Rigdon Landscape Restoration Project

The Rigdon landscape area is named for Stephen Rigdon and his wife Zilphia (Bristow), who ran a stage stop/way-station on the Wagon Road for about 25 years. The station was located in Rigdon Meadow, which is roughly in the center of the existing mixed conifer forest type. This traveler's oasis was located in this area because of the good forage for livestock and pack stock that existed here when forests were more open and grassy.

This document is purposed to provide background that describes collaboration with the Middle Fork Ranger District of the US Forest Service and the South Willamette Forest Collaborative (SWFC) to carry out restoration of the Rigdon Landscape. The Upper Middle Fork Willamette Action Plan describes the restoration goals. The Forest Service created an interdisciplinary team comprised of a landscape planner, a silviculturist, and multiple resource specialists. The Southern Willamette Forest Collaborative (SWFC) formed the Rigdon Collaboration Committee (RCC) to allow interested stakeholders to participate in the decision making process. SWFC has facilitated learning sessions, field trips, and roundtable discussions between the Middle Fork Ranger District and RCC members.

In this document, the current landscape conditions are described and various proposals for implementation that are under discussion between SWFC and the Forest Service are summarized. Two completed restoration projects are described. Project decisions will be guided by input from the collaborative to the Forest Service through the process of Zones of Agreement (ZOA), where recommendations are made through collaborative discussion and decision-making.

BACKGROUND

Oregon white oak and ponderosa pine habitats have decreased dramatically from historic conditions on the west side of the Cascades. Oregon white oak forests and savannas currently occupy less than one percent of their historic range in the Willamette Valley. Most of the remaining habitat is in private ownership. These vegetation types are also listed as conservation concerns in the West Cascades Eco-region (Oregon Biodiversity Project, 1998). Many plant and animal species associated with savannas are currently classified as at-risk due to this decrease in habitat. There are over 200 wildlife species that use Oregon white oak savanna habitat

(Brown, 1985). There is, thus, serious concern that an important element in landscape biodiversity may be lost in our lifetime.

Direction exists for conserving and restoring these habitats. The Willamette National Forest's Land and Resource Management Plan (USDA, 1990) contains general guidelines for maintaining biodiversity across the landscape; Forest Wide Standard FW-201 states "biodiversity shall be maintained or enhanced by providing an ecologically sound distribution and abundance of plant and animal communities and species of all age classes at the Forest, Basin, and stand level." (page IV-78,) . Forest Wide Standard FW- 211 provides direction to maintain special habitats and unique plant associations.

A goal of the Interagency Natural Fuels Management Strategy (USDA, USDI, 2000) is to "create, restore, and maintain structure and function in prairie, oak, and dry Douglas fir sites" that have been altered by fire suppression and other management activities. These sites are currently rare or have disappeared on Willamette National Forest lands.

PAST FOREST CONDITIONS

Open Forest Structure

It appears this part of the Middle Fork landscape used to support an open savanna of scattered trees, grasses and shrubs 120-150 years ago with about 14 – 40 large trees per acre scattered variably across the landscape. The tree species distribution in this open forest was roughly evenly split between ponderosa pine and Douglas fir, with occasional sugar pine and incense cedar and large, open-grown Oregon white oak in some places. Judging from the extent of large dead branches on the lower stems of the legacy conifers, historical crown depth was probably in excess of 60% of total tree heights. Crown closure in the original savanna was likely quite variable, ranging from nearly zero where there were few trees to as high as 50 or 60 percent. Evidence exists that this structure may have been created or at least maintained by intentional burning by Native Americans. Acorns, grasses, and associated forbs provided for abundant wildlife forage and human food plants, and the pines apparently provided medicinal and craft materials.

There were areas up to several acres not today associated with meadows that appear to have been free of large trees 120 - 150 years ago. More than 20 percent of the plots taken to estimate past stand condition did not contain evidence of any trees that were alive then. Since evidence of smaller trees no longer exists on these sites, it is not known to what degree smaller seedlings, saplings, or pole-sized trees might have existed. Given the fire frequency (see below) there were likely few small trees, or their abundance was episodic. Certainly some survived the periodic fires to replace the larger, more fire resistant trees as they succumbed to old age, windthrow, diseases or insects, and the occasional locally extreme fire. The historical tree species distribution in the Jim's Creek savanna from site - specific analysis is shown in Table 1.

Table 1 Stand Composition >100 years ago – on 505 acres
(Excluding plantations and class II and III riparian reserves)

Species	Trees per acre	Average diameter
Douglas-fir	5	38
Ponderosa pine	5	37
Oregon white oak	3	19
Incense cedar	1	36
Sugar pine	<1	48
TOTAL	14	35

Note: the above numbers reflect only trees greater than 10 inches in diameter

Ground Vegetation

It can be surmised that this open forest contained a more or less dense understory of bunchgrasses. Sparse remnants of a native bunchgrass, *Festuca californicum*, still exist under the younger canopy. This grass is known to thrive in open forest conditions, and this is also the grass that has responded so well in some of the young plantations. It can also be surmised that since soil moisture and ground level sunlight levels were higher in the more open forest that a large variety of herbs and forbs were also present such as camas, tarweed, mule's ear daisies, wood lilies, etc. Shrubs certainly occurred in this open forest as well, though to what extent is now unknown. The frequent fire regime would have kept shrubs in small stature and/or sparsely distributed. The shrubs included poison oak, hazelnut, oceanspray, deerbrush, tall Oregon grape, wild rose, huckleberry, trailing blackberry, black raspberry, and snowberry.

Fire Regime and Frequency

The periodic burning that occurred in this area appears to have been even more frequent than natural fire regimes described by Kertis (2000) at Warner Mountain, an area just to the north of the project area. This study found a fire return interval ranging from 19 to 48 years and averaging 27 years. As many as eight separate fire scars can be seen on the edge of some of the large basal fire scars on the older ponderosa pine in the Jim's Creek area, and five scars is not uncommon. The time period between these scars is typically 5 to 20 years.

The fires that maintained this savanna type must have occurred frequently and have been of fairly low intensity, given that many of the remnant pine have no apparent fires scars. This type of fire regime would favor low density forests of ponderosa pine, Douglas fir, and Oregon white oak with understories dominated by fire adapted bunchgrasses. High fire frequencies and dense bunchgrass discouraged establishment of Douglas fir and provided for the perpetuation of Oregon white oak.

Given the extensive evidence of Native American use of the area, and accounts that the original inhabitants of this landscape did use fire to modify their environment, it seems evident that intentional aboriginal burning was instrumental in maintaining this open forest. This forest could have originally developed during a drier climate regime, or Native American burning could have gradually created it.

We can also speculate as to why this intentional burning might have taken place. We know that the large diameter ponderosa pine were utilized in historic times but can only hypothesize the reasons. There are numerous examples of what have been called “medicine trees” or “cultural trees” scattered throughout the stand. These are ponderosa pine, which at one time had about 25 percent of their cambial surface exposed from 2 to 8 feet above the ground. Though the last fire has scorched many of the extant resulting scars, they typically do not occur on the uphill side of the trees’ stems as do most fires scars. Additionally, these scars do not extend down to the soil and are not triangular in shape like most basal fire scars tend to be. A few of these scars also have some tools marks in the exposed wood, and some of these marks were charred by fire after they were made, indicating they were made prior to the establishment of the existing 100 year old understory.

CURRENT FOREST CONDITIONS

Mixed Conifer Forest

Due to a rain shadow cast by the large and long ridge known as the Calapooya Mountains, portions of the Rigdon landscape have a unique climate (at least in the context of the Willamette National Forest). It is somewhat drier throughout the year than most west slope areas of the Cascades, and is more typical of areas further south. That climate reality, along with prescribed fire use by the Native American population, resulted in portions of this landscape being covered by an open, mixed conifer forest. These open forests generally occupied the lower elevations, particularly on south aspects. The trees in these forests were widely spaced and the ground vegetation was composed of grasses, wildflowers, and scattered shrubs, many of which provided important food and craft materials for the Molalla Indians who inhabited the area.

The advent of fire suppression during the last >100 years has resulted in the development of a dense secondary canopy throughout the landscape. This secondary mixed forest type is a mixture of ponderosa pine, sugar pine, and incense cedar along with the more dominant Douglas fir. This is a forest type unique on the Willamette National Forest, though it is similar to forest stands that occur more commonly on the Umpqua National Forest to the south of the Middle Fork watershed. Small patches of Oregon white oak habitat (usually associated with rocky meadows) occur throughout the mixed conifers. The contiguous secondary mixed forest (as delineated by Agar, 1998; see attached map showing Douglas fir habitat restoration area) contains about 25,000 acres that typically occur south of Hills creek reservoir in lower elevations and southerly slopes. It occurs in the upper (southern) portion of the Hill’s Creek

Reservoir and the lower portions of the Upper Middle Fork fifth field watersheds, which together constitute the greater portion of the Middle Fork of the Willamette River watershed above the Hill's Creek dam.

Approximately half of the mixed conifer type has been harvested over the past ten to 50 years and about 8,000 acres of that is composed of private industrial forest lands. This forest type was at one time a more open forest than it is now, and likely contained an open understory of grasses, forbs and some shrubs (Winkler, 1984; Hadley, 1997; Winkler and Bailey, 2002; Bailey and Kertis, 2002; and Bailey, 2005), as further described below in the Past Stand Conditions section.

Current Plant Series Distribution and Seral Stages on the Landscape

The predominant plant series that occur within the project area are strongly influenced by elevation and topographical location on the landscape. Five major plant series are currently recognized in the project area (Table 2). It should be noted that a pine and oak plant series once existed within the project area, but is no longer represented because of fire suppression and anthropogenic changes in landscape management. Pine and oak habitat was more prevalent historically in the project area. Pine and oak habitat would have been considered as a plant series if the plant series and vegetation communities layer had been created several hundred years ago. The pine and oak habitat type is better suited for resiliency in the face of warmer, drier conditions predicted to accompany global climate change.

The seral stages vary among and within each plant series based upon site history, disturbance, and past management practices. The seral stages present in the project area are displayed in Table 3.

Table 2. Plant Series in the Rigdon Project Area

Plant Series	Associated Habitat Types
Douglas-fir, Low Elevation White Fir	Douglas-fir Grand/white fir Pine/Oak
Western Hemlock	Western hemlock Pine/Oak
Pacific Silver Fir	Pacific silver fir
Mountain Hemlock	Mountain hemlock Knob cone pine
High Elevation White Fir	High elevation white fir Knobcone pine

Table 3. Seral Stages and Associated Coverage in the Rigdon Project Area

Seral Stage	Acreage	Percent of Rigdon Project Area
Early Seral Forest	7,804	8%
Mid-Seral Closed Forest	23,997	23%
Mid-Seral Open Forest	8,605	8%
Late-Seral Closed Forest	54,951	53%
Late-Seral Open Forest	6,246	6%
Non-Forested	2,334	2%

Seral stages are defined as follows:

Early seral forest. In this stage forest stands are young with open canopies. New trees and shrubs are seeding in and growing as resources are readily available. These forests generally occur between 0 to 30 years after a disturbance. Early seral forests can provide habitat for wildlife when shrubs, grasses, and/or forbs are a component of these forests. The Tumblebug Fire Complex accounts for the majority of the early seral forest acreage in the project area.

Mid-seral closed canopy forest. In this stage forest stands have developed dense, closed canopies where new trees and understory vegetation are generally prevented from establishing and where existing live trees may die due to competition for sunlight, water, and nutrients. This stage is often referred to as the stem exclusion stage (Oliver and Larson 1996) and generally occurs between ages 31 to 100 years. These stands are the second most common forest in the project area. Most mid-seral closed canopy forests are in or approaching the stem exclusion stage. This stage inhibits understory growth of trees, shrubs, forbs, and grasses. Mid-seral closed canopy forests provide the least benefit to wildlife of any seral stage, and therefore, should be considered the highest management priority from a wildlife prospective. Most trees have sacrificed growth in girth and root development by allocating growth to height during competition with other trees. Many stands have self-pruned, leaving existing crown ratios at 20% or less. These stands will eventually undergo tree mortality leading to canopy breaks. Canopy breaks will exacerbate windthrow, stem-breakage, possible regeneration (e.g., tree seedlings and saplings, shrubs, forbs, and grasses), partially downed trees functioning as ladder fuels, and downed trees serving as 100-hour fuels. At this point, these stands become stand replacing fuel hazards that not only threaten the stand itself, but other adjacent forested stands. Moreover, the mid-seral closed canopy forested stands create a significant threat to other stands in the project area because of their wide-spread spatial distribution and future potential for causing stand replacement events.

Mid-seral open canopy forest. In this stage the stands are generally the same as the mid seral closed canopy forest but have been opened up by small disturbances such as low to moderate severity fires or insects and diseases. Some of these forests may be functionally progressing towards a late-seral condition. Other mid-seral open canopy forests may be mid-seral closed canopy forests that are undergoing mortality from tree competition, insect infestations, disease, and other disturbances.

Late-seral closed canopy forest. In this stage the stands are mature to old growth forest where overstory canopy cover is often 60% or greater and the understory recruitment is dominated by shade-tolerant species such as western hemlock. Shade-intolerant species like Douglas-fir and pine often struggle to survive in the understory. This stage is often referred to as late-successional forest. These stands are typically over 80 to 100 years old. These forests provide habitat for late-seral associated wildlife species. Late-seral closed canopy forests are the dominant seral stage in the project area comprising a 53% coverage.

Late-seral open canopy forest. In this stage the stands are mature old growth forest that have been opened up by disturbances to the degree where canopy openings may be sufficient to allow recruiting shade-intolerant species such as Douglas-fir or pine. This stage is also referred to as late-successional forest. Generally these stands are over 80 to 100 years old (Barret et al 2010). These forests provide habitat for late-seral associated wildlife species.

Non-Forested. This stage includes habitats not necessarily suited for tree growth or may include natural meadows. In these areas, soils may be shallow, rocky, or talus. Some areas may have sporadic shrub, grass, or forb layers.

DESIRED FUTURE CONDITIONS AND MANAGEMENT RECOMMENDATIONS

Active management including mechanical thinning is widely accepted as appropriate to restore resilience to dry forests in eastern Oregon where significant fuel loads have accumulated since the exclusion of fire in the 1900s. There is more uncertainty about historical disturbance dynamics and appropriate active management in mature forests of the western Cascades. Westside federal forest managers are also significantly constrained by legal requirements to maintain multi-layered forest habitat for spotted owls and other late-successional/old growth (LSOG) associated species.

The southern Willamette National Forest encompasses diverse vegetation ranging from dry mixed conifer to mesic Douglas-fir/western hemlock forests. There is evidence that south Willamette forests historically experienced a rich variety of wildfire disturbance prior to extensive Euro-American management (Dunn et al. in review, Tepley et al. 2014, Tepley et al. 2013, Weisberg and Swanson 2003). But there is considerable uncertainty about how variability in fire disturbance shaped different forest types. There is strong need to develop conceptual frameworks that provide guidance about how managers can shape future disturbance patterns to provide for the conservation of LSOG species (USDI 2008).

A better understanding of how historical disturbance shaped forest communities will allow managers to apply restoration treatments to restore the natural range of biodiversity, forest complexity, and resilience to future disturbance and climate regimes. Active management in diverse forest types, if supported by collaborative stakeholder groups and informed by robust

scientific information, has the potential to simultaneously achieve species conservation objectives while providing economic opportunities for local communities.

The Rigdon Collaboration Committee recommends the following actions to restore forested areas:

- Return forest stands which exhibit a change in density and species abundance due to cessation of historical fire regime to their historical, more open conditions. Treatments should place stands on a trajectory for resilience to climate change to the extent possible, consistent with desired future conditions and other social, economic, and legal issues.
- Re-establish the historical frequent, low intensity fire regime where appropriate by letting natural fires burn under acceptable conditions, and by managed ignitions, when and where needed to achieve resource objectives.
- Actively control and/or eradicate non-native and invasive vegetation by manual, incendiary, prohibitory, or chemical means as needed and appropriate for site conditions and adjacent resources.
- Return non-forest vegetation types, such as meadows and savannas, to their historical abundance and distribution.
- Re-establish plant species that have declined over the past 150 years due to a change in the fire regime or disease, such as native bunchgrasses, Oregon white oak, ponderosa pine, sugar pine, and knobcone pine, to their historical abundance and distribution.
- Restore the diversity and resilience of vegetation and forest structure in plantations where intensive management has created unnaturally dense and/or uniform stands.

THE STREAM SYSTEM – UPPER MIDDLE FORK WILLAMETTE RIVER AND TRIBUTARIES

The name *Willamette* is of indigenous origin, deriving from French pronunciation of the name of a Clackamas Native American village. However, Native American languages in Oregon were very similar, so the name may also be derived from Kalapuya dialects.

PAST CONDITIONS

The larger streams and the main stem Middle Fork of the Willamette River were associated with wide floodplains with multiple channels, especially near confluences. This braided character of the streams provided for high quality spawning and rearing habitat for the anadromous runs of Chinook salmon that used this river system. Other native fishes were present. Sixteen of these native fishes in the Willamette watershed are listed in Table 4. In general the water in the stream system was cold and of high quality, as there was abundant shade along the streams, and cold springs in the upper watershed that released water from the melting snow of the Cascade winter snowpack. In the project area, there are many creeks that flow year round and connect with the main stem Middle Fork. Many of these feeder streams are spring-fed and served as seasonal refugia.

Chinook salmon were harvested as a major food source by the native people, probably by using weirs on the tributaries, and may have been traded with the white settlers. Beaver, river otters and turtles were common on the aquatic landscape and were used as food and likely were traded by natives. Fur trappers (French Canadians mostly working for the Hudson's Bay Company and The Northwest Company, which later merged) hunted for beaver and otter on rivers, streams, and coastlines. The pelts of these animals commanded substantial prices in the United States, Canada and eastern Asia, because of their "thick, luxurious and water-repellent" qualities. Fur traders heavily exploited the Willamette River and its tributaries during this period.

Table 4 - Native Fishes of the Middle Fork Willamette Watershed

Chinook salmon	Redside shiner	Rainbow trout
Speckled dace	Bull trout	Largescale sucker
Coastal cutthroat trout	Threespine stickleback	Chiselmouth
Reticulate sculpin	Prickly sculpin	Northern pikeminnow
Peamouth	Oregon chub	Sandroller
Brook lamprey	Pacific lamprey	Redside shiner

20th CENTURY CHANGES AND CURRENT CONDITIONS

Roads

The expansive road system in place by the end of the century resulted in severing aquatic habitat connectivity in many places by placing many culverts in permanent streams that were not passable to fish and other aquatic organisms. These roads also caused serious erosion in places during storm events and routed much fine and coarse sediment into stream channels. To protect the expanding road infrastructure, and in a misguided effort to improve fish passage, streams were cleaned out, removing the structure provided by large downed trees. Some streams became channelized with the construction of levees to facilitate timber harvest. Riparian forests with harvest blocks were removed, eliminating future sources of the large wood that provided stream channel stability. In some areas these activities led to streams of eroded channels with drained floodplains. Near the end of the century, forest management practices began to change; stream buffers were retained in harvested areas and the environmental liabilities of an extensive road system were recognized. As a result, many sections of the road system were decommissioned or closed in some way. Also near the end of the century the problems caused by woody debris removal began to be recognized and a program of in-channel wood re-introduction was begun.

Dams

In the 1960s, dam construction on the main stem of the Middle Fork River began. The dams were built to generate power, provide flood control for the City of Oakridge and the upper Willamette Valley, to provide for recreational opportunities and to regulate late season water flow. The Hills Creek Reservoir was built just downstream of the Rigdon landscape, and another large dam impounding the Lookout Point reservoir was built above the town of Lowell some 20 miles below Oakridge. These two dams were not provided with any sort of fish passage structure, so they extirpated the anadromous fish runs. The biological productivity of the stream system has declined, since the energy input from salmon migration was eliminated, reducing other species dependent upon that food source. In conjunction with the dam construction, there was a concerted effort to poison fish bearing streams up-stream of the Hills Creek reservoir to eliminate bull trout, a predator on rainbow trout that the Federal and State government wanted to stock the reservoir with. A fish hatchery was established in Oakridge to mitigate the dams' removal of accessible salmon spawning habitat. Salmon smolts were released below the Lookout Point dam, but during those years the Middle Fork above the dam remained free of salmon and bull trout.

Near the end of the century, both Chinook salmon and bull trout (a species dependent upon very cold water and salmon eggs and smolts for food) were listed as threatened in recognition of the severe decline in their populations due to dam construction and habitat degradation in the Willamette Watershed. Harvest of trees in the riparian zone has increased the temperature of some streams from the increase in sunlight to the point they no longer provide optimum

temperatures for coldwater fish life stages. The main stem river remains too warm for optimum bull trout habitat. A bull trout re-introduction program was begun and has been somewhat successful in reestablishing spawning areas in some of the spring-fed tributaries upstream of the Rigdon landscape. A restoration project that improved bull trout access to Indigo Springs and headwaters was completed in collaboration with the Middle Fork Willamette Watershed Council and the Forest Service in 2009. Other stream restoration, involving re-introduction of large wood to form more complex stream channel structure and removal or redesign of structures that block passage of aquatic organisms continues but there is much more to be done.

AQUATIC LANDSCAPE MANAGEMENT RECOMMENDATIONS

Streams and waterways will be maintained or restored to a condition where natural processes and function provide the habitat and water quality conditions necessary for all native species and life stages.

The Rigdon Collaboration Committee recommends the following actions to restore stream and aquatic habitat:

- Increase aquatic habitat diversity.
- Maintain/restore healthy riparian areas.
- Maintain/restore aquatic habitat for songbirds, beaver / terrestrial species dependent on aquatic ecosystems.
- Maintain/restore healthy, functioning floodplains where landforms allow (e.g., alluvial valleys, confluence areas, unconfined valleys).
- Provide sufficient woody material in streams for habitat and water storage.
- Provide adequate aquatic passage through man-made infrastructure (e.g., remove barriers).
- Maintain/restore resilient, functioning ecosystems for current and future climate change effects.
- Supply sufficient habitat for large numbers of native and migrating fish species.
- Store and treat roads to reduce human dumping and artificial sediment inputs

Species-specific (aquatic-dependent)

- Restore habitat for ESA-listed species and species of concern (Upper Willamette spring Chinook salmon, bull trout, western pond turtle, etc.) at a level consistent with historic conditions

Recreation/human uses

- Provide beneficial human connection to rivers and waterways to maintain and support human health and welfare

WILDLIFE

PAST CONDITIONS

The forests and meadows maintained by the various fire regimes that occurred in the landscape in the past (150+ years ago) supported large and healthy populations of native mammals, birds and fish. Large apex predators included black bears, grizzly bears, lions and wolves. Wolverines and fishers inhabited the open forests and uplands.

Due to the fur trade and a federal policy to eradicate predators, several large forest predators were essentially eliminated from this landscape. Grizzly bears, wolves, wolverines, and fishers all experienced a decline in numbers and were extinct from the landscape by the early 20th century. In the middle of the 20th century, populations of big game (elk, deer and black bear) increased as the early-seral habitat created by clearcut harvesting provided abundant forage vegetation. But toward the end of the century, as clearcut harvest levels began to drop, most of these young forests had grown in density to the point that forage vegetation was largely shaded out, and big game populations began to decline again.

CURRENT CONDITIONS

The Rigdon landscape currently includes numerous wildlife species ranging from invertebrates, to reptiles, amphibians, birds, and mammals. Because of the large number of wildlife species that exist within the project area, it is not practical to only address the needs of individual species or suites of species. Ecologically functional habitats provide the necessary components for maintaining robust wildlife populations. And wildlife occurrence is strongly tied to habitat types and the seral condition within those habitat types. Therefore, wildlife needs will be met by addressing seral conditions within the major plant series occurring in the project area.

Threatened and Endangered Species

Northern Spotted Owl

In 1990 the northern spotted owl was listed as an endangered species by the Federal government due to the loss of a considerable portion of its original late successional (old-growth) habitat. The listing of this bird resulted in preparation of The 1994 Northwest Forest Plan, which established large protected areas for northern spotted owl habitat maintenance. However, even with the designation of large reserves of older forest, the owl populations continued to decline. Later it was recognized that barred owls, a closely related species, provided an additional threat to the northern spotted owl. Barred owls used to occur only in the eastern portion of North American, but they began to expand westward in the middle part of the 20th century as land management practices in Canada created a habitat link across the great plains. Barred owls use habitats similar to the spotted owl, but can also thrive in more

fragmented landscapes and utilize more prey species. They are more aggressive than spotted owls and can compete with and can even prey upon spotted owls. The original seral condition of the Rigdon area was not ideal spotted owl habitat, but the change to more closed canopy late successional reserve forest type, where the owls have taken residence has forced additional limits to restoration plans.

Red Tree Voles

Red tree voles are small rodents inhabiting older, coniferous forests in western Oregon and northwestern California. A certain population of the red tree vole – the North Oregon Coast "distinct population segment" – became a candidate for federal Endangered Species Act protection in October 2011. The State of Oregon lists the red tree vole as a sensitive-vulnerable species in the coast range ecosystem. As arboreal (tree dwelling) mammals, red tree voles are vulnerable to habitat loss and fragmentation from timber harvest, wildfire, development, recreation, roads, and other disturbances. Loss of habitat in the North Oregon Coast Range has caused habitat fragmentation, isolation of subpopulations, and small population sizes, which can cause negative genetic impacts to a population. These effects are further exacerbated by the vole's naturally narrow habitat requirements, low mobility, low reproductive potential, and low dispersal ability to move among limited habitat.

On Forest Service and Bureau of Land Management lands in western Oregon, areas subject to timber harvest (except thinning activities in stands younger than 80 years old) must be surveyed for red tree voles and high-priority sites must be protected. Management goals for the red tree vole are generally compatible with those for the threatened northern spotted owl and other late-successional forest species. It is likely that the benefits of these management measures will overlap.

Chinook Salmon

Wild Chinook Salmon are listed as threatened in the upper Willamette Watershed (see previous section on streams). Since Hills Creek Dam has no fish passage, thus preventing anadromous fish from entering the upper Middle Fork, in order to fulfill requirements of the Endangered Species Act, The 2016 Middle Fork Willamette Spring Chinook Hatchery Genetic Management Plan (HGMP) required remedial action to restore these historical runs. Under contract with the Army Corps of Engineers (USACE) approximately 100,000 fingerlings are now released annually into Hills Creek Reservoir for fisheries. In addition, this HGMP allows for flexibility and adjustments in the total number of fish released, up to 2,300,000 fish to account for mitigation agreements as described in contractual arrangements.

Ungulates

Elk and deer populations are now low since most of early-seral habitat created by past clearcutting has grown into closed canopy forests that do not offer much forage vegetation, but

there are some large areas of early seral habitat that were created in recently burned areas such as the Tumblebug and Staley fires.

Big game populations will improve as restoration projects are developed. Restoration of the once open mixed conifer forests should also restore bird, small mammal and reptile populations that have declined as the open pine and oak habitat has shrunk. It is hoped that restoration forestry and an accelerated prescribed burning program will help maintain and protect remaining high quality habitat for these species.

WILDLIFE MANAGEMENT RECOMMENDATIONS

The Rigdon Collaboration Committee recommends the following actions to benefit wildlife:

1) Restore and preserve wildlife diversity
2) Identify habitat types and associated wildlife species and determine whether ecosystems are functionally supportive
3) Restore nonfunctional ecosystems for wildlife
4) Prevent or treat non-native invasive plant species that cause a loss of wildlife habitat

- Consider the plant series and appropriate associated habitat types for each stand and how habitat types fit with the surrounding plant communities to guide management recommendations.
- When warranted, treat forests to increase fire resiliency, minimize competition, insect infestation, disease, and hazardous fuels.
- Create a pine and oak plant series in appropriate zones in order to manage for ponderosa pine and Oregon white oak habitat type.
- Prevent early seral forests from progressing into mid-seral closed canopy forests that enter the stem exclusion stage.
- Consider successional restoration (i.e., complete removal of trees) in mid-seral closed canopy forests that are not suitable for thinning, variable density thinning, or other silvicultural practices.
- Where appropriate, convert mid-seral closed canopy forests into mid-seral open canopy forests where pine and oak are prominent stand components.
- Manage ecologically functional mid-seral open canopy forests using appropriate techniques to encourage their progression into late-seral open canopy forests.
- Manage late-seral closed canopy forests that favor mixed conifer forest communities to maintain the character and functionality of these forests.
- Manage late-seral open canopy and late seral closed canopy forests, that contain old growth pine and oak habitat, as late seral open canopy forests that favor a pine and oak plant series.

Species-specific (old growth dependent)

- Protect existing spotted owl habitat where possible by preserving late successional (old growth) forest areas where the birds are located.

Recreation/human uses

- Establish communication with recreational groups (hunters, fishers, foragers) to ensure use of the landscape that ensures protection and conservation of wildlife habitatat.

HUMAN USE ON THE RIGDON LANDSCAPE

Native Populations and Cultures

Before settlers came to the Oregon Territory, Native Americans had occupied this landscape for over 7000 years and possibly longer. The Kalapuya tribes peopled the Rigdon landscape. The Kalapuya were mountain dwelling people related to the Molalla tribes in the Willamette Valley, but had a lifestyle more oriented to hunting and gathering in the mountains and high meadows. Little is known of the Kalapuya, as their culture had essentially collapsed before literate settlers arrived in the Oakridge Area due to the host of exotic diseases that devastated their population. But based upon abundant archaeological findings, the Kalapuya apparently had a permanent village site in the Oakridge valley where they spent the winters. In the summer they moved up the main rivers to various seasonal camping areas and hunted and gathered in the mountains to obtain their food for the coming winter. Based upon the types of cultural artifacts found in the Oakridge valley, it is known these people utilized Oregon white oak acorns as an important food staple, as well as the abundant wildlife and fisheries resources. Cultural remnants are particularly abundant in the Rigdon landscape, concentrated along the streams.

Fire Management

While there are few historic accounts of how the Kalapuya lived, they certainly knew how to use fire to manage the land. Their cousins the Molalla in the Willamette valley were historically known to use prescribed fire on an annual basis for a number of purposes. Considering that fire was by the far most powerful tool possessed by these people, and based upon the numerous frequent fires scars on old pine – the frequency of which appears to be higher than natural fire occurrence in this area - the Kalapuya did use fire extensively, likely to maintain habitats suitable for food plants and game species, to keep travelways cleared of brush and deadfall, to fire-proof areas around their camps and to culture certain plants they used for food and craft materials.

Travel and Trade

The Native Americans, simply through repeated long-term use, established a network of trails and travelways throughout the area. The main route followed the Middle Fork of the

Willamette River, leading to their home base in Oakridge. This trail came to be known in later years as the Klamath Trail; though this landscape was not within the Klamath tribe's traditional lands, they were trading partners with the Kalapuya and Molalla, and the Klamath peoples maintained a right of passage to the Willamette Valley along this main travel route. There also were many subsidiary trails and routes that accessed the high country for hunting, and berry and craft material gathering along the high elevation lakes, ridges and meadows.

There are no specific historic accounts of the fur trade operating in this area, but since there were abundant beaver along the many rivers and streams, it is likely that "mountain men" came here in the early 1800s to harvest them, or to trade with the Kalapuya for them. Those agents of the fur trade certainly interacted with the native inhabitants. These interactions likely did not change the landscape dramatically, aside from a significant reduction in the population of fur-bearers, but they likely began the changes the culture of the Native Americans began to see, and those first contacts could have brought the infectious diseases that were to drastically reduce the population of Native Americans in the area. Interestingly, the many frequent fire scars on ponderosa pine stopped, reverting to the 50 to 100+ year interval between lightning ignited fires on a specific hillside, before settlers arrived in the area. This change in fire use was likely the result of the reduction of the Native American population to levels low enough that they could no longer have much of an influence upon the land.

Arrival of the White Settlers

The arrival of settlers to the Oregon Territory initiated a host of changes in this landscape. Initially, most of the settlement was within and around the Oakridge valley, but most of this century the settlers used the surrounding mountains much as the Native Americans did, at least in terms of hunting and berry gathering. The trail network established by the original inhabitants facilitated these activities. But the latter part of the 1800s brought some bigger changes.

Grazing The first significant ecosystem changes in the Rigdon landscape came from the uncontrolled livestock grazing that began in the area in the mid-1800s. The drastic reduction in the numbers of indigenous peoples led to the cessation of prescribed burning. Grazing reduced the density of the grasses in the open mixed conifer forests and that, along with the cessation of intentional burning, eventually led to the survival of many tree seedlings in these forests. As the century progressed, these young, dense trees grew up under the widely scattered large Douglas fir, pines, incense cedar, and white oaks and eventually shaded out most of the remaining grass and wildflower ground vegetation.

Road Construction The first road construction also began during this time period to facilitate transport of grazing animals and to establish another settlement route (the Free Emigrant Trail) across the Cascade Mountains to the southern end of the Willamette Valley. What became known as the Central Oregon Military Wagon Road was constructed in the 1860s and 70s. This initially crude road generally followed the traditional Native American travel route known as

the Klamath Trail. A stagecoach stop and way station was established at a large meadow complex along the Middle Fork River. This outpost was constructed and operated by Stephen Rigdon, whose name was given to this landscape and the meadow where be built the way station.

Economy Spotted owl habitat protection resulted in dramatic (nearly 8-fold) reduction of timber harvest late in the 20th century. This resulted in closure of two large lumber mills in the Oakridge/Westfir community. This, in addition to automation, antiquated equipment and an improvement of highway transportation caused a decline in employment opportunities in the community and damaged its overall economy.

RECOMMENDATIONS TO BENEFIT HUMAN USES

The Rigdon Collaboration Committee recommends the following actions to benefit human uses:

- Ensure a range of economic and social opportunities including but not limited to recreation, multi-use trails, increased trail access (parking) and signage, road to trail conversion, timber harvest, small diameter wood harvest, firewood, and special forest products utilization.
- Provide opportunities for social and economic benefits by contracting and hiring from surrounding communities first (including but not limited to jobs involving reintroducing and managing fire, pre-commercial thinning, habitat restoration, eco-tourism, and recreation).
- Balance ecological and cultural objectives while developing economically viable projects.
- Educate the public about the Rigdon landscape restoration project needs, benefits and opportunities.

HUMANS IN THE 21ST Century - OUR CHALLENGES TO RESTORE THE LANDSCAPE AND THE ECONOMY

Restoring the Land

To facilitate an accelerated restoration effort, the Forest Service has formed an interdisciplinary team of various resource specialists to begin answering landscape questions in order to determine what additional activities need to occur to provide for increased ecosystem resiliency and biodiversity. This interdisciplinary team has begun a Facilitated Landscape Analysis Design (FLAD) process. As part of that process, the Forest Service has welcomed input from the community as to what this analysis needs to consider, and what types of activities my need to be implemented in order to restore the diversity and resiliency of the Rigdon landscape. This collaborative process is proceeding with implementation scheduled to begin in 2020 and the years afterward.

In 2013 The Middle Fork Ranger District initiated the Outlook Landscape Diversity Project. After public comment an Environmental Assessment (EA) was written resulting in a Finding Of No Significant Impact (FONSI) in 2017. Two stewardship timber sales with embedded restoration projects were completed in 2017 and 2018 that will result in restoration of the landscape surrounding Lookout Point Lake. Retained receipts from these sales will be used for additional restoration.

Rebuilding the Economy

After the drastic reduction in timber harvest and the closing of the mills in the late 20th century, the economy of the Oakridge/Westfir community is now primarily based on provision of services to recreationists and residents. As a result, there are few jobs with salaries high enough to maintain a good living standard for those who are still here, let alone provide opportunities and attractions for new residents to replace the many that have left due to lack of employment. This reality threatens the optimum operation of the city government and the school district. It is hoped that an accelerated program of ecological restoration will begin to develop additional future economic opportunities for the community.

Southern Willamette Forest Collaborative – A Community Resource

The SWFC is a community-based forest collaborative group that works in the upper Middle Fork Willamette watershed to bring people and organizations together for healthy forests and communities. The SWFC convenes projects that seek mutual solutions through collaborative restoration.

Local communities have suffered with the declining timber industry and recent recession. According to Worksource Oregon data, 44% of the local workforce earns less than $1250 a month and the unemployment rate is 9%. Still, the forest industry remains vital to the economy; 20% of local residents work in Agriculture/Mining/Construction, earning over one third of community wages.

The Middle Fork Ranger District (MFRD) covers 750,000 acres of the watershed and restoration work is needed across the landscape. Much of the District was heavily clearcut and replanted stands are now densely stocked with limited understory development and diversity. Streams and rivers lack large wood, channel complexity and have problem culverts. Restoring this landscape to a healthy condition offers opportunity for living wage jobs in the local economy.

The SWFC has been working for 2 years building relationships between stakeholders. In 2016, the SWFC started two collaborative restoration programs for stewardship contracting and landscape planning. Over 30 participants from community organizations, agencies, conservation groups, small businesses and individuals have been working together on projects that will benefit forests and create local work.

1) The **Rigdon Collaboration Committee** is working together on landscape planning effort to restore 4 sub-watersheds across 105,000-acres. This complex landscape includes mixed conifer forests, oak savanna habitat, late successional reserves, and important bull trout and spotted owl habitat. This project covers the northern most extent of this unique imperiled habitat type. Continued collaboration is key to achieve the goals outlined by the Committee's zones of agreement that will inform landscape planning.

2) The **Implementation Advisory Committee** works with the Middle Fork District to provide input to implementation of timber sales and restoration projects utilizing Stewardship Contracting and Good Neighbor Authority agreements with Oregon Department of Forestry. The first two Outlook stewardship projects combined thinning, road and stream restoration, weed abatement and biomass removal. The committee is working together to increase the pace and scale of restoration across the District.

3) The **Community Firewood Program** helps Oakridge achieve federal air quality standards for wood smoke pollution and lift barriers to economic development. The program hires off-season firefighters to convert donated logging slash to firewood. Participants get affordable, seasoned firewood, free tarps, and information about home heating advisories, clean wood burning, weatherization and home heating assistance.

4) The **Recreation Committee** is a diverse group of recreationists and organizations that are providing multi-stakeholder recommendations to implement a sustainable recreation strategy for the Middle Fork District. A focus of the Committee is improving the recreation experience while providing economic opportunities to local communities. The Committee will work directly with the District and the City of Oakridge, Oregon State Parks and Travel Lane County.

Plans for Building a Better Community

- Explore stewardship contracting to accomplish forestry treatments.
- Consider opportunities to provide social and economic benefits through contracts and jobs in surrounding communities, including but not limited to jobs that involve reintroducing and managing fire, pre-commercial thinning, and habitat restoration.
- Ensure a range of other commercial and non-commercial opportunities including but not limited to recreation, multi-use trails, closed roads becoming trails, woodcutting, and small diameter wood and special forest products utilization.
- Manage smoke impacts through the use of prescribed fire and managed wildland fire that helps avoid significant smoke incursions from large out-of-control fire events.
- Balance ecological objectives while developing economically viable treatments.
- Encourage social values, such as recreation access, quality of life, scenic views, community safety, wildfire protection, healthy and abundant wildlife.
- Look for education opportunities that could include LNT (leave no trace) guided hikes or field trips, water quality issues, sustainability, trail safety, forest management, and forest history. Focus on youth employment. Possible opportunities: invasive weed

removal, cleanup of illegal dispersed campsites, trail building and maintenance. Make use of local Forest Service personnel, community group leaders, university experts and researchers.

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APPENDIX A

COMPLETED AND CURRENTLY ACTIVE RESTORATION PROJECTS

KNOBCONE PINE RESTORATION BY PRESCRIBED FIRE

Knobcone pine is a fire generated species and is now limited to 3-4 pure stands on the south end of the Middle Fork District. The species does not have a long life span, stands typically decline and fall apart after age 80. Historically, the species existed over a much wider areas on upper slopes. This fact is corroborated by dead Knobcone snags in single storied fire stands throughout the Middle Fork District. These stands are dominated by 80 to 100 old Douglas-fir, with Knobcone pine as a dead remnant in the understory. Retaining this species is dependent on fire disturbance. The species is declining due to an absence of wildfire on the District. This concern precipitated establishment of a reserve for the species.

Establishment of the Research Natural Area

The Rigdon Point Research Natural Area (RNA) was identified as a candidate RNA in the 1990 Willamette National Forest Plan. The 457-acre RNA, which lies on the south end of the Middle Fork District Forest in the Staley Creek Basin, is characterized by steep, rugged terrain and dry site, fire prone vegetation. The RNA was established to protect and perpetuate a population of Knobcone pine, which is on the Northern edge of its range. On May 15, 1996, the RNA Decision Notice and Designation Order were signed, formally establishing the RNA. In summer of 1996, an interdisciplinary team of specialists developed a Management Plan. The Rigdon Point RNA Management Plan called for some use of managed fire and prescribed natural fire to regenerate Knobcone pine. In the fall of 1996, a team of vegetation specialists monitored the condition of several Knobcone pine stands and found high stand densities and dead and dying Knobcone pine. Reddish pitch tubes on the boles of trees indicated that Mountain Pine Beetle attacks were occurring on groups of trees under stress. A concern of the team was that openings created by the dying Knobcone pine would release Douglas-fir seedlings. The team decided that using fire to regenerate Knobcone pine and reverse encroachment of Douglas fir would meet the objectives of the RNA. Since there is no information available on use of managed fire to regenerate Knobcone pine, the team of vegetation specialists was breaking new ground.

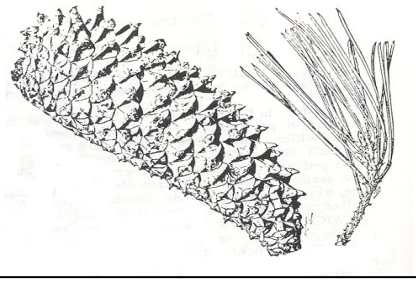


Figure 1 Cone and vegetation of Knobcone pine

APPENDIX A

Photo 1 Pre-test burn vegetation and fuels sample transects prior to 1997 burn.

Baseline vegetation transect information was collected in the proposed burn area. Several permanent vegetation transects were installed and groundcover was measured. Cooperators from the Native Plant Society of Oregon participated in collecting some of this baseline groundcover information. During the

Photo 2 Native Plant Society of Oregon project cooperator Mike Kinyon, evaluating pre-test burn vegetation condition. Note natural fuels as a result of bark beetle infestation.

winter of 1997, a prescribed burn prescription was developed for the site. The prescription determined some high intensity fire would be needed to remove duff and to get enough heat up into the crowns of designated seed trees so that the serotinous cones of the pine would open to release seed. A mineral soil seedbed would also be needed to allow Knobcone pine germination.

Complicating Factors

Several simple logistical factors complicated the test burn, first the RNA is surrounded Late Successional Reserve (LSR), whose management objective is to promote late successional stand characteristics. Therefore, the stand replacement fire would have to be hot enough to meet the silvicultural objectives, but be easily contained within the test burn area. This was not an easy prescription to implement, given the steep southwesterly topography of the area. Slopes exceed 60% in the test burn site and fuels included flashy golden leaf chinquapin and pitchy Knobcone pine. Topographic factors made it difficult to deliver water to the test burn area if needed for fire suppression. In addition, it was a concern that the test burn area be located away from existing road 2137. Roads tend to be noxious weed vectors, and by keeping the burn area away from weed sources, a weed initiation point in the RNA would not occur.

Implementation of the Prescription

Considerable internal debate in the Forest Service existed over the prescription. There was disagreement whether an active management prescription should be used in an RNA. Justification of the use of managed fire in the RNA centered on the declining nature of the Knobcone pine due to bark beetles, the need to establish a younger co-hort of Knobcone pine in the RNA, the limited size of the test burn (1/3 acre), and the need to understand more how fire could be used to perpetuate this vegetation type. The prescription also called for felling some of the dead and dying Knobcone to build a fuel bed to create a desired fire intensity. Since pure Knobcone stands in the RNA are an anomaly, it was decided to only experimentally treat a 1/3 to ½ acre portion of the stand. A total of 15 healthy seed trees per acre were left as standing seed sources. A fuel bed of 46 tons per acre was created.

The Test Burn

A $12,000.00 matching fund grant from the Forest Service Washington Office was obtained to do the prescribed fire treatment, cooperators on the burn included The Nature Conservancy and the Native Plant Society of Oregon. The test burn was ignited 26 June 1997. At the time of ignition, relative humidities were 27% and 1000 hour fuels had a moisture content of 40%. The fire intensity generated 8 foot flame lengths with temperatures hot enough at 20’ to scorch Knobcone seed trees in the lower crown. Moss on the boles of seed trees carried fire into the crown of some of the seed trees, igniting some entire crowns. As a result of the burn and intolerance of the species (thin bark), all the Knobcone left as seed trees in the burn area died within two years of the fire. Some were killed outright. As we would discover later, watching the forest succession after this burn, these standing dead Knobcones would continue to provide a function of seed source. Seed did not fall in one initial flush after the fire; instead, cones continue to provide seed to the site.

Photo 3 Ignition of the Knobcone test burn – note how the ignition pattern is designed to set up convective winds that pull fire and heat into the center of the burn and away from the surrounding stand.

Success or Failure?

One year after the test burn, there was considerable debate over the success of the burn. Over 80% of the duff had been removed. The site had a severely burned look. Persistent species revegetating the burn area included trailing blackberry and ceanothus. First year conifer germinants were limited to only 6-8 Knobcone seedlings. The outlook for Knobcone regeneration appeared to be bleak after surveys in the fall of 1998. Surveys in 1999 showed that over 20 seedlings of Knobcone had been established. In the spring of 2000 visitors from the Deschutes National Forest, this included Dave Linsdell, and Linda DePue monitored the RNA test burn. Linda was asked to review the project because of her interest in the Knobcone species. Linda was impressed by the numbers of natural Knobcone seedlings that were regenerated.

Photo 4 Dave Linsdell and Linda De Pue assist with Knobcone pine stocking surveys in year 2000; 161 seedlings found from 1-3 years of age. Note decomposing seed trees and a fire stimulated Deer vetch ground cover occupying nearly 75% of the open growing space.

Year 2000 Monitoring Results

Monitoring in year 2000, 3 years after the burn, revealed many new findings; specifically: 161 Knobcone germinants spanning 3 age classes were counted on the 1/3 acre test burn site.

Photo 5 Linda De Pue noting the vibrant color of a 3 year old Knobcone seedling and nitrogen fixing associate of Deer vetch. Knobcone needs mineral soil to regenerate.

The site was covered with a 70% ground cover of Lotus, sp., Deer vetch. The vetch appears to be shading the young Knobcone seedlings and adding nitrogen to the site. The only explanation for the deer vetch presence is a seed bank in the soil that was stimulated by the fire.

Underneath the Deer Vetch, a total of 161 Knobcone pine germinants were found. Age of the seedlings ranged from one year to 3 years of age.

Photo 6 Illustration of seedling/vetch ground cover association; note how buried in and under the vetch natural seedlings really are. The vetch may be acting to ameliorate the harsh conditions after the burn.

What We Learned

Through completion of the burn we learned several key points that relate to Knobcone pine silviculture, these include:

- Knobcone can seed in over a series of years after site disturbance; in this way, relay floristics are employed as long as mineral soil is present. The theory of initial floristics, where all seeds are released and germinate immediately after the fire; seems to be of lesser importance for establishment of this species than originally thought.
- The seed bank of wild Deer vetch seems to function on the site as an ameliorator, providing partial shade and nitrogen for the regeneration. Knobcone seedlings had higher survival and seedling vigor (color, caliper) underneath Deer vetch cover.
- Seedlings on the edge of the test burn site had better survival due to partial afternoon shade.
- The seed bank of wild Deer vetch seems to function on the site as an ameliorator, providing partial shade and nitrogen for the regeneration. Knobcone seedlings had higher survival and seedling vigor (color, caliper) underneath Deer vetch cover.

- Natural regeneration of Knobcone is highly correlated with exposed mineral soil. Presence of duff retards regeneration, especially on droughty sites
- Germinant Knobcone pine look identical to Douglas-fir germinants until cotyledons are converted into leaves at year 2.
- The Knobcone fuel type is resinous and pitchy; this coupled with Chinquapin can produce large flame lengths and can potentially present fire control problems. Professional fire managers are needed to execute prescribed burning in this fuel type; such as those in the Middle Fork Fire and Fuels Department.
- By buffering site disturbance from roads, spread of noxious weeds can successfully be controlled.
- It is possible to regenerate Knobcone pine with managed fire over a limited area to produce a new generation of the species.
- Knobcone snags created in the burn area with fire are not long lived; many of the standing dead trees have fallen since the fire. Sap rot pouch fungus quickly colonized the boles of dead trees and leads to downfall and decomposition.

New Results from Natural Fire

After the knobcone project was completed, a natural fire in the Rigdon Point RNA occurred in the summer of 2017. This low intensity fire was monitored and allowed to burn within the RNA. Subsequent field trips to the fire scarred area a year later showed minimal damage to standing large trees, some mortality in smaller trees and a reduction of litter and duff. A number of new sprouted knobcone pines were found scattered through the burned area, confirming the restorative function of natural fire on this landscape.

JIM'S CREEK

Pre-Restoration Conditions

Before restoration, the 638 acre Jim's Creek stand (Map) contained about 157 trees per acre greater than 8 inches in diameter (Table 5a.). Most of these, (130 per acre) are 100 to 130 year old Douglas fir. Approximately six trees per acre were large, averaging about 40 inches in diameter (Table 5b), live trees remaining from the previous savanna condition. About eight large trees per acre of those that existed >100 years ago (Table 1) exist as snags or down trees in various stages of decomposition. Some have recently died and are more or less intact, others are considerably deteriorated, though still quite evident. Older and larger ponderosa pines still exist in these forests but they are slowly dying either of old age or through chronic root competition from the dense Douglas fir understory.

Table 5a. Distribution of live trees

Species	Trees per acre
Douglas fir	130
Ponderosa pine	8
Incense cedar	15
Sugar pine/grand fir	4
Oregon white oak	0
TOTAL	157

Note: the above numbers reflect only trees greater than 8 inches in diameter. The stand does contain a few live Oregon white oak greater than this size, but only one fell into any of the 105 variable radius plots taken in this stand.

Table 5b. Size class distribution of live trees

Diameter class	Trees per acre
8-12"	78
14-18"	44
20-24"	21
26-30"	8
32-36"	3
38-42''	2
44-48"	3
>48"	1
TOTAL	160

Note: trees per acre totals in Tables 4a. and 4b. are not equivalent due to rounding error.

Though there were an average of about eight dead large trees per acre, half of which were standing snags and the other half down logs of decay classes I to IV, there was still very low amounts of woody debris of any size on these forest floors. This is likely a function of the past history of this stand and the stage in stand development of the 120 year old cohort. Barring some kind of disturbance that would facilitate the regeneration of ponderosa pine and Oregon white oak, it is likely this forest will soon become or more or less pure, closed canopy stand of even-aged Douglas fir.

Sixty three acres of 12-15 year old plantations created by past regeneration harvest are associated with the Jim's Creek stand. Two of these plantations are essentially pure ponderosa pine stands with variable tree densities and some sapling sized Oregon white oak. These young pine stands currently support a more or less dense stand of native bunchgrass which developed naturally subsequent to the harvest, presumably from the sparse grass that persisted under the original canopy. The other two plantations contain a shelterwood overstory of Douglas-fir, ponderosa pine, and sugar pine with a generally dense understory of Douglas-fir and ponderosa pine saplings. All of these plantations will soon become a closed canopy forest without the application of some management action to reduce sapling densities.

Oregon white oak were still present on these slopes, but they were more or less restricted to the margins of the several small, rocky openings which occur throughout the stand. These remaining oaks occupied the most marginal sites, and few living trees attain the stature that the now dead oak once achieved. Oak regeneration is rare, with just a few seedlings occurring in meadow fringes or along the single mid-slope road. They are not expected to survive long in the dense conifer canopy. There is no pine regeneration, other than within clearcut harvest units on the edge of the Jims' Creek stand, as pine seedlings do not grow well in the shade of a closed canopy forest, and pine seeds need a bare soil seed bed to germinate well.

Restoration and Current Conditions

Restoration of 450 acres was completed in 2010 (Jim's Creek Restoration Area Map) and was done as a stewardship project that had the benefit of external partner funding and retained receipts for restoration work. This was the first stewardship project on the district. The project was done with a skyline system and helicopter, which was expensive. This was done to preserve the cultural resources including culturally modified trees, protect areas of bunchgrass and soil. The contractor removed trees less than 24" in diameter, leaving 20 trees/acre.

The understory in the project area is now lush and varied, including California fescue, California oak grass, and more. 150 native forbs and grasses are present and these are attractive to elk. Having learned that the remnant plants will reseed, no reseeding was done, except in places where the 1996 fire burned and removed all the remnant grasses. The scattered meadows are seed banks that the grasses can grow out from. Invasive scotch broom and Himalayan blackberries are absent.

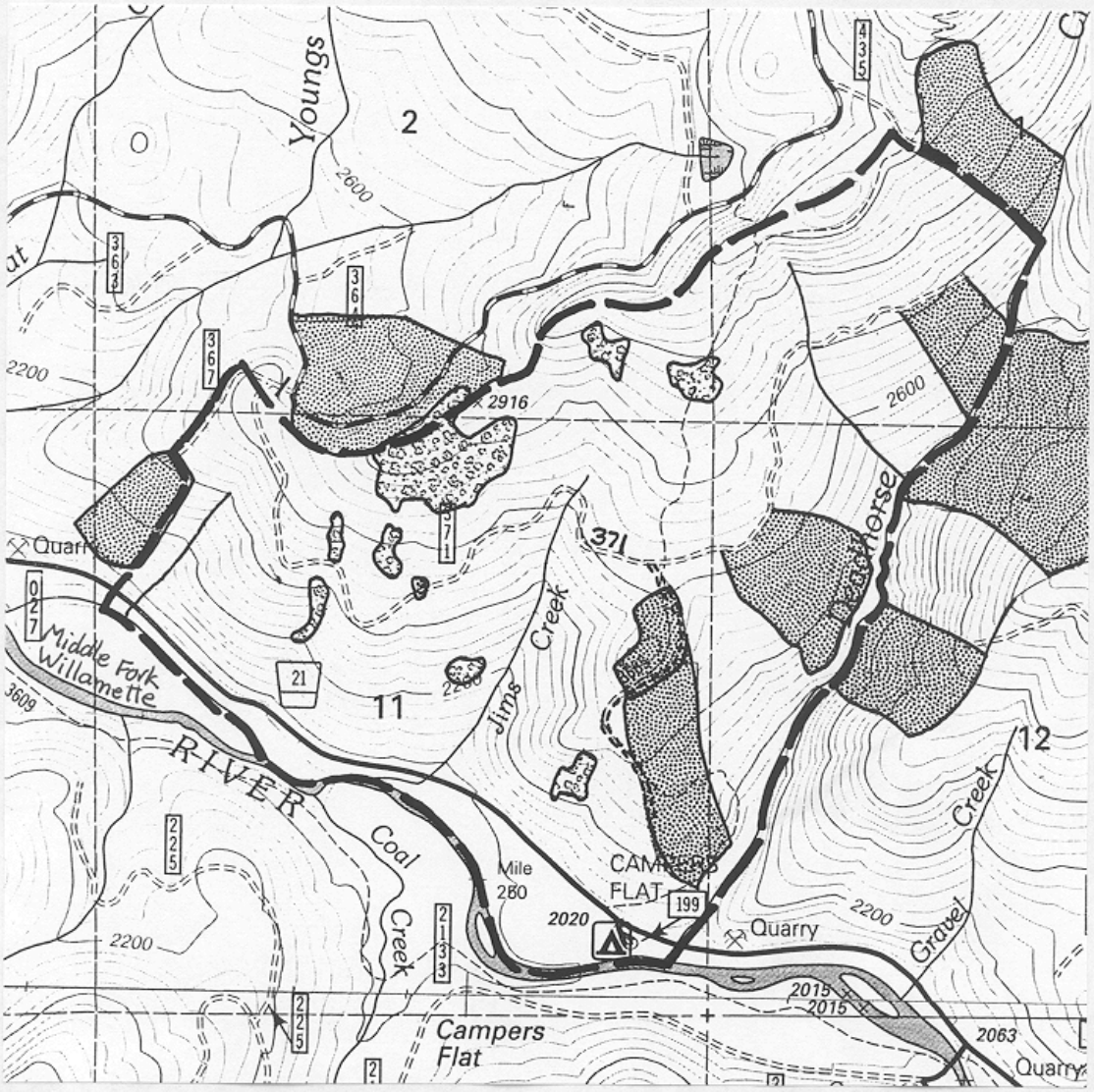
APPENDIX B

The project area has had an experimental underburn prescribed fire four years ago. The FS fire crew pulled back slash from the trees to prevent burns to the cambium on legacy trees. It is significantly cheaper to underburn than to hand pile and burn. Some legacy trees still caught fire from radiant heat, but very few were lost.

Tree core sampling at Jims Creek site

Jims Creek view after restoration

Vicinity Map
T. 24 S., R. 4 E.
Jim's Creek Savanna Restoration area



APPENDIX C

STALEY CREEK FOODPLAIN RESTORATION

Pre-Restoration Conditions

The Staley Creek sub-watershed is approximately 26,000 acres, ranges in elevation from 2,200 to 5,500 feet, and is almost entirely National Forest land. The upper elevations typically receive a significant snowpack each winter. The lower two and a half miles of Staley Creek was a depositional confluence area historically providing high quality spawning, rearing, and foraging habitats for Endangered Species Act-listed spring Chinook salmon and bull trout. Forty percent of the sub-watershed has a history of timber management with a significant amount of streamside clear-cutting occurring within the Staley Creek project area in the 1960s and 1980s by a previous private industrial landowner, as illustrated by historic aerial imagery. During that period, in order to protect logging infrastructure, Staley Creek was straightened, channelized and bermed which resulted in a degraded stream that was disconnected from its floodplain. Analysis using historic aerial photography and LIDAR clearly showed that Lower Staley Creek once had several floodplain channels and at least ten possible entrances into the Upper Middle Fork Willamette River, typical of alluvial fan features in the Western Cascades. These anthropogenic changes turned lower Staley Creek into a single thread, uniform channel that was both incised and flashy with concentrated flow. With limited floodplain connectivity, the stream was functioning as a transport reach despite an average slope of less than two percent.

Rivers and streams are dynamic environments that are constantly changing, or at least they should be. For the last 50 years, lower Staley Creek was static, which created several problems such as no slow water habitat for fish and other aquatic species and a lowered water table. There was also a lack of large wood in the stream due to past “stream cleaning” efforts and upstream logging. During July and August 2017, the Middle Fork Willamette Watershed Council and the US Forest Service Middle Fork Ranger District worked together to address these problems. Restoration occurred along a one-mile section of lower Staley Creek just above its mouth. Berms were removed and their material distributed throughout the channel in order to match elevations across the project area, ultimately reconnecting approximately 46 acres of floodplain habitat. Hundreds of trees were placed throughout the floodplain to slow down and spread flow and to provide refuge for aquatic species. These on-the-ground actions will increase water storage and create dynamic, diverse habitat that will benefit fish and wildlife species.

Restoration and Current Conditions

During a five week period in July and August 2017, the Staley Creek Floodplain Restoration Project was implemented which included:

- Pushing over approximately 250 whole trees with root wads in two ¼-acre and two ½-acre upland gaps;
- Transporting trees to the restoration site (250 logged trees plus 200 pre-staged trees);

- Grubbing approximately 20 acres of vegetation in the project area in order to reset floodplain elevations;
- Moving nearly 50,000 cubic yards of material as part of removing berms and bringing up incised channels; and
- Placing approximately 600 pieces of large wood and associated slash across the restored floodplain (this includes the 450 trees mentioned above plus those grubbed in the project area).

Through these actions, long-term restoration goals of restoring reach-scale hydrologic processes in a degraded unconfined valley, promoting habitat complexity within the project reach, and promoting diverse community assemblages were met.

This project is the first of its kind in the Upper Middle Fork Willamette (UMFW) watershed, and is of utmost importance for the watershed. The pre-project condition of Staley Creek can also be found in most of the other tributaries to the UMFW – streams in unconfined valleys that should be fanning out, depositing sediments, and offering slow water habitat to aquatic species, but instead are confined into single channels that behave as transport reaches and are disconnected from their floodplains. Plans are to continue developing and implementing similar floodplain restoration projects throughout the UMFW to increase the extent of properly functioning floodplain habitat. (Squires, Kurian, Helstab 2017)

Pictures of Staley Creek before and after restoration are presented.

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APPENDIX C

Old bridge site before restoration

Old bridge site after restoration

APPENDIX C

Looking downstream after restoration

Rootwads

Upper Middle Fork Willamette Action Plan for Restoration