25	0.00	0.00	0.25	5.87	APR-1

Table 2-2: Perennial Stream Segments with Fish Managed under the Oregon Forest Practices Act

(3.04 miles / 77.71 acres)

Creek Name	Miles Perennial Stream with Fish	Miles Perennial Stream	Miles Intermittent Stream	Total Stream Miles	Riparian Management Acres	Riparian Management Area
Ashland Creek LW Out City	1.45	0.00	0.00	1.45	34.42	LWR-1
Reeder Res*	0	0.00	0.00	0.00	14.46	LW-Res
Weasel Creek	0.40	0.00	0.00	0.40	6.52	WR-4
West Fork Ashland Creek	0.77	0.00	0.00	0.77	17.92	WR-2, WR-3
Winburn Trib 2	0.13	0.11	0.00	0.24	1.58	WR-8
Winburn Trib 3	0.07	0.00	0.00	0.07	0.78	WR-7
Winburn Trib 5	0.14	0.00	0.00	0.14	1.58	WR-5
Winburn Trib 6	0.08	0.00	0.02	0.10	0.45	WR-6

**Reeder Reservoir has fish populations but no stream miles.*

Ashland Creek Fishery

Ashland Creek is an important tributary to Bear Creek with approximately seven miles of stream, extending from the headwaters of the West Fork down to the confluence with Bear Creek below the City of Ashland's Wastewater Treatment Plant. The West Fork of Ashland Creek runs through the City-owned Winburn Parcel before flowing into Reeder Reservoir, and empties a drainage of approximately 6,966 acres (Bear Creek Watershed Council, 2007). The East Fork of Ashland Creek does not flow through City property and is not discussed here.

From the City's Water Treatment Plant located along Ashland Creek approximately one mile below Reeder Reservoir, the creek proceeds through residential and commercial areas of Ashland to its confluence with Bear Creek. It is a substantially confined, narrow channel with little or no riparian area. The urban portion of the stream is considered meager fish habitat, although, between Reeder Reservoir and the Winburn Way Bridge, the stream habitat is better as it flows down through Lithia Park, but is still considered poor fish environment (Bennett, 2000). If properly restored, lower Ashland Creek would provide excellent habitat for juvenile Coho (Williams et al., 2006).

The City of Ashland has a Water Resources Protection Ordinance which specifies development guidelines and riparian buffers along streams and wetlands for all property within the city limits. Forested private lands outside of city boundaries fall under jurisdiction of the Oregon Department of Forestry and the Oregon Forest Practices Act. This law requires riparian buffers of varying widths, depending on the size of stream and whether "game fish" are present.

Figure 2-3: Reticulate sculpin

Photo © Jay deLong/Rogue River Watershed Council

Ashland Creek fisheries are divided into several distinct reaches, most of which flow through City forestlands or Ashland Department of Parks and Recreation property. The *lower reach* starts at the confluence with Bear Creek and gently slopes up to the Granite Street Dam, approximately 2.5 miles upstream. This reach contains seasonal anadromous salmonids (Coho and Chinook salmon), reticulate sculpin (*Cottus perplexis*), and rainbow trout, the catadromous form of steelhead. In electroshocking surveys during the summers of 1997 and 1998, sculpin accounted for 92-97% of all captured fish in lower Ashland Creek (Broderick, 2000). It's possible that introduced warm-water fish from private ponds and Bear Creek have found their way into the *lower reach* of Ashland Creek, including large and small mouth bass, black crappie, bluegill, catfish, brown bullhead, yellow perch, carp, goldfish, and *Gambusia* (mosquito fish). To date, several native fish including suckers, pacific lamprey and speckled dace have not been found recently in Ashland Creek, although small-scale suckers were observed near Ashland in Bear Creek as recently as 2000 (Broderick, 2000).

In August, 2012, the ODFW conducted a survey of a stretch of Ashland Creek below the Water Street Bridge, showing that stream health was improving as the result of restoration projects. In a 300-foot section of the creek, fish biologist Dan Van Dyke reported finding 246 trout fry, 180 steelhead between 3 and 11 inches long, eight Coho salmon, three Pacific giant salamanders (*Dicamptodon tenebrosus*), and 167 sculpin. Native cutthroat trout are apparently no longer present in this reach. (Wheeler, 2012).

The *middle reach* of Ashland Creek extends from above the Granite Street dam to Reeder Reservoir, and is notable for an increasing gradient and narrow canyons. Rainbow and cutthroat trout exist in this little-used reach of Ashland Creek (Bear Creek Watershed Council, 2007).

Ashland Creek, from the confluence with Bear Creek to the Granite Street dam, supports a small summer steelhead run, a January - May winter steelhead run, and November - December Coho salmon run if water levels are adequate. Ashland Creek contains about three miles of spawning and smolt-rearing area from Bear Creek to the Granite Street Dam. There is also a resident rainbow trout population from this dam all the way down to Bear Creek.

Like any urban stream, lower Ashland Creek suffers from a variety of unavoidable street pollutants which affect fish and aquatic life, including petroleum products, creosote, herbicides, pesticides, fungicides, fertilizers, and metals (Baldwin et al., 2003; Hunter and Pyle, 2004; McPherson et al., 2004). In Ashland, most storm drains and ditches run directly into tributaries of Ashland Creek or Bear Creek.

Near the mouth of Ashland Creek, the City Wastewater Treatment Plant confines the channel and treated water is discharged into the stream which elevates the overall temperature of the creek. According to the Oregon Department of Environmental Quality (DEQ), stream temperatures near the outlet frequently exceed DEQ's water temperature criteria for fish (Oregon DEQ, 2012).

Ashland Creek in Lithia Park is often closed to the public towards the end of summer due to high *Escherichi coli* concentrations. This bacteria indicates the presence of fecal matter, which enters the creek from a variety of sources including wild and domestic animals, human activity in the creek, improperly functioning septic systems, and illegal dumping. In 2010, Rogue Riverkeeper and Southern Oregon University embarked on a field study to determine the causes of *E. coli* in Ashland Creek. The resulting 2011 report found that the primary source of the bacteria was the TID outfall near the top of Lithia Park. This 12-inch diameter pipe spills TID water into Ashland Creek during the summer months to supplement low water flows due to the City Water Treatment plant out-takes upstream. The TID water did not contain significant *E. coli* before it entered city limits, but picked up the bacteria as it flowed through the southeastern part of town in an open ditch (English et al., 2011).

West Fork Ashland Creek

Above Reeder Reservoir, Ashland Creek is divided into two tributaries, West Fork and East Fork. The West Fork of Ashland Creek runs upstream approximately 2.25 miles, flowing through the City-owned Winburn Parcel. The most recent stream survey data for this reach is the 2001 West Fork Ashland Creek Stream Study (Bennett, 2001), a level-two stream survey performed by the Siskiyou Research Group for the Forest Service. The 2009 *City Forest Lands Restoration Project Phase III: Winburn Parcel* (Restoration III) describes the West Fork Ashland Creek as flowing "through a colluvial canyon with steep, narrow canyons containing moderately entrenched channels with low bankfull width-to-depth ratios and moderate to high stream gradients. This valley-type is consistent with a good portion of the creek as it flows through the Winburn parcel, particularly the portion below Weasel Creek. Aquatic habitats on the creek consist of rapids, cascades with pocket pools, and plunge pools. Another key aquatic habitat type on the Winburn Parcel, as a result of confluences with several tributaries, is alluviated canyons characterized by discontinuous floodplains, scattered terraces, and other alluvial deposits. These portions contain gravel and cobble substrates, side channel habitat, and more spawning and rearing habitat, largely due to lower stream gradients. The presence of these alluviated canyons and associated features on the Winburn Parcel is important due to their relative scarcity on the West Fork Ashland Creek." (City of Ashland, 2009.)

The United States Geological Survey (USGS) provides web pages with live and historical data on stream flow in the West Fork Ashland Creek:

http://waterdata.usgs.gov/or/nwis/uv/?site_no=14353000&PARAmeter_cd=00065,00060

Approximately 0.77 miles of the West Fork Ashland Creek flows through the Winburn Parcel. This fork has five perennial tributaries feeding it, with Weasel Creek and four other unnamed tributaries containing fish. The Forest Service conducted stream surveys of West Fork in 1969 - 1970, and again in 1990 in a survey called West Fork Ashland Creek Stream Study (WFACSS). The West Fork was surveyed again in the 2001 WFACSS. The following table is a summary of conditions found in the West Fork (Table 2-3).

Table 2-3: West Fork Ashland Creek key measurements in the past 50 years.

	July 23, 1969	Sept 17, 1990	Sept 28, 2001*
Water Temperature	58 degrees F	55 degrees F	47-52 degrees F
Stream Flow	8-9 CFS	3.3 CFS	2.3 CFS
Fish Species	Cutthroat	Cutthroat	Cutthroat
Pool/Riffle ratio	10% pools	3% pools, 11% glides	16% pools, 83% riffles
Large Wood Material	unknown	153 pieces/ mile	0.7/mile

**2001 West Fork Ashland Creek Stream Study (WFACSS), Reach 1 data*

The 2001 WFACSS reported that "cutthroat trout were the only species observed however some identification was inconclusive and rainbow trout may be present in West Fork Ashland Creek." Habitat conditions were fair to good.

Stream survey records from 1990 show that large woody material exceeded the desired amount of 100 pieces per mile. However, the 2001 survey noted that large woody material was significantly deficient. The reduction in large woody material after 1990 could be explained by major floods in the intervening years. Pool-to-riffle ratio is low. Riparian vegetation is in good condition, providing ample shade, although more conifer vegetation would be desirable.

Weasel Creek

Weasel Creek is a perennial creek running 0.4 of a mile to the West Fork of Ashland Creek. Aside from some relic commercial recreation occurring along the stream for several decades between 1890 and 1920, Weasel Creek is largely untouched by urbanization. Overall stream habitat is excellent. It is a very small stream but supports a healthy population of native cutthroat trout. A large landslide occurred during the 1962 flood, depositing large quantities of sediment into the stream.

Clay Creek

Clay Creek begins on Forest Service land and runs 0.39 of a mile through City property in the southeast corner of Siskiyou Mountain Park and the full length of the Southern Oregon Land Conservancy's Oredson-Todd Woods. This creek is not part of the Ashland Creek watershed and flows directly through residential areas in Ashland emptying into Bear Creek.

Lower reaches of this intermittent creek may be used by anadromous fish, and the Bear Creek Watershed Council summarized the creek's condition as "Moderate-quality aquatic habitat (and moderate-size fish community)." A natural waterfall in Oredson-Todd Woods prevents migration of upstream fish populations, and just below the park, fish are obstructed by many man-made barriers all the way down to the confluence with Bear Creek (Bear Creek Watershed Council, 2007).

Hamilton Creek

Hamilton Creek drains a small watershed east of the Clay Creek drainage, and flows directly into Bear Creek. Only a tiny portion of Hamilton Creek crosses City property at the Alsing Tank Reservoir. There is a native trout population at this point, primarily above the reservoir, near Tolman Creek Road. It is unlikely this population can reach Bear Creek due to piped, residential stretches downstream. The mouth of the creek may be used by anadromous fish (Bear Creek Watershed Council, 2007).

Paradise Creek

In the northwest corner of Siskiyou Mountain Park the upper reaches of Paradise Creek begin. This intermittent stream does not contain fish. Like Hamilton and Clay creeks, Paradise Creek also suffers from piped areas and barriers as it flows through residential areas of Ashland (Bear Creek Watershed Council, 2007).

Ashland Ponds

In 2008, the City began a unique collaboration with Lomakatsi Restoration Project, the Bear Creek Watershed Council, Helman Elementary School, and the Ashland Parks & Recreation Commission to rejuvenate City wetlands near the mouth of Ashland Creek, including areas along Bear Creek, Ashland Creek, and a large pond at the site of an old gravel pit called the Ashland Pond. This area was overgrown with Himalayan Blackberry and non-native grasses and trees. Since the project began, with the help of students and parents from Helman Elementary School, over 2000 native trees have been planted. With extensive blackberry clearing, heavy mulching, semi-annual weeding, fertilizing and watering throughout the hot summer months, significant progress has been made in returning this area to a more natural, open condition with native plants (City of Ashland, 2015).

Conclusion

All of these waterways play a vital role in the health of City forestlands and the health of the forest habitats used by wildlife and aquatic animals. Stream flows in Ashland Creek are usually adequate for fish production. Temperatures are within limits for spawning and rearing. Riparian vegetation and shade structures that are important for keeping water temperatures within healthy limits are adequate. However, structural habitat (pools, gravel, and hiding cover) is only fair. According to the ODFW, there are opportunities for structural habitat improvement projects.

Figure 2-4: Ashland Creek in upper Lithia Park

Photo courtesy of Jeffrey McFarland

Chapter 3

Recreation: Multiple Use Challenges and Opportunities

Introduction

The forestlands around the city of Ashland have been used for recreation by local citizens and visitors for generations (Hess, 1986). The Wildland Urban Interface (WUI) offers several gateways via in-town trailheads to forestland owned by the City and to the larger Forest Service ownership in the Ashland Watershed. At various times in Ashland's history, initiatives have been explored and implemented by different government and private entities on City forestlands to increase and enhance visitor use and promote the city as a forested destination, while at the same time managing natural resources including wildfire risk and timber harvest (LaLande, 1980).

In 2005, the City of Ashland created a Trails Master Plan (TMP) to implement the vision of providing Ashland with "a diverse network of trails that connects downtown, schools, neighborhoods, and surrounding areas." The 2005 TMP covers City forestlands as well as other City lands that do not fall under the scope of this 2016 Ashland Forest Plan (AFP). The 2005 TMP is an important reference and planning document to incorporate into City forestlands management because it uses the City's forest lands trail system as the connector from urban areas to the Forest Service managed lands, Southern Oregon Land Conservancy lands, and other ownerships in the Ashland Watershed. The 2005 TMP identified the importance of developing and maintaining City forestland trails appropriate to their natural surroundings, level of use, and with regulations in place regarding the type of use for specific trails (City of Ashland, 2006).

In recent years, Forest Service and City personnel, as well as casual trail users, have noticed a sharp increase in the number of visitors to the greater Ashland Watershed (USDA FS, 2014). This recent escalation has impacted user experiences, strained natural resources and created parking issues at trailheads on City lands. Increased use combined with the existence of unsigned trails and unsanctioned, user-created trails has generated confusion and tension for trail users.

The current management trend is to identify trails on City forestlands for specific uses or, in some cases, multiple uses depending on user demand and natural resource management objectives. Sanctioned and sustainable trails are regularly repaired, signed and maintained while unsustainable trails are eliminated. In addition, trail managers try to create a challenging and positive trail environment where some users are not motivated to build unsanctioned trails (McFarland, 2015 personal communication).

In 2011 the Ashland Woodland Trails Association (AWTA), a local non-profit organization, developed their own master plan which listed the current state of the trails system, uses, concerns, conflicts and management recommendations (AWTA, 2011). As new types of trail usage arise within the recreation community with the inevitable attendant concerns, the various interested parties in Ashland are continually working together on developing adaptive management solutions to protect and enhance the valuable resource of Ashland Watershed forestland trails.

Trail Uses

Trail use in the City forestlands include: hiking, trail running, equestrian use, and mountain biking. The purpose of regulating trails for specific uses is to reduce user conflict, enhance user experience and to protect natural resources by promoting trail sustainability. In a typical year, eight special-use permits are issued for events within the Ashland Watershed. Some of these events have been occurring for decades and since City forestlands offer gateways to the Forest Service land beyond, the permitted events are required to seek approval from both the City and the Forest Service. These events draw nationwide attention to Ashland and bring fitness enthusiasts, adventure seekers and spectators to town. Large events can adversely impact the casual trail users and may result in temporary conflicts (AWTA, 2011 and USDA FS, 2014).

Figure 3-1: A hiker enjoying walking her dog on the Liberty Street trail in Ashland, Oregon.

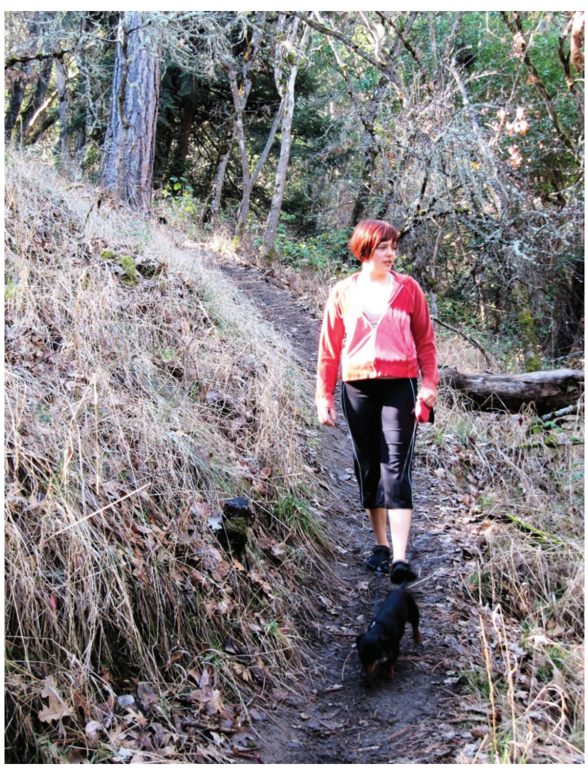


Photo Courtesy of Jeffrey McFarland, City of Ashland

<u>Hikers</u> have been drawn to the lands surrounding the city for over a hundred years. According to the Ashland Commercial Club's 1909 brochure, the Ashland Creek drainage, or "Ashland's Grand Canyon" as they called it, offers "…stillness, music, incense, light and shade and seclusion. What wonder that the young folks and old alike stroll through this cool retreat on Sunday afternoons…" (Ashland

Commercial Club, 1909). Hikers and their impacts are typically concentrated closer to trailheads and are affected by parking availability. The heaviest use occurs on the lower reaches of Road 2060 (both ends) and on the BTI, Alice in Wonderland, White Rabbit, Toothpick, Jabberwocky, and Caterpillar Trails (USDA FS, 2014). The Forest Service 2060 road is closed to vehicles for most of its length except for the portion between Morton Street and White Rabbit Trailhead and may be used by hikers looking for a longer route on a gentle grade. Many hikers and some trail runners bring dogs with them on their adventures.

Trail running has gained popularity more recently and this use often starts on City forestlands and extends to the Forest Service trails. Trail runners may start in the city itself and access Forest Service trails in the upper watershed via City forestland trails with trail runners looping via multiple trails. Other runners park at City trailheads to begin their runs. The trail running community has a history stretching back several decades of organizing weekly group runs which start in downtown Ashland and may include 10 to 20 participants. Several permitted events sponsored by the running community that use City forestland trails include the Lithia Loop Trail Marathon and the Mt. Ashland Hill Climb Run (AWTA, 2011).

Equestrian use of City forestland trails is infrequent due to the steepness of trails and lack of suitable trailer parking. It has become even less common recently due to conflicts with mountain bikers (AWTA, 2011 and USDA FS, 2014).

Off-highway vehicle use is prohibited on Ashland forestland trails.

The 2011 AWTA Trails Master Plan provides an excellent summary of the evolution of mountain biking and how it has led to new kinds of trail construction and use, and how this evolution has affected other trail users. Modern downhill mountain bikes are manufactured to go faster and achieve higher and longer jumps. Many current mountain bikers ride downhill only. The greater Ashland Watershed provides superior opportunities for rapid descent due to the approximately 5,000 foot elevation differential between Mount Ashland and the City of Ashland. These extreme downhill mountain bikers frequently finish their descents via the City forestlands trail system. With their increased speed and interest in doing tricks and jumps, their recreational needs can present a disruptive and dangerous feature when other trail users are present.

Figure 3-2: Mountain biker on Lower Waterline Trail while participating in the "Super D" race during summer of 2011.

Photo Courtesy of Jeffrey McFarland, City of Ashland

Extreme mountain bikers employ local shuttle drivers and have organized themselves to enhance their riding experience but also to reduce conflicts with other uses. One of their main concerns is that their bikes are built for a different kind of trail than the narrow switch-backing trails that previously existed on City forestlands. The lack of suitable trails for this extreme mountain biking has led to the creation of unsanctioned trails built specifically for rapid downhill descent (AWTA, 2011). Traditional mountain biking on City forestland trails still occurs, but the cumulative impact of increased numbers and intensity of the extreme mountain bikers has reduced traditional mountain biking on the trail system.

Camping is not a sanctioned use on City forestlands, but transients do use City forestlands and City forest trails for illegal camping. Homeowners with property adjacent to City forestland trails regularly express apprehension about the threat of wildfires from campfires started by this illegal activity (City of Ashland, 2014b).

Figure 3-3: Trash and cooking supplies left by illegal campers near the Gryphon trail, recorded in May, 2016

Photo courtesy of John F. Williams

Use of Ashland forestland trails for hunting and fishing is minimal due to road and Reeder Reservoir zone closures, the proximity of infrastructure and the non-hunting/fishing individuals that frequent these trails. Fortunately, there is an abundance of more accessible and appropriate forestlands for this type of activity in surrounding areas.

Cross-country skiing is rare on trails within City forestlands but has been known to occur during excessively snowy conditions. Skiers may enter forestlands from the city, but more typically they start at Mount Ashland and use Forest Service trails to descend into town, traversing over City forestland trails near the end of their expedition.

Figure 3-4: Trail overview map

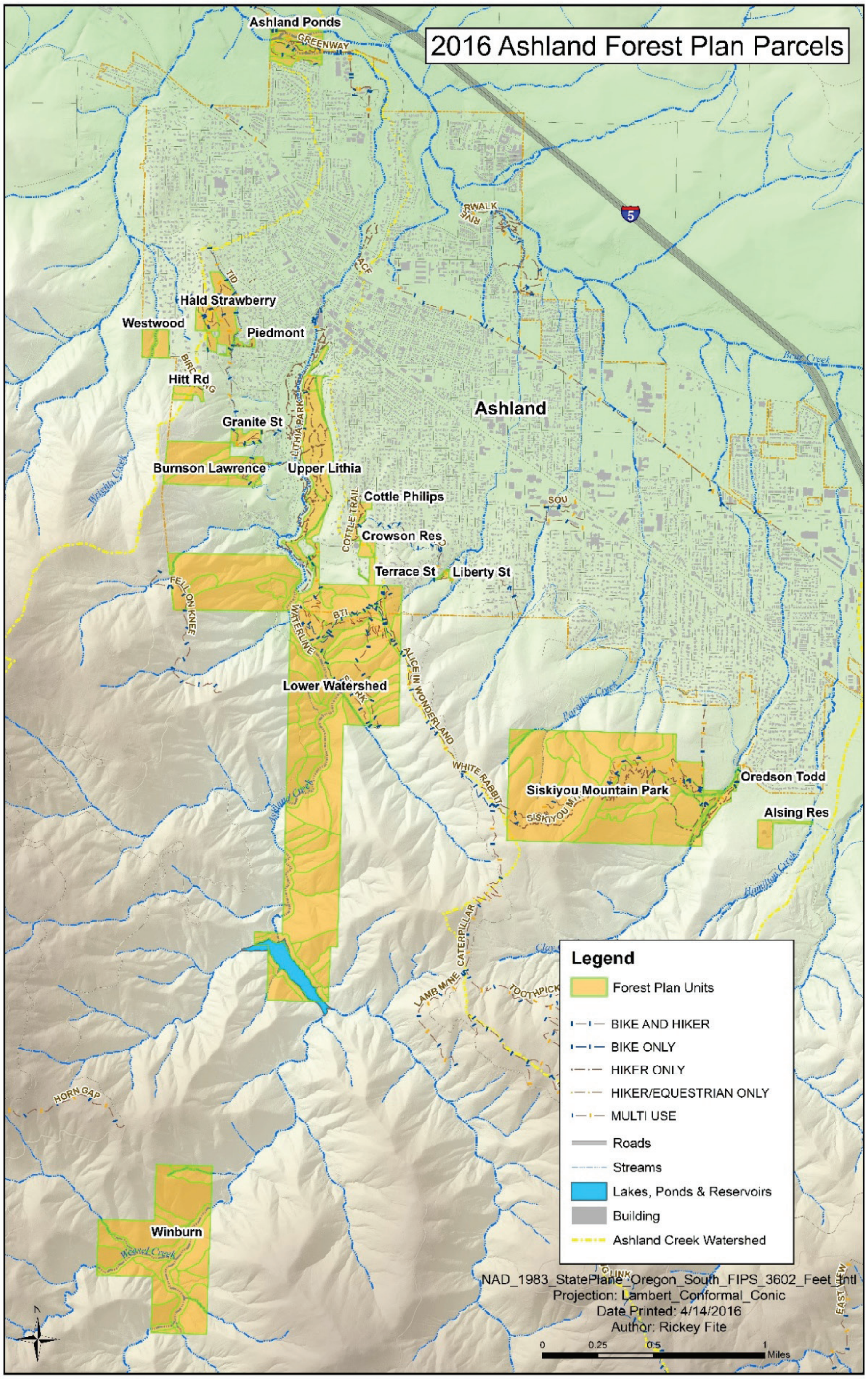


Table 3-1: The total miles of trail on City lands by use type for each parcel.

Trail use by type in miles per parcel						
Forest Land Parcels	Use Type					
	Hike Only	Hiker/Equestrian Only	Multi Use	Bike Only	Hike/ Bike Only	Total trail length
Ashland Ponds	0.15		0.27			0.42
Alsing Reservoir						0
Burnson - Lawrence	0.11		0.19			0.30
Cottle - Phillips	0.22		0.01			0.23
Crowson Reservoir	0.09		0.04			0.13
Granite Street			0.43			0.43
Hitt Road	0.05		0.05			0.05
Hald - Strawberry			1.19			1.19
Liberty Street			0.09			0.09
Lower Watershed	0.75	2.49	0.40	1.04	1.48	6.32
Oredson Todd Woods	0.5		0.28			0.78
Siskiyou Mountain Park	2.37		2.37			4.74
Upper Lithia	1.71		0.39			2.10
Total trail length per user type	**5.90**	**2.49**	**5.71**	**1.20**	**1.48**	**16.78**

Conflicts and Challenges

User Conflicts

Conflict happens in recreational settings when a user's expectation and desire for a positive recreational experience are not met. Such conflict occurs more frequently with increasing use and multiple use (USDA - FS, 2014). Conflict may arise between users in the same or different user groups. User conflict is experienced uniquely by individuals. What one individual deems as appropriate and an enjoyable recreation experience can be judged by another user as an unacceptable and unfulfilling recreational activity.

The primary user conflict in the Ashland Watershed is between downhill mountain bikers and pedestrians (hikers, runners, and dog walkers), and to a lesser extent, equestrians (USDA - FS, 2014). Pedestrians have reported becoming startled and fearful of near misses by extreme downhill mountain bike riders. The 2006 Ashland TMP also identified off-leash dogs, dog waste, and untenable noise as sources of user conflict between user groups (City of Ashland, 2006). It should be noted that the proximity of City forestlands to private residential property also creates potential user conflict between homeowners and trails users. This conflict is generally comprised of noise and visual disturbances, as well as perceived threats of trail-user created wildfires and the use of City forestland trails to establish transient camps in the broader Ashland Watershed (City of Ashland, 2006 and City of Ashland, 2014).

User conflict may be mitigated by creative trail design and by regulating the type of use on specific trails. According to the Forest Service, "…inadequate trail design can contribute to conflict because of inadequate sight distance, sharp switchbacks, narrow trails directly down the fall line, and overall inconsistent design on a particular trail" (USDA FS, 2014).

User conflict generally increases on the Ashland forestland trails closest to the city. The Forest Service has identified the east side of Ashland Creek, in the vicinity of White Rabbit trailhead, on the Alice in Wonderland, White Rabbit, and Caterpillar trails as having the highest user conflict. City forestlands that have experienced high user conflicts include the area below the BTI Trail where the Waterline Trail meets the Bandersnatch and BTI Trail intersections. The City sees an opportunity for ways to lessen user conflicts when new tie-in trails are developed to connect with the Forest Service trails in their Ashland Trails Project.

An additional area where user conflict has occurred is the top section of the Alice in Wonderland trail which traverses Forest Service land and three private properties before entering City forestland. The City has worked successfully with AWTA to obtain two of three trail easements needed to reconstruct, reroute, and separate trail traffic onto a future Alice in Wonderland trail and a new Bandersnatch trail to mitigate user conflicts. The City continues to seek the final easement to make this connection a reality.

Accessibility to trails is the most important factor that contributes to specific high-use rates with attendant high rates of conflict in the Ashland Watershed. The east side of Ashland Creek is more heavily used by extreme mountain bikers due to the easy location of shuttle drop-off points which concentrate users in this area (USDA - FS, 2014). Due to the nature of the topography and a lack of roads for shuttles, the west side does not experience a similar level of extreme mountain biking and thus user conflict is less frequent. Accessibility as a factor contributing to user conflict plays an important role in creative management of City forestlands because these forestlands serve as the gateway to the Forest Service trails and may serve as both the entry and exit through which most users obtain their trail recreation experience.

Trail Sustainability

Most of the trails within the City forestlands are authorized trails, and approximately two thirds of them receive annual maintenance with a goal of trail sustainability (McFarland, 2015 personal communication). According to the Forest Service, "a sustainable trail reflects a condition where soil movement is limited to that which can be addressed through annual or bi-annual maintenance" (USDA FS, 2014). Annual maintenance focuses on clearing vegetation to promote safe passage and sight distance, rerouting problem sections, removal of hazard trees, maintenance or replacement of trail signs, and upkeep of drainage structures to reduce erosion. The recent proliferation of unsanctioned trails provides the biggest threat for soil erosion as they are not constructed with a focus on resource protection. However, it should be noted that even sanctioned City forestland trails may suffer negative complications during unique weather events or from intense use…a complication that did not exist when the trails were originally constructed (McFarland, 2015 personal communication).

Figure 3-5: Jason Minica, Ashland Parks and Recreation Commission employee, hauling gravel with a Trail-Toter during construction of Rich's Trail above Lithia Park.

Photo Courtesy of Jeffrey McFarland, City of Ashland

In 2007, there was a marked increase in unapproved trail building for the specific purpose of increasing riding challenges for extreme mountain biking. During this time there was also an increase in reports of user conflicts (USDA FS, 2014). The construction of unapproved trails on Forest Service land, which is often accessed via City forestlands, came to a head in 2010 when a mini-excavator was used to construct unapproved trails in the area below Coggins Saddle (Four Corners). On a positive note, community outreach and education by the City, the Forest Service, and user groups has subsequently decreased the rate of unapproved trail construction (USDA FS, 2014).

Figure 3-6: Trail work crew performing "rough-in" work on new Red Queen Trail.

Photo courtesy of Torsten Heycke

Figure 3-7: High School students from the Lomakatsi Summer Youth Outdoor Program working with Ashland Parks to install crib logs on lower Bandersnatch Trail on a trail's workday. These students were from five different high schools in the area that were participating in the program. They worked with the Ashland Parks & Recreation crew for two days on the new section of Bandersnatch Trail.

Photo Courtesy of Jeffrey McFarland, City of Ashland

Management Recommendations

It is expected that the use of City forestland trails for running, hiking, equestrian use, and mountain biking will increase in the future. Users will continue to seek out high-value recreation experiences in the Ashland Watershed and utilize the City forestland trailheads to access the City forestlands themselves and Forest Service lands beyond. The City is committed to collaborating and partnering with Federal, State, and local jurisdictions, businesses, public and private schools, user groups, and individual citizens to provide trail users with a safe and gratifying experience while protecting the array of natural resources that the Ashland Watershed offers (City of Ashland, 2006). Below is a list of some specific goals identified by Jeffrey McFarland, the Central Division Manager for Ashland Parks & Recreation Commission, for the future of the city's trail systems:

- Enhance trail connectivity within the city limits (by obtaining easements, additional trail connections on right of ways, park areas, etc.)
- Develop additional sustainable and appropriate trail connections along or within several designated corridors that are identified in the 2005 TMP (i.e. Ashland Creek Corridor, Wrights Creek Corridor, Tolman Creek Corridor, Talent Irrigation District (TID) Corridor, etc.)
- Increase sustainable and appropriate trail connections in the WUI
- Work to accomplish regional trail connection goals including the Grizzly Peak Trail Connection and expansion of the Greenway Trail out to Emigrant Lake (McFarland, personal communication 2015)

To achieve these goals, the Ashland Forest Lands Commission developed the following management recommendations:

- Continue managing trails to promote sustainability and reduce the creation of unsanctioned trails
- Retain social and natural resource monitoring protocols and adaptive management strategies
- Continue community outreach and education
- Maintain collaboration with Federal, State, and local jurisdictions, businesses, public and private schools, and citizens

Chapter 4

Wildlife in the Ashland Creek Watershed

City of Ashland forestlands contain a variety of wildlife habitats ranging from the Riparian Management Areas (RMAs) through the drier lowlands, to the forests above Lithia Park and on into the Reeder Reservoir area and the Winburn parcel in the upper reaches of the Ashland Creek watershed. Throughout the varied City forestlands, there are six parcels with 20 different RMAs identified that cover 96.17 acres and 5.37 miles of stream. (See Management chapter, Tables 11-1 and 11-2 for details.) These diverse wildlife habitat areas lie on the northern slopes of the Siskiyou Mountains, a range known for its significant biodiversity (Wallace 1992). Even with significant urbanization and the resulting mix of non-native trees, this area continues to provide nesting and foraging habitat for migratory songbirds, woodpeckers, owls and other raptors as well as browse for deer and smaller herbivores, and habitat for carnivores such as raccoons, bobcats and other animals.

The Ashland Watershed, including the Winburn Parcel, is home and breeding ground for many species of birds. In fact, the Douglas-fir forests of the Pacific Northwest have the highest densities of birds of all coniferous forests in North America (Altman and Alexander 2012, Weins 1975). Many of these bird species are declining in population due to development, land and vegetation management, and possibly as a result of vegetation changes in the absence of fire. Birds are commonly used as indicator species due to their diversity and abundance, ease of census, and close associations to habitat and mobility.

Sensitive Species

Many sensitive wildlife species potentially exist on City forestlands, both within the city limits and in the Ashland Watershed. Identification and counts for these species are infrequent, with a few notable exceptions, so it is difficult to determine exactly how many sensitive species appear on City property and in what concentrations.

The state of Oregon and the federal government maintain separate lists of threatened and endangered species, although the Bureau of Land Management and Forest Service include all state listed sensitive species. Oregon's *Sensitive Species Rule (OAR 635-100-040)* defines "sensitive species" as those which are facing one or more threats to their population or habitat. Species added to this list are often candidates for the more stressed designations of "threatened" or "endangered."

The Winburn Parcel provides some dispersal and foraging habitat for the spotted owl and other raptors. The spotted owl prefers dispersal habitat where forests contain average tree diameters greater than 11 inches (28 cm), greater than 40% canopy cover, and open areas under the canopy for flight (Davis and Lint, 2005). Some areas have the potential to meet nesting, foraging and dispersal habitat requirements for spotted owls, primarily along the riparian corridor of Ashland Creek. Legally mandated protection of spotted owl habitat values is an important consideration affecting management directions and possibilities.

The rare Pacific fisher (*Martes pennanti pacifica*) was not known to occupy the Ashland Watershed until work on the Ashland Forest Resiliency (AFR) project began in 2010. Of the 26 fishers discovered by the Forest Service throughout the Ashland Watershed in 2015, telemetry shows that fishers sometimes enter Siskiyou Mountain Park. The United States Fish & Wildlife Service (USFWS) determined in April of 2016 not to list the Pacific Fisher as threatened under the federal designation.
The U.S. Fish and Wildlife Service reversed course from its earlier stance of 18 months ago and declined threatened-species protection for fishers in part because of voluntary and proactive wildfire and conservation measures improving forest health and fisher habitat in Ashland Watershed forestlands.

Figure 4-1: Pacific Fisher

Photo Courtesy of US Fish & Wildlife Service

General Management Goals for Wildlife

In 2009, *City Forest Lands Restoration Project Winburn Phase III Parcel* spelled out wildlife goals for the Winburn parcel.

Efforts will be made to increase the structural diversity of forest stands across the landscape.

Hardwoods, especially California black oak, will be retained and encouraged where appropriate.

Existing canopy gaps will be utilized to maintain structural diversity across the landscape.

Where possible, a multi-layered canopy will be retained or encouraged. Fuel hazard and density-reduction goals will be weighed with other goals.

Additional coarse woody material will be added to the forest floor, if a need has been identified on a unit basis, to provide needed micro-habitats.

Snags will be retained unless they pose a hazard or conflict with other management objectives.

Should removal of non-commercial trees be inadequate to reduce stand densities to desired levels, snag creation, as opposed to removal of large trees, will be considered to meet future snag and coarse woody material goals.

Cutting trees within riparian transition zones (100-300 feet of streams and draws) will be minimized if fuel hazard reduction goals can be met. Within riparian zones, thinning will entail either girdling or retention of downed trees on site as coarse woody material unless there is an associated hazard.

While recognizing that there will be an effect on terrestrial mollusks, salamanders and other organisms, activities will minimize the impact on terrestrial wildlife.

Several common wildlife species within Ashland are considered nuisance animals by some residents and staff, including raccoons, deer, and turkeys. Sightings of black bears and mountain lions within city limits result in special warning signs posted at nearby City parks and properties to help minimize surprise encounters, although there is no record of any such encounters resulting in human injury. In August, 2015, Mayor John Stromberg held a "Deer Summit" to garner public input on Ashland's growing deer population and potential management strategies. No consensus was reached at that meeting.

Figure 4-2: Deer in Lithia Park

Photo Courtesy of John F. Williams

Chapter 5

Climate Change: Global Yet Local

An emerging science is currently being developed to address projected global climate change. The subsequent impacts on forest ecosystems and human values, and the opportunities for adaptation of management strategies to accommodate these changes is a new and unsettled field of study. Given a high level of uncertainty about specific changes in the Ashland Watershed from impending climate change, most frameworks for present and future management suggest flexible approaches, ongoing monitoring, learning, and subsequent adaptive management. Important changes in forest and resource management strategies will have to occur on a much larger spatial and temporal scale than addressed in this 2016 Ashland Forest Plan (AFP). However, it is not a responsible option for the City of Ashland to do nothing.

The City will be challenged to integrate adaptive strategies that help ecosystems accommodate climate changes over time while encouraging mitigation strategies in our own jurisdictions that can help reduce human-caused influences on global climate. Adaptive strategies include *resistance options* (delay the impacts and protect highly-valued resources), *resilience options* (improve the capacity of ecosystems to return to desired conditions after disturbance), and *response options* (expedite transition of ecosystems from current to new conditions). Mitigation strategies include reducing overall greenhouse gas emissions and maximizing options to sequester carbon because forests are widely thought to be the most efficient terrestrial carbon accumulating system (Millar et al., 2007).

Management Objectives

Fortunately, management objectives and implementation strategies initiated over 20 years ago on City lands will continue to have climate-change relevance under the 2016 AFP, and contribute to the larger landscape's ability to adjust to future variability in temperature and precipitation. These management objectives include:

- reducing the likelihood of high-severity fire through strategically placed fuels treatments and subsequent implementation of prescribed underburning to maintain reduced fuels and less fire-prone conditions;

- managing for both development and maintenance of older forests that may sequester and retain large amounts of carbon over time;

- focusing on protection and restoration of diverse forest structures, plant communities and associated genetic resources which are important mechanisms of resilience;

- emphasizing multiple species management including species well-selected to thrive in future warmer and drier conditions such as pines, hardwoods and shrub species (within prescribed spatial considerations for their potential to aggravate fire potential and hazard); and

- monitoring and control of invasive species that are prone to establishment and/or expansion in changing climates.

The short-term focus for the City forestlands managed under the 2016 AFP will continue to be on adaptive strategies that improve overall ecosystem resistance and resilience from major perturbations, most notably from high-severity wildfire. This focus is of paramount importance for the City, not only on our lands but on associated Forest Service lands in the Ashland Watershed. The management dilemma that consistently presents itself is the conflict between strategies that reduce high-severity wildfire (namely, reductions in stand density and associated fuels that lessen the likelihood of potential negative impacts from a high-severity disturbance from insects and/or wildfire) and the above mentioned climate-change mitigation strategies (that is, maximizing options to sequester carbon because forests are widely thought to be the most efficient terrestrial carbon accumulating system).

The widely accepted hierarchy of community values attributed to forestlands in the Ashland Watershed, including municipal water production, late-successional and at-risk species habitat, and community recreation, must be able to live alongside compromises to those values that are driven by management strategies reducing the potential of high-intensity wildfire. This suggests that stand-density reductions and fuels management will continue to be an integral part of City forestlands policy. This is even more important given the potential for wildfire impacts on lives and property within the Ashland wildland urban interface.

These management directions may, in fact, not be positive in terms of *mitigation strategies* that sequester carbon and/or reduce the carbon footprint in the short-term, i.e., they could be carbon neutral or even a net negative. However, until such time that the Ashland Watershed morphs into a more resistant and resilient condition in the face of high-severity events, active management to reduce this potential and protect the important multiple values will continue to be prioritized above retention of trees solely to achieve short-term carbon sequestration.

The City will continue to use, whenever possible, multiple conservative interventions in the manipulation of vegetation that provide incremental steps and reversible directions if needed. These vegetation manipulations will be designed to, on the one hand, reduce the potential for high-severity insect, disease and/or fire-related events through strategic biomass reductions. And, on the other hand, emphasize strategic retentions that minimize potential adverse effects from slope failures and debris slide initiation, which will likely increase in frequency with the more severe storm events predicted in future climate change scenarios. Balancing these objectives will be a continuing challenge in the years to come.

The City will continue to rely on increasing our understandings of historical ecology that will inform us about past environmental dynamics and ecosystem responses to changes in our watershed over the past 150 years and earlier. This plan recognizes that we should not rely on past forest climate conditions and assume a steady weather regime to provide us with adequate targets for current and future management. More important than identifying historically accurate analogs is understanding the dynamics of vegetation development, functional processes and disturbance ecology that have produced existing species combinations and stand structures and how they developed into the conditions we have today. The 2016 AFP is designed to move existing stand and vegetation conditions, through "planned disturbances," to conditions that are both more resistant and resilient to major perturbations, but also help achieve current City designated objectives.

Conclusion

The City forestlands and the conjoined Ashland Watershed are uniquely positioned to test future impacts associated with climate change given the steep environmental gradient and eco-system variation that exists in the eight linear miles from downtown Ashland to the top of Mt. Ashland. Temperature and moisture regimes, which are the key environmental factors that will be modified with climate change exist in a wide variation within this swath of forestland. The naturally occurring differences makes for an ideal location from which to assess changes to individual vegetation and animal species over time and to identify adaptations and make adjustments.

The City is in a notable position to monitor changes over time, and perhaps help discern the rate of change and the consequences related to climate change through the continued use and analysis of existing and future data acquired through monitoring on City forestlands. This will help test the effectiveness of existing strategies aimed at improving resistance and resilience of our forests, as well as testing future *response options* and/or *mitigation strategies* relative to climate change.

At some point in the future, a more resistant and resilient vegetation on a landscape level will occur at which time long-term retention of the ensuing robust vegetation profile will hopefully provide important and sustainable carbon sequestration values.

Chapter 6

Invasive Plants: A Nuisance By Any Other Name

Invasive Species - A non-native species whose introduction is likely to cause or has the potential to cause economic or environmental harm to an ecosystem or harm to human health or commerce (Clinton, 1999).

Noxious weeds - A term that generally refers to native or non-native plants introduced into an ecosystem that tend to be aggressive, poisonous, toxic, difficult to manage and/or otherwise undesirable or threatening for healthy ecosystem functioning (City of Ashland, 2009).

The terms *noxious weed* and *invasive plant* are sometimes used interchangeably, which is not always accurate. All noxious weeds are invasive, whereas not all invasive plants are noxious weeds. Decades ago, agency control programs targeted plants that had adverse effects on human health, agriculture, and livestock. Those plants were then called *noxious weeds*. In recent years, control programs have included plants that had adverse ecological effects, particularly exhibiting the detrimental invasive habits and they were labeled *invasive species*. Today, noxious weeds and invasive plants are both generally regarded as plants with adverse social, economic, or ecological effects. Generally, noxious weeds take a higher priority because of their more aggressive nature and propensity to cause greater ecological or other detriment. Plants that may be less aggressive state-wide, could be more aggressive within the Ashland Watershed ecosystem and be considered locally noxious. For example, this is the case for both noxious pampas grass and butterfly bush along portions of the Oregon Coast, though those plants are not considered noxious in our inland valley environment.

Integrated Pest Management Policy

On lands administered by the Ashland Parks and Recreation Commission, invasive plant populations will continue to be managed under the existing Integrated Pest Management Policy adopted by the Ashland Parks and Recreation Commission on May 24, 2010 and last revised on April 28, 2014 (City of Ashland, 2010b). Ashland Parks and Recreation Commission's Integrated Pest Management Policy is based on park planning and design, manual maintenance, ecological and organic controls, and, as a last resort, use of chemical herbicides. The Commission works to reduce or eliminate the use of herbicides and will conduct an annual review of invasive plant management activities to further reduce herbicide use and seek effective alternatives.

On City forestlands, under the stewardship of the Ashland Forest Lands Commission (AFLC), the removal/eradication guidelines are consistent with the City's historic management of noxious weeds without the use of chemical herbicides with a process for City Council approval if a rare ecological threat is identified.

Types of Invasive Plants

Invasive plants come in many varieties and sizes, from trees to vines to shrubs, and the damage they can cause is just as varied. If left unchecked, many invasive plants can cause the eventual demise of desired plant species, alter wildlife habitat or directly threaten animals, choke waterways, or increase the intensity of a wildfire.

Trees
Invasive trees usually seed themselves very rapidly or root sprout, and become too abundant in the landscape, thereby outcompeting wanted varieties. Removals are generally manual and involve chain-saws and excavation. The long-term control technique is simply aggressive removal so they do not reseed. For a tree stump or root sprout, removal might include a cut and treatment with herbicide for control in a specialized circumstance in accord with the proper City policy guidance.

Shrubs and Vines
Shrubs and vines come in many different forms, from blackberries to English laurel. They tend to smother an area causing a loss of landscape plant diversity and can have detrimental effects on larger specimen trees. Non-native invasive shrubs and vines typically outcompete the surrounding plants as they possess an advantage in their new environment because the insects, diseases, and animals that would normally control them are often not found here. Damage to surrounding trees can range from excessive weight causing limb or full stem breakage down to superior ability to consume available water and soil nutrients.

Removal can include manually lopping and sawing some of the larger areas and, in the case of blackberries, cutting them down with a tractor mounted flail mower. Eradication of invasive shrubs and vines becomes challenging when they are mixed with desirable plants, a situation that involves a labor-intensive removal procedure. Long-term control techniques may include systematic continual removal only, or cutting and treating each stem with an herbicide in a narrowly targeted special circumstance following City policy.

Grasses/Annuals
Invasive grasses and grass-like plants can blanket receptive landscapes and prove challenging to control. Some propagate by use of stolons (rooting structures that spread along or under the ground) that produce more plants

from the roots. Annual grasses such as hedgehog dogtail reseed themselves every year and can become difficult to control.

Annual plants (non-grasses) can also be challenging. Examples are yellow star thistle (*Centaurea solstitialis)* and puncture vine *(Tribulus terrestris)*. Like annual grasses, annual invasive plants spread by seed and can be extremely aggressive and resist control. The seed source needs to be eliminated each year until seeds are exhausted. Removal can be manual, by machine, or even by carefully applied fire during the right season (usually fall).

Ground Covers

Invasive ground covers can smother susceptible large areas and outcompete native and desired plants. An example of an invasive ground cover is *Vinca major* also known as Bigleaf periwinkle. These ground covers are hard to remove because of all the rooting locations. Removals can be manual, by machine (if areas allow), or by using cardboard for an extended time to smother plant material. Long-term control involves vigilance in eradicating the new shoots as they arise by manually removing or possibly using narrowly applied herbicide applications in a persistent outbreak following City policy.

Rooting Species (Rhizomes)

Some species survive and spread via various pathways, including underground. The challenge is that pieces of the plant, such as root (rhizome) pieces or stem segments, can easily relocate and start a new colony elsewhere. Removal/eradication can take all forms—from manual to chemical. Long-term control takes persistent prescriptions from cut, remove, and digging to burning or possible biological or chemical treatments with the proper City policy guidance.

During the development of the 2016 Ashland Forest Plan (AFP), existing City documents were reviewed and a comprehensive list of invasive plants that occur on City lands was created. This list can be found in the Inventory chapter and will standardize the invasive plant species nomenclature used in the 2016 AFP.

The 2016 AFP Attribute Table lists invasive plants by unit, logs the last year treated, and type of treatment(s) accomplished. Each unit also has recommendations for the next invasive plant treatment and the projected year the treatment(s) will be accomplished.

Invasive Plant Treatment Definitions

IST-1) Manual treatments - mowing, weed-eating, cutting, grubbing, mulching, pruning, pulling/weeding, burning, root barrier installation, piling and burning, smothering

IST-2) Mechanical Treatment – brush flail

IST -3) Herbicide Treatments - organic herbicide spraying, cut/puncture/drip organic herbicide application, herbicide spraying, manual herbicide application, cut/drip herbicide application.
(City of Ashland, 2011)

Chapter 7

Infrastructure: The Ties That Bind

Infrastructure generally includes the public works facilities that enable the transport of people and goods, provision of municipal water, safe disposal of waste products, provision of energy, and transmission of information. There is a variety of infrastructure units in City of Ashland forestlands:

- transportation (roads and trails)
- public utilities (lines and appurtenances)
- buildings
- yards
- structures (includes reservoirs, dams, bridges, storage tanks, and pump stations)

Infrastructure may be impacted by City forest management activities, so a listing of infrastructure by unit is included in the 2016 Ashland Forest Plan (AFP). Management of infrastructure is not part of the 2016 AFP.

For the 2016 AFP, the specific existing infrastructure components fall into the category of publicly owned roadways, easements, wire, pipes and other appurtenances used for provision of public services such as electrical power, drinking water, irrigation water, sewage, overflow drainage and transportation.

Table 7-1: AFP Infrastructure

AFP Infrastructure Category	AFP Infrastructure Category Definition
Electric Fixtures	transformers, sectionalizing (splicing) cabinets, handholes, meters, lights, and poles
Electric Lines	electrical conductors underground in conduit or overhead suspended by cables
Sewer Fixtures	sewer manholes, cleanouts, and pump stations
Sewer Lines	underground sewer piping normally “6” diameter and larger
Storm Fixtures	manholes, ditch inlets, catch basins, curb inlets, vaults
Storm Lines	drainage piping including culverts and siphons, generally 12” in diameter
Water Fixtures	valves, vaults, hydrants meters, and flow control devices
Water Lines	irrigation or potable water mains normally “6” diameter and larger

Table 7-2 below aggregates current City-owned roads and utilities by Ashland Forest Plan Unit. Roads are given in lane-miles; linear features are given in feet of length; fixtures are shown as counts. Several forest management units have no City infrastructure units.

Table 7-2: Current City-owned Roads and Utilities by Ashland Forest Plan Parcel

Unit	Road (ln-m)	Drain Fix-tures	Drain Lines (ft)	Electrical Fixtures	Electrical Lines (ft)	Sewer Fix-tures	Sewer Lines	Water Fix-ture	Water Lines
AP		3	426			5	1282		
AR								8	2511
BL		1080							
CR		1	230	6	162	2	250	15	1310
GS		898							
HR									
LS						8		3	201
LW	7	1	572	40	12927	14	4713	4	15000
P					49				
TR								1	5
UL		4	1405	15	1435			6	2039
WP		1	33					1	7
Total	**7**	**1988**	**2666**	**61**	**14572**	**29**	**6246**	**38**	**21072**

Current Conditions

There are numerous structures owned and managed by the City that are either on or directly adjacent to City forestlands which may be impacted by forest management activities. Table 7-3 below lists the most significant of those structures, with the structures inside the 2016 AFP managed lands shown in ***Bold Italics.*** A map is provided in the appendix showing the locations of these structures with respect to the most significant location-specific natural hazards:

- landslide susceptibility
- 100 and 500 year probability flood boundaries
- dam inundation boundaries
- wildfire hazard zone boundaries

Table 7-3: Buildings, Structures, and Maintenance Yards by type

No	TYPE	Year built	Size	Unit
	OPEN RESERVOIRS/DAMS			
1	***Reeder Reservoir/ Hosler Dam***	1928	800 AF	
2	East Fork Diversion Dam	1909		
3	West Fork Diversion Dam	1909		
4	"Swimming Hole"	1890		
5	***Jones and Bryant Reservoir ("Ashland Ponds")***	1972	11.8 AF	
	POTABLE WATER STORAGE TANKS			
6	Granite Reservoir	1949	2.1 MG	
7	Crowson Reservoir	1927	2.1 MG	
8	***Alsing Reservoir***	1983	0.5 MG	
9	Fallon Reservoir	1994	2.1 MG	
10	***Loop Road Reservoir (proposed)***	2018	0.2 MG	
11	***Crowson 2 Reservoir (proposed)***	2018	2.1 MG	
	BRIDGES (* indicates replacement date)			
12	***Granite Street Bridge over Ashland Creek***	1997*		
13	***USFS 2060 access over Ashland Creek***	1997*		
14	***WTP over Ashland Creek (2 bridges)***	Unknown	30'+/-	
15	***WTP to Dam over Ashland Creek (6 bridges)***	1997*	30'+/-	
16	***East Fork Bridge***	2000	22'	
17	***West Fork Bridge (proposed)***	2018	55'	
	POTABLE WATER PUMP STATIONS			
18	Terrace Street Pump Station (TID)	1977		
19	***Park Estates Pump Station Vault***	1982		
20	***Strawberry Pump Station***	1994		
21	Duck Pond Pump Station (TID)	2008		
	BUILDINGS			
22	Parks Dept Main Offices	unknown		
23	Lithia Park Storage Building	unknown		
24	Lithia Park Restrooms	unknown		
25	Butler Bandshell	1947		
26	***Hydroelectric Powerhouse***	1911		
27	***Water Treatment Plant ("WTP"): 5 buildings***	1995*		
28	***Water Treatment Plant (proposed)***	2018		
	MAINTENANCE YARDS			
29	***"Granite Pit" aggregate storage***	unknown		
30	***Glenview Concrete Reclamation Yard***	unknown		
31	***Glenview Pipe Storage Yard***	unknown		

Chapter 8

Inventory

Inventory information for the 2016 Ashland Forest Plan can be found on the City of Ashland website: http://gis.ashland.or.us/2016afp/

This section of the 2016 Ashland Forest Plan (AFP) presents essential information in the form of lists, data sets, color schemes, and a specialized GIS Data Dictionary for interpreting data sets.

Table 8-1: Native Plant List (USDA NRCS 2016)

Scientific_Name	Plants_Sym-bol	COMMON NAME	Notes
Abies concolor	ABCO	White fir	uncommon
Acer macrophyllum	ACMA3	Big-leaf maple	riparian
Achillea millefolium	ACMI2	Common yarrow	openings
Achlys triphylla	ACTR	Vanillaleaf	
Achnatherum lemmonii	ACLE8	Lemmon's needlegrass	
Adenocaulon bicolor	ADBI	Trail-plant pathfinder	
Agoseris heterophylla	AGHE2	woodland agoseris	
Agoseris retrorsa	AGRE	spear-leaved agoseris	
Aira caryophyllea	AICA	Silver hairgrass	
Alnus rhombifolia	ALRH2	white alder	riparian
Amelanchier alnifolia	AMAL2	Western serviceberry	not abundant
Amsinckia intermedia	AMIN3	fireweed fiddleneck	
Anaphalis margaritacea	ANMA	Common pearly-everlasting	
Anemone deltoidea	ANDE3	Threeleaf anemone	
Anthriscus caucalis	ANCA14	bur-chervil	
Aquilegia formosa	AQFO	Sitka columbine	
Arabis oregana	AROR	Oregon arabis	oak openings
Arabidopsis thaliana	ARTH	mouseear cress	
Arbutus menziesii	ARME	Pacific madrone	
Arctostaphylos patula	ARPA6	Greenleaf manzanita	
Arctostaphylos viscida	ARVI4	Whiteleaf manzanita	
Arrhenatherum elatius	AREL3	Tall oatgrass	
Athysanus pusillus	ATPU	sandweed	openings
Balsamorhiza deltoidea	BADE2	Puget balsamroot	
Berberis aquifolium	BEAQ	Tall Oregongrape	

Table 8-1: Native Plant List (cont)

Berberis nervosa	BENE2	Dwarf Oregongrape	
Boschniakia strobilacea	BOST2	Ground-cone	
Bromus carinatus	BRCA5	California brome	
Bromus tectorum	BRTE	cheat grass	
Calocedrus decurrens	CADE27	Incense-cedar	
Calochortus tolmiei	CATO	Tolmie's mariposa	
Calypso bulbosa	CABU	Fairy-slipper	
Campanula prenanthoides	CAPR15	California harebell	
Campanula scouleri	CASC7	Scouler's harebell	
Cardamine nuttallii	CANU17	slender toothwort	
Cardamine oligosperma	CAOL	Little western bittercress	
Carex multicaulis	CAMU5	Manystem sedge	
Castilleja	CASTI2		
Ceanothus cuneatus	CECU	Buckbrush	
Ceanothus integerrimus	CEIN3	Deerbrush	
Cerastium glomeratum	CEGL2	sticky mouse ear	
Cercocarpus montanus	CEMO2	Birchleaf mountain-mahogany	
Chimaphila umbellata	CHUM	Common prince's-pine	
Cirsium	CIRSI		
Clarkia rhomboidea	CLRH	Common clarkia	openings
Claytonia perfoliata	CLPE	miner's lettuce	
Claytonia rubra rubra	CLRUR	red miner's lettuce	fire rings
Collinsia grandiflora	COGR2	Large-flowered blue-eyed Mary	
Collinsia linearis	COLI	Narrow-leaved blue-eyed Mary	
Collinsia parviflora	COPA3	Small-flowered blue-eyed Mary	
Cornus nuttallii	CONU4	Pacific dogwood	
Cryptantha	CRYPT		
Cryptantha intermedia	CRIN8	common cryptantha	
Cynoglossum grande	CYGR	Pacific hound's-tongue	
Cynosurus echinatus	CYEC	Hedgehog dogtail	
Cystopteris fragilis	CYFR2	Brittle bladderfern	
Cytisus scoparius	CYSC4	Scotch Broom	Invasive
Dactylis glomerata	DAGL	Orchard-grass	
Daucus pusillus	DAPU3	little wild carrot	openings
Deschampsia danthonioides	DEDA	little deschampsia	
Dichelostemma capitatum	DICA14	bluedicks	
Draba verna	DRVE2	Vernal draba	
Elymus glaucus	ELGL	Blue wildrye	
Epilobium brachycarpum	EPBR3	parched fireweed	

Table 8-1: Native Plant List (cont)

Erodium cicutarium	ERCI6	Redstem stork's bill	
Erythronium hendersonii	ERHE7	Henderson's fawn-lily	
Festuca californica	FECA	California fescue	openings
Festuca occidentalis	FEOC	Western fescue	
Fragaria vesca bracteata	FRVEB3	Woods strawberry	
Fritillaria recurva	FRRE	Scarlet fritillary	
Galium ambiguum	GAAM2	Obscure bedstraw	
Galium bolanderi	GABO	Bolander's bedstraw	
Galium triflorum	GATR3	Fragrant bedstraw	
Garrya fremontii	GAFR	Fremont silk-tassel	
Githopsis specularioides	GISP3	common bluecup	openings
Goodyera oblongifolia	GOOB2	Rattlesnake-plantain	
Heterocodon rariflorum	HERA3	little oak flower	openings
Hieracium albiflorum	HIAL2	White-flowered hawkweed	
Hieracium scouleri	HISC2	Scouler's woollyweed	
Holodiscus discolor	HODI	Creambush ocean-spray	
Hypericum perforatum	HYPE	Klamath weed	
Hypochaeris radicata	HYRA3	false dandilion	
Iris chrysophylla	IRCH	Slender-tubed iris	
Koeleria macrantha	KOMA	prairie junegrass	openings, ridges
Lathyrus nevadensis	LANEP	Sierra pea	
Lithophragma parviflora	LIPA5	Smallflower fringecup	
Lithospermum californicum	LICA11	California stoneseed	
Lonicera ciliosa	LOCI3	Trumpet honeysuckle	
Lonicera hispidula	LOHI2	Hairy honeysuckle	
Lotus micranthus	LOMI	Small-flowered deervetch	
Lupinus	LUPIN		
Lupinus bicolor	LUBI	miniature lupine	
Luzula comosa	LUCO6	field woodrush	
Luzula parviflora	LUPA4	Smallflowered woodrush	
Madia exigua	MAEX	little tarweed	
Madia madioides	MAMA	Woodland tarweed	
Maianthemum racemosum	MARA7	false Solomon's-seal	
Maianthemum stellatum	MAST4	starrySolomon's-seal	
Melica	MELIC		
Microsteris gracilis var. gracilis	MIGRG4	pink annual phlox	
Moehringia macrophylla	MOMA3	big-leaf sandwort	
Moenchia erecta	MOER	moenchia	

Table 8-1: Native Plant List (cont)

Montia parvifolia	MOPAP	small flowered miners lettuce	
Myosotis discolor	MYDI	yellow/blue scorpion grass	
Nemophila parviflora	NEPA	Small-flowered nemophila	
Oemleria cerasiformis	OECE	Indian plum	
Osmorhiza chilensis	OSCH	Mountain sweet-root	
Osmorhiza occidentalis	OSOC	western sweet-root	
Pachistima myrsinites	PAMY	Oregon boxwood	
Pectocarya pusilla	PEPU	little pectocarya	openings
Phacelia heterophylla	PHHE2	Varileaf phacelia	
Philadelphus lewisii	PHLE4	Lewis' mockorange	uncommon
Piperia spp.	PIPER2	Rein orchid	
Pinus lambertiana	PILA	Sugar pine	
Pinus ponderosa	PIPO	Ponderosa pine	
Plagiobothrys tenellus	PLTE	slender popcorn flower	
Plantago lanceolata	PLLA	English plantain	
Plectritis macrocera	PLMA4	desert plectritis	openings
Poa bulbosa	POBU	bulbous bluegrass	
Polypodium glycyrrhiza	POGL8	Licorice-fern	
Polystichum munitum	POMU	Western sword-fern	
Potentilla glandulosa	POGL9	Sticky cinquefoil	
Pseudostellaria jamesiana	PSJA2	sticky chickweed	
Pseudotsuga menziesii	PSME	Douglas-fir	
Pteridium aquilinum	PTAQ	Braken	
Pyrola picta	PYPI2	Whitevein pyrola	
Quercus garryana	QUGA4	Oregon oak	
Quercus kelloggii	QUKE	California black oak	
Ranunculus occidentalis	RAOC	Western buttercup	
Ribes sanguineum	RISA	Red currant	
Rosa gymnocarpa	ROGY	Baldhip rose	
Rubus leucodermis	RULE	Black raspberry	
Rubus parviflorus	RUPA	Thimbleberry	
Rubus ursinus	RUUR	Pacific blackberry	
Rumex acetosella	RUAC3	Sheep sorrel	
Salix	SALIX	willow	draw, trail
Salix scouleriana	SASC	Scouler's willow	ridge
Sambucus nigra ssp. cerulea	SANIC5	blue elderberry	
Sanguisorba	SANGU2	minor garden burnet	
Sanicula crassicaulis	SACR2	Pacific blacksnakeroot	
Sanicula graveolens	SAGR5	Sierra snakeroot	

Table 8-1: Native Plant List (cont)

Satureja douglasii	SADO5	Yerba buena	
Sedum stenopetalum	SEST2	Wormleaf stonecrop	
Senecio integerrimus	SEIN2	Western groundsel	
Silene campanulata	SICA5	bell catchfly	
Symphoricarpos albus	SYAL	Common snowberry	
Synthyris reniformis	SYRE	Snow-queen	
Taeniatherum caput-medusae	TACA8	medusahead	
Taraxacum officinale	TAOF	dandelion	
Tauschia glauca	TAGL	Glaucous Tauschia	
Taxus brevifolia	TABR2	Pacific yew	
Tolmiea menziesii	TOME	Youth on age	
Tonella tenella	TOTE	Small-flowered tonella	
Torilis arvensis	TOAR	field hedge-parsley	
Toxicodendron diversilobum	TODI	Poison oak	
Tragopogon dubius	TRDU	Yellow salsify	
Trientalis latifolia	TRLA6	Western starflower	
Trifolium dubium	TRDU2	little hop clover	
Trillium ovatum	TROV2	White trillium	
Valerianella locusta	VALO	corn salad	
Vancouveria hexandra	VAHE	White inside-out-flower	
Verbascum thapsus	VETH	Common mullein	
Vicia americana	VIAM	American vetch	
Viola glabella	VIGL	Stream violet	
Vulpia microstachys	VUMI	Nuttall's fescue	

Table 8-2: Problematic or Invasive Plants (USDA NRCS 2016)

Scientific Name	Plants_ Symbol	Common_Name	Oregon A List	Oregon B List	Oergon T List
Acer platanoides	ACPL	Norway maple			
Aesculus hippocastanum	AEHI	Horse chestnut			
Ailanthus altissima	AIAL	Tree of heaven			
Amaranthus palmeri	AMPA	Carelessweed			
Anthriscus caucalis	ANCA14	Bur chervil			
Brassica rapa	BRRAR	Field mustard			
Bromus diandrus	BRDI3	Ripgut brome			
Bromus tectorum	BRTE	Cheatgrass			
Buddleja davidii	BUDA2	Orange eye butterfly-bush		XX	
Centaurea solstitialis	CESO3	Yellow star-thistle		XX	
Cirsium arvense	CIAR4	Canada Thistle		XX	
Cirsium vulgare	CIVU	Bull thistle		XX	
Clematis vitalba	CLVI6	Evergreen clematis			
Conium maculatum	COMA2	Poison hemlock		XX	
Cynodon dactylon	CYDA	Bermudagrass			
Cytisus scoparius	CYSC4	Scotch broom		XX	
Daucus carota	DACA6	Queen anne's lace			
Dipsacus laciniatus	DILA4	Cutleaf teasel		XX	
Equisetum telmateia	EQTE	Giant horsetail			
Euphorbia esula	EUES	Leafy spurge			
Foeniculum vulgare	FOVU	Sweet fennel			
Geranium robertianum	GERO	Robert geranium		XX	
Hedera helix	HEHE	English ivy		XX	
Hypericum calycinum	HYCA10	Aaron's beard		XX	
Ilex aquifolium	ILAQ80	English holly			
Iris chrysophylla	IRCH	Yellowleaf iris		XX	
Lactuca serriola	LASE	Prickly lettuce			
Lapsana communis	LACO3	Common nipplewort			
Ligustrum vulgare	LIVU	European privet			
Lythrum salicaria	LYSA2	Purple loosestrife		XX	
Melilotus officinalis	MEOF	Sweet clover			
Melissa officinalis	MEOF2	Common balm			
Polygonum cuspidatum	POCU6	Japanese knotweed		XX	
Polygonum sachalinense	POSA4	Giant knotweed		XX	
Portulaca oleracea	POOL	Little hogweed			
Prunus avium	PRAV	Sweet cherry			

Table 8-2: Problematic or Invasive Plants (cont)

Prunus cerasifera	PRCE2	Cherry plum			
Prunus laurocerasus	PRLA5	Cherry laurel			
Prunus lusitanica	PRLU	Portugal Laurel			
Pyracantha coccinea	PYCO2	Scarlet firethorn			
Rosa canina	ROCA3	Dog rose			
Rubus armeniacus	RUAR9	Himalayan blackberry			
Senecio jacobaea	SEJA	Tansy ragwort		XX	
Spartium junceum	SPJU2	Spanish broom		XX	
Tribulus terrestris	TRTE	Puncturevine		XX	
Trifolium dubium	TRDU2	White clover			
Ulmus pumila	ULPU	Siberian elm			
Verbascum blattaria	VEBL	Moth mullein			
Vicia americana	VIAM	American vetch			
Vinca major	VIMA	Bigleaf periwinkle			
Vinca minor	VIMI2	Common Periwinkle			

Ashland Forest Plan
GIS Data Dictionary

(Definitions were developed specifically for this data dictionary except where otherwise noted.)

Acres – The number of acres in the Landscape Unit.

Aspect - The direction in which any piece of land faces (City of Ashland 2009).

- **Fuel Model** - The collections of fuel properties are known as fuel models and can be organized into four groups: grass, shrub, timber, and slash. The differences in fire behavior among these groups are basically related to the fuel load and its distribution among the fuel particle size classes. Each fuel model is described by the fuel load and the ratio of surface area to volume for each size class; the depth of the fuel bed involved in the fire front; and fuel moisture, including that at which fire will not spread, called the moisture of extinction.

- **Fuel Model 1 (Grass)** - Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through the cured grass and associated material. Very little shrub or timber is present, generally less than one third of the area.

- **Fuel Model 4 (Shrub)** - Fires intensity and fast-spreading fires involve the foliage and live and dead fine woody material in the crowns of a nearly continuous secondary overstory. Besides flammable foliage, dead woody material in the stands significantly contributes to the fire intensity. California mixed chaparral is a typical example.

- **Fuel Model 6 (Shrub) -** Fire will drop to the ground at low wind speeds or at openings in the stand. The shrubs are older, but not as tall as shrub types of model 4, nor do they contain as much fuel as model 4. A broad range of shrub conditions is covered by this model.

- **Fuel Model 8 (Timber)** - Slow-burning ground fires with low flame lengths are generally the case, although the fire may encounter an occasional "jackpot" or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidities, and high winds do the fuels pose fire hazards. Closed canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and occasionally twigs because little undergrowth is present in the stand.

- **Fuel Model 9 (Timber**) - Fires run through the surface litter. Concentrations of dead-down woody material will contribute to possible torching out of trees, spotting, and crowning.

- **Fuel Model 10 (Timber)** - The fires burn in the surface and ground fuels with greater fire intensity than the other timber litter models. Dead-down fuels include greater quantities of 3-inch or larger limbwood resulting from overmaturity or natural events that create a large load of dead material on the forest floor. Crowning out, spotting, and torching of individual trees are more frequent in this fuel situation, leading to potential fire control difficulties. Any forest type may be considered if heavy down material is present; examples are insect- or disease-ridden stands, windthrown stands, overmature situations with deadfall, and aged light thinning or partial-cut slash (Anderson 1982).

Invasive Species - A non-native species whose introduction is likely to cause or has the potential to cause economic or environmental harm to an ecosystem or harm to human health or commerce (Clinton 1999).

Infrastructure - Infrastructure is defined as publicly owned roadways or easements and wire or pipes including other appurtenances used for provision of public services such as electrical power, drinking water, irrigation water, sewerage, overflow drainage and transportation. Infrastructure can be divided into the following categories:

Table 8-3: Infrastructure

AFP Infrastructure Category	AFP Infrastructure Category Definition
Electric Fixtures	transformers, sectionalizing (splicing) cabinets, handholes, meters, lights, and poles
Electric Lines	electrical conductors underground in conduit or overhead suspended by cables
Sewer Fixtures	sewer manholes, cleanouts, and pump stations
Sewer Lines	underground sewer piping normally "6" diameter and larger
Storm Fixtures	manholes, ditch inlets, catch basins, curb inlets, vaults
Storm Lines	drainage piping including culverts and siphons, generally 12" in diameter
Water Fixtures	valves, vaults, hydrants meters, and flow control devices
Water Lines	irrigation or potable water mains normally "6" diameter and larger

Landscape Units and Descriptions:

Landscape Unit Number – Updates and standardizes nomenclature for all management units covered by the Ashland Forest Plan. A unique code has been created for each management unit consisting of a one to three letter parcel identifier and a unit number for each management unit within the parcel. Nomenclature supersedes that from Main, 2002. Information shown in Table 1 below and under Landscape Units and Descriptions is intended to assist in providing a transition from earlier vegetation classification to that in the Ashland Forest Plan. Parcel identifiers are as follows:

Table 8-4: AFP Parcels

Parcel Name	Parcel Identifier
Alsing Reservoir	AR
Ashland Ponds	AP
Burnson - Lawrence	BL
Cottle - Phillips	CP
Crowson Reservoir	CR
Granite Street	GS
Hald - Strawberry	HS
Hitt Road	HR
Liberty Street	LS
Lower Watershed	LW
Oredson Todd Woods	OTW
Piedmont	P
Siskiyou Mountain Park	SMP
Upper Lithia	UL
Westwood Park	WP
Winburn	W

Unit Numbers will be sequential beginning with the number 1. For example, the first inventoried unit for Ashland Ponds will be coded as AP-1, the second unit will be coded as AP-2 and so on until all the Ashland Pond units have been listed. Burnson - Lawrence units will be coded as BL-1, BL-2, etc.

Table 8-5: Ashland Forest Plan Landscape Units

Landscape Unit	Description	Wildfire Hazard Rating	Seral Stage	Fuel Model
A	Grassland / Non-vegetated	Low	Early	1
B	Oregon White Oak	Moderate	Early - Mid	9*
C	Ponderosa Pine / Oak 25 to 50 years	Extreme	Early - Mid	6
D	Whiteleaf Manzanita 25 to 50 years	Extreme	Early	4
E	Douglas-fir / Madrone / Deerbrush 25 to 50 years	Extreme (-)	Early	6
F	Conifer Plantations 10 to 25 years	Extreme	Early	4
G	Mixed Conifer and Hardwoods 75 to 125 years	High (+)	Mid	10
H	Douglas-fir (dying) / Madrone 75 to 100 years	High (+)	Mid	10
J	Douglas-fir 75 to 100 years	High	Mid	8*
K	Riparian	Moderate	Variable	8*

* Fuel Model updated in 2014 analysis (Main 2002)

Landscape Unit A - Grasslands or Non-Vegetated

- Topography - 0 to 30 percent slopes at low elevations on various aspects.
- Vegetation - Landscape Unit A sites have very limited existing vegetation, largely due to vegetation removal activities in the past. These sites remain dominated by various grasses and herbaceous vegetation, usually growing close to the ground.

Landscape Unit B - Oregon White Oak

- Topography- 15 to 45 percent slopes at low elevations on various aspects.
- Vegetation - Landscape Unit B sites are uncommon on City lands but represent a unique vegetation type. The vegetation is indicative of harsh, droughty sites where moisture availability is limited due to either (1) very shallow soils, or (2) the high percentage of clay in the soil. Vegetation is dominated by Oregon white oak up to 30 feet tall. Understory vegetation is dominated by native or non-native grasses and herbaceous vegetation. A second understory type occurs in which whiteleaf manzanita, wedgeleaf ceanothus, and most notably birchleaf mountain mahogany occurs with the oaks.

Landscape Unit C - Ponderosa Pine/Oak

- Topography - 25 to 40 percent concave slopes on various aspects.

- Vegetation - Shallow soils result in low site productivity (although greater than that found on Landscape Unit B). Sites are generally dominated by California black oak and ponderosa pine. The pines are present often as scattered overstory trees up to 20+ inches DBH, as well as younger, smaller trees primarily in openings. California black oak forms a considerable part of the overstory and mid-story canopies, as well as being a prevalent understory species. Other vegetation includes whiteleaf manzanita and occasionally Douglas-fir and incense cedar. Sites are subject to bark beetle mortality of pines.

Landscape Unit D - Whiteleaf Manzanita Dominated Brushfields

- Topography - 15 to 45 percent (occasionally steeper) slopes located on dry, southerly aspects and other dry sites, most notably ridgelines.

- Vegetation - Sites are characterized by vegetation indicative of a major, high-intensity disturbance generally within the last 10-50 years, such as the 1959 fire and the 1973 Hillview fire. Sites are dominated by dense whiteleaf manzanita, with clumps of stump sprouting Pacific madrone, although scattered ponderosa pine, California black oak, and deerbrush ceanothus may also occur. Brushfields are dense and continuous, fully occupying the site and generally preventing establishment and/or growth of other vegetation. Many of these sites are capable of, and historically probably did support, mixed stands of conifers (particularly ponderosa pine) and hardwoods.

Landscape Unit E - Douglas-fir / Pacific Madrone / Deerbrush Ceanothus

- Topography - Sites are located on mostly steep (primarily 40 to 65 percent, although ranging as high as 80+ percent) primarily northwesterly to northeasterly aspects in the upper half of concave slopes. The steep topography makes slope stability an important issue on slopes over 50% and/or when other signs of potential slope failure exist.

- Vegetation - Sites are characterized by early seral native vegetation initiated after major high-intensity wildfire events (the 1959 wildfire and the 1973 Hillview fire). Vegetation is primarily Douglas-fir, Pacific madrone, and deerbrush ceanothus. Other species include snowberry and dwarf Oregon grape.

Landscape Unit F - Conifer Plantations

- Topography - 15 to 30 percent slopes on ridgelines and southerly aspects.

- Vegetation - Sites are an uncommon vegetation type on City lands. These sites were planted 10 to 25 years ago, primarily to Ponderosa pine. Plantations have often been reinvaded by other brush (most notably whiteleaf manzanita) and hardwood species.

Landscape Unit G - Mixed Conifer & Hardwood, 75-125 Years

- Topography - 25 to 45 percent, mostly southerly/southeasterly aspects at low to mid elevations.

- Vegetation – Sites are a wide array of age classes, species compositions, structures and densities. Sites are dominated by a mixed overstory of equal amounts of Ponderosa pine and Douglas-fir in the 60 to 100 (occasionally older) year age class. These two conifers generally comprise approximately 75% of the total stand basal area. California black oak and especially Pacific madrone are also common parts of the overstory with the larger conifers (typically up to 24+ inches DBH) overtopping the hardwoods. Other overstory species include sugar pine, incense cedar, and on less productive microsites Oregon white oak. Brush species are primarily deerbrush ceanothus and whiteleaf manzanita. Douglas-fir snags are common. Bark beetle mortality of overstory conifers can be a concern during drought years.

Landscape Unit H - Douglas-fir (Dead & Dying)/Pacific Madrone

- Topography - 25 to 55 percent slopes on primarily northwesterly to northeasterly aspects.

- Vegetation - Moisture stress on these sites make the conifers (primarily Douglas-fir) highly susceptible to attack from bark beetles, due to excessive stand densities. Bark beetles focus on the larger diameter classes, so the remaining Douglas-fir tends to be the smaller, suppressed individuals formerly in the understory. Hardwoods form a much greater percentage of the overstory, averaging two-thirds of the total stand basal area, with Pacific madrone about twice as abundant as California black oak. The availability of site resources following Douglas-fir mortality, results in rapid development of understory vegetation, most notably deerbrush ceanothus, poison oak, snowberry, hairy honeysuckle, and various grasses and broadleaved herbaceous plants.

Landscape Unit J - Douglas-fir/Pacific Madrone

- Topography - 40 to 65 percent (and occasionally steeper) slopes on northerly aspects, in upper slope positions, including headwalls

- Vegetation - Stands initiated after intense wildfire in 1901 or 1910 are dominated by dense Douglas-fir poles 4 to 16 inches DBH. Douglas-fir generally comprise 75 to 90 percent of this total stand basal area, with the remainder being similar sized Pacific madrone that are rapidly becoming overtopped and shaded out. The Douglas-fir are ripe for bark beetle related mortality.

Landscape Unit K - Riparian

- Topography - Along creeks and draws most of which flow in a northerly to easterly direction.

- Vegetation - Tree species include Oregon ash, black cottonwood, red alder, bigleaf maple, and willow species. Other plant species present are mock orange, ninebark, horsetails, sedges, and rushes. Invasive species such as Himalayan blackberry and English ivy have become well established in many riparian habitats, often to the exclusion of other native species (Main, 2002).

Last Treatment – Most recent type of treatment accomplished

Last Treatment Year – Year most recent type of treatment accomplished

Next Treatment – Recommended next treatment to accomplish.

Next Treatment Year – Projected year next recommended treatment will be accomplished

Overstory Species - Three most common species of live trees in the uppermost canopy layer in an inventory unit. Species are listed by plant symbol as shown on the Ashland Forest Plan species list.

Overstory Species Size Class -

- Cohort #1 - generally 25 to 50+ inches DBH; 150+ years.
- Cohort #2 - generally 10 to 25 inches DBH; 50-150 years.
- Cohort #3 - generally 1 to 10 inches DBH; 1-50 years.

Overstory species will be listed by Plant_Symbol and cohort number. For example, legacy (Cohort -1) Ponderosa pine will be listed as PIPO – C1; younger Douglas-fir will be listed as PSME – C2 (City of Ashland, 2004).

Overstory Species Stocking (see below for table definitions)

Table 8-6: Ashland Forest Plan Overstory Species Stocking

Plant Series	Current Basal Area (in square feet)	Acceptable Range of Basal Area (in square feet)	Current Basal Area Stocking Level Rating
Douglas-fir		80 to 150	
Ponderosa Pine		60 to 120	
White Fir		110 to 200	

Plant Series – plant series is based on the dominant, most shade tolerant, regenerating tree species on the site (Atzet et al., 1996).

Current Basal Area - taken from stand data for that inventory unit; tally includes all tree species on the site; basal area is the cross-sectional area of tree boles in a forested area as measured at the diameter at breast height (DBH).

Acceptable Range of Basal Area – target amount of basal area for a plant series to achieve full site occupancy and meet management objectives (Goheen, 2014, personal communication).

Current Basal Area Stocking Level Rating – existing basal area as a percentage of the maximum acceptable basal area for that plant series.

Table 8-7: Ashland Forest Plan Current Basal Area Stocking Level Rating

Current Basal Area Stocking Level Rating	Basal Area Stocking Density	Current Basal Area as a Percentage of Desired Basal Area
1	Low	< 40%
2	Moderate	40 to 69%
3	High	70 to 100%
4	Overstocked	101 to 140%
5	Severely Overstocked	> 140%

Plant Association Group (PAG) - A group of plant associations that share a common feature of favoring development of particular tree species that will become dominant over time if the forest matures without disturbance. Plant Association Groups are an intermediate stratification between plant associations and plant series. The coarsest level is the forest or plant series, which denotes all types that have the same climax dominant tree species, defined by shade tolerance (i.e., the Douglas-fir series). The finest level is the plant association, which denotes an overstory species that is the most shade-tolerant of the species found in that type along with one or more indicator understory species (i.e., Douglas-fir/ Oregon grape plant association) (USDA FS, 2003).

Old-Growth Forest - A forest stand usually at least 180-220 years old and typically suggesting the following characteristics: moderate to high canopy closure; a multilayered, multispecies canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood (decadence); numerous large snags; and heavy accumulations of wood, including large logs on the ground (City of Ashland, 2009).

Seral Stage - The series of relatively transitory plant communities that develop during ecological succession from bare ground to the climax stage.

- **Early Seral Stage** - The period from disturbance to development of crown closure of conifer stands. Grass, herbs, and brush are plentiful in this stage. Early seral stage is defined as having trees up to 5 inches DBH.

- **Mid-Seral Stage** - The period in the life of a forest stand from crown closure to ages of 15 to 80-100 years. Mid-seral stands include diameters between 6 and 24 inches average DBH.

- **Late-Seral Stage** - The period in the life of a forest stand older than 80 years and approaching 200 years or more. Late-seral stands average 24 inches or greater DBH.

Slope - A standard way of measuring the steepness of any slope; specifically, a percent figure based on the rise in elevation in feet over a 100 foot distance (i.e., 25% slope equals a rise of 25 feet over a 100 foot distance). Although no uniform standards describing steepness exist, a typical classification is as follows: flat (0-5%), gentle (6-25%), moderate (26-55%), steep (56-75%, very steep (76%+) (City of Ashland, 2009).

Treatment Types:

- **Hazard Tree Removal (HR) –** The removal of trees that have been identified as a potential risk, for failure that would cause injury to a person or damage to property (Helms, 1998).

- **Invasive Species Treatments (IST)** –

  IST-1) Manual treatments - mowing, weed-eating, cutting, grubbing, mulching, pruning, pulling/weeding, burning, root barrier installation, piling and burning, smothering

  IST-2) Mechanical Treatment – brush flail

  IST-3) Herbicide Treatments - organic herbicide spraying, cut/puncture/drip. Organic herbicide application, herbicide spraying, manual herbicide application, cut/drip herbicide application (City of Ashland, 2011)

- **Non-commercial thinning (NCT)** - The removal of trees of little or no commercial value from a forest stand to achieve a pre-designated silvicultural objective (e.g., improve stand vigor, reduce wildfire danger, etc.) (City of Ashland, 2009).

- **Non-commercial thinning/slashing in preparation for underburn (NCT / PU)** - similar to non-commercial thinning but includes the additional objectives of reducing ladder fuels, increasing height-to-crown base, and creating more discontinuous fuel conditions, both horizontally and vertically, while producing more favorable fire management conditions which prepares the site for safe application of a future low severity prescribed fire regime.

- **Overstory Removal (OR)** – The cutting of trees constituting an upper canopy layer to release trees or other vegetation in an understory (Helms 1998).

- **Piling and burning (PB)** - Smaller non-merchantable material is thinned and piled on site without the aid of machinery and contains needles, twigs, small-diameter branches, and boles. In areas with a major shrub component, cutting and hand piling is also used for reducing heavy surface fuels. Use of hand piling mitigates soil compaction concerns and widens the prescribed burning window, allowing managers to use fire under weather and fuel moisture conditions that are inappropriate or ineffective for broadcast burning. Pile burning can be more easily monitored and controlled, minimizing escape potential (Wright et al., 2009).

- **Planting (P)** - Artificial restocking of an area with forest trees, shrubs, or grasses.

- **Prescribed fire (underburning) (PFU)** - Involves the controlled application of fire to understory vegetation and downed woody material when fuel moisture, soil moisture, and weather and atmospheric conditions allow for the fire to be confined to a predetermined area and intensity to achieve the planned resource objectives (City of Ashland, 2009).

- **Radial Thinning (RT)** - Density reduction for a fixed distance beyond the dripline of the retention tree or as a function of the crown radius of the retention tree (i.e. two or three crown radii out from the retention tree) to create crown separation and horizontal canopy fuel discontinuity.

- **Sanitation Cutting (SC)** – The removal of trees to improve stand health by stopping or reducing the actual or anticipated spread of insects and disease (Helms, 1998).

- **Thinning from below (TFB)** - The cutting of non-dominant trees in a stand, usually in order to give more site resources to the dominant trees or to reduce ladder fuels (City of Ashland, 2009).

- **Variable Density Thinning (VDT)** - A thinning method that attempts to enhance stand structural heterogeneity by deliberately thinning at different intensities throughout a stand. VDT may create stands with dense areas, open areas, and other areas that may be intermediate in density. Subsequent stand development forms a more varied structure than is common in many even-aged forest stands (O'Hara et al., 2012).

Understory Density - Existing understory cover as a percentage of the site

Table 8-8: Ashland Forest Plan Understory Density Rating

Current Understory Stocking Level Rating	Understory Stocking Density	Current Understory Stocking as a Percentage of the Site
1	Low	< 40%
2	Moderate	40 to 69%
3	High	70 to 100%

Understory Species - Three most common species of live trees and shrubs in the lower canopy layer in an inventory unit. Species are listed by Plant Symbol as shown on the Ashland Forest Plan species list.

Unit History – List of management treatments accomplished, acres treated, and year(s) treated.

Wildfire Hazard Rating - The kind, volume, condition, arrangement, and location of fuels and vegetation that creates an increased threat of ignition, rate of spread, and resistance to control of wildfire.

- **Extreme (Red)** - These landscape units are characterized by a likelihood of very explosive wildfire behavior, largely due to dense, early successional vegetational profiles on moderate to steeper topography.

- **High (Orange)** - These are mid-successional units and are slightly less likely than units in the extreme class to initiate and/or sustain crown fires due to more inherent structural discontinuities in fuels, particularly vertically as ladder fuels drop out in typical stand development. However, greater overall fuel loading and relatively continuous canopy fuels can result in uncontrollable wildfire behavior. Fire is more likely to burn at a range of intensities in this category.

- **Moderate (Yellow)** - Units in this category are less likely to burn with to severe wildfire behavior, either due to greater live moisture percent in vegetation through the summer season or generally reduced site productivities and subsequent fuel loadings.

- **Low (Green)** - Units in this category have site conditions that offer wildfire management opportunities at low or minimal cost, largely due to very low or even non-existent fuels, and generally gentle topographical locations. Examples include pastureland or other grasslands, orchards, quarries, or other areas where vegetation is significantly reduced (Main, 2002).

Comments - Any useful information the evaluator felt should be passed on to the data user. No more than 250 characters. Examples include tree data, such as radial growth rate and live crown ratio, species regenerating, presence of pathogens, and smaller inclusions of other vegetation types atypical of the larger unit.

Chapter 9

Vegetation: Retrospective, Trends, and Challenges

Variables and Factors Determining Vegetation

Manipulation of vegetation to achieve objectives on City forestlands has been guided by a thorough understanding of the existing vegetation. This has been facilitated by the recognition that existing vegetation results from the interaction of three factors:

- Relatively constant environmental variables, including, but not limited to, elevation, aspect, seasonality of annual rainfall, temperature, and soil
- Typical successional changes as vegetation develops through time
- Changes in vegetation composition, structure, and density resulting from human interactions with the landscape, encompassing a range of disturbances that began with Native American activities, was altered when early settlers arrived, and continues to change today

With an understanding of existing vegetation and how it came to be, informed decisions have been made and planned manipulations implemented on the City forestlands over the past 20 years to produce desired changes. This has been particularly challenging due to the reasons listed below:

- The Klamath province is known for its high level of biodiversity.
- Disturbance histories have been significantly altered, often in highly diverse and complicated ways, since early settlers arrived in the mid-1800s.
- Vegetation communities today are functionally, compositionally, and structurally complex making projections as to future stand trajectories difficult.
- The difficulty in projecting existing conditions into the future is exacerbated by the uncertainty of how modeled climate change trends and extremes will affect this region.

Variations in the environmental variables which determine vegetation produce significant differences in site conditions including elevation, aspect, seasonality of annual rainfall, temperature, and soil characteristics. In the Klamath province, these environmental variables are generally most critical in the influences they have upon moisture availability for plants, as moisture is usually the limiting factor affecting plant survival and growth. This is particularly important at lower elevations in the eastern edge of the region where the City forestlands are located. They are within the rain shadow of Mt. Ashland, such that precipitation amounts average only 20 to 30 inches annually on lower City ownership at approximately 1800 feet in elevation, compared with close to 60 inches at the top of Mt. Ashland (7,533 feet in elevation), only eight miles to the south. In particular, the lack of precipitation during summer months greatly affects the type, quantity, and diversity of vegetation that can persist. The steep moisture gradient between Mt. Ashland and the city significantly influences vegetation, with cooler and moister conditions increasing rapidly with increasing elevation.

Aspect is an important environmental variable because greater amounts of solar radiation on southerly aspects during long, dry summer months limits moisture availability much more so than on northerly aspects (with easterly and westerly slopes intermediate). Species such as Douglas-fir, white fir, Pacific madrone, and deerbrush tend to dominate the more northerly aspects, while drought tolerant species are increasingly common on more southerly aspects (i.e. ponderosa pine, Oregon white oak, California black oak, whiteleaf manzanita, etc.).

Variations in soil properties are important determinants of vegetation on any given site. Soils in the watershed are derived primarily from granitic parent material of the Tallowbox (on steeper sites) and Shefflein (on gentler slopes 10-35%) soil series (Johnson, 1993). These are relatively deep, and well-drained to excessively-well-drained soils of a very coarse nature which are prone to erosion. Both surface erosion and mass wasting events, most notably debris slides and debris flows, have frequently occurred on City forestlands and throughout the Ashland watershed, even in unmanaged landscapes, and are a historic and integral part of the disturbance regime. The potential for increasing these erosion events through active management (i.e. manipulation of vegetation) is of major concern. The high-intensity storm events of 1964, 1974 and, most recently, the New Year's Day storm of 1997 revealed the potential landslide activity and major associated flooding that may occur in the Ashland area.

As vegetation develops, it typically progresses through a series of successional stages, each of which contains specific and recognizable characteristics (Oliver and Larson, 1990). Prior to early settlement of southern Oregon, the primary disturbance mechanism in the Klamath province, and on City forestlands, was fire ignited by Native Americans or lightning (Atzet and Martin, 1991). Sensenig found a frequency averaging twelve years across a wide range of sites in southern Oregon during this era (Sensenig, 2002).

The Metlen et al. 2012 analysis of 91 fire scars sampled across many biophysical settings in the Ashland watershed, (although on somewhat higher elevations than on most of the City ownership) suggests that historically fires were frequent – occurring every three years (range 1-14), and 44% of fires were recorded on at least three of sites up until the early 1900s. Fires returned to a given site every 13 years, ranging up to 40 years. Sampled trees typically survived tens of fires over their lifetime.

Understanding of these three categories of site condition determinants (environmental site conditions, vegetation development patterns, disturbance history), can help explain the existing condition of vegetation type on a site. These factors set the stage for the dominating and rapid alteration to disturbance history which took place within the last 150 years with the arrival of early settlers. Beginning in the first half of the 19th century, significant vegetation modification and changes in disturbance history began to occur as Native American application of fire was eliminated and radically new forms of disturbance began to be implemented across the landscape on City forestlands and in the broader Ashland Watershed. Forests began to be harvested in earnest to help build the developing town of Ashland, and the resulting slash from these operations, coupled with the resulting increase in more flammable early successional vegetation, created a landscape much more likely to burn at larger scales and higher intensities. In some cases, high-intensity fire was purposely initiated by ranchers desiring more pastureland or miners hoping to expose more rock strata and make mining easier—both clear and purposeful objectives.

"The fiercest timber fire that has ever taken place close to Ashland has been raging along the hillsides of Ashland Creek Canyon for the past three days, and its work of destruction was only placed under control last evening."

- Ranger W. Kripke, August 26, 1901 (City of Ashland, 2004)

Over the last 115 years, large-scale, high-severity fires have become a much more common type of disturbance in the emerging disturbance regime. Major wildfire events occurred in 1901, 1910, 1959, 1973 and 2009 both in and around the current City ownership. The 1901 and 1910 events were very likely largely fueled by over fifty years of logging and the creation of slash and early successional vegetation, resulting in a much more flammable landscape. The 1901 and 1910 wildfires were part of a national trend that led to a policy of fire suppression and subsequent fire exclusion from forest ecosystems that remained in place for most of the 20th century. Almost all of the area below Reeder Reservoir and a large percentage of the City ownership has vegetation initiated after those events. Trees older than 115 years are rare in that area.

Once initiated, however, the pattern of infrequent but intense wildfires (as opposed to frequent fires of low intensity) may be reinforced by the resulting increased amounts of more wildfire-prone early successional vegetation, which often occurs in relatively continuous vegetation and fuel profiles. Breaking this pattern and restoring more benign fire regimes through active vegetation management has been the underlying strategy on City lands over the past 20 years for helping to achieve more fire-resistant and resilient stands and landscapes, and subsequently helping to achieve a primary objective: reduction in the likelihood of high-severity fire on City lands. In essence, the City has decided through its vegetation and fuels management activities to increase the likelihood of low-severity fire when fire does visit our lands, and to subsequently reduce the likelihood and effects of high-severity fire.

Historically, forests in the Ashland watershed contained two-thirds fewer trees than found currently with the major increases in small white fir, Douglas-fir, and Pacific madrone (Metlen et al., 2012). A profusion of white fir, Douglas-fir and Pacific madrone has grown since the change in disturbance history initiated by early settlers, with a subsequent reduction in the percentage of pines and oaks. This change is represented in the graphs below. Stands are denser, more populated by shade intolerant species and much more susceptible to high-severity disturbance from both fire and insects. This is a striking change with consequences for long-term vegetation development, fire behavior and ultimately accomplishment of City management objectives.

Figure 9-1: 1901 Tree Diameter Distribution (Metlen et al., 2012)

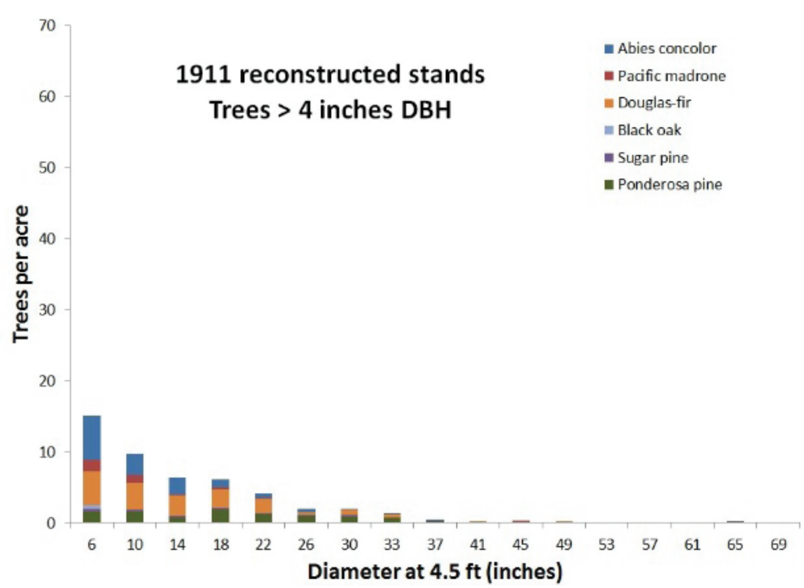


Figure 9-2: 2012 Tree Diameter Distribution (Metlen et al., 2012)

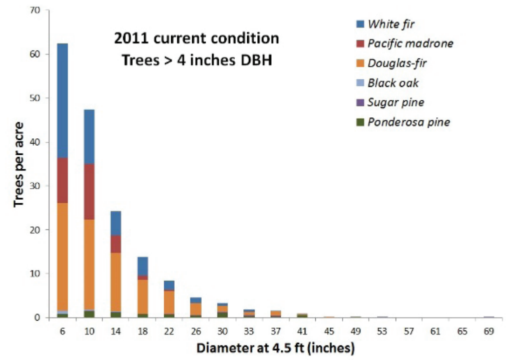
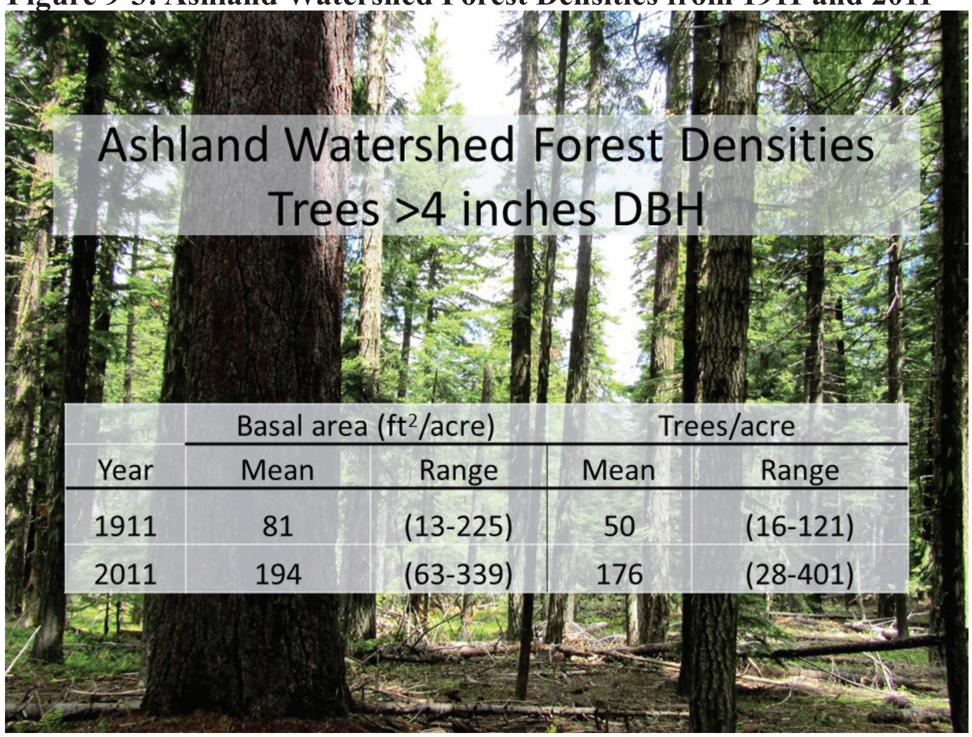


Figure 9-3: Ashland Watershed Forest Densities from 1911 and 2011



(Metlen et al., 2012)

In historical fire regimes in the western forests of the United States, fire varied in intensity from site-to-site and tended to interact cumulatively in balance with other disturbance agents (especially insects and disease). The progression in the 20th century of higher vegetation density and relatively continuous structure, both horizontally and vertically, has created conditions for a fire to rapidly escalate in magnitude beyond historically healthy cycles. The weakened trees resulting from these high stand-densities also increase the likelihood of insect-related mortality and pathogenic damage such as dwarf mistletoe.

In a vicious cycle, this increased tree mortality has tended to further increase the potential likelihood of a severe wildfire.

Data show dramatic increases in the number of small Douglas-fir, Pacific madrone, and white fir, while regeneration of ponderosa pine, sugar pine, and black oak has been very limited. Spatial patterning of trees within stands has changed as well, resulting in significantly less light to the forest floor and much larger aggregations of trees. Gaps between trees and tree cluster are important for a variety of reason. Gaps are where snow is retained best, and where early seral species, and seed/fruit-bearing understory plant species and dependent wildlife thrive. Increased forest density, species composition shifts, and increased uniformity in spatial pattern are widespread trends seen in other dry, fire-exclusion-adapted forests across the west.

Vegetation Changes in the Ashland Watershed Effecting Wildfire Behavior

High-severity fire occurred in the historic landscape and is an important part of healthy and resilient forest ecosystems. However, it was likely much smaller in size, severity, and impacts, and likely occurred at a wide and discontinuous range of locations. In today's environment, particularly on City lands high-severity fire is not desirable. Nonetheless, in some situations it cannot be prevented, although it is the intent of this plan to attempt to do so whenever and however possible and to limit fire severity and scope, and reduce the likelihood for fire to spread to larger areas with subsequent impacts on lives, property and resource values.

The Siskiyou Fire
On September 21, 2009, a wildfire ignited on the hillside near 3500 Siskiyou Boulevard, just above Interstate 5. Strong winds from the east that day (National Weather Service: Red Flag Conditions) quickly fanned the fire despite the timely arrival of fire suppression resources including engines, helicopters, and retardant planes.

Within two hours of the ignition, five retardant planes and three helicopters were providing aerial support for many engine crews who protected structures and attacked the fire. The fire advanced throughout the morning and afternoon, causing evacuations of approximately 150 homes and ultimately consumed one structure and several outbuildings. A fireline was constructed by both bulldozer and hand crews primarily along the east and west flanks of the fire. Fortunately, pre-fire fuels-reduction work altered the fire behavior and significantly aided in the protection of structures and the successful containment of the fire east of Tolman Creek Road.

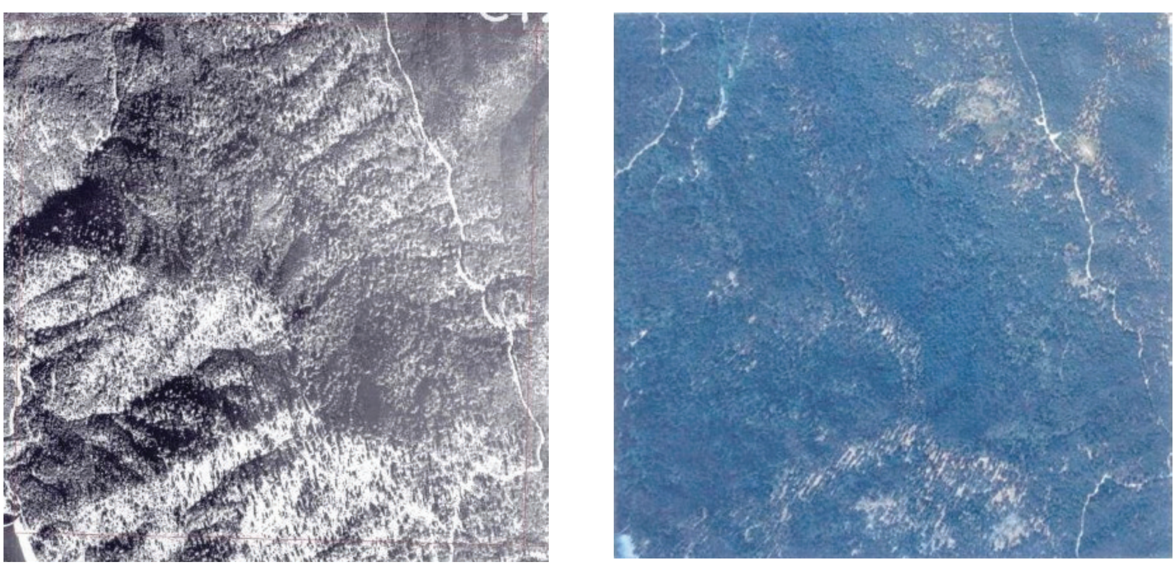
In nearly all locations where the fire was controlled, vegetation had been managed through either an Oregon Department of Forestry sponsored National Fire Plan grant program, or a similar program coordinated through Ashland Fire & Rescue.

There were several areas of crown fire that spread directly into fuels treatment zones. In all cases except one, the fuels treatment areas caused the crown fire to drop down and become an intense surface fire, and particularly on the western and southern flanks, the crown fire became a low-severity underburn.

Exactly 80 acres within the 188 acre fire perimeter were thinned under these programs and to varying degrees altered the fire's behavior and intensity and provided opportunities for suppression via air or ground. In addition, this vegetation management improved the post-fire ecological effects (Chambers, 2009).

Recently, as part of the monitoring for the 2004 Community Wildfire Protection Plan, the City of Ashland quantified some of the historical changes in forest composition and structure in the Ashland Watershed (fig.9-4, table 9-1).

Figure 9-4: Township 39 South, Range 1 East, Section 21, White Rabbit Parcel -- Change in Forest Conditions 1939 to 2004



1939 2004

(Ashland Forest Resiliency Stewardship Project, 2004; City of Ashland, 2004)

Table 9-1: Change in Forest Conditions 1939 to 2004

1939 Photo	2004 Photo
Primarily open canopy forest maintained by fire events	Primarily closed canopy forest. Open canopy forest a result of human activity
On 420 out of 460 acres (91%), grazing was the recommended management	Little to no shrub component due to closed forest canopy
Ceanothus and manzanita species were common, occurring together on 360 out of 460 acres (78%).	Ceanothus and manzanita species are less common, occurring together on approximately 30% of the acres.
Stand conditions favor more fire-tolerant, shade-intolerant tree species (pines and hardwoods)	Stand conditions favor less fire-tolerant, shade-intolerant species (Douglas-fir).

(*Ashland Forest Resiliency Stewardship Project. 2004; City of Ashland, 2004)*

Vegetation and Forest Pathogens

Insects

Insects that damage or kill conifers and other vegetation are important contributors to healthy, functioning forest ecosystems, serving many important ecological roles. They are an essential form of disturbance that can effectively reduce stand densities, improve overall stand vigor, provide important wildlife habitat values, supply coarse woody material for the forest floor, facilitate nutrient cycling, and perform other important ecological functions.

In most healthy forest ecosystems, insect-related mortality is usually light and scattered, with generally the weakest trees being attacked. However, in forests of increasing levels of stress and/or declining in health, damage from insects can increase significantly and become an uncharacteristically high-severity disturbance. Bark beetles attack trees that are suffering severe cumulative stress factors because the insects can detect stressed trees. Stress factors include drought, fungal disease, soil compaction or disturbance, and mechanical logging damage. The most common form of stress in the forests of southern Oregon and especially the Ashland Watershed is uncharacteristically high stand-densities. These high stand-densities are primarily the result of a change in fire regimes through fire suppression and the subsequent lack of more frequent, light disturbances such as low-intensity fire. Increased stand density over time reduces the availability of site resources for individual trees (e.g., soil moisture, nutrients, and available light). The resulting reduced tree vigor makes conifers more susceptible to successful attack by various insects. Once a bark beetle gains entry into a weakened tree, it can chemically communicate this fact to others of its species, thereby causing a mass attack, which kills trees outright. Tree stands that experience a high level of mortality can result in a disturbance regime of increased scale and severity.

Each coniferous tree species is associated with a set of species-specific bark beetles. Ponderosa pine is susceptible to attack from the western pine beetle (*Dendroctonus brevicomis*), pine engraver beetle (*Ips pini*) and the red turpentine beetle (*D. valens*) among others. A separate cadre of beetles, including the Douglas-fir twig weevil (*Cylindrocopturus furnissi*), flatheaded fir borer (*Phaenops drummondi*) and the Douglas-fir beetle (*D. pseudotsugae*) attack Douglas-fir. White fir is particularly susceptible to infestation from the fir engraver beetle (*Scolytus ventralis*). Sugar pine is most often attacked by the mountain pine beetle (*D. ponderosae*). Each of these insects has its own particular biology and style of interaction with its particular host species.

Rapid expansion of flatheaded fir borer populations in the Ashland interface area resulted in significant mortality of Douglas-fir during the major droughts of the early 1990s (e.g., almost all of the Douglas-fir in the Lithia Park uplands were killed in that event) and again during the 2001-2002 drought event. If conditions allow bark beetle populations to build up to high numbers, even healthy trees can be overcome by mass attacks. As many as four generations of some bark beetle species can occur in one summer season, allowing for rapid population expansion. Larger conifers of low to moderate vigor, often the most desirable trees for retention in the Ashland Watershed, are particularly susceptible to bark beetle related mortality during these outbreaks.

Knowledge of the insect biology and associated ecological interactions is key to formulating and implementing an appropriate planned disturbance (i.e., ecologically based silvicultural or stand management activity) to return the stand to a healthy co-existence with forest insects.

Mistletoe

Mistletoe is a parasitic plant. Mistletoes are flowering, seed-bearing, perennial plants that attack trees. They do not have enough chlorophyll to produce their own food. Thus, they rely totally on host trees for nutrients and water. The pathogen will ultimately kill the infected tree, although more typically it makes the tree more susceptible to demise from other agents, most notably bark beetles from reduced tree vigor. When the host tree dies, the mistletoe plant dies. Heavily infected trees with abundant vertically arranged brooms (thick foliage masses produced by the tree in response to the disease) are more susceptible to conflagration in prescribed and wildland fire. Heavily infected trees can also be wildfire accelerators by transporting low to moderate-intensity fire into upper canopy layers thereby increasing crown-fire development, spotting, and wildfire rates-of-spread.

True mistletoes (*Phoradendron* spp.) attack both conifers and hardwoods but mostly hardwoods. True mistletoes are most prevalent in Oregon white oak. They stress the host tree, create weak areas and provide an entry point for decay fungi.

Dwarf mistletoe (*Arceuthobium* spp.) infects conifers. Each conifer has its own host-specific species of dwarf mistletoe.

Reproduction is by seed, which is aerially spread from tree to tree. Rate of spread is generally about one to two feet per year, although the sticky seeds, forcibly shot from the fruits in fall, can fly as much as 30 to 40 feet or more. Since they prefer high levels of sunlight, dwarf mistletoes can spread more rapidly in open stands than in closed stands. For this reason, partial cutting and/or thinning has been known to rapidly increase dwarf mistletoe infections if a diligent job of removal is not accomplished. A second entry to remove infected trees that were missed in the first entry is not uncommon. The most undesirable element of dwarf mistletoe infection occurs when poor quality, infected overstory trees spread the disease to young, healthy saplings in the understory, thereby ensuring the long-term continuation of the disease. The pathogen is a slow, subtle form of disturbance that can significantly change stand conditions over time.

Moreover, infection of younger Douglas-fir in the short term may limit their lifespan, thereby reducing recruitment of mature Douglas-fir in the future and facilitating a compositional shift toward white fir. Unfortunately, white fir tends to grow in multiple layers with relatively high crown bulk densities, characteristics that may exacerbate potential wildland fire behavior under some conditions.

Dwarf mistletoe brooms are particularly important for wildlife nesting at lower slope positions and canyon bottoms, suggesting that some retention may be desirable. At upper slope positions, where aerial spread of the parasite is more pronounced and wildland fire management goals may be more readily compromised, dwarf mistletoe should be managed to meet project fire-management goals.

White Pine Blister Rust (*Cronartium ribicola)*
White pine blister rust is an exotic disease. The causal fungus is native to northern China, Siberia, and the Russian Far East. It was introduced into Europe via the Crimea in 1854, and was transported to western North America in 1910 on a single shipment of infected white pine that was sent to British Columbia from France. White pine blister rust found ideal conditions in the Pacific Northwest, became established on native hosts, and spread rapidly. It was first reported on the National Forest in the late 1920s. If 1850 is used as a standard for "past natural conditions," white pine blister rust did not occur in the Ashland Watershed in historical times. All impacts of white pine blister rust have occurred in the period from about 1928 to the present (USDA FS, 2003).

Root Disease
Root diseases are another slow, subtle form of disturbance that has long-term repercussions for vegetation development and stand succession. Root diseases are often underrated and difficult to control after establishment. Although they appear to be uncommon on City forestlands at this time, these damaging agents are prevalent in surrounding forests.

Four major species of root disease are common in southern Oregon– Armillaria root disease (*Armillaria ostoyae*), Laminated root rot (*Phellinus sulphurescens*), Annosus root disease (*Heterobasidion annosum)*, and Black Stain root disease (*Leptographium wageneri*). Each has its own particular biology and options for management. Unlike dwarf mistletoe disease, destruction of the above-ground portions of trees does not necessarily remove root disease from forest ecosystems. Ongoing monitoring and early protection is critical for preventing excessive destruction from these diseases. Minimizing damage to residual stems during logging, planting and encouraging resistant species, and particularly maintaining stands with trees of high vigor are the most important management techniques that can help limit the spread of most root diseases.

Botany: Rare Plants

There are two plant species listed in the Oregon Natural Heritage Plan (ONHP) that occur on lands to be managed under the 2016 AFP.

Three Leaved Horkelia
There is a population of three leaved horkelia (*Horkelia tridentata*) in unit C2 in the Lower Watershed parcel. Three-leaved horkelia is an ONHP List Two species. List Two species are taxa that are threatened with extirpation or presumed to be extirpated from the state of Oregon. These are often peripheral or disjunct species which are of concern when considering

species diversity within Oregon's borders. They can be very significant when protecting the genetic diversity of a taxon. The ONHP Center regards extreme rarity as a significant threat and has included species which are very rare in Oregon on this list. In Oregon this species is only known from the Ashland Creek Watershed. It grows in dry forest openings (City of Ashland, 2009).

California Smilax
There is a population of California smilax (*Smilax californica*) in unit AP-1 at Ashland Ponds. California smilax is an ONHP List Four species. List Four species are taxa which are of conservation concern but are not currently threatened or endangered. This includes taxa which are very rare but are currently secure, as well as taxa which are declining in numbers or habitat, but are still too common to be proposed as threatened or endangered. While these taxa may not currently need the same active management attention as threatened or endangered taxa, they do require continued monitoring. This species occurs on streambanks in coniferous forest.

Landslide Hazard Zones

Areas with steep slopes offer the potential for both surface erosion and mass soil wasting, with the very steep slopes obviously of much greater concern. Surface erosion delivers sediments to draws where it accumulates over time, increasing the potential for eventual debris slides.

Areas such as identified landslide hazard zones may benefit from retention of higher densities of trees in order to reduce the likelihood of slope failure in the short-term. These benefits should be balanced with associated long-term drawbacks on a site-by-site basis. For example, this strategy may lose its effectiveness over time if excessive bark-beetle-related mortality occurs due to an overstocked stand condition and subsequent moisture stress. In this scenario, increased loss of larger overstory trees, which are more effective in holding soils together at deeper depths, is also a potential disadvantage in the long run. There can also be a higher level of fire hazard associated with these stand conditions, with increased impacts on soils and slope stability in a fire event. That is, when wildfires occur, a high percentage of the vegetation in a stand is killed and large areas of soil are exposed, which is the single most potential negative impact that can contribute to large mass wasting events.

Vegetation Development and Disturbance in the Riparian Forest

In southwest Oregon, fire exclusion in the 20th century triggered a shift in the stand dynamics of riparian forests from frequent fire disturbance and shade-intolerant tree recruitment in canopy gaps to one characterized by the replacement of overstory trees by shade-tolerant species through individual tree-fall gaps (Messier et al., 2012). Fire-sensitive and shade-tolerant white fir is represented in far greater numbers than it was prior to 1900 and few Douglas-fir trees that recruited after 1900 are on the trajectory to canopy dominance. Growth rates of Douglas-fir recruited during the 20th century, however, suggest they were not growing in canopy gaps, but in the shaded understory and thus are growing much slower than the older, dominant trees. In the shade, 20th century Douglas-fir trees would not have received enough sunlight to support the rapid growth rates achieved by the dominant trees from older cohorts. Previous work in old-growth, upland forests of southwestern Oregon found that the majority of dominant trees were the largest trees in their cohort at age 50 and they tended to remain dominant for at least 250 years. Few Douglas-fir trees that recruited after 1900 are on the trajectory to replace the large-diameter trees that currently dominate the canopies of riparian forests on northerly aspects because slow-growing, suppressed trees have reduced potential to become large, dominant trees later in life.

The most significant change in disturbance regimes in the Ashland Watershed, as well as most of southern Oregon, has been in the frequency, severity, size, and duration of fire. Mature trees typically survived multiple fires over their lifetimes.

In riparian forests on southerly aspects, vegetation was most likely shaped by a low-severity fire regime, similar to that of southwestern ponderosa pine where frequent fires killed most tree seedlings and maintained open savannas or woodlands with shade-intolerant hardwoods and scattered, open-grown conifers. The age structure of live Douglas-fir observed for these sites suggests the survival of trees to a fire-resistant size was infrequent, resulting in low conifer densities relative to northerly sites.

In riparian forests on northerly aspects, patches of high-severity fire within the moderate-severity matrix apparently created canopy gaps in which new cohorts of Douglas-fir could establish within existing stands and perpetuate Douglas-fir overstory dominance. Fire exclusion has been associated with an increase in tree density and an increase in the recruitment of white fir, a fire-sensitive, shade-tolerant species. Without large canopy gaps, Douglas-fir recruitment has been restricted to the shaded understory where

it grows very slowly and is unlikely to replace the large canopy dominant Douglas-fir trees that recruited before 1900. The Douglas-fir dominated canopy may eventually be replaced by white fir, which does not produce high quality, large diameter, more decay-resistant standing snags and coarse woody debris that are desired
for both terrestrial and aquatic species habitat.

The dominant trees in riparian forests would likely have been the individuals that recruited into canopy gaps after fire where they were able to develop full crowns and grow rapidly out of the "lethal flaming zone". Until the late 19th or early 20th century, it appears most tree recruitment into the overstory of northerly aspect riparian forests occurred in large canopy gaps (greater than 30 meters in diameter) created by fire.

Vegetation Change Due to Managed Disturbance, 1995-2015

Over the past 20 years, the City has implemented active management of existing vegetation structures to more closely create conditions that would reach their objectives. The intent has been to begin to move forest vegetation closer to the more open stand conditions of the historic forests while more closely emulating natural functional processes and ecologic outcomes over time. In the process, vegetation has again been modified by this new disturbance regime that can be generally characterized by the following factors:

- Frequent gradual reductions in stand density to improve tree vigor and reduce the potential for insect-related mortality
- Thinning-from-below to improve forest structures, create fuel discontinuities and decrease likelihood of high-severity fire
- Shift to more open stand conditions and encourage development of more shade- intolerant species while also reducing likelihood for spread of high-severity crown fires
- Regular slash reduction of activity-generated fuels to ensure ongoing reduction in the potential likelihood and severity of fire when it occurs
- Reintroduction of low-intensity fire through an active prescribed underburn program to restore this important ecological and functional process to forest ecosystems

Stand and Landscape Patterns

The City of Ashland has implemented vegetation manipulation through planned disturbances on a fine scale, with prescriptions and implementation occurring on a unit basis. These prescriptions and the subsequent implementation has been site-specific and closely monitored in a collaboration between City staff, contract personnel, and the Ashland Forest Lands Commission. The results of that work are shown in chapters 8 and 10 of this document – Inventory and Monitoring respectively, and describe current vegetation conditions for each unit, as well as the past management activities that have produced current outcomes and projections for additional vegetation modifications in the future. Although management on City lands will continue to be done on a very site specific, fine scale approach, the following information provides general guidelines for desired vegetation conditions by plant association group (PAG).

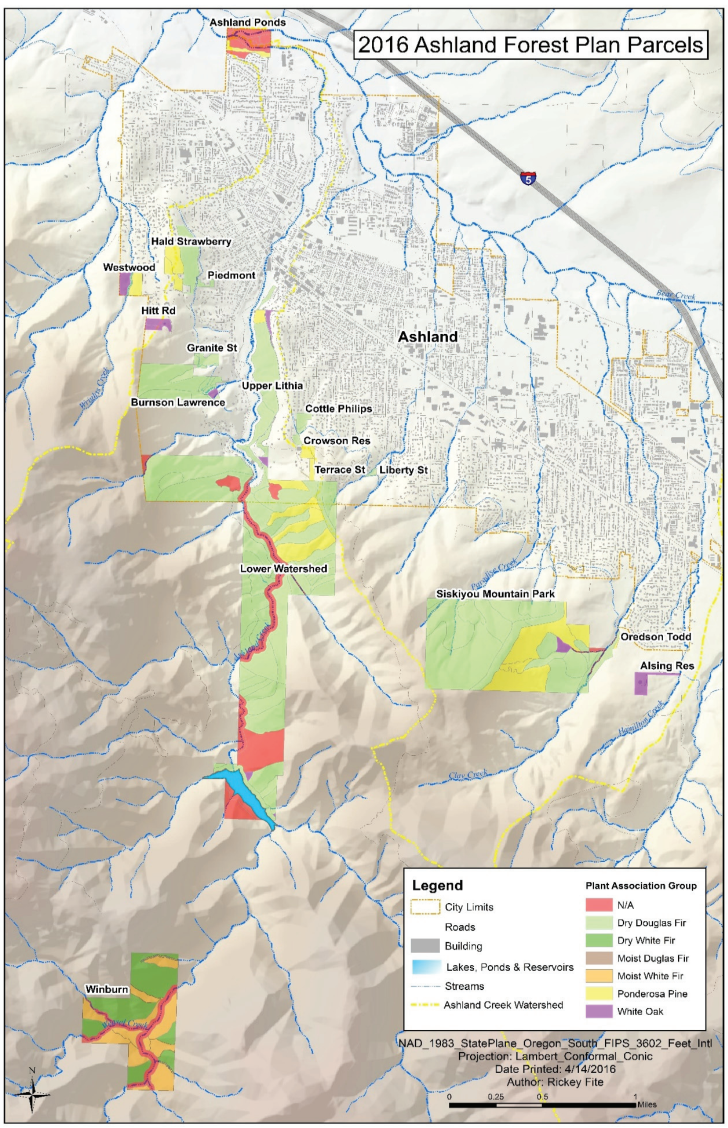
Plant Association Groups (PAGs)

Trees, shrubs and other plant life can be classified in many different ways fulfilling a variety of purposes. The Ashland Watershed, including the City of Ashland forestlands, has been stratified into designations called Plant Association Groups (PAGs) in order to expedite accurate discussion and address the specific vegetation concerns and prescriptions. Plant Association Groups provide a general picture of major vegetation patterns across a forest. Each PAG is comprised of closely-related plant associations, or groupings of plants that occur together in similar environments. These environments are typically defined by their temperature and moisture regimes, soils, and history of natural disturbances, such as wildfires, diseases and insect outbreaks. PAGs may also be characterized by features other than vegetation, such as cinder, glacier, lava, meadow, rock and water. Together, the PAGs provide a picture of both the vegetation and the non-vegetative features within a large area (Grenier et al., 2010). The City lands covered under the 2016 Ashland Forest Plan are primarily in the Dry Douglas-Fir PAG.

Table 9-2: PAGs on City of Ashland Forestlands

PAG	Number of Acres	Percent of City Forestlands
Dry Douglas-fir	675.8	59.8
Moist Douglas-fir	0.0	0
Oregon White Oak	20.6	1.8
Ponderosa Pine	130.1	11.5
Unclassified	131.0	11.6
Dry White fir	71.2	6.3
Moist White fir	102.3	9.0
Total	1,131.0	100.0

Figure 9-5: PAGs on City of Ashland Forestlands by Parcel



The following short descriptors of each PAG were assimilated from the Upper Bear Assessment (USDA FS, 2003)

Dry Douglas-Fir PAG

The primary disturbance agent in this PAG was frequent, low-severity fire, occurring on a 5 to 15 year average return interval. Insects, diseases, and fire return time interacted to determine fire severities. These frequent fires burned in a mosaic pattern missing some patches, allowing development of the mid-seral closed structure type. These most likely occurred in riparian areas associated with perennial streams and springs, and on some lower slopes of north aspects.

At the stand level, this PAG would commonly be considered uneven-aged with most of the structure consisting of groups of trees. As a whole, stands may appear to have had up to three layers due to the number of different age classes within the stand. Shrubs and grasses were a substantial feature of this PAG with the relative abundance of shrubs over grasses depending on the number of years since the most recent fire. A longer fire interval allowed more shrub development.

Surface erosion and landslide potential were moderate for this portion of the landscape. Several debris flow landslides occurred during 25, 50, and 100-year flood events, but probably not as frequent as compared to current conditions. In addition, larger trees that existed in the past would have aided in slope stabilization.

Moist Douglas-Fir PAG

The primary disturbance agent in this PAG was frequent, mixed-severity fire, occurring on a 15 to 25 year average return interval. Insects, diseases, and fire interacted to determine fire severities. Although the typical fire was of mixed severity, low-severity fire tended to predominate.

Seral stage dynamics in the moist Douglas-Fir PAG were very similar to those of the dry Douglas-Fir PAG with a slightly more dominant shrub layer, and a slightly higher probability of a stand moving from an open structure type to a closed type. Sugar pine was more common.

The ability of this PAG to retain soil moisture is high, due to slope aspects involved, and therefore, it is slightly less stable than the Dry Douglas-Fir PAG. Moist soils, steep slopes, dense dendritic drainage pattern, and high fire risk caused this PAG to be at a moderate-to-high risk for landslides and at high risk for erosion potential. To a large extent, these disturbances occurred in and/or adjacent to stream channels, springs, seeps, and concave drainage features. Moderate and large conifer trees were frequently removed and transported down slope during these mass wasting events. Sediment, large rock, and other debris were often carried and deposited far down slope from the source of the landslide.

Oregon White Oak PAG
Human-caused fire, initiated on a regular basis, strongly influenced vegetation conditions in this PAG. Well-established and uniformly distributed perennial grasses offered regular opportunities for indigenous burning, and a five year average return interval is estimated.

Oregon white oak was the dominant tree in these clay soils, with a lesser amount of California black oak. Ponderosa pine was scattered on the landscape as the large overstory dominant trees. It is probable that the trees in this open, savannah-like landscape were mostly older individuals, ranging up to 300 or more years. Closed structure types were rare.

This PAG is considered low risk for landslide hazards due to decreased slope gradients and gradation away from the coarser, less-cohesive granitic soils of the neighboring Ponderosa Pine and Dry Douglas-Fir PAGs.

Pathogens thrived generally at lower levels compared with those seen today. Sparsely located ponderosa pine were attacked by bark beetles during extended droughts but this sparse tree distribution substantially reduced the likelihood of any spreading disease. Mortality was probably related to site characteristics (e.g., shallow and/or clay soils) interacting with climatic extremes.

Ponderosa Pine PAG
The primary disturbance agent in this PAG was frequent, low-intensity fire, occurring on a 5 to 10 year average return interval. This PAG is most commonly located on the dry, more southerly aspects and these conditions, coupled with Native American burning in the nearby oak woodlands, contributed to increased fire frequency.

Under this disturbance regime, mid-seral and late-seral open structure types were by far the most common. Generally, vegetation tended to occur in clumps with a range of ages expressed between individual trees or clumps of trees. At the stand level, this PAG could be described as uneven-aged with ponderosa pine the most common conifer species, comprising 50 to 75 percent of the total composition, with the remainder in Douglas-fir and sugar pine. Pacific madrone and Oregon white oak probably comprised less than ten percent of the pre-settlement stands.

Vegetation and fuels were horizontally discontinuous in this PAG, with numerous openings maintained by frequent fire. Grasses and herbaceous vegetation were much more common than shrubs due to the frequent fire interval.

Surface erosion and landslide potential were low-to-moderate in this PAG, due to decreased slope gradients on these southerly aspects. Although this PAG tended to have more bare soil than others, surface erosion may not have been high due to abundant but thin grass cover. Reduced risk for high-intensity wildfires also reduced risk of large landslides and erosion that often follows a fire.

Low levels of ponderosa pine and sugar pine mortality occurred from western and mountain pine beetle (less than 0.5 percent per year). Dwarf mistletoe was likely of very low occurrence in pines or Douglas-fir.

Dry White Fir PAG

The primary disturbance agent in this PAG was mixed-severity fire occurring on a 25 to 35 year average return interval. Low-severity fire tended to predominate.

Seral-stage dynamics in this PAG are similar to those of the Dry Douglas-Fir PAG. The mid-seral open structure type was the most common. Some closed structure types were more likely to develop and persist than in the Douglas-Fir PAGs. The longer fire intervals resulted in a more dominant shrub layer and a higher probability of a stand transitioning from an open to a closed structure type. Individual patches could have up to three canopy layers, particularly in the late-seral closed type.

This PAG is completely within the rain-on-snow zone. Consequently, the risk for landslides to disturb and/or remove vegetation is considered moderate to high. Surface erosion for this area is also classified as high. Soil productivity and fertility would have periodically been adversely affected when topsoil was removed during large-scale surface erosion occurrences. These erosive actions upon the soils have caused vegetative cover to be reduced in areas that were usually highly productive. It would take a long period of time for soils and vegetation to recover from these large-scale erosion events. A majority of the damage occurred during the large flood events that commonly occurred in a time span ranging from 10 to 25 years apart.

Douglas-fir dwarf mistletoe was present at some unknown level, perhaps about 35 percent of the stands. Dwarf mistletoe was probably found in scattered stands in all mid-seral and late-seral stages, but it was likely most concentrated in the mid-closed and late-closed stages.

Moist White Fir PAG

Fire in this PAG was of mixed-severity, occurring on a 40 to 50 year average return interval. The relative proportions of low and high-severity fire were roughly equal. Other substantial disturbance agents included bark beetles, defoliators, dwarf mistletoe, and laminated root disease. Both fire and root diseases were responsible for creating small to medium-sized openings.

High productivity resulted in a predominance of closed structure types. The combination of disturbance agents promoted greater variation between the relative proportions of structure types, compared with the drier PAGs. Western white pine was a minor, but important species and sugar pine was most abundant in this PAG. Shrubs and forbs were more predominant in all structure types, and forbs tended to dominate the undestory in the closed structure types.

The landscape included such wide variation in patch sizes that it is very difficult to describe with averages. The Moist White Fir PAG had the highest level of within-stand and between-stand variation compared with the other PAGs in the landscape.

This PAG is located on east and north aspects and would tend to retain a larger percentage of soil moisture. It also falls completely within the rain-on-snow area for this landscape. Consequently, the risk for landslides to disturb and/or remove vegetation in this PAG is considered high. Surface erosion potential for this area is also classified as high with similar outcome potentials as the Dry White Fir PAG.

Small to moderate scale epidemic outbreaks of bark beetles or defoliators were possible, especially in the late seral closed structure type. Laminated root disease and dwarf mistletoe were relatively common.

Vegetation: Dilemmas and Directions

The key to the preservation of water quality and the other forest resource values within the Ashland Watershed is contingent upon the ability to manage the geographical distribution and intensity of wildfires that will occur within the watershed. The majority of wildfires that have burned in the Ashland Watershed during the last century have occurred at lower elevations within the Wildland Urban Interface (WUI) and have burned into the watershed in response to upslope wind patterns, slope, aspect and vegetative patterns. Of these four factors, vegetative pattern is the only one that can be pre-emptively managed. The effective manipulation of wildfire fuel vegetation within the WUI and in the larger Ashland Watershed can significantly reduce the threat of a catastrophic wildfire.

However, an inherent false dichotomy may appear to exist within the strategies currently employed by City forestland managers as they manipulate and disturb the vegetation in the Ashland Watershed.

On the one hand, as clearly outlined in City objectives, there is a strong desire to prevent, suppress, and prepare for fire where it threatens lives and properties. In and near the city, a single goal applies across yards and homes: protect lives and property. Effective vegetation management to reduce the potential of wildfire within the WUI is of even greater importance when these areas are located in or adjacent to municipal watersheds and also experience heavy recreational use.

On the other hand, research and collected data suggest the imminent need to restore fire as a key ecological process in the long-term health of the Ashland Watershed. Further compounding this dichotomy, is the general desire of the citizenry to reside safely within a forested landscape that has evolved historically and can only be kept healthy with frequent, low-intensity fires.

The restoration of a natural, landscape-scale patch diversity and balanced fire regimes close to a WUI is an outcome few (if any) forestland managers have accomplished on a watershed scale. This objective is being pursued by the City with an understanding that the current set of watershed conditions reflects an interruption of vegetation cycles and ecological interactions that are complex and not easily duplicated. What is universally understood by all stakeholders who value our forestlands is that doing nothing other than fire suppression is not an option.

Chapter 10

Monitoring: Plots and Protocol

Monitoring, in general, is obtaining accurate information over time and maintaining a long-term record. Forest monitoring entails a purposeful and systematic observation and documentation of characteristics of the landscape and responses of the landscape to various management strategies including a "no management" option.

Monitoring is an essential and ongoing part of the restoration of City forestlands. It provides the basis for an adaptive management approach by regularly assessing conditions that can give valuable feedback and initiate appropriate changes in management activities. Over time, there will be changes in understory vegetation and tree growth. It is imperative that the effects of stand density reductions, prescribed fires, and other silvicultural treatments be monitored to evaluate their effectiveness and inform future work.

There are two types of monitoring, qualitative and quantitative, both of which have intrinsic and unique value.

Figure 10-1: Qualitative Monitoring – Subjective Assessment

Photo courtesy of City of Ashland

Qualitative Monitoring

Qualitative observations are any observation made using the five senses. Qualitative evaluations may involve value judgments and emotional responses. They are produced through anecdotal evidence, surveys, community meetings, and sensory observations.

The word "subjective' is often applied to qualitative monitoring. The type of intimate understanding of the forestland and the associated resources, as well as the public context in which their management exists, has important values that cannot necessarily be obtained through quantitative, data-driven monitoring. Complex biological relationships can be analyzed and assessed experientially over time in ways that are not necessarily available through quantitative assessments alone.

This type of monitoring has been conducted for more than twenty years by City staff, the Ashland Forest Lands Commission (AFLC), Ashland Parks and Recreation Commission, and Small Woodland Services, Inc., the City's contract forestry and resource management consultant.

Figure 10-2: Quantitative Monitoring – Objective Assessment

Quantitative Monitoring

Quantitative monitoring employs repeated measurements of important numerically assessable indicators that can be tracked over time. The resulting data sets offer important insights into longer term trends and changes. Quantitative approaches are very useful in balancing institutional and individual biases that are a normal part of organizational processes. Quantitative monitoring can inform a qualitatively-oriented decision making process and provide a base of unbiased information upon which to base those decisions. The maintenance and repeated measurement of more permanent quantitative data can allow for a reliable assessment of changes over time and offer a solid continuity, even though individuals in the decision making process may change. The inherent reliability offered by quantitative monitoring can also help develop a greater level of trust among community members than might occur through qualitative methods alone.

Photo courtesy of City of Ashland

City of Ashland Forestlands Monitoring Protocols

Forestlands monitoring is most effective when it integrates knowledge and understanding that emanates from both qualitative and quantitative sources. To date, the City has been fortunate to be able to incorporate information from both forms of monitoring.

Unlike larger ownerships, such as federal agency holdings, where there is far more acreage than can be closely monitored, the City ownership is of a size in which ongoing interactions by professionals and involved citizens has resulted in an understanding of considerable depth and breadth, both ecologically and socially, that might not be obtained otherwise. It is expected that the qualitative monitoring that has provided the solid foundation for City forestlands management for more than twenty years will continue with monitoring protocols and longitudinal data solidly in place.

To date, the City has invested in a series of 206 permanent inventory plots, with two rounds of inventory data collection that allows for assessments of both current conditions and changes over time. Analysis of that data has been largely dependent on episodic needs of City staff (e.g. to help answer an important question), rather than as a regular analytical occurrence. This has been due, in part, to budgetary requirements that prioritized implementation of projects over additional post-monitoring analysis. Recent efforts to standardize inventory and monitoring on all City lands, including on lands managed by Ashland Parks and Recreation Commission, is a significant step forward for the City of Ashland, particularly as more landscape level approaches to forest and resource management are imperatively driven by wildfire prevention strategies.

Figure 10-3: Plot 4, Winburn Parcel, 2003
(note stump; left of center in photo)

Photo courtesy of Marty Main

Figure 10-4: Plot 4, Winburn Parcel, 2009
(note stump; left of center in photo)

Photo courtesy of Marty Main

Figure 10-5: Plot 4, Winburn Parcel, 2013
(note stump; lower left in photo)

Photo courtesy of Marty Main

Monitoring provides information to help determine if management actions are meeting the objectives of the Ashland Forest Plan. The monitoring plan is designed to do the following:

- Track ecosystem elements that are likely to change as a result of management actions including tree vigor, ground layer vegetation, species composition, and soil cover
- Compare effects of treatments at different locations
- Ensure that the desired effects are produced
- Provide feedback on the effectiveness of our individual actions so we can respond in an adaptive management framework

Phases of Quantitative Monitoring
Typically, quantitative monitoring consists of four phases:

1. **Inventory or Baseline Monitoring**: to provide an initial assessment of species distribution and environmental conditions. (i.e., "What is there now?"). A problem encountered during the development of the 2016 AFP was the inconsistency of available inventory data. The Lower Watershed and Winburn Parcel both have a systematic forest inventory consisting of formal plots. However, other parcels have inventory data resulting from individual projects and local knowledge. This inventory data exists in multiple formats: spreadsheets, narratives, and photographs. To solve this incongruence in data, a new inventory format was designed for the 2016 AFP. The 2016 Unit Attribute Summary has 21 individual attributes for each AFP unit and is now consistent for all lands managed under the plan. A GIS database has been created so that the information can be analyzed to assist in developing management recommendations. The Attribute Table and Data Dictionary can be found in Chapter 8 and includes both quantitative and qualitative assessments.

2. **Implementation Monitoring**: to determine if management actions were accomplished as planned. (i.e., "Did we do what we said we would do?"). For example, following the 2004 Restoration II project in the Lower Watershed Parcel, permanent plots were re-visited post-harvest to determine if implementation occurred as it had been designed (e.g., were the trees marked for removal the actual trees removed in the operation?).

3. **Effectiveness Monitoring**: to determine if a management action achieved the stated objectives. (i.e., "Did our actions accomplish what we wanted them to?"). For example, *effectiveness monitoring* has been used on the Winburn Parcel to determine whether restoration work has reduced the number of small trees competing with the highly desirable larger trees, and whether pine species have been retained while white fir has been reduced. This was represented by measurement of trees per acre of each species, and basal area of each species, both before and after work was completed.

4. **Validation Monitoring**: to determine if the assumptions and models used in developing the existing management plan have proven correct, and modify them as necessary (i.e., "What have we learned from what we have done?"). For instance, improved tree vigor is an important gauge of density management effectiveness. This is most easily represented as diameter growth rate in rings-per-inch acquired through increment boring. Forest inventory plots can help determine if tree vigor is actually improving through increasing the rate of diameter growth. For example, ongoing monitoring on the Winburn Parcel Restoration III project will determine if goals to increase the health of pine and other leave trees was achieved by reducing stand density.

Monitoring of City Forestlands Management to Date

What is learned from City forestlands monitoring efforts is key to guiding future adaptive management strategies. When resource objectives are met, those management practices are continued. When resource objectives are not met, monitoring data assists our forest managers in changing management techniques to reach stated objectives. Since 1995, four significant forest management projects have occurred on City forestlands:

1. **Restoration I**, beginning in 1996 and continuing to date, has focused primarily on stand density and fire hazard reduction through thinning of non-commercial size classes of trees, with follow up slash treatment, throughout the City forest lands.
2. **Restoration II**, beginning in 2004 on the Lower Watershed Parcel, was primarily additional stand density reduction through helicopter thinning on 183 acres, with follow up treatment of activity-generated fuels.
3. **Restoration III**, beginning in 2013, consisted of helicopter thinning and follow up treatment of activity-generated fuels on 74 acres of the Winburn Parcel.
4. **Restoration IV**, the name given to the ongoing practice begun in 2013, primarily involves prescribed underburning that has been implemented following completion of the various projects in Restoration I-III. These treatments have recently been elevated by City forestland managers to a long-term ongoing management practice, used once units have undergone stand reduction activity so that fire can be utilized as a planned low-severity disturbance event.

Each of these four projects (Restoration I-IV), has included a different mix of qualitative and quantitative monitoring. The following sections and tables describe each phase of quantitative monitoring done for each of the four projects and provide examples of each.

Baseline Monitoring Results to Date

The City established 206 permanent monitoring plots and initiated data collection on both the Lower Watershed Parcel (137 plots on 486 acres) and the Winburn Parcel (69 plots on 160 acres) in 2000-2002. More data was collected in 2007-2009. Data collected at each plot included:

- Site data such as slope percent, aspect, location;
- Stand exam tree data such as live/dead, species, Basal Area (BA), Diameter at Breast Height (DBH), Quadratic Mean Diameter (QMD), Relative Density Index (RDI), Trees per Acre (TPA), height, crown ratio, dwarf mistletoe, rating, radial growth, age, crown closure;
- Fuels by size class (Brown's transects);
- Species, size, decay class of coarse woody material;
- Soil types such as bare soil, rock, litter, live vegetation, duff cover, duff/litter depth;
- Vegetation composition details such as layer, species, and percent cover;
- Photos.

Plots were not established in Riparian Management Areas (RMAs) as no active management projects were planned. Plots were also not established in scattered smaller parcels under City jurisdiction. No plots were established on lands administered by the Ashland Parks and Recreation Commission.

Data from these plots have been summarized and analyzed by the City, primarily on an *ad hoc* basis. There are, however, a number of variables that have never been summarized and/or analyzed because there was never an explicit need by the City to do so. The capacity to perform needed retrospective summaries/analyses at any time is in place because the actual plot data for all variables is permanently stored in City of Ashland files. The City plans to re-visit the plots again (budget depending) within the next several years. This ongoing data collection provides the opportunity to assess long-term changes in the biophysical features on City forestlands.

Implementation Monitoring Results to Date

Implementation monitoring is used to determine if management actions were accomplished as planned. Three major projects have occurred on the City ownership in which follow-up quantitative implementation monitoring has occurred. The results of quantitative monitoring were presented in a number of documents (Main, 2003; Main, 2006; Main, 2007; Main, 2010; Main, 2013; Main, 2014).

An example of implementation monitoring that has been completed occurred in the 2004 helicopter thinning project (Restoration II) on 183 acres of City lands in the Lower Watershed Parcel. The data are summarized in Table 10-1 (Main, 2003).

Table 10-1: Trees Removed in Restoration Project Phase II

Diameter	Live trees	Dead trees
≤17” dbh	4202	1563
>17” dbh	120	283

Following the harvest, a revisit to permanent plots confirmed that what had been planned had actually occurred: the trees marked for removal were the ones removed. This is shown in Table 10-2.

Table 10-2: Trees Removed by Unit in Restoration Project Phase II

Unit	Acres	17" dbh Live	< 17" dbh Dead	> 17" dbh Live	> 17" dbh Dead	Total	Trees / Acre
A2	7.0	62	43	0	4	109	15.6
Barranca	1.8	0	111	0	3	114	63.3
B 2, 3, and 4	33.1	485	787	2	48	1,322	39.9
B 5, 6, and 7	9.4	298	143	3	20	464	15.6
D1	7.5	25	150	0	31	206	27.5
D2	4.2	209	9	3	6	227	54.0
E 2, 3, 4, and 5	11.0	218	92	9	38	357	32.5
F	4.5	126	30	1	4	161	35.8
H	3.5	26	35	2	27	90	25.7
J	5.0	104	6	13	10	133	26.6
K1 and 2	7.0	20	14	6	39	79	11.3
K3	4.3	96	47	6	17	166	38.6
L1	3.5	89	2	10	0	101	28.9
M	15.0	320	2	21	2	345	23.0
N	21.3	984	16	8	7	1,015	47.7
P/Q	40.3	905	36	33	14	988	24.5
S2	5.0	235	40	3	13	291	58.2
Totals	**183.4**	**4,202**	**1,563**	**120**	**283**	**6,168**	**33.6**

Effectiveness Monitoring Results to Date

Effectiveness monitoring is used to determine if a management action achieved the stated goals. This is dependent on clearly articulating desired goals and simultaneously selecting appropriate monitoring indicators to quantitatively measure achievement of the specific goals. If goals and monitoring indicators are not developed concurrently, it is common to have goals that cannot be measured quantitatively and must then be assessed only by qualitative methods.

The following goals have been developed for projects on City ownership:

Restoration I (R-I) Goals:

1. Protection of watershed values and maintenance of water quality and quantity for the City
2. Maintenance and/or promotion of forest and ecosystem health
3. Reduction in wildfire hazard and risk

Restoration II (R-II) Goals:

1. Promote healthy forest stands for the long term through reducing stand densities by thinning understory and middle-canopy trees
2. Maintain structures, features and processes critical to the functioning of mature forests such as large trees, snags, down logs, multi-layer canopy, soil structure and nutrient recycling
3. Significantly reduce the likelihood of a large scale, high-intensity wildfire through activities that will restore a disturbance regime more closely emulating the historic range of natural disturbances. Although highly variable, these natural disturbances included frequent, low-intensity fires as opposed to infrequent, high-intensity fires. This goal will not be accomplished with a single management action and may take years or decades to complete
4. Minimize the need for continued intervention in the landscape and eventually allow natural fire cycles and other disturbance events to occur
5. Protect and improve riparian transition zone habitat, specifically those areas where the vegetation shows a distinctly different plant community compared to the adjacent uplands
6. Increase stability of surface soils by increasing effective ground cover, including coarse woody debris, mosses, native grasses and low shrubs
7. Develop an approach for reducing stand density while protecting slope stability in moderately sensitive geologic areas (Hazard 2 Zones)
8. Encourage and preserve native species diversity on a landscape level

Restoration III (R- III) Goals:

1. Promote forest health through reducing stand densities
2. Maintain structures, features, and processes critical to the functioning of late seral forests, such as tree densities and biodiversity appropriate to the forest type, large snags, down logs, multi-layer canopy, soil structure, and nutrient cycling
3. Significantly reduce the likelihood of a large-scale, high-intensity wildfire through activities that will restore a disturbance regime more closely emulating the historic range of natural disturbances, including reintroduction of natural and/or prescribed fire
4. Protect and improve aquatic and riparian transition zone habitat
5. Increase stability and productivity of surface soils by increasing effective ground cover, including coarse woody material, mosses, native grasses and low shrubs
6. Maintain and protect wildlife by preservation of key habitat characteristics and retention of structural diversity across the landscape

Restoration IV (R-IV) Goals:

1. Return low-intensity fire as an ecosystem process
2. Reduce one and ten hour fuels by 30% to 60% to minimize potential for wildfire ignition/spread
3. Reduce developing understory vegetation, especially sprouting madrone, whiteleaf manzanita seedlings, hairy honeysuckle and other shrubs by 25% or greater to promote native grass and herbaceous vegetation
4. Maintain existing overstory conifers and hardwoods by limiting overstory mortality to 10% or less
5. Maintain 1000 hour fuels for large woody debris by retaining 50% or more of these fuels
6. Protect existing duff layer with objective to retain 50% of the duff depth over 75% or more of the area

Using data from permanent monitoring plots, a number of the above-described goals were quantitatively assessed for effectiveness. [Basal Area (BA), Diameter at Breast, Height (DBH), Quadratic Mean Diameter (QMD), Relative Density Index (RDI), Trees per Acre (TPA)]

For example, reductions in stand densities have been quantified to help assess effectiveness in achieving goals R-I.2, R-I.3, R-II.1, R-II.3, R-III.2 and R-III.4. Monitoring data from Restoration III has made clear that stand density reduction had occurred (Tables 10-3 and 10-4).

Table 10-3: Pre and Post Stand Density in Winburn Parcel Units

Unit (#plots)	Pre-Helicopter (2007-08)				Post-Helicopter				Post-Helicopter (w/ NCT)			
	TPA	BA	QMD	RDI	TPA	BA	QMD	RDI	TPA	BA	QMD	RDI
1 (n=19)	335	222	11.0	0.74	222	158	11.5	0.52	135	139	13.7	0.42
4 (n=4)	102	250	21.2	0.64	74	215	23.1	0.53	74	215	23.1	0.53
5 (n=5)	204	225	14.2	0.68	124	165	15.6	0.48	90	155	17.8	0.43

It was also confirmed (Table 10-4) that a reduction in trees per acre of shade tolerant species had occurred, while no shade intolerant species had been removed. This was an important species composition shift pertinent to Goal R-III.3.

Table 10-4: Pre- and Post-Thinning Stand Density by Species in Winburn Parcel

Tree Species	Unit 1 Pre-Treatment			Unit 1 Post-Treatment		
	TPA	BA	BA%	TPA	BA	BA%
Black Oak	3	<1	<1	3	<1	<1
Douglas-fir	203	150	68	129	95	60
Incense-cedar	30	6	3	6	4	3
Pacific Madrone	26	9	4	19	6	2
Ponderosa Pine	6	30	14	6	30	19
Sugar Pine	1	5	2	1	5	3
White Fir	66	21	9	57	17	11

Tree Species	Unit 4 Pre-Treatment			Unit 4 Post-Treatment		
	TPA	BA	BA%	TPA	BA	BA%
Black Oak	0	0	0	0	0	0
Douglas-fir	93	235	94	73	187	98
Incense-cedar	0	0	0	0	0	0
Pacific Madrone	0	0	0	0	0	0
Ponderosa Pine	0	0	0	0	0	0
Sugar Pine	0	0	0	0	0	0
White Fir	9	15	6	1	5	2

Tree Species	Unit 5 Pre-Treatment			Unit 5 Post-Treatment		
	TPA	BA	BA%	TPA	BA	BA%
Black Oak	0	0	0	0	0	0
Douglas-fir	177	194	86	106	137	83
Incense-cedar	0	0	0	0	0	0
Pacific Madrone	8	4	2	0	0	0
Ponderosa Pine	4	20	9	4	20	12
Sugar Pine	0	0	0	0	0	0
White Fir	15	7	3	15	7	4

Discussions, both qualitative and quantitative, of other stand attributes that changed during the Restoration III project are discussed in greater detail in the Winburn Parcel 2013 Treatment Summary (Main, 2013). The value of using both qualitative and quantitative monitoring was evident during the development of that report.

For example, post-treatment results for basal area and relative density index (RDI) in Unit 4 (Table 10-3) were somewhat higher than planned and implemented during the project. This may have been due to the low number of plots (n=4) in the small unit. The subsequent addition of six systematically-arranged plots resulted in an actual basal area of 192 ft^2/acre, rather than the 215 ft^2/acre previously reported. The higher retention of basal areas and RDI than might typically be retained in many prescriptions was the result of two qualitative judgements not reflected in the data:

- High height/diameter ratios and small crowns in the unit made it appropriate to leave more trees for potential loss from windthrow, helicopter damage, etc.
- This site was judged to have a higher potential maximum stand density index (SDI) than other sites which would result in an RDI that was lower than indicated by the data alone.

Several of the goals outlined above could not be quantified, such as Goal RII.4, RIII.1, and portions of others. In some cases, these could be assessed qualitatively. In many cases, additional qualitative assessments could improve the analysis.

In Restoration IV, an overarching goal has been to return low intensity fire as an ecosystem process where appropriate - a goal partially accomplished by utilizing prescribed burns. Accomplishment of this goal can be a qualitative assessment (i.e., the goal was accomplished if fire was re-introduced as an ecosystem process).

Quantitative assessment of this goal can be accomplished with more elaboration, such as measuring flame length to indicate low-severity fire. Retention of a duff layer, an important factor in reducing the potential for soil erosion, can be quantitatively assessed after prescribed underburning. Effectiveness monitoring in Unit E2 found that significant increases in percent of bare soil occurred after prescribed underburning (Main, 2014).

Table 10-5: Unit E2 Pre and Post Burn Soils[1]

[1] Soils inventory protocol developed by David Steinfeld, USFS Soil Scientist

Date	Bare soil (%) (n = 200')	Live vegetation (%) (n = 200')	Duff/Litter (%) (n = 200')	Duff Depth (inches) (n = 20)
Pre-burn (6-7/2007)	7.9	24.0	68.1	0.75
Post-burn (1/2014)	55.5	3.0	41.5	0.4
Post-burn (7/2015)	37.3	18.7	44.1	0.46

Additional *effectiveness monitoring* will continue on prescribed underburns on City forestlands and will be used to inform adaptive management by trying other methods for protecting duff layers. Eventually, *validation monitoring* may be employed through repeated permanent plot re-measurements to determine the level of validity assumed wherein prescribed underburning can be used while protecting duff and watershed values.

Validation Monitoring Results to Date

Validation monitoring verifies or refutes the assumptions that guide proposed management actions, and modify them as necessary (i.e., "What have we learned from what we have done?"). For instance, improved tree vigor is a very important gauge of density management effectiveness. This is most easily represented as diameter growth rate in rings-per-inch acquired through increment boring. This data has been collected on all forest inventory plots on the City ownership and can help determine if thinning has improved tree vigor as measured by increasing diameter growth over time. For example, ongoing monitoring on the Winburn Parcel Restoration III project will determine if goals to increase the health of pine and other leave trees was achieved by reducing stand density.

In "Post-Treatment Monitoring- Lower City of Ashland Ownership" (Main, 2006), radial growth had not improved in the years following thinning treatments, although understory vegetation had increased significantly. This raised the question as to the validity of the underlying assumption that thinning would improve vigor of the retained trees on this portion of the City ownership, with notable differences by sites, species and crown ratios.

Longer time frames are often needed to measure the validity of underlying assumptions and models. The short interval following the 2004 Restoration II helicopter thinning may not have been enough time to determine outcomes for validation monitoring, especially given the presence of high populations of flatheaded borers in Douglas-fir that can affect stand level responses to thinning.

On the Winburn Parcel, inventory data collected over 13 years suggested no increase in mortality of older legacy trees even when higher basal areas were retained around those trees. The removal of smaller, more competitive size classes, both around individual legacy trees and later on a stand level basis, likely helped produce that outcome. The extensive data set, with one repeat measurement and a second planned in the next several years, should offer ample opportunity to conduct *validation monitoring* as needed by the City.

Monitoring Under the 2016 Ashland Forest Plan

The 2016 AFP goals (see Management chapter) are more general than some of the project level goals discussed above for R-I, R-II, R-III and R-IV. While both qualitative and quantitative monitoring has been and will continue to be important in guiding City forest management, future monitoring under the AFP will emphasize specific quantitative indicators. In addition to monitoring which provides new data, both the Lower Watershed Parcel and Winburn Parcel have extensive data from past monitoring that is available for future review and analysis.

Given the limitations on both fiscal and human resources, monitoring, in the short term, will focus on the indicators that make the most effective use of those resources and that build on past monitoring. Ultimately, by considering all of the quantitative information supplied by indicator assessments, a final, more comprehensive qualitative assessment can be made as to progress with each individual goal.

The 2016 AFP describes management actions and subsequent monitoring by the City of Ashland on City forestlands. These are the monitoring indicators marked below with an asterisk (*). Other monitoring indicators, while providing important information toward achievement of 2016 AFP goals, are outside of the scope of this plan (e.g., Ashland Creek watershed stream temperature as measured by USGS gauges upstream of City forest lands).

Monitoring Indicators for Goal I-A: Promote healthy, resilient forest ecosystems

1. Stand Vigor*
   A. Radial growth
   B. Crown ratio
   C. Basal area, relative density
   D. Insect and disease extent and ratings

2. Tree species composition*

3. Stand density*
   A. Basal area and relative density by unit
   B. Seedling stocking

4. Plant species abundance and composition*

5. Existing or developing late seral forest conditions
   A. Tree size class distribution by species
   B. Snag and large woody debris
   C. Canopy closure

6. Frequency and magnitude of natural disturbance regimes, and deviation from them*
   A. Regional aerial insect mortality detection surveys
   B. Dwarf mistletoe disease- extent, severity

Monitoring Indicators for Goal I-B: Significantly diminish the likelihood of a high severity wildfire through active vegetation and fuels management that emulates the historic range of natural disturbances

1. Strategic location of fuel reduction treatments*
   A. Areas, total acres on City of Ashland ownership

2. Possibility for stand level crown fire initiation*
   A. Surface fuels
   B. Understory cover
   C. Height to crown base

3. Possibility for sustaining crown fire*
   A. Horizontal discontinuity of fuels
   B. Canopy closure
   C. Crown bulk density

Monitoring Indicators for Goal I-C: Maintain water quality and quantity for use by the City of Ashland and for the enhancement of aquatic life in the watershed, minimizing the potential for soil erosion and landslide events

1. Soil resources and surface erosion*
   A. Understory cover
   B. Percent bare soil

2. Slope stability*
   A. Slope stability hazard mapping
   B. Location, size and extent of recent landslides

3. Water quality
   A. Stream temperature
   B. Turbidity/total suspended solids

4. Aquatic habitat
   A. Fish habitat and abundance (via ODFW or USFS Stream Surveys)
   B. Stream bottom composition

5. Riparian Management Areas
   A. Collect baseline data for Riparian Management Areas

Monitoring Indicators for Goal II-A: Encourage citizen input and increase public awareness and education in the process of maintaining the health of the forest lands, the urban interface and the Ashland Watershed

NOTE: Social indicators are difficult to measure solely on City forestlands. A broader discussion of social monitoring and indicators has been pursued at the landscape level and references to those studies are in the Social Chapter. Indicators listed here will be measured in conjunction with broader efforts as funding allows.

1. Community knowledge and acceptance of restoration activities and the perceived benefits
   A. Prescribed burning/smoke management
   B. Ecologically sensitive timber harvesting
   C. Protection of municipal water supply
   D. Protection from wildfire

2. Opportunities for fostering connection to the watershed and sense of responsibility for outcomes

   A. Number of individuals and hours worked by volunteers or students on work projects and monitoring
   B. Number of public tours given on City forest lands, and number of people participating
   C. Number of programs and presentations given, and number of people attending
   D. Number of reports, brochures, videos and other outreach materials produced and distributed

Monitoring Indicators for Goal II-B: Integrate recreational opportunities into the larger context of active forest management.

A. Ashland Woodland & Trails Association data on numbers and types of recreational users of trails on City forestlands
B. Miles of trail built and maintained on City forest lands
C. Number of trail signs installed and maintained on City forest lands
D. Number of recreational opportunity maps and brochures published and distributed

Conclusion

A proficient monitoring process will continue to provide information to shape the improvement of both planning and implementation of future work on City of Ashland forestlands. These monitoring protocols will offer an ongoing assessment of the 2016 AFP's overall effectiveness. With new information and ecological understandings that result from good monitoring, necessary adjustments to planned activities will occur in the ongoing spirit of adaptive management.

Chapter 11

Forestlands Management: Goals and Guidelines

The original Ashland Forest Plan (AFP) stated that the primary mandate of City administration is to "manage the city forest lands in a manner which maintains and enhances the Ashland Watershed and provides the City with a sufficient, high quality source of water." The 1992 AFP further states: "In order to emulate the historical role of fire in the ecosystem, a carefully applied program of tree salvage, thinning, and prescribed fire will be introduced" (McCormick et al, 1992).

Goals

Pursuant to this mandate, the Ashland Forest Lands Commission (AFLC), adhering to its mission to "develop forest management plans for the City's municipal forests", holds forth with the following five goals that will continue to guide our work. These goals will apply to all City forestlands administered under the 2016 AFP.

Ecological

- Promote healthy, resilient forest ecosystems including appropriate native plant and animal habitat.
- Significantly diminish the likelihood of a high-severity wildfire through active vegetation and fuels management that emulates the historic range of natural disturbances.
- We acknowledge that fire will occur on City lands in the future and that our management efforts are designed to allow it to occur at times, locations, scales and intensities that more closely meet current resource objectives.
- Maintain water quality and quantity for use by the City and enhance aquatic life in the watershed while minimizing the potential for soil erosion and landslide events.

Social

- Encourage citizen input and increase public awareness and education in the process of maintaining the health of the forest lands, the Wildland Urban Interface (WUI) and the broader Ashland Watershed.
- Integrate recreational opportunities into the larger context of active forest management.

Guiding Principles

Restoration projects will be planned to embrace ecosystem health. Thus, management activities will be based on thorough site evaluations, where applicable, by experts in botany, fire ecology, fisheries, fuels, geology, hydrology, silviculture, soils, and wildlife.

Proposed active management and restoration treatments will not be broad brush strokes but site-specific activities based on environmental site conditions including existing vegetation, past management actions, current management objectives, and Desired Future Conditions (DFC).

Forest management activities will generally be designed to maintain or enhance development of older forest conditions.

Proposed active management and restoration treatments will continue to draw from the mounting volume of data emerging from the monitoring of our own site-work that has been ongoing since 1995. Monitoring and data collection protocols will be continued and broadened to allow for regular and continued adaptive management.

No trees will be removed simply for economic value. *What is left behind is more important than what is removed.* Timber and other forest commodities will be generated only as a by-product of designed management and restoration activities

As has been successfully practiced for over 20 years, management decisions will be considered within the social context of local citizen involvement using the Ashland Forest Lands Commission as the venue for public input and interaction.

Management Basis

Achieving goals for forest ecosystems generally involves manipulating vegetation - a process humans have been involved in for thousands of years. This portion of the 2016 AFP describes the various factors that have guided active forest management over the past 20 years and includes updated strategies and directions that will guide implementation of this next phase of forest management.

In the early 1990s, the City began a project of actively manipulating vegetation on their ownership to achieve land management objectives. However, before beginning that process, a clear understanding of the wide diversity of vegetation types was needed. Given the range of vegetation conditions on the City ownership, a more formal process of categorizing City forestlands vegetation into units was initiated with associated suggested management activities based on that categorization. Each of these units also received a prescription for needed management activity - a planned disturbance(s) designed to achieve management objectives on both a unit and landscape level. More recently, lands held and managed by the Ashland Parks and Recreation Commission have also come under the forestry management umbrella of the AFLC and have been stratified into management units.

Although the large percentage of the acreage owned and administered by the City and addressed in the 2016 AFP is located in forests dominated by mixed conifers and hardwoods, other non-forested parcels are included. These non-forested parcels contain grasslands, shrublands, small tree-diameter woodlands and openings on less productive sites with their own unique set of values and opportunities. Due to the urban/semi-urban location of most of these small parcels, fire management goals are paramount, while hydrological and slope stability goals are less emphasized. Recreational opportunities tend to be highlighted on these smaller parcels and management of these lands will use site-specific approaches often unique to the parcel itself (e.g., retaining certain unique vegetation and habitat types such as Oregon white oak woodlands or small whiteleaf manzanita brushfields).

With this initial categorization of units, the City began actively working to adjust forest stand structure, density and species composition to help achieve the goals in ways that more closely emulates historical patterns of disturbance. Prescribed management activities will encourage the development of forest conditions that allow for the occurrence of functional processes, such as frequent, low-to-moderate-severity fire or insect infestation in a frequency, severity, scale and duration that are closer to that which occurred historically.

The need for active management can change both spatially and temporally. The importance of both qualitative and quantitative monitoring allows, through adaptive management, appropriate alterations in management direction.

Early assessments of forest and vegetation conditions on the City forestlands found a range of site and/or stand characteristics that suggested a strong need for active management to achieve City objectives.

Individual units were analyzed for three general characteristics:

- The inherent fire susceptibility of the vegetation in the unit and the benefits of, on a landscape level, altering that vegetation to achieve fire management objectives

- Existing stand and vegetation structure, density and/or species composition that was far from desirable and in some cases threatened by insects, disease, and excessively high stand densities

- Site conditions with an inherent high susceptibility for slope failure

These three priority conditions were mapped, analyzed and guided forest management decision-making and subsequent implementation of forest and resource management activities.

After 20 years of carefully planned and strategically targeted management activities, the resulting forests and stands have been altered in ways that have resulted in the following:

- Reduced potential for impacts from high-severity fire

- Structures, densities and species compositions that are more vigorous, and offer a greater likelihood of resistance to, and resilience from, high-severity disturbance

- Stand conditions that continue to minimize the likelihood of slope failure

These changes have been well documented. Qualitative valuations have been performed through periodic work done by City staff, AFLC and our contract forester, and quantitative assessments through regular data collection and analysis on the 206 permanent plots on the City ownership.

Vegetation Management

Initial management practices were guided by silvicultural prescriptions developed for each unit with eventual review and analysis by City staff and the AFLC. To achieve City forest management goals, implementation has largely occurred at a unit-level or stand-level basis. Restorative prescriptions in forested areas largely call for stand density reduction by thinning- from-below which improved tree and stand vigor and accelerated development of older forest conditions. The resulting activity fuels from these operations have been hand-piled and burned. In some cases, this was followed by prescribed underburning and removal of surface and ladder fuels with the subsequent reduction in wildfire potential in the post-treatment forest.

In the first decade of active management on the City property, thinning-from-below primarily occurred in tree size-classes less than eight inches diameter at breast height (dbh) that had limited commercial value. Thinning-from-below has also been employed in two cases (2004 and 2013) on the City ownership where size classes of trees to be removed retained adequate and useful market value. Once retrieved, through the use of helicopters, their sale helped offset the costs of management.

This general stand management strategy of thinning-from-below was combined in specific places with variable density thinning and/or radial thinning around older mature trees where the removed trees were most often of shade intolerant species. The implementation of this range of silvicultural practices, each determined on a site specific, unit-by-unit basis, encouraged continued development of older forest structures by retaining and nurturing the larger and older trees in any stand. Following initial attempts to improve overall stand density, succeeding entries have included strategies that encourage a modified clumped distribution of trees at various scales more typical of historical forests.

Throughout this time, forest management activities have largely been implemented on the stand level on City forestlands, with improvements in density, structure and species composition more important than focusing on individual trees. However, in the interest of conserving older legacy trees, radial thinning around legacy trees has been prioritized and implemented on City ownership. This targeted thinning treatment occurred mainly during the first five years of active management primarily as a stopgap measure to buy more time until more extensive stand level treatments were accomplished.

Initial radial thinning mainly focused on smaller, non-commercial size trees which are more competitive for site resources which disproportionately affects the vigor and survivability of the desired legacy tree. These small trees contribute to a significant increase in potential fire behavior around a legacy tree, whether the fire is planned or not. Our past experience has justified this management approach: prior to initiating the first prescribed underburning on City forestlands in 1997, radial thinning of non-commercial trees and shrubs was implemented around all older legacy trees in the unit, promoting reduced fire behavior and impending small-tree competition impacts to the legacy tree.

Figure 11-1: Unit C2 in 1996 Pre-Treatment

Photo courtesy of Marty Main

Figure 11-2: Unit C2 after non-commercial thinning

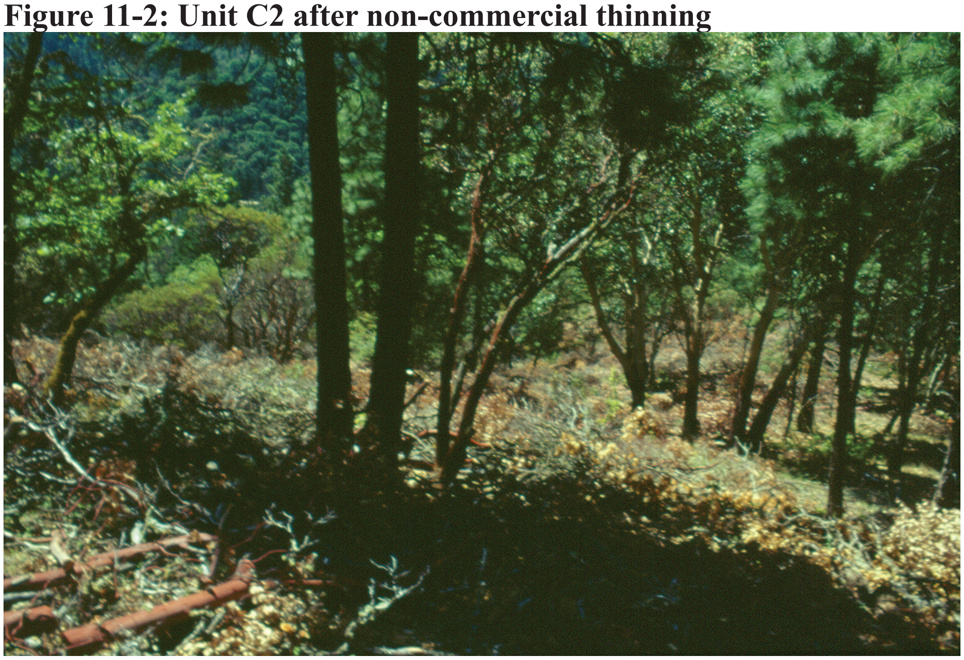


Photo courtesy of Marty Main

Figure 11-3: Unit C2 after non-commercial thinning slash was burned

Photo courtesy of Marty Main

Figure 11-4: Unit C2 post underburn in 2015

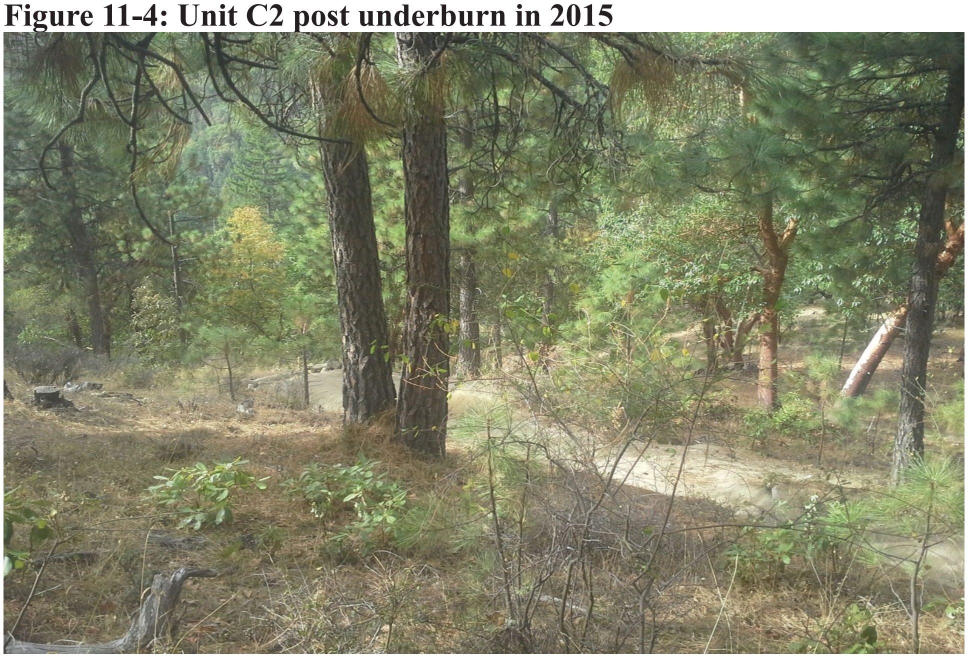


Photo courtesy of Marty Main

On the Winburn Parcel where the large majority of legacy trees on City forestlands exist, a three-stage process has been completed encouraging survivability of larger, older legacy trees:

1. Initial removal of 90% of the smaller trees (up to eight inches dbh) in the immediate vicinity of individual legacy trees in 2000
2. A more extensive stand-level thinning in 2003 of smaller trees in units that contain legacy trees
3. In 2013, additional stand-level thinning of larger-sized but suppressed trees, using helicopters, as well as additional smaller tree radial thinning around legacy trees as needed during the treatment of activity fuels

Monitoring data has revealed that around individual legacy trees, basal areas were reduced from 198 to 171 ft^2/acre in the first treatment in Unit One in 2000, and to 90 ft^2/acre after the second treatment in 2013. On a stand level, initial 2000 pre-treatment unit densities of 218 ft^2/acre were ultimately reduced to 139 ft^2/acre following treatments in 2013.

These multiple-entry, conservative interventions around older, highly-stressed, legacy trees gradually released them from unfavorable stand conditions that was the result of over 100 years of growth without disturbance. These interventions were also accomplished over a 13 year time frame that included significant drought events with minimal loss of legacy trees (i.e. losses were below endemic levels). This mirrored the results of a retrospective study by Latham and Tappeiner who found that release and improved vigor occurred in conifers 168-650 years old in southwestern Oregon over a wide range of post thinning retained basal areas (up to 252 ft^2/acre) and concluded that “vigor of the trees can be improved without intensive density reduction” (Latham and Tappeiner, 2002). On the Winburn Parcel, a wide range of retained densities around legacy trees occurred (20-180 ft^2/acre), with tree retention around the legacy tree focusing on vigorous and larger trees of desired species at various spatial configurations rather than imposing a pre-determined spacing guideline for tree removal. Thinning styles and intensities were also adjusted to fit the different species of legacy trees, including hardwoods such as oaks and Pacific madrone.

A primary long-term strategy exercised on City forestlands is to gradually shift stands towards older forest conditions, with the concomitant forest health and fire management benefits, while, at the same time, encouraging the retention of legacy trees of various species and ages. On the Lower Watershed Parcel, Oregon white oaks are often the only legacy trees and these oaks may be as or older than any of the oldest conifers on the entire

City ownership. These legacy trees will be promoted through individual tree and stand-level practices. Even in stands without existing individual legacy trees, implementation of pre-legacy thinning in the vicinity of the oldest, most vigorous trees of desired species is prioritized in order to encourage development of older forest structures.

Over the past 20 years, forest thinning on a stand level basis, whether commercial or non-commercial, has shifted forests on City forestlands to less dense, more open forest conditions that has resulted in more vigorous trees and stands. This has improved stand resistance to high- severity wildfires, as well as resiliency from insect and disease attack. An occasional high-intensity, stand-replacing disturbance may be beneficial to dry forest ecosystems over time and within more remote locations. However, the close proximity of City forestlands to lives and property that would be threatened by a rapidly expanding high-severity fire will demand continuing forest management on a path of reducing the likelihood of a stand-replacing wildfire event.

The above-described forest management activities have more recently been favorably viewed on a regional (and even national) basis as the primary strategy in dry forests for retaining our existing array of forest values. At this point, the City has one of the longest track records of actively applying these management strategies. While these strategies have mainly been implemented on the stand or unit level on City forestlands, future collaborative and federal agency directions now suggest an increasing trend towards a wider landscape context across other ownerships in the Ashland Watershed, a process in which the City is actively involved. *It is important to note that the very first accomplishment of cross-boundary work by the Forest Service in the nation occurred on City forestlands in the 1997 prescribed underburn near Reeder Reservoir.*

Riparian Management Areas

Production of high quality water from the Ashland watershed for use by the City remains a primary goal guiding City forestlands management on both City ownerships and in the larger Ashland Watershed. The key to successfully achieving this objective is promotion of healthy, fully-functioning aquatic and terrestrial riparian ecosystems, as well as the associated upland forest ecosystems previously described.

A single, specific management plan for the aquatic and riparian resources on the City ownership in the watershed has not been developed. To date, little management activity has occurred within the newly created Riparian Management Areas (RMAs).

City forestlands administered under the 2016 AFP present 5.37 miles of streams flowing through them and 96.17 acres of RMA. Outside of the City limits, management direction for streams on non-federal lands, including those owned by the City, is provided by the Oregon Department of Forestry (ODF) under the Oregon Forest Practices Act. Streams that flow within the City limits are governed by the City Riparian Ordinance. The remainder, which is the large majority of streams in the Ashland Watershed, are located on Forest Service ownership and are governed by a separate set of rules specific to that organization.

Intermittent and ephemeral streams, which are not mapped as such in the current data set, will be treated per the regulations governing that class of stream based on site specific review during unit level implementation.

Table 11-1: Stream Segments Managed under the City Riparian Ordinance (1.32 miles / 15.77 acres)

Streams Inside Ashland City Limits (Ashland Riparian Ordinance)						
Creek Name	Miles Perennial Stream with Fish	Miles Perennial Stream	Miles Intermittent Stream	Total Stream Miles	Riparian Management Acres	Riparian Management Area
Ashland Creek AP	0.23	0.00	0.00	0.23	4.73	APR-2
Ashland Creek LW IN City	0.31	0.00	0.00	0.31	2.93	LWR-1
Bear Creek	0.25	0.00	0.00	0.25	5.87	APR-1
Clay Creek	0.00	0.00	0.39	0.39	1.22	OTWR-1 SMPR-3
Hamilton Creek (AR)	0.00	0.00	0.01	0.01	0.06	ARR-1
Westwood Park	0.00	0.00	0.13	0.13	0.96	WR-3

Table 11-2: Stream Segments Managed under the Oregon Forest Practices Act (3.9 miles / 80.41 acres)

Creek Name	Miles Perennial Stream with Fish	Miles Perennial Stream	Miles Intermittent Stream	Total Stream Miles	Riparian Management Acres	Riparian Management Area
Ashland Creek LW Out City	1.45	0.00	0.00	1.45	34.42	LWR-1
LW Trib1	0.00	0.00	0.13	0.13	0.80	LWR-4
LW Trib 2	0.00	0.00	0.19	0.19	0.64	LWR-3
Paradise Creek	0.00	0.00	0.19	0.19	0.81	SMPR-1
Reeder Res	0	0.00	0.00	0.00	14.46	LW-Res
Weasel Creek	0.40	0.00	0.00	0.40	6.52	WR-4
West Fork Ashland Creek	0.77	0.00	0.00	0.77	17.92	WR-2, WR-3
Winburn Trib 1	0.00	0.00	0.21	0.21	0.45	WR-1
Winburn Trib 2	0.13	0.11	0.00	0.24	1.58	WR-8
Winburn Trib 3	0.07	0.00	0.00	0.07	0.78	WR-7
Winburn Trib 5	0.14	0.00	0.00	0.14	1.58	WR-5
Winburn Trib 6	0.08	0.00	0.02	0.10	0.45	WR-6

Many of the stream segments in the above tables have been considerably altered by various land uses that have compromised riparian and aquatic function. This is especially true within the city limits of Ashland, as well as in the segment between the city limits and Reeder Reservoir. In these settings, objectives can be quite different than in more wildland settings. Existing infrastructure, property values, intense human usage and multiple values are already in place adjacent to the RMAs.

Above Reeder Reservoir, and specifically on the Winburn Parcel, aquatic and riparian functions are more intact. Even in this parcel, the lack of fire disturbance is affecting vegetation development. Although very little active management has occurred to date to improve conditions in the aquatic/riparian network on City forestlands, work could be undertaken to improve these zones and, in most cases, that work would involve alterations in existing vegetation.

Riparian vegetation provides many important ecosystem services that contribute to healthy aquatic ecosystems including:

- bank stability and mitigation of erosion;
- natural water filtration, trapping waterborne sediment;
- shade structures and subsequent reduction of water temperatures;
- reduction of flood-stage flows and promotion of slower, year-round release of water;
- substrate framework for insects and other organisms with soil nutritional inputs; and
- large woody material that provides cover and improves functional habitat for fish and other organisms.

To date, the RMAs have been a lower management priority and the City has only cautiously intervened. Increased knowledge and understanding about these types of riparian/aquatic systems and how they function has been developed in recent years (Bear Creek Watershed Council 2007, Messier et al., 2012). Key to this understanding is the emerging knowledge that stream systems are used to having regular disturbances within a wide range of frequency, intensity, duration, and scale.

A century or more of alteration in the historic fire regimes in dry forests has also affected system-level functioning of the RMAs on the City forestlands. Changes in disturbance regimes have shifted many of these forests into a new successional trajectory with these undesirable traits:

- Uncharacteristically high tree densities
- Increased recruitment of fire-sensitive species
- Temporal patterns of tree recruitment unlike those of the past

This increased understanding of riparian functions, suggests that the City may consider a more proactive approach to management of the RMAs based on an individualized approach for each RMA. Large-scale, high-intensity storm events are undesirable for the City, particularly in larger stream segments where flow intensities and impacts can be devastating (e.g. 1997 flood in Ashland). In smaller stream segments, including intermittent/ephemeral streams higher in the Ashland Watershed, upland forest disturbances, such as fire, will likely have a greater effect than those effects resulting from storm events. Emulating this continuum of disturbance within RMAs on City forestlands is a guiding principle for active intervention to improve hydrologic/ecologic functioning.

If thinning and prescribed fire treatments are to be applied within RMAs, City management will need to balance those objectives with the in-stream habitat requirements for fish and water quality. In particular, the need for a steady supply of large woody material and a well-shaded aquatic environment may appear incompatible with the restoration of more open forests such as likely occurred on more southerly aspects, and particularly on more savanna or woodland conditions. Ironically, reductions in tree density upslope as a function of forest restoration or fuels reduction to reduce fire intensity may increase water infiltration into the soil, reduce transpiration loss, and result in greater stream flow and cooler in-stream temperatures.

Treatments may include the creation of canopy gaps, retention of untreated areas, clumps and irregularly-spaced trees. Generally, smaller trees (Cohorts 2 and 3) will be thinned from below to establish the more desired open forest structure and to the extent possible, the largest trees of all species in the stand would be retained. Therefore, density reduction will primarily include trees in the less than 100-year age class and less than 17-inch diameter size. Trees of larger size classes may be considered for removal only if sufficient amount of snags and the coarse woody material (CWM) components have already been retained. In addition, trees to be thinned are also candidates for retention as in-channel structures if that ecosystem component is lacking.

Proposed treatments are site-specific based on Plant Association Groups (PAGs). For instance, on stable slopes with southerly aspects, more open stand conditions will be promoted to maintain and encourage pine and hardwood species. On moist, northerly aspects, management will primarily encourage a more closed canopy stand condition with some exceptions.

Table 11-3: Riparian Management Areas

Forest Type	Amount	Objective(s)
Closed Canopy	Greater than 50% of the acres	• Maintain a closed canopy forest that can survive an underburn
Gap	Gap plus refugia acres combined equal remaining acres not being managed for Closed Canopy forest	• Promote the development of large (> than 24” dbh) conifers • Target species include sugar and ponderosa pine, Douglas-fir or incense cedar • May be natural regeneration or planted stock
Refugia	Gap plus refugia acres combined equal remaining acres not being managed for Closed Canopy forest	• Promote development of fire intolerant species including alder, bigleaf maple, and Pacific yew • Maintain heavier fuel loading and increased understory species diversity compared to the closed canopy forest type

Ashland Ponds

Ashland Ponds will have a specific management strategy developed for that parcel. This unique parcel is the only one on all City ownership with potential for anadromous fisheries enhancement. Both Bear Creek (0.25 stream miles / 5.9 RMA acres) and Ashland Creek (0.23 stream miles and 4.7 RMA acres) have opportunities for aquatic habitat improvement.

These opportunities include

- adding stream shading,
- creating off-channel rearing habitat,
- improving bank stability,
- placing of instream structures (whole trees with root wads and large boulders), and
- reconnecting the stream with its floodplain.

Numerous restoration projects have been cooperatively implemented on this parcel by Ashland Parks and Recreation Commission and the Lomakatsi Restoration Project.

Snags and Coarse Woody Material

A number of activities and historic processes have affected the snag and coarse woody material (CWM) component of City forestlands. Actions such as mortality salvage logging can immediately change forest structure by removing the snags and subsequently changing downed log volumes. A subtler change in the dead wood component has also occurred through fire exclusion, which has increased the amount of CWM on the forest floor particularly in the small to medium size classes. Downed logs previously consumed during wildfires now have a longer forest floor residence time as they decompose rather than burn. This has allowed a higher volume per acre of downed logs to accumulate than would have occurred with a more frequent fire return interval. In addition, the increased mortality rate among trees of all sizes from insects and disease has increased the amount of snags and eventually CWM developing in the Ashland Watershed. At the same time, the absence of a fire that would have killed live trees, thus creating snags, has reduced the natural recruitment of downed logs and snags (City of Ashland, 2009).

Snags

Snags, particularly larger diameters, offer critically important wildlife habitat values as well as contributing to the essential CWM component of the forest floor. Large snags over 21 inches dbh are particularly valuable. At least 96 wildlife species in Oregon and Washington are associated with snags as they use snags for shelter, roosting and hunting. Most species utilize snags greater than 14 inches dbh.

Cavity nesting species are particularly dependent on large snags.

Snags can compromise wildfire suppression activities by rapidly escalating the rate-of-spread through firebrand production at their tops representing a significant safety hazard that can limit or even prevent fire-fighter deployment into critical fuel management zones. Similar problems can occur during prescribed fire but are mitigated through preplanning and treatment design. Given these potentially conflicting management objectives, snag retention has been adjusted on City forestlands to maximize benefits and minimize concerns. In particular, snags are less desirable in the Lower Watershed Parcel, particularly close to homes and improvements, where fire management goals are paramount. Snags are also less desirable close to trails and other areas that receive a considerable volume of public use.

In more wildland settings, ridges, upper thirds of slopes, and RMAs or lower third of slopes are very important for late successional dependent species such as fishers and other forest carnivores.

Snags on ridges are essential for bats. Bats generally are thought to prefer snags near ridge tops for day roosts. Snags taller than the general canopy are preferentially used by bats, particularly as maternity roosts with these snags providing the warm microclimate necessary for rapid fetal and juvenile development. Clusters of snags are especially important.

Snag management along ridges and upper slopes will seek to retain snags at current levels unless their retention will create a wildfire control hazard. Snags that increase fire hazard will be felled and left on site as CWM unless they, in turn, increase wildfire hazard as ground fuel overload. Snags should be retained as high as possible on slopes.

Snags that extend above the primary canopy, but do not extend above the level of the ridgeline will be priorities for retention. Areas around clusters of three or more snags are a priority for understory vegetation slashing and pruning. Activity fuels will be off-zone hand piled and burned to reduce the potential for ignition around snag clusters.

In RMAs and upslope areas prone to landslide, snags of all size classes contribute the large woody debris component that is critical to creation and maintenance of stream structure and function. Recruitment of large woody material to stream beds provides support for the aquatic ecosystem by creating physical habitat structure as well as nutrient cycling and other in-stream processes. Snags in various size classes also are important to the recruitment and decay sequences as downed logs revitalize and build forest soils.

Table 11-4: Snag Recommendations from Restoration II

Ponderosa Pine	Dry Douglas-fir	Moist Douglas-fir	Dry White Fir	Moist White Fir
3 – 4 snags > 17" dbh / acre	3 - 4 snags > 17" dbh / acre	4 snags > 17" dbh / acre	Average 4 large snags / acre	3 to 6 snags / acre

(City of Ashland 2003)

Snag inventories were conducted on the Winburn Parcel in 2000 to provide baseline data.

Table 11-5: Winburn Parcel Snags in 2000

Unit Number	Snags / Acre	
	> 18" dbh	All Sizes
1	3.3	8.1
2	4.2	6.8
3	4.5	4.5
4	7.1	7.1
5	4.6	13.0
6	6.1	10.5

(City of Ashland 2009)

Coarse Woody Material

Coarse woody material (CWM) performs vital ecological services, including stabilizing surface soils, increasing organic content in soils and providing habitat for the many organisms that depend on wood in various stages of decay. The volume of CWM retained on City forestlands will depend on site-specific considerations such as existing plant communities, topography, slope gradient, fire management considerations, the potential for insect outbreak, and others.

Although CWM data has been collected at two different times on permanent plots in the City ownership, only a limited amount of summary and analysis of that data has occurred, and this only from the original data collection in 2000-2002. While some changes may have occurred since then, the summary data is still instructive.

Table 11-6: Coarse Woody Material Recommendations from Restoration II

Ponderosa Pine	Dry Douglas-fir	Moist Douglas-fir	Dry White Fir	Moist White Fir
Few - no numbers given	Moderate to high levels - no numbers given	No numbers given	Moderate level – 2 to 6 logs / acre	High level – 8 to 10 logs / acre

(City of Ashland 2003)

Coarse woody material inventories for the entire Winburn Parcel were generally high, at least in part due to logging slash left after the 1990 logging.

Table 11-7: Winburn Parcel Coarse Woody Material by Unit in 2000

Unit Number	Down Logs / Acre		
	5 to 9” diameter	10 to 19” in diameter	> 20” diameter
1	1	18	11
2	9	15	14
3	0	11	24
4	0	0	3
5	0	3	8
6	0	5	20

(City of Ashland 2009)

None of the inventory data from 2007-2009 has yet to be summarized and analyzed. Furthermore, current comparisons between data sets and summaries used in this report should be cautiously accepted because data collection protocols and models for calculating summaries may also have been different. Additionally, none of the data collected has yet to be summarized by decay class. Such a summary would provide valuable comparisons with earlier data sets and render important insights that could guide CWM management on the City forestlands.

CWM distributions are complex. Surprisingly, more than 50% of the acres analyzed throughout southwest Oregon show no CWM at all, indicative of the highly variable nature of CWM distribution. In general, however, the highest volume of downed logs should be left in RMAs for the same reasons mentioned above for snag retention. Away from streams, the southerly aspects historically would have very few downed logs. Three out of four acres would have no downed logs at all with the remaining acre having 50 to 75% less than seen on the northerly aspects (City of Ashland, 2003).

A dilemma similar to the snag-retention conflict exists between retention of downed logs for their important contributions to site productivity and other values, and the negative impacts that result from a wildfire management perspective when excessive amounts of CWM exist in fuel reduction zones. The above data suggest that amounts of CWM may be within acceptable ranges on both the Lower Watershed Parcel and on the Winburn Parcel. However, fire management concerns on the Lower Watershed Parcel, coupled with its lower site potential and more frequent historical fire regime, suggest that lower amounts of CWM are appropriate vis a vis the Winburn Parcel.

Pathogen Management

Insects and diseases that damage or kill forest vegetation are important parts of healthy, functioning forest ecosystem serving many important ecological roles. They are an essential form of disturbance that can effectively reduce stand densities, improve overall stand vigor, provide important wildlife habitat values, supply CWM for the forest floor, facilitate nutrient cycling, and perform numerous other ecological functions (City of Ashland, 2009). Many of these pathogens tend to cause tree mortality in small groups causing gaps that can encourage early seral vegetation while creating vital gaps in crown fuels that can reduce the potential for developing a high-severity crown fire.

In most healthy forest ecosystems, insect-related mortality is usually light and scattered, with primarily the weakest trees being attacked. However, in forests of increasing levels of stress or declining in forest health, damage from insects can increase dramatically and reach uncharacteristically high severity and perhaps attain a large-scale disturbance. Bark beetles, which are sensitive to "stressed" trees, attack weakened trees that are suffering from a range of severe cumulative stress factors that include drought, disease, soil compaction, soil disturbance, and logging damage. The most common form of stress in the Ashland Watershed is high stand densities, primarily the result of a change in fire regimes through fire suppression and the subsequent lack of more frequent, low-intensity fires. Increased stand densities over time reduce the availability of site resources for individual trees including soil moisture, nutrients, and available light. The resulting reduced tree vigor simply makes trees more susceptible to successful attack by insects and diseases.

Insects

Insects attack trees under stress. Once an insect, especially the bark beetle, gains entry to a stressed tree, it can chemically communicate this fact to others of its species, thereby causing a "mass attack," which kills trees outright. As insect populations increase, stand level mortality of conifers can result in a disturbance regime of increased scale and severity.

A general preventative prescription calls for fostering vigorous growing conditions for potentially susceptible host trees. Ecologically-based silvicultural strategies to reduce the likelihood of higher severity disturbance from insects will focus on continuing to reduce stand densities in most of the stands on the City forestlands. Ideally, these treatments would be applied well in advance of a drought, allowing time for improved tree vigor to repel insect infestation. Additional silvicultural practices to limit the frequency, scale, and severity of insect-related disturbances include:

- rapid disposal of available insect breeding habitat (i.e., green slash produced during thinning activities) which is particularly important for pines;
- seasonally appropriate thinning (usually autumn) when most beetles are dormant and the resulting slash has time to desiccate before beetle re-emergence the next spring;
- stand management practices that maximize species and structural diversity including the use of a gap-based approach for development of a more heterogeneous stand structure.

The natural disturbance process of insect-related mortality, currently at an increased potential of severity and scale as a result of forest management practices over the last 150 years, may further increase in scale, severity and frequency in the wake of predicted global warming scenarios.

Table 11-8: Common Insects on City Lands

Insect	Objectives / Considerations
Douglas-fir beetle (*Dendroctonus pseudotsugae*)	Minimize damaged (fire kill, windthrow, and logging slash) host trees.
Douglas-fir twig weevil (*Cylindrocopturis furnissi*)	Damage is most common on young, open grown Douglas-fir. Damage is pronounced during drought years. Effects are of minor importance in natural stands.
Fir Engraver Beetle (*Scolytus ventralis*)	Fir engraver activity is strongly associated with root disease, drought and defoliation. During outbreaks, significant mortality may occur over large areas. Management of root disease will also manage for the fir engraver (see management of laminated root disease below).
Flatheaded Fir Borer *(Phaenops drummondi)*	In southwest Oregon, flatheaded fir borers may behave aggressively attacking and killing Douglas-fir and white fir that are encroaching on sites that were historically occupied by oaks. Remove encroaching Douglas-fir and white fir from white oak sites.
Mountain Pine Beetle (*Dendroctonus ponderosae*)	During outbreaks, the mountain pine beetle attacks apparently healthy trees and can cause extensive tree mortality over large areas. Stand susceptibility is strongly correlated with high stocking levels and tree age.
Pine Engraver Beetle (*Ips pini*)	Do not create fresh pine slash during spring or early summer. Thin clumps of pole sized pine. Thinning should be done between August and December so slash will dry and not be suitable for the first generation of beetles flying in the spring.
Red Turpentine Beetle *Dendroctonus valens*)	Minimize injury to standing trees. Ordinarily not very aggressive and do not become epidemic. During periods of drought or through repeated attacks, these beetles sometimes kill scattered individual trees.
Western Pine Beetle (*Dendroctonus brevicomis*)	Populations fluctuate at low levels breeding in declining mature, windthrown, diseased, or otherwise weakened trees. Outbreaks are most common with large old growth and overcrowded second growth stands. During periods of drought, western pine beetle may become prominent and overcome healthy trees.

(*Goheen and Willhite 2006)*

Figure 11-5: Pine engraver beetle: *Ips* species most likely *Ips paracon-fusus*, the California five spined *Ips* from the Ashland Watershed

Photo courtesy of Frank Betlejewski

Forest Diseases

Damage to conifers from forest diseases is often insidious, scattered in occurrence, and difficult to monitor and manage. Forest diseases tend to weaken trees and make them susceptible to demise from other agents such as insects, fire or untenable stand densities. Management strategies that reduce damage from forest diseases, or at least do not aggravate them, are an important aspect of forest management on City forestlands.

At the same time, like insects and other forms of disturbance, forest diseases are natural and important parts of healthy forest ecosystems. Balance is a key concept and the degree to which a specific disease has moved outside its normal range of disturbance will dictate the appropriateness and degree of a management response in line with City forestland objectives. Many forest diseases have increased over the past 150 years, especially with the advent of fire suppression and exclusion.

The two most important forest diseases currently affecting City forestlands are dwarf mistletoe disease and laminated root disease in Douglas-fir.

Dwarf Mistletoe (*Arcuethobium* species)
Dwarf mistletoe is a native parasitic plant that can hypothetically infect all conifers in the Ashland Watershed. Each conifer species has its own, host-specific species of dwarf mistletoe. Dwarf mistletoe is rare on all species in the Lower Watershed Parcel. Inventory results in the year 2000, prior to active management on the Winburn Parcel, indicated that 26% of the Douglas-fir were infected. In addition, this parasite is well established on ponderosa pine, Douglas-fir and white fir. It is most prominent on Douglas-fir.

When seeds of dwarf mistletoe mature, they are forcibly ejected out into the forest canopy potentially infecting adjacent trees of the same species up to 50 feet from the source tree. The seeds may also be spread over long distances by birds and other animals when the seeds stick to their feathers or coats. The disease will eventually kill the infected tree, although more typically, the disease makes the tree susceptible to demise from other agents, most notably bark beetles as the reduced tree vigor invites attack.

Since they prefer high levels of sunlight, dwarf mistletoes can spread more rapidly in open stands than in closed stands. For this reason, partial cutting and/or thinning has been known to rapidly increase dwarf mistletoe infections if a diligent job of removal is not accomplished. A second entry to remove infected trees that were missed in the first entry is not uncommon. The most undesirable element of dwarf mistletoe infection occurs when poor quality, infected overstory trees spread the pathogen to young, healthy saplings in the understory, thereby ensuring the long-term continuation of the disease. The pathogen is a slow, subtle form of disturbance that can significantly change stand conditions over time.

Heavily infected trees with abundant vertically arranged brooms – copious foliage masses produced by the tree in response to the disease – are more susceptible to conflagration in a prescribed or wildland fire. Heavily infected trees can also be wildfire hazards by transporting low-to-moderate intensity fire into upper canopy layers thereby increasing crown-fire development, spotting, and wildfire rates-of-spread. The lack of frequent, low-to-moderate intensity fire in the last century has significantly increased the abundance and severity of this disease. In heavily infected stands, dwarf mistletoe can initiate unfavorable stand conditions and development trajectories with the loss of large Douglas-fir and associated structural and habitat values and the infection of younger Douglas-fir causing undesirable long-term changes in species composition.

Large dwarf mistletoe produced brooms of Douglas-fir, are important nesting locations for spotted owls in the Ashland watershed, particularly those in larger trees in the lower slope positions preferred by the owls. At least three nest site locations have been documented within one-half mile of the Winburn Parcel. Large brooms are also used by prey species for the owl, as well as animals such as the Pacific fisher.

Balancing multiple objectives in managing dwarf mistletoe is challenging. On the Winburn Parcel, and much less commonly on the Lower Watershed Parcel, this will be assessed on a site-by-site basis. Where mixed tree species occur, isolation can also be used to minimize spread where an infected Douglas-fir is surrounded by non-host species (pine, white fir, hardwoods, etc.) (City of Ashland, 2009).

Other silvicultural options to be considered on a site-by-site basis include 1) girdling infected trees and retaining them in place in areas deficient of snags or large woody debris, 2) removal of low level infected limbs through manual pruning (pruning has only been shown to be effective long-term in ponderosa pine) 3) retaining infected trees in places where the pathogen is less likely to spread, such as in low spots in the topography (e.g., draws), as opposed to ridges or other high locations where seeds can spread much longer distances, 4) encouraging vigorous growth in dense stands of Douglas-fir that can occasionally shade out and kill low level infections of shade intolerant dwarf mistletoe, 5) clumping the distribution of infected trees into small widely separated groups thereby reducing spread and levels of contiguous infection.

The City's current program of utilizing low-intensity prescribed fire to accomplish multiple objectives, including protection of municipal watershed values, will likely remove some smaller stature trees infected with dwarf mistletoe, but not affect brooms located higher in larger trees. Prescribed underburning, then, will not significantly reduce dwarf mistletoe in most situations where retained infected overstory trees continue to re-infect understory trees after an underburn.

True Mistletoe (*Phoradendron species*)
Host tree species include hardwoods and conifers, but mostly hardwoods. True mistletoe can be common on oaks. True mistletoe is spread mainly by birds such as robins, bluebirds, thrushes, and cedar waxwings which feed on the berries. Birds digest the pulp of the berries and excrete the living seeds onto the twigs and branches of the host species, where they germinate and infect the host tree. Incense-cedar is also a true mistletoe host. Management techniques include removal of heavily infested trees and pruning infected limbs from trees with light infection.

Laminated Root Disease
Laminated root disease, is caused by the native fungus *Phellinus sulphurescens*. It is a disease that affects both Douglas-fir and white fir. Pines and incense cedar are resistant to the disease and hardwood trees are completely immune. Laminated root disease survives in the soil up to fifty years after the death of an infected tree and therefore is a disease "of the site." It requires root-to-root contact to spread and cannot grow freely through the soil. Disease hubs expand radially an average of one to two feet per year, although many healthy-appearing trees on the edge of expanding centers can be infected without showing symptoms. Windthrow of infected trees is common and is easily observed by the presence of root balls created when roots have rotted off just below the root crown (Thies & Sturrock, 1995). On City forestlands, this disease has only been found in a few small locations on the Winburn Parcel and does not appear to occur on the Lower Watershed Parcel.

Options for managing laminated root disease are listed below:

- Thin stand densities while favoring root disease resistant species especially pines, incense cedar and hardwoods
- Thin early and avoid partial harvests

The preferred treatment for minimizing the effects and spread of laminated root disease would be removing all Douglas-fir and white fir in and around infested sites and planting and encouraging pines or incense cedar or hardwood species (Hagle, 2009).

Other Pathogens
There are numerous other pathogens that exist on City ownership, but none are currently of enough significance to warrant particular management action. Regular monitoring for outbreaks of pathogens should continue to be a priority on City forestlands. It is always appropriate to map and inventory existing insect and disease locations for future reference. This is especially true for diseases "of the site" such as laminated root disease.

Prescribed Burning

The history of wildfire in the Ashland Watershed, as well as the escalation of wildfire events throughout the American West, makes a strong case for adopting robust precautionary measures to protect lives, homes, and the watershed. Taking this cue, the City has a history of active forest management employed to protect residents as well as to minimize the spread and impact of fire to the City's forestlands and the larger watershed.

Since 1995, the City has been aggressively manipulating vegetation in strategic locations throughout their forestlands such that fire, planned or unplanned, can burn in a more benign manner that more fully accomplishes management goals within the City forestlands and the Wildland Urban Interface (WUI). Many of these treated sites have now become well-suited for prescribed underburning that reduces surface and ladder fuels and returns fire as a critical ecosystem process. To that end, the City has embarked on an aggressive program of annual prescribed underburning if site conditions are within the parameters of a carefully developed burn plan. Ongoing prescribed underburning is a critical part of the long-term forest management strategy on City ownership and is key to continued reduction of fuel loading and subsequent protection of soils and hydrologic function in the Ashland Watershed. The specific objective is to develop opportunities where applied fire can reduce fuels, while maintaining sufficient ground cover. Spring burning is most often preferred over autumn burning, at least initially, to protect soils, minimize duff and litter consumption, and maintain hydrologic functioning.

Figure 11-6: Unit A2- Prescribed underburn, spring 2013

Photo courtesy of Marty Main

Figure 11-7: Unit A2 early 2014

Photo courtesy of Marty Main

Figure 11-8: Unit A2 in 2016

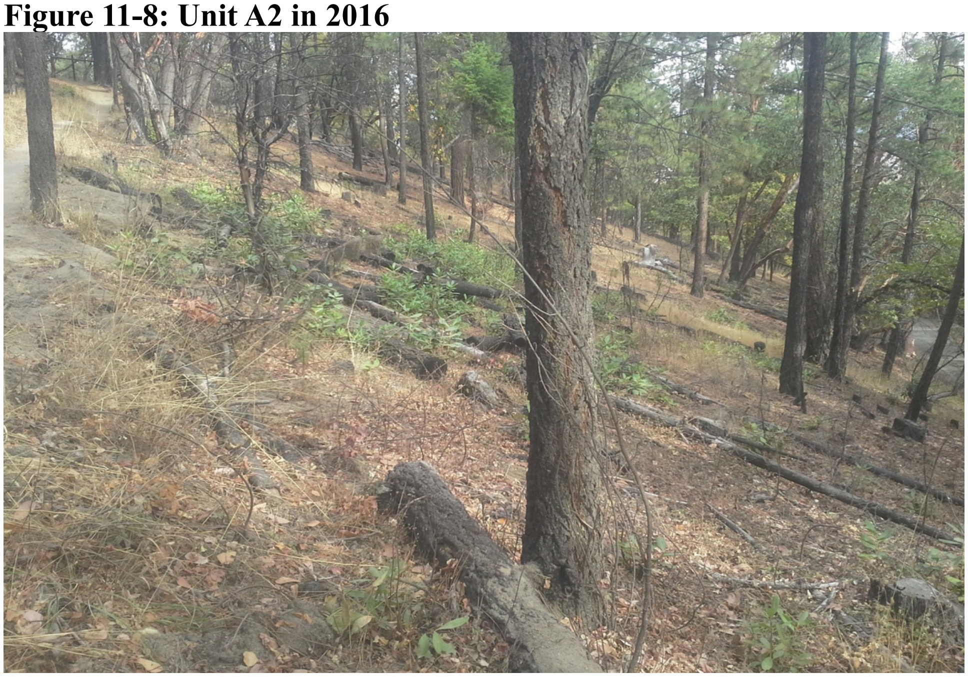


Photo courtesy of Marty Main

In the process of implementing stand management and the use of prescribed fire, the City has been encouraging a change in tree species composition back to one that is more diverse and more representative of historical compositions. In the absence of the cleansing, more frequent, low-severity fires, an unhealthy density of small, shade tolerant and/or fire sensitive trees (small Douglas-fir, white fir and Pacific madrone) have grown in since the settlement era. The number of Douglas-fir and Pacific madrone have increased dramatically in both the Douglas-fir and white fir plant association groups (PAGs), with similar increases in white fir in the white fir PAGs. This has adversely affected the development of more shade-intolerant and less fire sensitive pines, oaks, and other early successional shrubs and grasses. Carefully applied, low- severity, prescribed underburning selects against the more shade tolerant and/or fire sensitive species and restores a closer approximation of historical species compositions.

In the past, shade tolerant species were numerically dominant on cooler, more northerly aspects. On warmer and dryer settings, the proportion of shade intolerant to shade tolerant trees was about equal. In the absence of disturbance in contemporary forests, the proportion of shade tolerant trees far exceeds the proportion of shade intolerant trees, regardless of solar insolation. Long-term stand management on the City lands will continue to emphasize a return to species compositions more reflective of historical numbers and locations, while reducing ladder fuels and wildfire hazard in the process.

In all areas planned for prescribed underburning to date, and likely in the future, pretreatment will be required prior to any underburning. Pretreatment is required in most situations because the existing vegetation, developed outside of the natural fire regime, has resulted in conditions where fire can easily escalate outside of desired low severities. Pretreatment includes, but is not limited to: cutting, hand piling, and hand-pile burning of understory vegetation. Pretreatment allows for the opportunity to safely introduce low-severity prescribed fire and maintain or reduce the risk of high-severity fires.

Prescribed underburning is complicated by a host of competing factors that can make its use problematic:

- fuel hazard reduction
- duff retention
- soil protection
- smoke management
- liability exposure
- availability of trained personnel
- coordination with adjacent outside agencies and private landowners
- conflicting management objectives
- narrow environmental windows to accomplish the work
- poor access and associated difficulty in mop up
- limited road access on City lands and associated limited access to water
- high costs of the necessary pretreatment

To date, the City has conducted eight prescribed underburns covering over 100 acres in an ongoing program with more underburns expected annually.

Soils and Landslides

Soils and their essential hydrologic function are key elements of the Ashland Watershed that protect and promote forest health and our municipal water supply. These elements are fundamentally related and can be significantly altered by a variety of forest and resource management actions.

Soils
Soils on most of the City forestlands are similar to those found elsewhere in the Ashland Watershed: decomposed granite derived from intrusive igneous rocks formed during the Jurassic Age, 145 to 164 million years ago. These gravelly, sandy loams are moderately deep, coarse- textured soils

that are generally well drained. The lack of cohesion of these soils allows them to be easily detached and eroded. This is particularly true during major storm events when a high probability for surface (sheet and gully) erosion, as well as mass soil movements such as debris slides and debris avalanches can occur. The 1999 Forest Service EIS, "Ashland Watershed Protection Project", describes the soils:

> *Soils have been classed as having severe and very severe erosion hazard rating on the steeper slopes because of a combination of factors which include non-cohesive sandy texture of the soil, general lack of coarse fragments, and steeper slope gradients. On gentler slopes however, the erosion ratings are moderate. Topsoils are generally less erosive than subsoils because of the soil organic matter and root systems that bind the sands together. The subsoils, when exposed, are highly erosive. Areas in the Watershed where exposed subsoil can be observed are: on many of the cutbanks of roads transecting the Watershed, bike trails, recent landslide scars, and over-steepened slopes adjacent to perennial and intermittent streams*. (USDA FS, 2001).

Minimizing surface soil erosion is important in the management of City forestlands. The easily detached soils are a major factor in contributing sediment to the hydrologic network- into Upper Ashland Creek flowing into Reeder Reservoir from the Winburn Parcel and into Bear Creek from the Lower Watershed Parcel- affecting water quality throughout and storage space in the reservoir and in creek beds. Surface soil erosion also tends to accumulate in ephemeral and intermittent draws higher in the landscape, increasing the likelihood of slope failure and debris slide development in these landslide-prone locations.

Surface soil erosion and sediment delivery into the aquatic system is controlled by a variety of factors:

- soil type
- ground cover
- root strength
- root abundance
- slope gradient
- number and size of landslides

- magnitude and timing of precipitation
- proximity of landslides to draws or live streams

Fire, and especially high-severity fire, can reduce protective vegetation as well as duff and litter layers, while increasing runoff rates, surface erosion, likelihood of mass wasting events, and eventual sediment delivery into the aquatic system. Creation of a water repellant soil crust can often develop following a high intensity wildfire further increasing surface erosion and runoff rates.

Minimizing surface soil erosion depends on maintenance of adequate duff and litter as protective layers over the soil. This is challenging when implementing prescribed underburning and care is taken to retain adequate amounts of these soil covers during burning. This conflict between retaining vegetation and duff to protect soils while removing it to reduce the potential for wildfire is a constant balancing act. The City has already initiated a monitoring program to assess changes in fuels, vegetation and soils following prescribed underburning.

Landslides
A classification technique referred to as Landslide Zonation and Risk Evaluation was completed for the City forestlands and has been used to guide forest management activities ever since. This technique identifies and maps landslide features and active soil movement through detailed field reconnaissance. It also assigns activity levels and influence zones to all landslide terrain and subsequent determination of hazard levels. With this information, the City will continue to modify forest management activities such that the likelihood for slope failure is minimized. This mitigation effort is accomplished by maintaining trees and associated canopy cover to help stabilize soil profiles. Vegetation older than 25 years of age, especially conifers, hardwoods and brush species, have larger, deeper root systems than younger vegetation. Roots are the "twine" that provide soil cohesion, while simultaneously transpiring significant amounts of water that would otherwise increase soil overloading and encourage slope failure (City of Ashland, 2003). Loss of roots due to excessive tree mortality either from tree thinning, insects, disease or fire exacerbates the potential for both surface erosion and mass soil movement, at least until vegetation fully reoccupies the site. Generally, the period of 5 to 10 years following the demise of deep-rooted vegetation and the eventual root decay, is the most likely time for slope failure to occur.

Ecologically based tree thinning that retains enough canopy cover and root mass to maintain full site occupancy and protect forest soils while creating stand structures that reduce the likelihood and severity of fire is a balanced management strategy that tries to maximize benefits and minimize risks on the City ownership. Light thinning from below, in small steps or stages over several years, has been utilized by the City to allow leave trees to develop the additional root structure necessary to stabilize soils while continuing to reduce fire hazard. Trees prioritized for retention include the larger, fire-resistant species (i.e. older pines, Douglas-fir, incense-cedar) and sprouting hardwoods which maintain rooting structures post-fire and have the potential to more quickly stabilize the site.

Thinning and other tree removal practices have been restricted on slopes greater than 65%, with only smaller trees < 7” dbh considered for removal to encourage more vigorous stands in the long-term. Achieving fire management objectives is more difficult on these steeper slopes which are more prone to problematic fire behavior given the fact that vegetation modification has much less of an effect on fire behavior in steep terrain. In addition, on slopes with gradients of 55-65%, full site occupancy of well-distributed trees is desirable to encourage an adequate root network for holding soils in place. Stand densities are managed to insure that full site occupancy is retained while allowing available site resources to grow trees vigorously for many years to come.

Thinning-from-below has been widely used to create optimal vertical fuel discontinuity for fire management benefits. Slope stability concerns are generally less problematic on slope gradients less than 55%. Adjustments in stand thinnings to create more structural diversity, including more gaps and open forests with greater horizontal fuel discontinuity, have been, and will continue to be implemented in strategic locations on the gentler slopes in deference to challenging soils and slope stability features.

Adaptive Forest and Resource Management

The City of Ashland has demonstrated a fundamental commitment to continue its current direction of active forestlands management as described in this 2016 AFP. The ongoing adaptive management that has been in operation since the first Ashland Forest Plan in 1992 has resulted in the following understandings that will guide forest management into the future.

Wildfire Risk Management
The increased potential for high-severity fire has relentlessly extended throughout the western United States in recent years as the smoke-filled skies of summer too often remind us.

Continued, and even heightened, efforts to reduce the potential for a damaging wildfire while sustaining current stand and fuel treatment régimes is a paramount goal in the future management of City lands.

Wildland Urban Interface and Beyond: Private and Public
Minimizing the potential for large-scale, high-severity fire requires a significant level of coordinated planning on a broad landscape level irrespective of ownership. Initial planning done by the City resulted in effective work on private lands in the WUI through Ashland Fire & Rescue grant programs starting in 2001 up to present (Main and Uhtoff, 2002). Cost-share grants with City and privately-owned properties allowed for non-commercial fuels thinning and slash disposal on 352 properties and 1,308 acres between 2001 and 2009 with a three-fold focus on structures, property and watershed protection. The program continued in 2010 under the *Firewise Communities* banner, a national recognition program for neighborhoods working collectively to reduce wildfire danger. Ashland now has 23 certified *Firewise Communities* and a handful have reached their five-year anniversary. In the process, not only has protection of lives and property from advancing wildfire been enhanced but also the likelihood of wildfire initiating in the WUI and advancing onto City lands and into the Ashland Watershed has been significantly reduced

On an even larger scale, the inter-jurisdictional collaboration, Ashland Forest Resiliency Project (AFR), was launched in 2009 after considerable community and City input over the previous five years. The initial 7,600 acre fuels treatment and restoration footprint on Forest Service land in the Ashland Watershed is expected to be complete by summer of 2018. The City has been a key partner in the creation of AFR and now contributes over $175,000 per year from a special fee attached to citizen water bills as an annual input toward Forest Service fuels reduction projects on acreage surrounding City forestlands. This fund is over and above the annual City and Parks forestland budgets. In 2014, the AFR treatment footprint was expanded even further to include privately owned parcels and adjacent agency forestlands, totaling 58,000 acres. The recognition of the importance of forest restoration across the landscape and the indiscriminant nature of wildfire's impacts has spawned these funding opportunities that required an outsized collaboration across boundaries. The AFR partners were fiscally successful in both 2015 and 2016 under this program, securing a total of $5.6 million dollars for landscape level fuels reduction and forest restoration.

Reducing Stand Densities
Fire histories offer us a look back at pre-settlement stand reconstructions and have increasingly validated stand thinning as an appropriate strategy

for creating more resilient forests that are less prone to severe fire in the dry forest ecosystems of southern Oregon. There appears to be validity in reducing stand densities even further in order to protect and promote older forest characteristics. There are likely opportunities to complete a second, or in some cases, even a third phase of stand density reduction to provide desired benefits while still maintaining other resource objectives. The City will continue to reduce stand densities and create more open forests to improve tree and stand vigor and reduce the likelihood of high-severity disturbance, especially from wildfire

Encourage Landscape Diversity
The Lower Watershed Parcel, as well as much of the adjoining private and agency lands, are dominated by relatively homogenous, even-aged forest structures. A greater diversity of stand structures on a landscape basis, with associated gaps and breaks in fuels, both horizontally and vertically, is desired. As the City forestlands are nudged toward healthy stand densities, reduced wildfire potential, and improved tree and stand vigor, the encouragement of these more diverse stand structures can be accomplished through additional thinning and/or prescribed fire. As part of a strategy to increase structural variability on City lands, increasing development of native, yet uncommon early successional vegetation, especially those species that do not exacerbate fire behavior, will be prioritized. The City's long background in the use and encouragement of native grass communities will be valuable in this endeavor. In addition, the City will not be reluctant to nurture native, yet uncommon, plant species and communities. These include oak woodlands, intact shrub communities, rocky outcrops with associated vegetation and individual rare or sensitive plants.

Riparian Management Revitalized
To date, very little work has been implemented in the RMAs within City forestlands. Throughout the next management period, appropriate stream-segment specific modifications of vegetation will be targeted to improve aquatic and hydrologic function. Active management within the RMAs will promote processes consistent with disturbance regimes that are thought to have historically existed in riparian communities in dry forests in southwestern Oregon.

Prescribed Fire
Prescribed fire will continue to be carefully applied to reduce hazardous fuels thus re-introducing fire as a fundamental ecosystem process. Prescribed fire will be applied in those stands and vegetation types that have been properly prepared through active vegetation manipulation over the past 20 years to accept more benign fire types similar to those of historical disturbance regimes.

Conclusion

The original forest and resource management planning that was completed in the late 1990s, coupled with the follow-up initial active management on City forestlands, still has considerable relevance today. In many respects, the City of Ashland was a forerunner in the implementation of multiple forest and resource management strategies that are now being employed throughout dry forests in the region. The work performed on City forestlands lands was inconspicuously initiated a full 15 years before similar and critically acclaimed activities were executed on adjacent Forest Service ownership in the context of the Ashland Forest Resiliency Project (AFR). The City's early strategies at encouraging and developing full and transparent participation of interested individuals and organizations provided a workable template that others have since applied. Such an inclusive approach has proven essential in obtaining the political and social acceptance for adaptive forest management designed to achieve mutually agreed upon goals within our City forestlands and beyond.

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2016 Ashland Forest Plan Glossary

All definitions in the Glossary are from the City Forest Lands Restoration Project Phase III unless otherwise indicated.

Superscript 1 indicates the definition is from City Forest Lands Restoration Project – Phase II.

Superscript 2 indicates the definition is from the Upper Bear Assessment.

age class: A classification of trees of a certain range of ages.

anadromous fish: An anadromous fish, born in fresh water, spends most of its life in the sea and returns to fresh water to spawn. Salmon, smelt, shad, striped bass, and sturgeon are common examples (NOAA, 2012.)

aspect: The direction in which any piece of land faces.

basal area: The cross-sectional area of tree boles in a forested area as measured at the diameter at breast height (dbh).

biological diversity: The variety of living organisms considered at all levels of organization, including the genetic, species, and higher taxonomic levels, the variety of habitats and ecosystems, as well as the processes occurring therein.

board foot: A unit of measurement represented by a board one foot long, one foot wide, and one inch thick. Also, a standard way of measuring volume of standing trees, logs, or lumber, usually expressed in thousand board feet (mbf).[1]

bole: The main stem or trunk of a tree.

broadcast burning: Intentional burning of fuels and/or vegetation where the fuel has not been separately piled and the fire is applied under predetermined conditions such that it is allowed to spread freely throughout a pre-designated unit.

Brown's transects: Technique developed by James Brown to estimate fuel loading per acre. This line intercept method calculates weights and volumes per acre for all diameter size classes. The method also provides depth of fuel and duff at locations along the line (Brown, 1974).

brushing: A generic term referring to the practice of removing all, or a portion, of the brush component in a unit of forest vegetation to meet some pre-designated objective (e.g., fuel reduction, seedling establishment, etc.); can be done manually or with equipment.

canopy: The more or less continuous cover of branches and foliage formed collectively by adjacent trees and other woody species in a forest stand. Where significant height differences occur between trees within a stand, formation of a multiple canopy (multi-layered) condition can result.

catadromous: Catadromous fish are a special category of marine fish that spawn in salt water and whose young migrate long distances to enter fresh water to complete their growth and development to the adult stage. E.g., eels (USFWS, 2014).

coarse woody material (CWM): Portion of tree that has fallen or been cut and left in the woods. Pieces are at least 16-inch in diameter (small end) and at least 16-foot long.

cohort: A group of trees developing after a single disturbance, commonly consisting of trees of similar age, although it can include a considerable range of tree ages of seedling or sprout origin and trees that predate the disturbance.

crown class: A class of tree based on crown position relative to the crowns of adjacent trees.

> **dominant**: Crowns extend above the general level of crown cover of others of the same stratum and are not physically restricted from above, although possibly somewhat crowded by other trees on the sides.
> **co-dominant**: Crowns form a general level of crown stratum and are not physically restricted from above, but are more or less crowded by other trees from the sides.
> **intermediate**: Trees are shorter, but their crowns extend into the general level of dominant and co-dominant trees, free from physical restrictions from above, but quite crowded from the sides.
> **suppressed**: Also known as overtopped. Crowns are entirely below the general level of dominant and co-dominant trees and are physically restricted from immediately above.

crown fire: Fire that advances through the tops of trees.

defensible fuel reduction zones: Areas of modified and reduced fuels that extend beyond fuel breaks to include a larger area of decreased fuels. These would include managed stands with reduced amounts, continuities, and/or distributions of fuels that would provide additional zones of opportunity for controlling wildfire.

density management: Cutting of trees for a variety of purposes including, but not limited to: accelerating tree growth, improved forest health, to open the forest canopy, promotion of wildlife and/or to accelerate the attainment of old growth characteristics if maintenance or restoration of biological diversity is the objective.

diameter at breast height (dbh): The diameter of a tree 4.5 feet above the ground on the uphill side of the tree.

down, dead woody fuels: Dead twigs, branches, stems, and boles of trees and shrubs that have fallen and lie on or near the ground.

eco-type: A more or less homogeneous natural community type which occupies specific niches in the landscape. More or less synonymous with "landscape unit," but landscape units often will sub-divide an eco-type (often based on steepness of slope).

fire hazard: The kind, volume, condition, arrangement, and location of fuels and vegetation that creates an increased threat of ignition, rate of spread, and resistance to control of wildfire.

fire regime: The characteristic frequency, extent, intensity and seasonality of fires within an ecosystem.

fire risk: The chance of various ignition sources, either lightning or human-caused, causing a fire.

fire season: The period of time, usually during the summer and fall, when there are drier conditions and higher temperatures, and restrictions and rules designed to minimize forest fire risks are put into effect.

fire severity: Measures the effect of fire on an ecosystem, especially the effect on plants. Fires are commonly classed as low, medium, and high.

fire weather conditions: The state of the atmosphere within 5 to 10 miles of the earth's surface indicated by measures of temperature, pressure, wind speed, wind direction, humidity, visibility, clouds, and precipitation. The potential for fire weather conditions to influence fire behavior is generally described in terms of low to extreme.

forest health: The ability of forest ecosystems to remain productive, resilient, and stable over time and to withstand the effects of periodic natural or human-caused stresses such as drought, insect attack, disease, climatic changes, fire, flood, resource management practices, and resource demands.

fuel continuity: A qualitative description of the distribution of fuel both horizontally and vertically. Continuous fuels readily support fire spread. The larger the fuel discontinuity, the greater the fire intensity required for fire spread.

fuelbreak: A strip of land in which vegetation has been manipulated such that fires burning into one are more easily controlled.

Hawksworth dwarf mistletoe rating: A method of determining the level and/or severity of infection of dwarf mistletoe disease (*Arcuethobium* species). See the Hawksworth rating system description in the Appendix for more detail.

hydrologic function: The capacity of an area to capture, store and safely release water when that water originates from rainfall, run-on or snow melt (Lund et al., 2014)

invasive species: A nonnative species whose introduction is likely to cause or has the potential to cause economic or environmental harm to an ecosystem or harm to human health or commerce (Clinton, 1999).

ladder fuels: Flammable vegetation that provides vertical continuity between the surface fuels and tree crowns.

leave trees: trees intentionally marked to remain standing in a treatment area, i.e., "leave" behind or "leave" alone (Traugott and Dicke, 2006)

landscape unit: A defined area of land with relatively consistent topography and vegetation.

log decomposition class: Any of five stages of deterioration of logs in the forest; stages range from essentially sound (class 1) to almost total decomposition (class 5).

lop and scatter: A method of slash treatment in which slash is cut into smaller pieces and spread out to decrease fuel accumulations so that it lies closer to the ground to increase decomposition rate.

mature stand: Traditionally defined as a discrete stand of trees for which the annual net rate of growth has peaked. Stands are generally greater than 80-100 years old and less than 180-200 years old. Stand age, diameter of dominant trees, and stand structure at maturity vary by forest cover types and local site conditions. Mature stands generally contain trees with a smaller average diameter, less age class variation, and less structural complexity than old-growth stands of the same forest type.

merchantable timber: Trees large enough to be sold to a mill.

monitoring: The process of collecting information to evaluate if objectives and expected results of a management plan are being realized or if implementation is proceeding as planned.

mycorrhizae association: Symbiosis between particular species of fungi and the roots of vascular plants.

noxious weeds: A term that generally refers to non-native plants introduced into an ecosystem. Noxious weeds tend to be aggressive, poisonous, toxic, difficult to manage and/or otherwise undesirable or threatening for healthy ecosystem functioning.

old-growth forest: A forest stand usually at least 180-220 years old and typically suggesting the following characteristics: moderate to high canopy closure; a multilayered, multispecies canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood (decadence); numerous large snags; and heavy accumulations of wood, including large logs on the ground.

overstory: The uppermost canopy layer in a stand.

plant association: A group of plant communities which share the same set of dominant species and usually grow in a specific range of habitat conditions. There can be significant variation between sites and there is a great deal of variation at different successional pathways, vegetation trends and management opportunities. Plant association classification is based on the concept of potential natural vegetation. The potential natural vegetation for a site is the vegetation that would be present under climax conditions. In other words, if the site were allowed to grow, undisturbed by fire, insects, diseases, flood, wind, erosion, or humans, in approximately 500 to 1,000 years it would theoretically reach a steady state condition in climax vegetative composition that would be characteristic of the site potential.[2]

plant association group (PAG): A group of plant associations that share a common feature of favoring development of particular tree species that will become dominant over time if the forest matures without disturbance. Plant Association Groups are an intermediate stratification between plant associations and plant series. The coarsest level is the forest or plant series, which denotes all types that have the same climax dominant tree species, defined by shade tolerance (i.e., the Douglas-fir series). The finest level is the plant association, which denotes an overstory species that is the most shade-tolerant of the species found in that type along with one or more indicator understory species (i.e., Douglas-fir/ Oregon grape plant association).[2]

plant community: An area of vegetation in which the same set of species is present in all layers (tree, shrub, herb/grass, moss, and lichen).

plant series: A group of plant associations that share a common feature of favoring development of particular tree species that will become dominant over time if the forest matures without disturbance.

precommercial (noncommercial) thinning: The removal of trees of little or no commercial value from a forest stand to achieve a pre-designated silvicultural objective (e.g., improve stand vigor, reduce wildfire danger, etc.)

prescribed underburning: Involves the controlled application of fire to understory vegetation and downed woody material when fuel moisture, soil moisture, and weather and atmospheric conditions allow for the fire to be confined to a predetermined area and intensity to achieve the planned resource objectives.

radial thinning: Density reduction for a fixed distance beyond the dripline of the retention tree or as a function of the crown radius of the retention tree (i.e. 2 or 3 crown radii out from the retention tree) to create crown separation and horizontal canopy fuel discontinuity.

relative density index: The ratio of the actual stand density to the maximum stand density attainable in a stand. Used as a way to measure quantitative differences between stand densities. Measured on a scale between 0 and 1.00.

release: A term used to indicate the increased growth that occurs in a tree or stand of trees following stand density reduction.

restoration ecology: The study of theoretical principles and applications in population and community ecology aimed to restore and rehabilitate highly disturbed or degraded ecosystems to their more natural states.

riparian area: A geographic area (150-300-foot) influenced by an aquatic component and adjacent upland areas.

seral stage: The series of relatively transitory plant communities that develop during ecological succession from bare ground to the climax stage. Four seral stages are utilized in this report:

> **early seral stage** - The period from disturbance to development of crown closure of conifer stands. Grass, herbs, and brush are plentiful in this stage.
>
> **mid-seral stage** - The period in the life of a forest stand from crown closure to ages of 15 to 80-100 years.
>
> **late-seral stage** - The period in the life of a forest stand older than 80 years and approaching 200 years or more. Old-growth forests are included in this category and typically include stands at least 180-220 years old.[2]

silviculture: The art and science guiding the establishment, growth, composition, health and quality of vegetation in forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis.

site index: Site index is a method of measuring and describing the potential productivity of any given site based on the height of dominant conifers by species at a given age.

site productivity: The capacity of an area of land to produce carbon-based life forms.

slash: Tree tops, branches, bark, and other typically non-merchantable debris left after forest management activities.**slope percent**: A standard way of measuring the steepness of any slope; specifically, a percent figure based on the rise in elevation in feet over a 100 foot distance (i.e., 25% slope equals a rise of 25 feet over a 100 foot distance). Although no uniform standards describing steepness exist, a typical classification is as follows: flat (0-5%), gentle (5-25%), moderate (25-55%), steep (55-75%, very steep (75%+).

snag: Any standing dead or partially-dead, tree at least sixteen inches in diameter at breast height (dbh) and at least sixteen feet tall.

stand (Tree Stand): in ecology, a continuous group of similar plants. In silviculture and as used in this Assessment; a contiguous group of trees sufficiently uniform in age-class distribution, composition, and structure, and growing on a site of sufficiently uniform quality to be a distinguishable unit.[2]

stand density: An expression of the number and size of trees on a forest site. May be expressed in terms of numbers of trees per acre, basal area, stand density index, or relative density index.

stand density index: A measure of stand density independent of site quality and age. From the stand density index, an approximate number of trees, of a chosen diameter, capable of being supported on an acre can be determined.

stocking level: The number of trees in any given area expressed as trees/acre.

succession: The process through which vegetation develops over time as one community of plants replaces another; often described in terms of stages.

swamper burning: A method of burning in which slash is thrown onto a burning pile.

thinning-from-below: The cutting of non-dominant trees in a stand, usually in order to give more site resources to the dominant trees or to reduce ladder fuels.

tree vigor: A measure, either subjective or quantitative, of the relative health of an individual tree.

underburning: A type of broadcast burning that is applied under an existing stand of trees.

understory: The vegetation layer between the canopy and the forest floor, including forbs, shrubs, smaller trees, and other low-lying vegetation.

wildland urban interface (WUI): A geographic area in which the urban and/or suburban setting is juxtaposed and transitionally grades into the wildland environment.

windthrow: windthrow is defined as the uprooting of a whole tree at the interface of the trunk with the soil, which may involve the lifting of roots, the snapping of roots or the failure of the trunk at the soil surface (Moore, 2014).