City Forest Lands Restoration Project
Phase II
Project Financial Prospectus

The City of Ashland Forest Lands Restoration Project embraces an ecological approach that seeks to manage the city forest lands in a manner which maintains and enhances the Ashland Watershed and provides the City of Ashland with a sufficient, high quality source of water. The project design provides that tree removal will never occur simply to add volume to a timber sale. The focus of the project is on what is left behind, not what is taken. Timber and other forest commodities will be generated only as a by-product of restoration activities.

Project Description

Mortality salvage and stand density reduction through commercial thinning is designated for 183 acres of the 486 acres, or 37.7% of the City of Ashland ownership in the lower watershed. Treatments were not prescribed for the remaining 303 acres for the following reasons; (1) those areas burned in the 1959 wildfire contain little, if any, merchantable volume requiring removal as part of a thinning effort, (2) areas with significant slope stability concerns where tree removal is not recommended, (3) riparian management areas along Ashland Creek & Reeder Reservoir, and (4) reserve areas retained to maintain a diversity of forest structures on the landscape, (5) quarries, roads, Reeder Reservoir, and other non-forest sites, and (6) areas where previous non-commercial work has already met forest health objectives.

Timber Removal

Timber proposed for removal has been marked by our consulting forester, Marty Main of Small Woodland Services, Inc. Currently, 460,000 board feet has been marked for removal. It is important to note that this volume may be decreased if the geological hazard survey currently underway identifies slope stability risks associated with proposed tree removal. The majority of trees marked for removal (68.4%) fall into a diameter class of 7" to 12" dbh (diameter at breast height). An additional 27.4% exist within the 13" to 18" dbh classification. The remaining 4.2% are in diameter classes of 19" and above. The total number of trees marked for removal consists of 6,168 individuals, of which 1,846 are standing dead trees and 4,322 are live trees.

Project Costs

The value of timber marked is estimated to be $230,000 to $276,000. Mill prices for delivered logs ranges from $500 to $600 per thousand board feet gross scale. The volume marked for removal is approximately 460,000 board feet. The estimated cost of a helicopter harvest project ranges from $427 to $484 per thousand board feet. The total cost estimated for a helicopter harvest project is $215,000 to $244,000. Restoration activities, including the seeding of native grasses and tree planting, will be funded from the annual Forest Interface budget allocation. A grant application has been submitted to the Bureau of Land Management for $250,000 to provide additional financial support for the project. A project cost / revenue breakdown is shown in the following table:

Project Component	Cost Range	Revenue Range
Timber Removal	215,000 – 244,000	230,000 – 276,000
USFS Road Use Fee	(to be determined)	
Forest Products Harvest Tax	1,335	
Slash Treatment	300 per acre	
Total	271,235 – 300,235	230,000 – 276,000

Table 2
Total # Trees Marked for Removal

Unit	Acres	<17 dbh Green	<17 dbh Dead	>17 dbh Green	>17 dbh Dead	Total	Trees/ Acre
A2	7.0	62	43	0	4	109	15.6
Barr	1.8	0	111	0	3	114	63.3
B234	33.1	485	787	2	48	1322	39.9
B567	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
E2-5	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&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	1015	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	4202	1563	120	283	6168	33.63

Total % trees marked less than 17" dbh = 93.5%
Total % trees marked dead - 29.9%

City Forest Lands Restoration Project

PHASE II

Prepared for:
The City of Ashland
City Council

Prepared by:
Ashland
Forest Lands
Commission

Frank Betlejewski
Richard Brock
Elizabeth Crosson
Jo Anne Eggers
Stephen Jensen
Anthony Kerwin
Bill Robertson (Chair)

OCTOBER 2003

TABLE OF CONTENTS

City Forest Lands Restoration Project: Phase Two

Background

The City of Ashland, under the stewardship of the Ashland Forest Lands Commission (AFLC), has been working for the past six years planning the restoration of city owned forestlands. Throughout the city ownership the AFLC has been engaged in cooperative forest health projects with neighbors and other jurisdictions, both in planning and groundwork. Forestry professionals, concerned citizens, and environmental groups have guided these projects.

Based on detailed forest inventories and silvicultural assessments, it is clear that the City of Ashland needs to proceed without delay into a second phase of forest thinning which will involve removing trees of commercial value.

Much of the city ownership is overstocked due to the suppression of natural fires in the watershed. In addition, there are areas of old logging slash that were created during past harvest operations and have been left untreated. While brush and small trees continue to be thinned, this thinning work has focused on the removal of small, understory trees (less than 7" diameter) that have been cut and burned on site. This work has reduced ladder fuels and promoted age diversity in some areas. On occasion, a small number of commercial size trees have been removed to mitigate hazard tree areas.

Nevertheless, many stands still exist with very high tree densities in larger size classes (greater than 7" diameter). These dense stands experience increased stress during drought periods. As a consequence, they are subject to substantial beetle and parasite attack as well as increasing the fire fuels potential. There are currently many stands with increasing tree mortality.

> *" The UDSA Forest Service and Oregon Department of Forestry have been doing annual aerial tree mortality detection surveys in Oregon since 1951. The Annual Cooperative Aerial Mortality Survey in the Rogue/Illinois Valleys, Siskiyou Foothills, Umpqua Interior Foothills and Inland Siskiyou ecoregions showed dramatic increases in tree mortality from 2001 to 2002. Sugar pine mortality increased from 144 trees in 2001 to 699 trees in 2002. Increases in ponderosa pine and Douglas-fir mortality were even greater; 417 trees to 20,986 trees for ponderosa pine and 321 trees to 32,148 trees for Douglas-fir."* (Goheen and Goheen, 2003)

Fire regimes have had a significant role on the Ashland watershed. A fire regime includes fire frequency, season, intensity, duration and scale (patch size), as well as periodicity and variability. Fire regime information will help inform our decisions for prioritizing areas for hazardous fuels treatments, silvicultural treatments, and prescribed fire use.

> *"Fire has played an integral part in creating the forest environment of the Pacific Northwest (Agee, 1981), and a particularly significant function in shaping the plant communities in southwestern Oregon (Atzet and Wheeler, 1982). The absence of fire (due*

to effective fire suppression) has had a dramatic effect on vegetation composition, density, and structure as well as dead fuel amounts, size and distribution."

Ashland Forest Plan

The AFLC is charged with implementing the Ashland Forest Plan (AFP), adopted by the City Council in May of 1992. The purpose and need for the AFP was to place the City's 1,075 acres of forestland under a workable regime of protection and management. The AFP states the following: "In our judgment, created disturbance that emulates natural processes must be reintroduced into the watersheds. This means vegetative manipulation and prescribed fire." The 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." Appendix A of the AFP listed a number of priority projects to be completed by May of 1993. This included quarry restoration, road maintenance, prescribed fire treatments and construction of fuelbreaks. Additional lower priority projects such as fuel reduction, grass seeding, tree planting, hand piling and burning, closing roads, and road maintenance are also listed.

In November of 2001, the AFLC revised the goals and strategies of the AFP. These revised goals and strategies tier directly to the original goals and policies of the AFP. The revisions reflect the changes that have occurred on city owned lands since 1992. The effects of increased population in the wildland urban interface, increased mortality of commercial sized trees, and extended drought are some of the reasons that led to the adjustments of the AFP.

The city has accomplished a number of non-commercial treatments listed in the original AFP. These include brushing and pre-commercial thinning, establishment of native grasses, tree planting, and prescribed fire application (handpiling and burning). The City Forest Lands Restoration Project (Phase II) is the next step in a continuing process of forest management.

Purpose

As stewards of the city forestlands, the Ashland Forest Lands Commission (AFLC) wrote this proposal to direct the continuing restoration work. Our ongoing research and field observations will help guide the practicing professionals whose work will continue to restore this community resource.

In addition, we want to inform the community, whose watershed lands we are charged with protecting and restoring. The use of specialized terminology is minimized in this proposal but cannot and should not be avoided. A comprehensive glossary is included in Appendix A offering standard definitions of words commonly used in forestry practice.

The goal of this second phase of the Forest Lands Restoration Project is to restore a level of resilience and forest health by attaining stand densities that are sustainable over the long term. This will be done by removal of primarily small and low vigor trees in the understory and middle canopy.

There will be an associated fire fuels reduction from the thinning resulting in: a) reduced tree density, b) a shift in species favoring shade intolerant and fire tolerant species, c) an increase in larger trees with higher, less flammable crowns, and d) reduced potential for future fuel buildup

from tree mortality. This project will treat (burn) existing logging slash and will also treat any slash created from the project itself.
Much of the city owned forestland is surrounded by US Forest Service lands. In the past, the Forest Service cut fuel breaks on their lands, some of which abut past and proposed treatment areas on city lands. While our proposed treatments will adjoin the Forest Service fuel breaks, we are not proposing a continuation of these fuel breaks. Our proposed treatments differ from fuel break treatments because they reduce fuel hazard on a landscape scale. Simply stated: our proposal will create landscapes that are less wildfire prone rather than creating fire suppression zones. Treatments will be lighter-handed than the Forest Service prescriptions and will treat a broader area.

Many of the trees to be thinned are in a size class that allows for a commercial timber sale. Since this topic tends to be controversial, we have provided a detailed description of the project to foster public discussion and review.

There are many areas of moderate to high geologic hazard on the city forestlands. There is a distinct conflict between the goal of reducing tree density to assure stand health and the necessity of maintaining enough tree cover to protect slope stability. To date the city has deferred thinning these areas. Continuing to defer management activity in these areas, however, could lead to accelerated tree mortality after a drought (as is happening now in some areas). Trees holding the soil in place could be lost. As part of this project, treatments will be recommended to help resolve this inherent conflict. A series of entries for careful treatment may be necessary on these sites.

In planning this next phase, the AFLC has specified the Desired Future Condition (DFC) of the various forest stand types on the city ownership. This process has been interdisciplinary and has considered a wide variety of factors that are essential for the maintenance of a healthy forest ecosystem. Factors addressed include: adequate water supply, healthy soils, stable slopes, reduced fire hazard, dead and down woody materials, and the broad category of biodiversity protection which includes managing for existing native animal, plant and fungi species.

This document is not intended to address the City of Ashland's ongoing fuels reduction program involving small non-commercial trees and ground fuels. In addition, this proposal does not include the details of any prescribed burning that may follow removal of vegetation.

Community Priorities

As stated in the Ashland Forest Plan (adopted by the City Council in May, 1992), it is the primary goal of the City to "manage the city forest lands in a manner which maintains and enhances the Ashland Watershed and provides the City of Ashland with a sufficient, high quality source of water." To attain this goal, the AFLC has embarked on this project with a process that adheres to high ecological standards.

The lower watershed parcel of the city's ownership intersects the wildand-urban interface. This crucial zone, where human development meets forested areas, is a high priority for restoration work. Due to past fire suppression efforts and management activities, some of these areas have

extremely high tree densities. In order to effectively protect the community from catastrophic fire, it is necessary to accomplish fire fuels reduction in this interface area.

On a larger scale, the AFLC is also involved with other city projects within the wildland-urban interface. The commission's involvement in the interface project is to inform and help initiate projects on private land as a part of the larger mission to protect the Ashland watershed and ensure quality drinking water.

This second phase of the Forest Lands Restoration Project uses an ecosystem approach. In this approach it is important that all ownerships within the Ashland Watershed be involved in the planning process. The Ashland Forest Plan requires activities of the AFLC to be compatible with management plans for the adjoining Rogue River National Forest (RRNF) and other properties. Coordination between landowners has been mutual. Members of the AFLC, RRNF, Ashland Parks and Recreation, Ashland City Council, Ashland Fire Department, private landowners and other concerned stakeholders regularly confer on the concepts and proposed activities presented in this and other planning documents for the larger Ashland Watershed. This project is intended to compliment work already underway.

The AFLC is committed to ecologically responsible stewardship and to an open and transparent community decision-making process.

Goals

- Promote healthy forest stands for the long term through reducing stand densities by thinning primarily understory and middle canopy trees.

- 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.

- Reduce significantly the likelihood of a large scale, high intensity wildfire through activities that will ultimately 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.

- Minimize the need for continued intervention in the landscape and eventually allow natural fire cycles and other disturbance events to occur.

- Protect and improve riparian transition zone habitat, specifically those areas where the vegetation shows a distinctly different plant community compared to the adjacent uplands.

- Increase stability of surface soils by increasing effective ground cover, including coarse woody debris, mosses, native grasses and low shrubs.

- Develop an approach for reducing stand density while protecting slope stability in moderately sensitive geologic areas (Hazard 2 Zones).

- Encourage and preserve native species diversity on a landscape level.

Guiding Principles

- We acknowledge that forest ecosystems are complex and dynamic and that we cannot understand completely how to manage the interlocking ecological functions of a healthy watershed. Management activities will be based on thorough site evaluations by experts in forest ecology, geology, silviculture, fire ecology, botany, wildlife, soils, and fisheries. In addition, we will continue to draw from the experience of our own site-work over the past six years. Monitoring protocols will be continued and broadened to allow for adaptive management.

- *No trees will be removed simply to add value to a timber sale.* First and foremost, this project will be planned to address forest health. Stand density reduction will be ecosystem driven. 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 restoration activities.

- Proposed treatments are site-specific based on vegetation types. On stable slopes with southerly aspects, more open stand conditions will be promoted to encourage a more diverse stand composition (e.g. more pine and black oak). On moister, northerly aspects with steep slopes, a more closed canopy stand condition (mostly Douglas-fir) will be promoted emphasizing a full rooting profile to mitigate potential geologic hazards.

- Determination of the trees to be removed shall be determined by the particular Desired Future Condition (DFC) for that stand including desired stand densities, structures, and compositions rather than by any specific diameter or age class delineation. The trees to be removed will mostly be in the age class of 50 -100 years old. This is the age class that has developed in these stands as a result of fire suppression efforts since 1910.

- Management activities are designed to protect and promote larger diameters / older age classes of conifers and hardwoods on the city ownership. Exceptions to this principle will be clearly identified, mapped and explained. Promoting these more mature forests will most effectively accomplish the goals and guiding principles identified for the city forestlands.

Project Locations

Restoration work will be planned based on location. There are two distinct "landscape locations" within the city forestlands. They each hold different sets of conditions, opportunities and concerns.

The Lower Watershed Area: This area extends from the upper end of Reeder Reservoir to Granite Street. It is composed mostly of early to mid-seral conifer-hardwood forest (60-100 years old) and shrub-hardwood communities on moderate to steep slopes. None of these areas have reached late successional conditions. Portions of the area were burned in 1901 and again in 1910 with the northwest portion burning a third time in 1959. Trees in this area are mostly 8"-22" DBH, but there are some larger trees (24"-30" DBH or larger) that survived the fires.

This area is fairly dry with plant communities described as the Black Oak / Ponderosa Pine / Douglas-fir type (Unit C and part of Unit U), the Ponderosa Pine / Douglas-fir type (Units D, E, F, H, M2 and Unit P), the dry Douglas-fir type (Units A, B, G, J, K, Q, S, T and part of Unit U) and the moist Douglas-fir type (Units L, M3, N, Q and Unit R). The most significant resource consideration is Ashland Creek and the steep slopes bordering the creek. Critical municipal infrastructure is in place within this area: the water pipeline, powerline, water treatment plant, and the access road.

The total area to be thinned under this proposal has not yet been determined. It is expected that significant portions of this area will not be treated in deference to geologic or slope stability issues, infrastructure concerns or because additional stand density reduction is not needed at this time. For instance, much of the area (200 acres) has received an initial stand density reduction treatment, which focused on understory hardwoods and conifers less than 7 inches DBH. Some of this area needs further thinning of larger trees (greater than 7 inches DBH).

Approximately 1/3 of the area is zoned as "high hazard" on slope stability scales determining landslide potential due to the steepness of the terrain and types of soils. As always, these areas will be treated with utmost care to prevent slope failure. Historically, this has meant no treatment or minimal treatment. Additional consultation is currently under way to address specific site concerns and determine appropriate future management actions.

The Winburn Parcel: This area is 160 acres centrally located in the watershed with a diversity of older forest types including mature stands and stands with late successional or old growth characteristics that have the potential to develop into old growth stands. It includes moist north aspects where white fir is common, described as the Douglas-fir / White fir type (Units 2, 4, 5 and 6), as well as drier south aspects with more ponderosa pine, described as the Ponderosa Pine / Douglas-fir / White Fir type (Units 1 and 7). The west fork of Ashland Creek runs through the center of the Winburn Parcel feeding Reeder Reservoir a short distance downstream.

Important issues to consider on the Winburn Parcel include water quality and quantity, protection of late succesional characteristics, spotted owl foraging habitat, resident fish populations, cultural (historical) resources, and slope stability concerns on a significant portion of the area.

Stand structure is variable, reflecting the impact of stand-replacing fires, logging, fire exclusion, and lower intensity fires. Most of the Winburn Parcel was logged in 1990 through a land exchange between the City of Ashland and a private timber company.

The dense understory layer is currently stressing many of the larger trees. Thinning of small diameter trees (less than 7" DBH) has already occurred directly under many of these big overstory trees in an effort to reduce moisture stress. This work is ongoing.

Much of the Winburn Parcel also has high to very high tree densities in the intermediate size classes. In order to ensure continued survival of the largest overstory trees, some additional density reduction is needed. Some of the Winburn Parcel will not be treated in deference to other resource values or because additional stand density reduction is not needed at this time. Portions of the Winburn Parcel are relatively intact native forests with little need of management.

Ecological Priorities

Soils and Geology

Protection and improvement of soils is a central goal on the city forestlands. Healthy soils support healthy forests. In addition, they act as moisture banks and reduce creek sedimentation. The soils in the Ashland watershed are well known for their highly erosive and unstable characteristics. 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*. (page III-7)

Geologic inventories commissioned by the City of Ashland have mapped many areas of geologic sensitivity and potential slope failure. Additional detailed assessments are currently in progress. Slides are a potential risk on most of the steeper slopes. Given these conditions, extreme care must be taken to avoid soil displacement or compaction. It is also critically important to maintain healthy root zones.

Tree roots are the "twine" that holds the subsoil layers to the hillside. Loss of this rooting layer due to excessive tree mortality from beetle kill or fire will inevitably lead to slope failure. In all areas with steep slopes, the tree and shrub densities will be maintained to provide a healthy dense root layer.

During this density reduction project, log removal will be done with helicopter to minimize compaction and soil displacement. Maintenance and improvement of effective ground cover to avoid surface erosion is also critical. The Forest Service standard is to maintain 85% or more soil cover. We have considered four strategies for achieving effective ground cover on the various sites found in the city forestlands.

<u>Soil Protection Strategies</u>

1. Leave a high quantity of down woody material and maintain a dense tree canopy to favor mosses. This strategy utilizes woody material of all sizes to stabilize slopes and provide effective

ground cover. Coarse Woody Material (CWM) left on site is high (8-12 logs per acre) in this strategy. Small wood (under 3 inches diameter) is reduced or removed to reduce fire hazard. Larger wood is placed in contact with the soil with attention given to side-hill placement (on the contour) to slow surface movement. This strategy will lead to improvement of the duff layer and an increase in mosses and shade tolerant herbaceous cover. Mosses can be "seeded" on these sites where moisture allows. This tactic is especially suited to steep slopes. There is some concern about increasing fire hazard by leaving high quantities of wood on-site. The material left, however, will be too large to have much effect on fire intensity or flame length. This large wood will allow fire to reside (smolder) on the site longer perhaps increasing mop-up and monitoring time. This approach would also make prescribed burning more difficult.

2. Open tree canopy enough to allow grasses and low shrub layer to develop. Seed with grasses.
This strategy utilizes the natural ground layer vegetation on dry sites where grasses and low shrub species are an important ecosystem element. On these sites, a relatively quick growth response can be seen in ground layer vegetation (particularly from hairy honeysuckle) when the tree canopy is reduced to 40%-50% cover. Grasses (western fescue, California fescue, Idaho fescue) can be slower to respond on dry sites, so seeding will be needed. The City of Ashland has been experimenting with native grass seeding and has developed considerable technical expertise. Dry site mosses can also be "seeded". Under this strategy small woody material (4"-8") is utilized in the short term for holding surface soil. CWM is maintained at low quantities. These sites become prime candidates for future prescribed fire. One problem with this strategy is that non-native species of grass (e.g., dogtail grass) and forbs (e.g., beggars ticks) can quickly invade following a thinning event, so seeding needs to be timely.

3. Thin to favor black oak and madrone in order to develop a thick leaf litter layer.
These hardwood species produce and shed a high volume of leaf litter that forms very effective ground cover directly under the trees. This tactic is suitable for dry sites where more open tree canopies can be sustained to allow hardwoods to flourish.

4. Leave a dense sapling layer even though larger trees may become stressed and die.
This strategy is a "default" approach that recognizes that a dense stand of small trees and shrubs can be quite effective in holding soil. There are many negatives to this approach. There is a high level of fire hazard associated with these stand conditions. This strategy may also lose its effectiveness over time if complete stand mortality occurs due to moisture stress. It is likely, at least, that larger overstory trees will die due to beetle attack or moisture stress. These larger trees are more effective in holding the deeper soil layers. Because of these negatives, this is not a strategy that will be used much, but it may be effective for the short term and may be the preferred approach in areas of geologic instability or excessively steep slopes where dense sapling/shrub layers currently occur. Thinning these areas in small steps over several years will allow the remaining trees to develop the root structure necessary to stabilize soils.

Botany

Lower Watershed

The forests of the Lower Watershed range from the Black Oak / Ponderosa Pine / Douglas-fir type to the dry Douglas-fir type to the moist Douglas-fir type found in the vicinity of Ashland Creek types.

The dry forest is a mix of Douglas-fir, ponderosa pine and madrone with some black oak on the driest sites. The shrub layer is usually dominated by low growing species such as hairy honeysuckle, snowberry and poison oak but can include taller species like deerbrush, ceanothus (previously burned sites), whiteleaf manzanita (driest sites) and ocean spray (moist sites). The grass layer includes perennial bunchgrasses such as California fescue, woodland brome and western fescue as well as the invasive hedgehog dogtail grass.

When tree canopies are dense, the shrub and grass species are relatively sparse. When tree canopies are reduced, these species increase. The low-growing shrubs and perennial grasses can be highly valuable for stabilizing soils while not adding significantly to fire hazard. Native grasses are suitable as a part of a soil cover strategy in some of these dry-site forests, but it is important to plant seed quickly after thinning to give these species a competitive advantage over dogtail grass which will quickly occupy any bare soil areas.

Douglas-fir dominates both the dry and moist Douglas-fir types with some madrone and occasional ponderosa pine. When under a dense tree canopy, the shrub layer in these forests is usually fairly sparse with snowberry, poison oak and ocean spray common. When the canopy is open in this type, the high shrub layer (ocean spray, deerbrush, hazel) increases. The combined densities of these shrubs along with re-sprouting madrone and seedling/sapling Douglas-fir can increase fire hazard significantly.

Rare plants potentially found in the lower watershed area include the three-toothed horkelia (*Horkelia tridentata*), clustered ladies slipper orchid (*Cypripedium fasciculatum*), and mountain ladies slipper orchid (*Cypripedium montanum*). The area was surveyed in 1997. The horkelia was found in few locations east of Reeder Reservoir, recently along the powerline right-of-way that runs through the area, and near Crowson Reservoir. At both of these latter sites horkelia appears to benefit by increased light afforded by removing manzanita and, in the case of the powerline, trees. The horkelia appears to have adapted over time to the frequent disturbances that kept the forest canopy relatively open. Maintaining these open canopies on the driest sites will benefit this species. The ladies slipper orchids have not been found here but they are often quite difficult to find and occur in small populations (often just a single plant). It is possible that some may be found on the steeper, moist, north facing slopes. In these habitats it would be best to maintain the high canopy closure that this and associated species prefer.

Another species of interest identified in the 1997 survey is a moist-site grass, crinkle-awn fescue (*Festuca subuliflora*). This species has coastal and northern affinities and is quite rare in the eastern Siskiyous. Management of crinkle-awn fescue is, for the most part, a matter of maintaining tree canopy on moist sites.

Noxious weeds are a potential problem in the Lower Watershed. Currently there are populations of Scotch broom, yellow star thistle, Himalayan blackberry, Palmatian toadflax and English ivy. Eradication of these invasive and noxious populations is an on-going effort.

The mosses and lichens are mostly common species. We have found at least two species of interest that are regionally rare although locally well represented. These are *Bryoria tortuosa* and

Dendriscocaulon intricatulum (yellow horsehair lichen). Both of these species occur on the driest sites, the *Bryoria* on large pines and the *Dendriscocaulon* on black oak, particularly on trees in the range of 3"-12" DBH. Black oak, in fact, is a host to many lichen species that do not occur on other substrates in this area, suggesting the importance of keeping black oak where it is found. It is possible that there are some other interesting species in the rock outcrops and aquatic zones.

No format surveys have been done on the present fungi species. Fungi utilize a wide variety of habitat types. To maintain high quality fungal habitat in moist sites, significant amounts of down wood material should be maintained.

Winburn Parcel

The vegetation in the Winburn area ranges from dry south aspect forest to very moist north aspect riparian forest. The higher elevations have white fir as the dominant understory tree on most sites with Douglas-fir co-dominant on south aspects.

South aspect forests are part of a plant community that only rarely occurs in the Ashland Creek watershed. In this community, large ponderosa pine, Douglas-fir and occasional sugar pine dominate the overstory. The understory is white fir and Douglas-fir. The shrub and herb layers are sparse. The large pine is a valuable heritage resource as well as a wildlife resource and should be protected. This plant community has a number of successional pathways. In the distant past, it has been open pine forest at times and fairly dense Douglas-fir, but white fir forest at other times. When open, grasses such as California fescue and perennial herbs such as beargrass (*Xerophyllum tenax*) can flourish. In this document, the plant community is described as the Ponderosa Pine / Douglas-fir / White Fir type.

North aspect forests are white fir associations with Douglas-fir in the overstory and white fir in the understory. Madrone and sugar pine are also occasionally found. In this document, the plant community is described as the Douglas-fir / White Fir type. The shrub layer is diverse and responds vigorously to increased light from an open canopy. Moss cover is often quite dense. Some of this forest is quite old and has old growth features. Maintenance of a healthy overstory should be a priority in these stands. The riparian influence zones are wide with an abundance of salal. This species is quite rare in the eastern Siskiyou Mountains.

Habitat potential exists for several rare plant species including the ladies slipper orchids, Lemmon's catchfly (*Silene lemmonii*), Greene's hawkweed (*Hieracium greenei*) and three-leaved horkelia. None of these has been found on the city forestlands but the Lemmon's catchfly has been found on adjacent Forest Service land. All these species, except the orchids, prefer somewhat open conditions on dry aspects.

There is potential for a rare liverwort (*Ptilidium californicum*) and large tree-dependent lichen (*Calicium viride*) in this area. Douglas-fir trees larger than 24" DBH on northerly aspects have the potential for these two species. There is also potential for rare lichen species in the creek, particularly *Leptogium rivale*. There are no rare species likely to be associated with trees under 20" DBH.

As in the Lower Watershed, there is little known about the fungi species that occur here. Maintenance of an adequate down wood component is important but equally important is maintenance of landscape diversity so that those species that prefer more open conditions can have a niche.

Coarse Woody Material (CWM)

The general strategy is to utilize coarse woody material (CWM) to stabilize surface soils, increase organic content in soils over the long term and provide habitat for the many organisms that depend on logs in various stages of decay. The volume of CWM retained in this project will depend on management considerations such as plant community, fire danger, rural interface, and the potential for insect outbreak. There is data on existing CWM in the Winburn parcel and on Forest Service land in the watershed.

A number of activities and processes can affect the CWM component and have affected the current conditions as well as altered the historic conditions of city owned forestlands. Actions such as mortality salvage can immediately change forest structure by removing the snags and subsequently changing down log amounts. A more subtle change in the dead wood component of the Ashland watershed has also occurred. Just as fire exclusion has changed the live tree composition of the forest, fire exclusion has also had an effect on dead tree composition.

Down logs previously consumed during fires now have a longer residence time as they decompose rather than burn. This has allowed a higher volume per acre of down logs to accumulate than would have occurred with a more frequent fire return interval. In addition, the absence of a fire, that would have fallen dead trees or killed live trees creating snags, has reduced the natural recruitment of down logs and snags.

While the exact number of snags and down logs appropriate to a particular plant community with a normal fire return interval is unknown, recent data analyses in southwestern Oregon do show some patterns. Snags and down logs are not distributed in the same fashion across the landscape. Snags are distributed in a more uniform pattern. The recommended approach for managing snags in the Ashland watershed is to concentrate snags in the riparian area to provide habitat in areas with higher use by wildlife. Snags should be well distributed along the entire length of the stream. The per acre ratio between riparian area snags and the number of upland snags is unknown, but a 2 to 1 ratio (2 in the riparian area and 1 in the upland) will be a reasonable starting point.

Down log distributions are more complex. More than 50% of the acres analyzed throughout southwest Oregon show no large down logs at all. The highest amount of down logs should be left in riparian areas for the reasons mentioned above for snags. A slightly lower amount could be left on northerly aspects away from streams: perhaps 67% to 75% of that seen along the streams. Away from streams, the southerly aspects would have very few down logs. Three out of four acres would have no down logs at all with the remaining 25% of the southerly aspects having 50 to 75% that seen on the northerly aspects. If only the low end of the size range exists, up to six logs is acceptable.

Based on this data, the following general recommendations are offered allowing for differences in specific sites. For example, if a riparian area had six down logs, a northerly aspect acre might have four, and one out of two southerly aspect acres would have one down log. On steep slopes, higher quantities will be maintained for slope stability.

Wildlife

One of the goals of this restoration project is to maintain or enhance wildlife habitat. Along with the primary goals to preserve water quality, maintain forest health and reduce the threat of catastrophic wildfires, wildlife habitat protection and enhancement will be a priority throughout this project.

Existing conditions

The *lower watershed* is dominated by dry site eco-types. This area provides 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 area is not currently inhabited by any threatened or endangered species and does not meet habitat requirements for the Northern Spotted Owl. Some areas have the potential to meet nesting, foraging and dispersal habitat requirements for spotted owls, primarily along the riparian corridor of Ashland Creek.

The *Winburn Parcel* is composed mainly of mature forests and, except for perhaps a few small areas, does not meet the definition of old growth. This area provides for dispersal and foraging habitat for the Northern Spotted Owl and other raptors, but does not currently meet nesting habitat requirements for the spotted owl. The riparian corridors currently meet dispersal and foraging needs for forest carnivores and den sites are adequate along Ashland Creek except where logging or other disturbance has reduced the forest structure to early successional stages.

Goals for Wildlife Enhancement

Density reduction treatments will follow these guidelines to maintain or increase wildlife habitat:

- Efforts will be made to reduce the structural uniformity of tree stands horizontally across the landscape.
- Treatment will aim to retain at least 15 to 20% of untreated, dense stands in the project area. In many cases, adequate areas of untreated vegetation will be retained for wildlife as a function of slope stability concerns, riparian and other reserve areas.
- 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.
- During project layout and tree marking, trees that have indications of nest sites or cavities >6” diameter will be retained and buffered to reduce impacts to wildlife viability. Additional logs will be added to the forest floor to provide needed micro-habitats. Snags will be retained unless they pose a hazard and snag recruitment (current and future) will be encouraged.

- 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 providing 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 debris unless there is an associated hazard.
- Active fuel management treatments in the Winburn parcel will be restricted between March 1st and July 30th to minimize impacts to breeding populations of forest dwelling species. No cutting or chainsaw use will be allowed after March 1 and no prescribed burns will be allowed after April 1.
- While recognizing that there will be an affect on terrestrial mollusks, salamanders and other organisms, activities will minimize the impact on the landscape (i.e. there will be no tractor logging, and timber removal will be done by helicopter).

Forest Disturbances

Significant changes in disturbance patterns within the last 150 years have created vegetation conditions that are much different than occurred prior to European settlement of Southern Oregon. Changes in vegetation patterns include:

1) increased stand densities and stocking levels
2) increased fuel levels and wildfire prone vegetation types
3) shifts in stand structure and species composition
4) increased likelihood of mortality from insects and disease
5) decreased ecosystem diversity

These vegetation changes have produced a potential for high intensity, large-scale disturbances particularly from fire and insects. Higher vegetation density and relatively continuous structure, both horizontally and vertically, have created conditions for a fire to rapidly escalate in magnitude. It is from this dynamic condition that one of the primary restoration goals emerges*: to reduce fuel levels and restore vegetation to a more discontinuous vegetation complex*.

Increased stand density over time has reduced the availability of site resources for individual trees (e.g. soil moisture, nutrients, and available light). The resulting reduced tree vigor has made conifers more susceptible to successful attack by various insect agents.

Ponderosa pine is susceptible to attack from the western pine beetle (*Dendroctonus brevicomis*), pine engraver beetle (*Ips pini*) and the red turpentine beetle (*Dendroctonus valens*) among others. A separate cadre of beetles, including the Douglas-fir twig weevil (*Cylindrocopturis furnissi*), flatheaded fir borer (*Melaniphila drummondi*) and the Douglas-fir beetle (*Dendroctonus pseudotsugae*) attack Douglas-fir.

Stand density reduction to improve tree vigor is a proven way to reduce the susceptibility of conifers to insect attack and resulting tree mortality. However, as populations of beetle explode in certain stands, successful attack on vigorous trees by the host-specific cadre of beetles can occur. Other less prominent forms of disturbance on the city forestland include various diseases (most notably dwarf mistletoe), windthrow, landslides and other slope failures.

It is our intent to use the planned disturbance inherent to a stand density reduction project to emulate other disturbance forms in creating more desirable vegetative conditions.

Prescribed Fire

One of the primary goals of work on city forestlands is to significantly reduce the likelihood of a large, stand-destroying wildfire. Ultimately, the goal is to reintroduce low intensity fire (underburning), which is the type of fire disturbance that more closely emulates the historic fire regime for the Ashland watershed. Our intent is to allow these forests to return to their natural, pre-settlement fire cycles. This cycle included frequent, low intensity fires.

Over the last two hundred years, fires in the Ashland watershed have burned with variable intensities with occasional high intensity fires. Although a high intensity fire may be beneficial to the ecosystem over time, it is our priority to retain forest canopy and soil stability consistent with a healthy municipal watershed. Therefore, significant efforts will be made to reduce the likelihood of a stand-destroying fire.

In most areas, pretreatment will be required prior to any underburning. Pretreatment includes, but is not limited to, cutting, hand piling and hand-pile burning of excess vegetation. Pretreatment is required in most of these units because the existing vegetation has developed outside of the natural fire regime. Responsible underburning cannot be accomplished without first reducing the existing fuels in some way (pretreatment).

Road access is limited on city lands. Access is also limited to water sources. These two important factors limit the feasibility of successful underburning on many portions of city-owned land. If underburning without pretreatment were to be attempted, all fire control lines would have to be dug by hand due to erosive soils. Water needed to hold these lines would have to be pumped from reliable water sources such as Reeder Reservoir or one of the creeks. This would require portable pumps and tanks to be carried in along with the hoses and fittings to "plumb" all the hand dug firelines.

A further difficulty presented by underburning comes from the fact that there may be no difference in canopy cover within the unit to be burned and the adjacent areas. Therefore, the fuel moistures within the underburned unit would be the same as those outside the unit, making containment of the fire within the unit difficult. Other considerations include smoke management, liability issues, availability of trained personnel, and a narrow calendar window of opportunity to accomplish the work.

Given the above constraints, handpiling the slash and burning the piles has the best chance of successfully reducing the brush fuel loading. Slash created by this project will be immediately piled for burning as part of the project and burned within 2 years.

Mistletoe

Dwarf mistletoe is a parasitic plant that is host specific. Douglas-fir, white fir and pine all have their own species of dwarf mistletoe associated with them. Mistletoe causes trees to form thick foliage masses called "brooms". When seeds of dwarf mistletoe mature they are forcibly

projected out into the forest canopy potentially infecting adjacent trees of the same species up to 50 feet from the source tree.

In heavily infected stands, mistletoe can initiate unfavorable stand conditions and development trajectories (loss of large Douglas-fir and associated structural and habitat values, infection of younger Douglas-fir and undesirable long-term changes in species composition).

Traditionally, mistletoe trees have been targeted for cutting. Trees that are heavily infected with Douglas-fir dwarf mistletoe are highly flammable and can 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.

Where mixed tree species occur, isolation can be used to keep dwarf mistletoe from spreading. However, retention of larger and older infected Douglas-fir for Northern Spotted Owl (and many other species) nesting habitat, structural diversity and other late-successional values may be more appropriate particularly for trees with larger brooms on the Winburn Parcel. Wherever possible, isolation technology should be used where larger infected trees can be retained if few understory Douglas-fir exist in the immediate vicinity and if the larger trees are surrounded by other non-host species such as madrone, black oak, pine, or white fir. Another option that will be considered is snag creation of highly infected trees if two-thirds of the crown is infected. Removal of dwarf mistletoe infected Douglas-fir in younger (<100 year) understory cohorts should be a priority in most situations, although some retention can still occur (i.e., in low topographical positions using isolation technology). Hand removal of mistletoe brooms will be used as a method as well.

Large Trees

In general, the objective is to leave the largest healthiest trees and remove the weakest and smallest trees. This will primarily include removal of trees in the 50-100 year age class and 6”-18” diameter size range. However, to meet density reduction objectives, trees of larger size classes may be considered for removal if a sufficient number of snags and the coarse woody material components have already been retained. In these cases, individual trees to be removed that are over 17” DBH will be tracked with explanations for public review. Examples of large trees considered for removal include:

1. *Mid-successional to mature stands with excessive density*

Such a stand would have all large trees and the steadily increasing stand density is compromising vigor and long-term sustainability of the stand as evidenced by high basal areas, very slow growth rates, weakening crowns, the loss of pine or hardwood species and high levels of in-stand mortality.

2. *Large conifers in suppressed or intermediate crown classes under more dominant and vigorous overstory conifers*

Removal of these trees can improve vigor of adjacent large overstory conifers particularly overstory pine species and hardwoods. In some cases, clumps of three or more large trees are growing in close proximity and removal of one or several could be considered, especially if those removed are considerable smaller than those retained (e.g. one 24 inch DBH pine is

removed while three 36 inch pines are retained.) In general, clumps of the same species will be considered as single trees provided additional stand density reduction is completed around them.
3. *Hazard Trees along roads or near structures*
4. *Dead or Dying Trees*
Individual trees may be considered for removal (if snag and CWM needs have been met) in order to minimize the spread of rapidly expanding insect or disease populations.

Monitoring

"Monitoring could be defined as simply obtaining accurate information and maintaining a long term record of it. The monitoring of our watershed entails a purposeful and systematic observation and documentation of its landscape, its inhabitants, it perturbations over recent times and what management has worked and not worked." (AWSA, 1999).

Monitoring is an ongoing part of the restoration on city forestlands. It is expected that over time there will be changes in understory vegetation and tree growth. The effects of the density reduction, prescribed fire, or other silvicultural treatments need to be monitored to evaluate their effectiveness. Currently our consulting forester is responsible for monitoring. He has established sites and methodology for the monitoring process. Ideally, over time, an agreement with Southern Oregon University could incorporate monitoring work into projects and research curriculum for students at nominal cost to the city.

The monitoring plan is designed specifically to:

1) track ecosystem elements that are likely to change as a result of the stand density reduction; these include tree vigor, ground layer vegetation, species composition, and soil cover.
2) compare effects of treatments at different locations
3) ensure that the desired effects are produced
4) provide feedback on the effectiveness of our actions so we can respond in the future to make better management decisions (adaptive management)

The Four Phases of Monitoring:
1) *Inventory or Baseline Monitoring*: to provide an initial assessment of species distribution and environmental conditions.
2) *Implementation Monitoring*: to determine if the activity is accomplished as planned.
3) *Effectiveness Monitoring*: to determine if an activity achieved the stated goals or objectives.
4) *Validation Monitoring*: to determine if the assumptions and models used in developing a management plan are correct.
Implementation of each phase of monitoring includes:
1) Inventory Monitoring
The city has conducted an inventory of many ecosystem elements including the establishment of many permanent forest monitoring plots. Baseline data has been collected on tree vigor and density, snag development, coarse woody material, perennial vegetation cover, and soil (ground cover). Photos were taken at each plot center and then mapped using a Global Positioning System (GPS). A thorough geologic hazards inventory has been completed and a more refined inventory is currently under way on a portion of the ownership. In addition, a rare plant species inventory has been conducted. The Forest Service in the vicinity of the Winburn Parcel has

monitored spotted owl activity. A stand-by-stand assessment has been prepared (Main 1996, 1998) as well as a detailed timber cruise (Main 2000). Inventory has not yet been done for songbird populations, mosses, lichens, fungi or invertebrates. We do not anticipate that this project will have significant direct impacts on these species and we are not conducting such inventories for this project.

2) Implementation Monitoring
There will be stages of review for interested parties to assess the progress of the project relative to the stated goals. Periodic public tours will be offered during the layout and marking stage to review tree marking. Additional tours will be conducted after the thinning.

Trees over 17" DBH that are proposed for removal will be tracked. One or more field tours will be scheduled to review these sites.

Existing permanent forest inventory plots will be re-measured the first spring/summer after density management and prescribed fire treatments are completed. This will include at least one photo point taken at each plot for a permanent visual record.

3) Effectiveness Monitoring
Tree vigor is a very important gauge of effectiveness of the density management effort. This is most easily represented as diameter growth rate in rings-per-inch acquired through increment boring. Forest inventory plots will be re-visited, probably at five-year intervals to measure this.

Soil cover has been inventoried using a standard transect method at each of the long term monitoring plots. Some of these plots are in stands that will be included in this phase of density management while others are not. Repeat monitoring will be done periodically to determine changes.

Ground layer vegetation has been inventoried in 1/5th acre plots at each forest inventory plot with major perennial species cover estimated in percent total cover. This will be repeated at 5-year intervals to determine changes.

Bark beetle activity will be monitored systematically as needed. Quantitative data is available at the permanent forest plots.

4) Validation Monitoring
We are just beginning to implement this phase. What we learn from what we have done will be key to our adaptive management strategies.

Economics
As previously stated in *Goals* and *Guiding Principles*, the philosophical foundation of this restoration proposal is promotion of forest health on the city forestlands.

Given this, there has been a conscious deferment of any detailed discussion of financial factors that typically influence resource management proposals. In our process, we have looked at the economics in the "big picture" with the financial aspects being just one part of the economic

matrix. Our values have placed the highest priority on ecosystem services. Ecosystem services associated with an ecologically healthy watershed would include: drinking water supply, flood control protection, soil and slope stability, erosion control, water infiltration, recreation, wildlife habitat and maintenance of soil fertility.

During this early stage of planning, economic and financial factors have been deferred while watershed and forest health values have been prioritized. During the upcoming detailed planning stage over the next few months, economic and the underlying financial costs will be assessed.

We realize that as the data comes in and the project moves forward, the financial considerations will become more apparent. We cannot know what these are now and it is our hope that the finances will fall in place with the other values that we have prioritized in the overall economic evaluation.

Note that due to the sensitive soils and steep slopes in the Ashland watershed, tree removal is proposed to be accomplished using helicopters except possibly in a few locations near roads. Main (1996) summarizes the economics of helicopter yarding.

> *" Unfortunately, achieving silvicultural objectives can be very expensive when helicopters are the intended harvest system. In this management area, the small size of the logs suggested for removal, the scattered nature of these logs, the low volumes per acre, and the low total volume all combine to suggest quite high helicopter logging costs, perhaps to the point of superceding log value."*

Projected costs include
- Cost of planning, sale implementation
- Cost of layout/marking of trees
- Cost of cutting and removal of trees
- Cost of slash burning and placement of remaining logs in contact with the ground
- Cost of mitigation measures such as bark beetle protection

Potential Sources of funding for the project include:
- Normal Operating Budget
- National Fire Plan Funding
- Regional Advisory Committee Grant
- Project revenue

PART II – DESCRIPTIONS, LONG TERM DESIRED CONDITIONS AND TREATMENTS

Desired Future Conditions (DFC) are being used to develop guidelines for stand density reduction. This section describes the long-term goals for each vegetation type on both the lower watershed and the Winburn Parcel. In most cases, long-term stewardship will be required to see these stands arrive at a DFC. This cannot usually be achieved with one management effort. We anticipate multiple entries may be needed to reach management objectives. Throughout the watershed, a drought cycle combined with a large beetle infestation could considerably alter the

number of live trees. The treatments being proposed in this project are intended to take the steps necessary to give the best possibility for development of the DFC's.

To clarify our landscape descriptions, areas are classified by different vegetation types: four in the Lower Watershed and three on the Winburn Parcel. Landscape units that are composed of these vegetation types are designated with a letter or number (consistent with the Draft Interface Landscape Unit Map). These descriptors are similar to the Plant Association Groups used by the Forest Service. A brief overview of the vegetation type is presented followed by a description of the Desired Future Condition (DFC).

Lower Watershed

The rolling topographic variation in this area provides a range of habitat conditions, which allows for a natural diversity of forest structures and species composition. Southerly aspects have historically supported fairly open forests of ponderosa pine, sugar pine, black oak, white oak, madrone and Douglas-fir. It is probable that moister, cooler northerly aspects have been more variable depending on fire frequency, sometimes supporting dense Douglas-fir while at other times having more open forests with high amounts of pine and madrone.

The Lower Watershed is divided into six units based on vegetation types and stand conditions. The Lower Watershed will be managed to bring the vegetation more toward the natural range of variability of conditions that occurred prior to the era of control of all wild fires. Our intent is to encourage more open stand conditions that will make control of fires in the wildland-urban interface easier while restoring more natural stand conditions.

Black Oak / Ponderosa Pine / Douglas-fir Type (Landscape Units C and part of U)
This type occurs on mid-slope and ridgeline positions with a south or west aspect. Currently these areas are dominated by whiteleaf manzanita, poison oak with scattered madrone, ponderosa pine and black oak. All of the acreage of this type is in early seral condition. On the drier portions, trees grow very slowly. Slopes are stable on these management units. There is a considerable amount of this type elsewhere in the Ashland wildland-urban interface zone (including Lithia Park) but only three stands within the area are being considered in this project.

The stands will have relatively open tree spacing (25-45% canopy closure) to allow for development of a healthy grass layer (Idaho fescue, California fescue), which is native to these sites. Pine will be a major component along with black oak and madrone. Small openings will be common. Manzanita will be present but maintained at low density. Repeated entries will be needed to reduce the amount of manzanita that grows on the site. A long-term goal is maintaining an average of one large snag per acre. These stands will take the role that they historically have had of providing breaks in the forest canopy to slow wildfire. The stands of this type on city ownership have already been treated (most of the manzanita removed, pine planted on a wide spacing) and are on a trajectory toward this DFC except that there is a general lack of grass layer (planting needed). There is a serious threat of invasion from dogtail grass and yellow star thistle in this type of stand, therefore any soil disturbance needs to be quickly seeded with native species.

Fuels: A horizontally discontinuous fuel profile is maintained by limiting the shrub layer and allowing for a variety of habitat niches for grasses and herbaceous plants. These units offer opportunities for limited prescribed burning.

Ground Cover Strategy: Encourage grass and herbaceous cover. Utilize small diameter down woody material.

Ponderosa Pine / Douglas-fir Type (Landscape Units D, E, F, H, M2 and P)
This is the dominant type on the south and west aspects in the Lower Watershed. These sites are dry but with soils deep enough to support a healthy, though fairly open, mixed species tree canopy with ponderosa pine, sugar pine, Douglas-fir, madrone, incense cedar and black oak. These areas are intermediate between pine types and Douglas-fir types and historically have supported both. High frequency-low intensity fire regimes would have favored pine and large hardwoods while relatively fire-free periods have favored Douglas-fir and dense stands of smaller hardwoods. Hence, these are good areas to manage for pine, oak and madrone but also can be managed to support moderate densities of Douglas-fir. The ground layer vegetation is currently sparse with scattered grasses (western fescue and California fescue) and low shrubs (honeysuckle, poison oak). These species increase in cover when the canopy is opened up through thinning or tree mortality. Dense shrub layers (manzanita, deerbrush ceanothus) can develop in early seral conditions, particularly following fire.

These stands are very susceptible to beetle attack due to excessive stand densities exacerbated by the relatively shallow soils with low moisture holding capacity. Surveys done this fall indicate a dramatically increasing tree mortality from the current wave of bark beetles. Douglas-fir snags are common (Main, 2002 and Goheen and Goheen, 2003).

The goal in these stands is to have a mix of tree species with healthy individuals of ponderosa pine, sugar pine and black oak especially favored. A mix of species is the best strategy for ensuring that trees remain dominant on the site while also maintaining diversity. There will be within-stand variation with some fairly dense small stands of Douglas-fir and some rather open areas with pine oak and madrone. Tree spacing will be moderate (30-55% canopy closure). The more-open areas will allow for development of a stable ground layer including a grass component (California fescue), a low shrub component and shade intolerant herbaceous species. Maintenance will be needed to keep manzanita and other tall shrubs at relatively low levels. Areas with denser tree canopies will have relatively sparse ground layers with more shade-tolerant herbaceous species and dry-site mosses. There will be relatively few large downed logs. The goal will be to maintain 3 to 4 large (>17" DBH) snags per acre.

Slopes are mostly stable in this type but become steep near draws (60%-80%) and prone to slides. Steep slopes will be managed more for Douglas-fir (denser spacing) with healthy madrone, black oak and pine left where they occur. It is expected that snag development will be greater on these sites and CWM will be managed at a higher level.

Fuels: In this type, a horizontally discontinuous fuel profile is maintained in both the canopy and in the ground layer. Where pine and black oak are dominant, tree spacing will be greater and the ground layer vegetation may increase. Where Douglas-fir is dominant, tree spacing will be less

and the ground layer less developed. These units would be good opportunities to implement limited prescribed burning in the future.

Ground Cover Strategy: encourage grasses, low shrub layer (such as hairy honeysuckle) and hardwoods. Utilize small woody material (4"-10") to cover soils until vegetation layer develops. On steep slopes utilize higher levels of CWM and more dense tree cover.

Dry Douglas-fir Type (Landscape Units A, B, G, J, K, Q, S, T, parts of U)
This type occurs on north and east aspects and the lower one-third of some south slopes. Douglas-fir dominates this Landscape Unit with smaller amounts of madrone, ponderosa pine, and black oak. Currently most stands are even-aged with very high stand densities of relatively small-diameter trees. Early seral stages include high covers of shrubs such as deerbrush ceanothus, poison oak, honeysuckle, snowberry, and clumps of young madrone. Many areas are steep with slope stability concerns.

The goal for these stands is to have moderate tree spacing (40%-60% average canopy closure) with the emphasis on maintaining as much root holding capacity as possible. Shade tolerant herbaceous ground species will be dominant in the ground layer while minimizing the development of shrubby species by maintaining relatively high canopy closure. Douglas-fir will be favored with healthy pine, madrone and black oak left where they occur as dominants or co-dominants. On stable sites, particularly on dry micro-sites, a more open canopy will be maintained to favor pines, madrone and black oak. There will be a moderate to high level of CWM developed over time. The long-term goal will be to maintain 4 large (>17" DBH) snags per acre though there are currently few trees in this larger size class. A significant amount of maintenance may be needed to manage the shrub layer in the more open parts of these Landscape Units.

On steep slopes (>60% slope), a more cautious approach will be taken with soil stability being the over-riding concern. A large percentage of these areas are likely to be left un-thinned or with only small diameter suppressed trees cut due to the risk of slope failure. Where tree density is high, girdling for snag creation or felling and leaving will be given primary consideration. As a result, snag density and CWM density will be high.
These stands are very susceptible to beetle attack due to the high tree densities and limited soil moisture capacity. Without thinning, there is an increasing likelihood that patches of trees will die. Options for reaching DFC improve with elevation and decreased moisture stress.

Fuels: In this type, vertical discontinuity (few fuel ladders) is more important than horizontal discontinuity during the mid-seral stages. Maintaining enough canopy to discourage understory and shrub development is important. There will be a relatively high amount of CWM but this should not add significantly to fire hazard.

Ground Cover Strategy: Utilize relatively high CWM and moderately dense tree cover. Where canopy is sparser, encourage low shrub and herbaceous cover.

Moist Douglas-fir Type (Part of Landscape Units L, M3, N, Q and R)

This type occurs on very steep northerly aspects in the southern half of the Lower Watershed. It is adjacent to, and includes portions of, the riparian transition zones. Douglas- fir is dominant with some madrone and ponderosa pine present (but at a competitive disadvantage). Stands are currently very dense with a high potential for tree mortality. Some of the larger tree sizes (20"-30"DBH) can be found on these units. Slope stability is usually a central issue.

The goal for these stands is to have a high level of canopy closure (50-70%). Douglas-fir will be favored but madrone and other species may be important in areas where Douglas-fir dwarf mistletoe is a factor. Higher levels of stand density may be appropriate where slope stability is a concern. These units have the best potential (compared to other stands in the Lower Watershed) for attaining late-successional characteristics at some point in the future given the comparatively higher moisture levels in the soils. The number of large down logs will be high to allow for full development of the soil and to help with slope stability. The goal is to maintain 4 large (>17" DBH) snags per acre.

Ground Cover Strategy: Utilize CWM and moderately dense tree cover.

Riparian Transition Zones: The areas upslope from creeks and draws that have riparian indicator plant species have an integral place in the landscape as critical moisture-holding zones important for water production and plant and animal species habitat. These are the areas that will have the highest snag and CWM concentrations. Care will be taken to keep ladder fuels and fine ground fuels minimized to reduce fire hazard while emphasizing the large wood component.

Winburn Parcel

The Winburn Parcel is at mid-elevation with a high degree of variability in forest stand structure and species composition. The moderate elevation and generally deeper soils has allowed these forests to develop differently than the Lower Watershed. Large trees are common, as are the other important elements that make older forests unique, including large snags, large logs and canopy diversity. Current conditions are variable, but many areas have a distinct two or three layered stand structure with large trees standing above the intermediate and understory trees. In many areas, a high stand density of small and intermediate trees creates stress in the larger trees. The goal in the Winburn Parcel is to protect and encourage mature and old growth stand characteristics as well as to enhance habitat for old growth dependent species. This will entail the usual small tree (<7"dbh) thinning and, in much of the area, additional thinning of intermediate and suppressed trees.

There are three general forest types in the Winburn parcel: 1) the Pine-White Fir type, 2) the Douglas-fir-White Fir type and, 3) the Riparian Transition Zone Forest.

Ponderosa Pine / Douglas-fir / White Fir Type (Management Units 1 and 7)
This forest type is on a southerly aspect with slopes ranging from gentle to very steep. These stands are characterized by three primary cohorts (age classes): 1) 150+ year old, large ponderosa pine, Douglas-fir and scattered sugar pine and incense cedar; 2) 80-100 year old (predominantly 6-14" dbh) Douglas-fir, white fir and Pacific madrone; and 3) a younger cohort of ¼"-5"dbh seedlings and saplings. There is a mosaic of two basic structure types present in this stand described mostly by the amount of cohort 1 (large trees). In some areas these big trees form impressive patches while in other areas they are mostly lacking and the 80-100 year old cohort (cohort 2) is then the key feature. Stand densities are variable with patches of high density interspersed with canopy gaps of early seral vegetation (as a result of the 1990 logging operations).

Given this general mosaic, and the desire to keep the 150+ year old cohort trees alive and vigorous, we envision two primary stand management zones within this area. These can be described as a "pine management zone" where stand densities will be lower to favor the survival of the older cohort pines and a "Douglas-fir-white fir management zone" where densities are higher.

In the pine management zones, the older cohort trees will be retained and cohort 2 trees will be thinned making a more open intermediate canopy layer. Thus, it is expected that these zones will develop a vigorous grass/forb layer. The fir management areas will likely look similar to how they are presently except with fewer and larger trees. In general, the density reduction will be less in the fir management zones.

There will be a moderate amount of CWM (2-6 logs per acre) and an average of 4 large snags per acre. The ground layer will vary from high cover of grasses and herbaceous plants in open areas to more sparse in more densely forested areas.

These areas will be mosaics of open canopy ponderosa pine and Douglas-fir stands and denser Douglas-fir dominated areas. The more open areas will occur where there are currently large overstory pines present. The more dense stands are mid-layer trees, mostly Douglas-fir and white fir. Canopy closure in the more open areas will be 30% to 35% while in the more dense areas will remain relatively high at 60% to 70%. Relative densities will be 0.3 to 0.35 and 0.4 to 0.5 respectively. There will be a moderate amount of CWM (up to 6 logs per acre) and an average of 4 large snags per acre. The ground layer will vary from high cover of grasses and herbaceous species in open areas to more sparse in the more densely forested areas.

Steep slopes and draws will be part of the denser forested portion of the mosaic with high canopy cover and higher levels of CWM.

Douglas-fir-White Fir Type (Management Units 2, 4, 5 and 6)
This forest type occurs on north, east or west aspects, mostly on steep to very steep slopes. Typically Douglas-fir is dominant in the overstory with occasional ponderosa or sugar pine. White

fir occurs in the shady understory with Douglas-fir in open spots. Madrone is found on the drier sites. Over time (without fire disturbance) the tendency is for white fir to dominate. Under natural fire regimes, however, Douglas-fir remains dominant. These stands are currently highly variable with patches of large trees and scattered individual large trees. Some are multi-aged stands with a high degree of canopy diversity and patchiness and complex stand density characteristics. Some stands have even-aged 80-100 year old canopies with obvious high-density related stress.

These are moist, productive forests capable of developing into classic old growth if given enough time without severe disturbance. The strategy for these forests is to carefully and conservatively thin intermediate and understory trees to protect existing old growth. This will take the development of a variety of strategies to address the stand diversity. In some stands, there is a need for fairly significant thinning of co-dominate intermediate sized trees to avoid the potential of losing many overstory trees. It is likely that some trees over 17" DBH will be cut. These goals, however, are conservative in nature. The proposed thinning will not reduce the late successional characteristics highly encouraged in the Winburn Parcel.

Though there will be a high level of variability in these units, in general, canopy closure will range from 60% to 70% or more with a mixed age of trees. CWM will be at high levels (up to 8-10 logs per acre as per coarse wood soil strategy). Large snags will be present to meet 100% of cavity-nesting bird needs (3-6 per acre). In areas that currently have uniform even aged canopies there will be an increase in structural diversity. For the most part, Douglas-fir will be the dominant overstory species, but where healthy (vigorous crown) pine and madrone occur on stable slope locations, there will be a lower stand density to ensure their survival.

Ground cover will be variable depending on canopy closure. Where large trees are dominant and overall density relatively light, the shrub and herb layers are expected to be well developed. Where younger trees are dominant and canopy denser, the shrub and herb layers will continue to be relatively sparse and dominated by herbaceous species.

Riparian Transition Forest (Management Units 3, 8 and lower slope portions of units 4, 5 and 6)
The riparian zones (adjacent to creeks) and riparian transition forest (upslope but heavily influenced by the riparian zones) are extremely important in the Winburn Parcel both ecologically and as a water source for the City of Ashland. These are mostly healthy functioning ecosystems with well-established riparian vegetation though much of the riparian corridor is currently lacking in large downed woody material. The riparian transition forest is variable including many large trees and many patches of relatively even-aged 80-100 year old trees. The shrub layer is unique with the occurrence of salal, which is very rare in the eastern Siskiyou Mountains. Slopes are variable, including some gentle floodplain type areas and some very steep unstable slopes.

The goal for these forests is to encourage high canopy closure (70%+), and encourage further development of old growth characteristics.

An increase in large downed woody material would increase the diversity along the creeks further enhancing the provision of quality water for the city of Ashland. Large snag density would be from 4 to 6 per acre. CWM would be 8-12 per acre.

Winburn: A Work in Progress
The detailed stand information needed for restoration thinning in the Winburn parcel is not as well developed as in the Lower Watershed area. Significantly more planning and discussion is needed before exact prescriptions are developed.

The resources and focus of the AFLC and staff has been to plan for work on the Lower Watershed to begin as soon as possible. This phase of the project is currently in the final stages before implementation. The planning and discussions to arrive at prescriptions for the Winburn parcel is the next project of the AFLC.

REFERENCE

Agee, J.K. "Fire Effects on Pacific Northwest Forests: Flora, Fuels, and Fauna." *Northwest Forest Fire Council Proceedings: pp. 54-66. Northwest Forest Fire Council, Portland, OR*. 1981.

Atzet, Thomas A. and David L. Wheeler. "Historical And Ecological Perspectives On Fire Activity In The Klamath Geological Province Of The Rogue River And Siskiyou National Forests". *U.S. Department of Agriculture, Forest Service, Siskiyou National Forest, P.O. Box 440, Grants Pass, OR 97526*. 1982.

Ashland Ranger District. *Ashland Interface Fire Hazard Reduction Environmental Assessment.* 1998.

Ashland Ranger District. *Ashland Interface Fire Hazard Reduction Draft Environmental Assessment.* 1999.

Ashland Ranger District. *Bear Watershed Analysis.* 1995.

Ashland Ranger District. *Final Environmental Impact Statement Ashland Creek Watershed Project.* 2001.

Ashland Watershed Stewardship Alliance. *A Draft Comment and Proposal for the Ashland Ranger District and interested citizens in response to the Ashland Watershed Protection Project Draft Environmental Impact Statement.* 1999.

Goheen and Goheen. *Applegator.* May/June, 2003.

Hannon, Nan and Clayton G. Lebow. *An Inventory, Historic Documentation, and Assessment of Cultural Resources At Lithia Springs and Winburn Camp.* 1987.

Hicks, B. G. *Landslide Mapping for City of Ashland Forest Lands Within the Ashland Creek Watershed.* 1997.

LaLande, Jeff. Rogue River National Forest. *Archaeological Inventory and Evaluation Report: Site 35-JA-168 (RR-797).* 1983.

Main, Marty. *A Preliminary Assessment of Forest and Resource Management Priorities on City of Ashland Owned Lands.* Developed for the City of Ashland by Small Woodland Services, Inc. 1995.

Main, Marty. *A Preliminary Overview of the Winburn Parcel.* Developed for the City of Ashland by Small Woodland Services, Inc. 1999

Main, Marty. *A Silvicultural Prescription for High Priority Forest Management Areas.* Developed for the City of Ashland by Small Woodland Services, Inc. 1996.

Main, Marty. *City of Ashland Forest Lands.* Developed for the City of Ashland by Small Woodland Services, Inc. 1998.

Main, Marty. *Native Grass Establishment – Project #2.* n.d.

Main, Marty. *Permanent Inventory Plot Establishment Protocols, City of Ashland Forest Lands.* Developed for the City of Ashland by Small Woodland Services, Inc. 2000.

Main, Marty. *Silvicultural Prescriptions for Additional Forest Management Areas – An Update.* Developed for the City of Ashland by Small Woodland Services, Inc. 1998.

Main, Marty. *Silvicultural Update: Potential Forest Management Activities.* Developed for the City of Ashland by Small Woodland Services, Inc. 2000.

Main, Marty. *The Ashland Wildland/Urban Interface Wildfire Management Inventory, Analysis, and Opportunities.* Developed for the City of Ashland by Small Woodland Services, Inc. 2002

Main, Marty. *Timber Cruise Report City of Ashland Ownership.* Developed for the City of Ashland by Small Woodland Services, Inc. n.d.

Main, Marty. *Unit Descriptions and Prescriptions Units G, H, J, K, L, M, N, P, Q, R, S, T, U, V.* Developed for the City of Ashland by Small Woodland Services, Inc. 1998.

Rolle, Wayne. *1997 Botanical Survey, City of Ashland Lands in the Ashland Creek Watershed.* 1997.

Siskiyou Research Group. *Ashland Creek 2000 Level II Stream Survey Report.* 2001.

Siskiyou Research Group. *Ashland Creek Stream Survey (Bear Creek to Reeder Reservoir).* 2000.

Thomas, Harold A. and Hopkins, Howard G. *Twenty Years Ago – The Ashland Fire.* Timberlines, volume 23, September 1979.

Todt, Donn. *Pre-Settlement Vegetation of Lithia Park.* 1994.

Appendix

GLOSSARY

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

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, and 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, or mbf.

Bole: The main stem or trunk of a tree.

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.

Coarse Woody Material: Portion of tree that has fallen or been cut and left in the woods. Pieces are at least 16 inches in diameter (small end) and at least 16 feet 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 shrugs 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.

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

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.

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 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.

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. (USDA, 2001)

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') influenced by an aquatic component and adjacent upland areas.

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 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.

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) - An aggregation of trees occupying a specific area and sufficiently uniform in composition, age, arrangement, and condition so that it is distinguishable from the forest in adjoining areas.

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.

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

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