Terrestrial Vegetation

What is the Array and Landscape Pattern of Plant Communities and Seral Stages in the Watershed? What Processes Caused These Patterns?

A. Plant Series

A plant series is the broadest level within the plant association classification system and classifies a site by the potential climax dominant tree species. Classification often entails extrapolating early stand conditions to determine the potential climax dominant species. This is common in southern Oregon where climax conditions are rarely found due to the historical fire regime and human disturbance that maintain fire resistant species and earlier seral conditions. Plant associations are a finer resolution of the classification system and further separates a series by the associated understory plant species. Plant series and plant associations can provide useful information such as site productivity, soil depth, biological response and a common plant community reference. Plant series level information will be used to characterize the Middle Illinois Watershed and supplemented with plant association information where data is available **(See Middle Illinois River Watershed Plant Associations)**.

The most common plant series found in the Middle Illinois is the Jeffrey pine (PIJE) series, followed by the tanoak series (LIDE3), the Douglas-fir series (PSME), and the white fir series (ABCO). Because white fir (*Abies concolor*) and other thin bark climax species are susceptible to repeated fires, Douglas-fir (*Pseudotsuga menziesii*) has emerged as the dominant overstory species on non-serpentine sites. This is because Douglas-fir is associated with fire disturbance and the thick bark insulates it from lethal temperatures. Jeffrey pine (*Pinus jeffreyii*), on the other hand, dominates serpentine sites due to its tolerance of minerals toxic to other tree species. Table 1 provides the estimated plant series composition of the Middle Illinois River Watershed for the Siskiyou National Forest managed land. The Bureau of Land Management estimates that approximately one-third of the 15,500 acre Kerby sub-basin is PIJE.

Table 1. Estimated acres and percentage of plant series within the Middle Illinois River Watershed (PMR data, 1988). This does not include the area within the Kerby sub-basin.

Plant Series	Acres	%
White fir	4,600	7
Tanoak	3,000	4
Tanoak/Douglas-fir	19,000	29
Jeffrey pine	36,000	55
Douglas-fir	2,600	4
Douglas-fir/tanoak	14	<1
Total		**100%**

The two major soils found in the Middle Illinois River Watershed are separated into serpentine or non-serpentine and support distinctly different plant communities. The following are plant series descriptions for the Middle Illinois River. This information was provided by the Canyon Environmental Impact Statement, the Preliminary Plant Associations of the Siskiyou Mountain Province (Atzet and Wheeler, 1984) and Field Guide to the Forested Plant Associations of Southwestern Oregon (Atzet, 1996).

Jeffrey Pine Series

PIJE is the dominant plant series and forms a contiguous block on the Josephine, Six Mile and Kerby sub-basins and a separate block on the northwest portion of Oak Flats sub-basin. Jeffrey pine stands generally form a savannah: a simple stand structure composed of a sparse, open-canopied pine overstory with a mixed understory of low shrubs and grasses. Vegetation is sparse and biomass production is relatively low. Trees have a stunted appearance and are seldom larger than 15 inches in diameter and 40 feet in height. Large, continuous stands of Jeffrey pine, 500 acres or more in size, are common. Lands occupied by the Jeffrey pine associations are unsuitable for timber management, mainly because they are very difficult to regenerate.

The Jeffrey pine associations occur almost exclusively on ultramafic soils. Ultramafic (serpentine/peridotite) soils are toxic to most plants due to high concentrations of magnesium and iron. Soil chemistry has a stronger influence on the structure, composition, and function of Jeffrey pine associations than any other environmental variable, including climate, topography or elevation. Total species richness is low averaging 29 species. Jeffrey pine dominates the overstory with occassional Douglas-fir and incense-cedar (*Calocedrus decurrens*). The upper layer tree cover averages 23%.

Tanoak Series

Stands in the tanoak (*Lithocarpus densiflorus*) series can be found in one of two distinct environments. On north -facing slopes tanoak associations are highly productive and, owing to the natural disturbance pattern, are dominated by closed-canopy stands of Douglas-fir. On south and west-facing slopes tanoak associations are poor in productivity and dominated by dense, shrubby mixed-hardwood stands. Tanoak can also tolerate serpentine conditions but takes on a shrub-like appearance.

Douglas-fir Series.

In the Josephine sub-basin, PSME plant associations tend to occur on east-facing slopes with light and moisture conditons that are intermediate between the highly productive, tanoak associations found on north-facing slopes and the shrubby, hardwood-dominated tanoak found on south-facing slopes. PSME is generally found on warmer, drier sites Tanoak is often found and sometimes occurs as a co-climax species with Douglas-fir. Outside the serpentine influences PSME transitions into the tanoak series as sites become more productive and moisture is less limiting.

White Fir Series

The white fir series is found on the coolest, highest elevational sites above 3,500' in the Josephine sub-basin in the vicinity of Fiddler Mountain, Hungry Hill and Canyon Peak. However, these white fir associations are not suitable for timber production due to the prevalence of rocky, shallow soils often found near ridgetops. ABCO is also found in the upper productive sites of the Six mile subwatershed. In higher elevation stands white fir is the most common species, but in lower elevation it appears in later successional stages under Douglas-fir.

B. Seral Stages

Stands in southern Oregon are generally all-aged (multi-cohort) stands of variable tree ages and size classes. This multi-cohort condition is primarily the result of periodic, low intensity fires. The area's fire regime, however, is a combination of frequent, low intensity fires and infrequent, high intensity fires. The seemingly all aged condition overlays an infrequent pattern of high intensity, stand replacing fires which tend to create relatively even-aged structures.

After moderate to severe disturbances, the sequence of succession, in concept, progresses from early to mid to late seral stage and eventully old growth on typical sites. However, ultrabasic soils drastically effect typical plant community development (Hickman, 1997). Serpentine soils climax to a steady-state condition that outwardly resembles early seral to mid-seral stand structures. Serpentine areas are

relatively unproductive and contain low amounts of biomass. There are approximately 34,000 acres of steady state in Middle Illinois River Watershed. Estimated Middle Illinois acres for each seral stage on Siskiyou National Forest managed land is displayed in Table 2. The 15,500 acre Kerby Watershed Analysis by the BLM suggests most of the Kerby sub-basin is early to mid-seral on non-serpentine sites.

Table 2. Estimated Acres and Percentage of Seral Stages in the Middle Illinois River Watershed (PMR data, 1988). This does not include the 15,500 acre Kerby sub-basin.

Seral Stage	Acres	Percent
Early seral	7,100	11
Mid-seral	16,200	25
Late seral	7,400	11
Non-forest	700	1
Steady state	34,000	52
Totals		**100**

- *Early seral*: Includes recently disturbed areas that are vegetated with grasses, forbs, shrubs and young tree stands. Young stands include seedlings, saplings and pole sized trees up to 10.9" DBH. Approximately 7,100 acres meet these conditions. Even-aged timber harvesting has created 2,800 of these acres.
- *Mid-seral*: Trees are generally 11" DBH or larger and are 40-100 years of age. Approximately 16,200 acres meet this criteria.
- *Late-seral*: This seral stage includes mature and old growth conditions. Stands are over 100 years of age and may have a multi-layered canopy. Approximately 7,400 acres meet these conditions.
- *Steady-state:* Lands have 10% crown cover but grow less than 20 cubic feet/acre/year of commercial species.

Other Unique Plant Communities?

Brewer Spruce

Brewer spruce (*Picea breweriana*) has a geographical range limited to southwestern Oregon and northwestern California. This tree is found on the western portion of the Watershed and at elevations higher than 4,000 feet. Brewer spruce is not a sensitive plant species but has received scientific as well as public interest due to its limited range.

Port-Orford-Cedar

Port-Orford-cedar (*Chamaecyparis lawsoniana*) is limited to coastal-interior lands in northwestern California and southwestern Oregon. Port-Orford-cedar (POC) is distributed mainly within riparian areas throughout the watershed. When growing on ultramafic soils, Port-Orford-cedar can be found as thickets of sapling and pole sized trees, mostly within 15 feet of stream channels or near "sag" ponds with a seasonal high water table. It is also found in the riparian areas in the metamorphic terrain. There are approximately 8,700 acres of POC stand in the Watershed **(See Middle Illinois River Watershed POC map)**. POC densities with less than 1% in canopy closure, or scattered trees, were generally not mapped. Fire also has a major influence on the distribution of POC as frequent fires may have eliminated POC from drier microsites. POC seedling and saplings are more susceptible than associated conifers to fire because early growth is slow. Fire exclusion and management related disturbances, such as road construction, that create locally wet microsites is allowing POC reproduction in areas not historically typical for this species.

Port-Orford-cedar is the most shade tolerant conifer within its range and a contributor to diversity in mixed species stands. It is the primary conifer and often the largest tree species in riparian areas on ultramafic soils. It can significantly improve soil fertility by incorporating calcium into ultramafic soils. POC is a common component of many riparian areas where it provides large tree structure, shade, and superior long-lasting downed wood that enhances stream structure and fish habitat.

Port-Orford-cedar root rot is caused by the fungus *Phytophthora lateralis.* This fungus has been killing POC as early as 1922. The disease is entirely dependent on free water for spread and infection and on man for long distance spread. It can also be spread by movement of infected soils such as vehicle tires or taken as road fill. Once introduced into a streamcourse, POC root disease eventually kills most of the POC downstream and within about 20 feet of the high water line.

POC infected with Phytophthora has not been found in the Middle Illinois Watershed. However the Watershed is considered to be contaminated because infestations are found upstream and above this Watershed. Infestation with root disease is highly dependent on the presence of free water in the vicinity of POC roots. High risk areas are stream courses, drainages, low lying areas downslope from already infested areas, or areas below roads and trails where inoculum may be introduced. Preventing further spread of the disease should focus on limiting the movement of contaminated soil and water, and removing susceptible host roots from high risk areas.

Other Tree and Shrub Species

Trees and shrubs common between more than one plant series include: sugar pine (*Pinus lambertiana*) , incense-cedar, canyon live oak (*Quercus chrysolepis*), golden chinkapin (*Castanopsis chrysolepsis*), California hazel (*Corylus cornuta* var. *californica*), California laurel (*Umbelleria californica*), pinemat manzanita (*Arctostaphylos nevadensis*) and poison oak (*Rhus diversiloba*). Vegetation found mostly within the tanoak series include salal (*Gaultheria shallon*), dwarf Oregon grape (*Berberis nervosa*), California black oak (*Quercus kelloggii*), and ocean spray (*Holodiscus discolor*). Those species common to the the white fir series include Shasta red fir (*Abies shastensis var. californica*), Brewer spruce, knobcone pine (*Pinus attenuata*), Sadler oak (*Quercus sadleriana*), red huckleberry (*Vaccinium parvifolium*), thin-leaved huckleberry (Vaccinium membranaceum), grouse huckleberry (*Vaccinium scoparium*) and prince's pine (*Chimaphila umbellata*). Plants common to the Jeffrey pine associations include, western white pine (*Pinus monticola*), Port-Orford cedar (*Chamaecyparis lawsoniana*), dwarf ceanothus (*Ceanothus pumilus*), coffeeberry (*Rhamnus california*), whiteleaf manzanita (*Arctostaphylos viscida*), and grasses, including bluegrasses, bromes and fescues. Common to the Douglas-fir series include ponderosa pine (*Pinus ponderosa*), Pacific madrone (*Arbutus menziesii*).

What are the Current Conditions and Trends of the Prevalent Plant Communities and Seral Stages in the Watershed?

As much as 60% of the Josephine and 30% of each of the Oak Flat, Six mile and Kerby sub-basins are composed of serpentine soils (**See Middle Illinois River Watershed Soils map**). This suggests that, at a maximum, only **half of the Watershed has the potential to develop old growth conditions**. One definition of old growth conditions, found in Interim Definitions for old growth Douglas-fir and Mixed Conifer Forests in the Pacific Northwest and California (1986), is canopy closure of 40-60% and at least 6 trees per acre greater than 32" dbh, or 200 years old. Serpentine areas show the least amount of human disturbance because the lack of timber harvesting due to its low biomass production. Fire and wind damage will most likely continue to be the most common disturbances in the future.

Due to the recent trend of decreasing ecosystem disturbance within the Middle Illinois Watershed, plant communities are becoming less prepared to adjust to future disturbances. Disturbance, or the disruption of succession, is essential to maintain ecosystem stability, biological diversity, resilience, and ecosystem health. According to Atzet and Martin (1991), the future of our forests is tied to management of disturbance processes. Therefore, disturbance should be reintroduced in order to strengthen plant communities' ability to respond to change. Prescribed burning, maintenance thinning and harvesting of older stands (though not necessarily compatible with LSR objectives) are management tools that can reduce stand densities and restore the historical role of fire and the importance of disturbance to this Watershed. MacCleery (1994) points out that even in the absence of timber harvesting, exclusion of fire will eventually eliminate forest types dependent on frequent fire regimes.

Plant series average fire return intervals for Southwest Oregon are provided in Table 3. The estimated fire return inteval for ABCO is 25 years, 15 years for PSME, 14 years for PIJE and 12 years for LIDE3 (Atzet, 1999). These return intervals vary between plant series and include a wide range of variablility, such as LIDE3 which has a range from 10-300 years. This range is due in part to the climatic differences in this geographical region. Intervals tend to be farther apart near the coast, where condtitons are cool and moist, and closer inland as conditions become hot and dry. Agee (1993) estimated a return interval of 18 years for LIDE3 found on the Illinois Valley ranger District.

Table 3. Fire disturbance characteristics for southwest Oregon (Atzet, 1999).

Series	Average Stand Age	Average Interval	Estimated Interval Range
ABCO	213	24	10-60
PSME	230	15	1-20
PIJE	282	14	10-80
LIDE	243	12	10-300

Fire suppression this past century has placed stands within the Middle Illinois River Watershed at a higher risk for a severe stand replacement events. The Siskiyou National Forest Late Seral Reserve Assessment (1995) recognized the potential for more severe wildfire as fine and coarse fuels increase without disturbances. The Longwood fire of 1997 was a severe fire event because the area had missed two or three fire intervals and ready for a severe burn. In the prolonged absence of these stand-maintenance fires, stands become predisposed to epidemic insect and disease outbreak and severe stand replacement fire (Williams, 1994). Managed stands of Douglas-fir and sugar pine that were planted in the 1960's to 1980's are now in need of release and thinning. Tanoak is aggressively competing for site dominance and the accumulation of vegetation places these stands at an increasing fire risk.

Suppression of fire has also changed the successional process in the Watershed. Stands historically dominated by Douglas-fir will shift in composition towards the site's potential climax tree condition without disruptions to successional processes. White fir and and tanoak will express dominance and begin to replace the shade intolerant species in this emerging fire regime. Understories will also favor reproduction of these tolerant species. Atzet and Wheeler (1982) state that the high frequency of fire has been reduced, the rate of fuel buildup has increased, and climax tree species are making a comeback.

Stocking levels are above acceptable levels in the Middle Illinois River due to the lack of disturbance this past century. Stand level data is lacking on serpentine sites because of its low interest for timber production. Stand density index (Reineke, 1933) and growth basal area (Hall, 1987) are two methods to measure relative stand densities and establish desired stocking levels. Stand density index is based on the relationship of stand diameter and trees per acre. Maximum stocking levels vary by species and, for

example, are higher for white fir than ponderosa pine. Above 55% of their maximum stocking level, stands enter into a zone of "imminent competition-mortality" (Drew and Flewelling, 1979) and the risk of mortality from inter-tree competition, fire, insect and disease increases. The Southwest Oregon LSR Assessment (1995) recommends commercially thinning stands when they reach a relative density of 60-70%. The 2,800 acres of regeneration harvesting created young plantations that are now in need of timber stand improvement treatments. However, changes in land allocation have not provided the funding to treat many of these acres.

Insect and disease damage is a natural recycling process but attracts attention when desired resources are placed at risk by an outbreak or epidemic. Though Douglas-fir dwarf mistletoe is considered the most damaging disease of Douglas-fir in southern Oregon, damage is considered minimum here. Fires historically sanitized stands by killing infected trees, killing lower infected limbs and mistletoe brooms, or by reducing infection spread through thinning of the stand. The greater concern for the Watershed is the overstocking and interruption to the areas historical fire regime. The higher stand densities developed from the absence of fire may affect the relative vigor of sugar pine and influence their ability to resist diseases and insect infestations (Sugihara and McBride).

Mortality of pine species is increasing across the Forest due to increasing stand densities and their susceptibility to pine beetle attack. Competition for moisture, especially during the recent drought period, predisposed pines to attack by western pine beetle and mountain pine beetle. Generally speaking, when stand stocking levels exceed 180 square feet of basal area, acre on sites of good quality, the pine component of the stand is at higher risk of bark beetle attack (Goheen, 1994). Bark beetles rarely attack healthy, vigorous trees. Rather they are much more successful on low-vigor or stressed trees. The sugar pine component is expected to diminish in the future as this Forest trend continues.

The trends for this Watershed are increased growth in vegetation due to fire suppression and significant decline of timber harvesting. The present land designation of Late Seral Reserve, botanical and wilderness restrict or de-emphasize harvesting. Continued fire suppression will continue to effect the historical fire interval rates for both low to medium and and stand replacement fire events.

What is the Historical Array and Landscape Pattern of Plant Communities and Seral Stages in the watershed? What Processes caused these Patterns?

Ecology plot information gathered on non-serpentine sites within the Watershed found that the most recent disturbance events were human caused, followed by fire and then wind. On serpentine sites, fire and wind were the most prevalent causes of disturbance. Harvest activities, road building and mining are the most apparent human activities but fire started by Indians, settlers or miners are not easily separated from natural lightning starts. Fire suppression this past century has largely erased the scale and historical importance of fire within this area. Fire records are incomplete beginning from the turn of the century and nearly non-existant before that time.

Regeneration harvesting that occurred between the 1960’s and 1990’s on Forest Service administered land created approximately 2,800 acres of early seral conditions. These activities were on the more productive Six-mile and Oak Flats sub-basins. The Kerby sub-basin is divided into either private ownership or BLM public lands. Aerial photographs of the Kerby sub-basin taken in 1953 revealed that most of the private lands had just recently been logged, most likely just after World War II (BLM Kerby Watershed Analysis). The private lands, which now contain 40-50 year old pole sized trees, are considered to have included the most productive late seral stands in the watershed.

If the total harvested acres within the Watershed initially represented late seral conditions, then the pre-1950's seral conditions were likely 28 percent late seral, 32 percent mid-seral and 40 percent early seral. Table 4 compares the shows how the seral stage ratings in the Stair creek watershed are similar to those throughout the Siskiyou National Forest and are within the range determined for the three forest grouping, though heavy on the early seral and lighter on the late seral than average, as determined by the Southwest Ecosystem Assessment Team (Atzet et. al. 1993).

Table 4. Comparison of historical and current seral stage pattern in Middle Illinois River Watershed on non-serpentine soils.

Seral Stage	**Middle Illinois River Watershed**		**Siskiyou/Rogue River/ Umpqua National Forest Baseline Data**
	Current	**Prior to 1950**	
Early Seral	25	40	40 (10-40)
Mid Seral	57	32	15 (10-15)
Late Seral	18	28	45 (45-75)

Differences between historic and existing seral stage ratios can be largely attributed to recent fire suppression and timber harvesting activities.

What are the Natural and Human Causes of Change Between Historical and Current Vegetative Conditions?

Hickman (1997) mentions that due to Indian burning, lightning fires, disease, insect outbreaks, drought, windstorm damage, etc. in the Illinois Watershed, past and present vegetation would include a range of successional stages ranging from near-climax to recently disturbed stands. Tehre are increasing amounts of literature written recently about the influence of fire on the landscape regionally and nationally. The scale of native American burning had previously been ignored. Indian use of fire as a management tool is considered to have had a profound influence on the ecology of most of the forest land in southwest Oregon, the west coast and the nation. In the absence of Indian burning, natural lightning fires in many forested landscapes would have been both less frequent, and more intense than Indian fires. Native American burning is assumed to reduce the numbers of high intensity fires that would have been caused by lightning (Pyne, 1982). As Indian burning ceased in North America, about 1880, there has been rapid change in forest ecology: prairies have become woodlands, savannas became dense forests, and open forests were invaded by dense undergrowth (MacCleery, 1997).

European settlement began in the Middle Illinois River around 1850 by the discovery of gold. Fire suppression began through the creation of the National Forest System in 1905 but did not become effective on the Siskiyou National Forest until the 1940s when fire suppression methods were mechanized (Taylor and Skinner, 1995). Records indicate that commercial harvesting began in Middle Illinois in the early 1960's. The cumulative effect of 2,800 acres of dispersed managed stands has been to change vegetative patterns and to create additional edge effect between adjacent stands of older and younger trees. Some late seral stands have been reduced in size by inclusions of staggered harvest blocks.

According to Henderson (1990), recent harvesting does not provide the same pattern of disturbance to the landscape that a large pre-historic fire would. Harvested areas occur as small holes in the forest and are relatively evenly distributed. Natural wildfires burn repeatedly on the drier sites, less on wetter areas, and tend to create large contiguous areas of disturbance. Skinner noted that spatial characteristics of stands on the Klamath have changed considerably since the 1940's. Sizes of openings have decreased as distances between them have increased.

The increased build-up of vegetation is the result of a century of fire suppression activities; however, the forest conditions encountered by the first Euro-American settlers were also a result of human intervention.

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