TIOGA APPENDIX: FIRE HISTORY

The pre-fire suppression landscape supported vegetation patterns that were affected fire intensity, severity and frequency. Fire behavior, is affected, in part, by aspect, slope, topographic position. Fire directly affected species and age composition by which plants it killed on the site. Fire affected the amount of regeneration and species composition through quantity and quality of seed bed created, and the amount of competitive vegetation killed. The number of mature trees surviving a fire also influences regeneration species composition and distribution through shading and root competition. These fire caused vegetation patterns, of both within and between stand age structure and species composition, are an interlocking serpentine mosaic corresponding to the interlocking pattern of streams and ridges.

The fire history for Tioga Creek Subwatershed, and for the other fire histories referred to in this document (Middle Creek, North Fork Coquille, East Fork Coquille and West Fork Smith River) were determined using methods based on techniques described by Morrison and Swanson (1990).

Fire Chronology

The earliest detectable fire event in the Tioga Subwatershed was in or before 1403. That event is document by a regeneration pulse found on one site, which dates from 1403 to 1414. The amount of land once covered by this age class is unknown. Subsequent fires destroyed all other evidence for occurrence and extent of this age class. Those fires also destroyed all evidence for other age classes or fires from before 1534 except a single scar on one of the 1403/1414 trees showing an event in 1478.

The next documented event is the 1534 fire. This was the first fire in the 1534 to 1621 fire episode. During this period, four fires are documented by scars or by scars accompanied by regeneration pulses. An additional three to five fire events are documented by regeneration pulses alone[1]. Stands regenerated during the 1534 to 1621 fire episode in the Upper Tioga Drainage show little evidence for subsequent fires until the 20th century. Evidence for the 1534 to 1621 fire episode on the north half of the west rim was destroyed by later fires. Evidence for the 1534 to 1621 fire episode is also found across the Middle Creek Subwatershed (USDI in preparation).

From 1622 to 1707 was a quiet period, with respect to fire. Most of the trees that regenerated during this time were western hemlock. There was no pattern to this regeneration but on one site there was a pulse of hemlock regeneration from 1656 to 1669. That particular stand was almost pure hemlock. Based on the Douglas-fir ages in this stand and a near by stand, the hemlocks seeded in about 100 years after the Douglas-firs. The 100-year separation between the Douglas-fir and the shade tolerant hemlock regeneration pulses suggests either a local fire killed part of the Douglas-fir and weakened most of the rest creating a natural shelterwood and prepared a suitable seed bed (Hofmann 1924). Or there was a disturbance, possibly blowdown, that killed most of the Douglas-fir overstory releasing advance hemlock regeneration.

Fire became a frequent visitor to the subwatershed again from 1707 to 1799. Scars or scars associated with regeneration show eight fires during this time[2]. Two additional fires are documented using tree birth dates only. During this period, the most wide spread and highest severity fires took place from 1741 to 1780. The earlier and later fires, during the 1707 to 1799 episode, appear to be low to moderate severity local burns, and evidence for these fires is found in the older stands on the east end of the subwatershed. The 1741 to 1780 fires also affected the adjacent Middle Creek and North Coquille Subwatersheds. A 1769 fire is documented in the West Fork Smith River Subwatershed 35 miles to the north (USDI 1997). An unpublished fire history map prepared by Jerry Phillips, retired forest manager of the Elliott State Forest, showed what he called the "1770 fire." The south end was by McKinley, OR. The north end extends past the northeast corner of Coos County and beyond the map boundary. The wide

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[1] Regeneration pulses indicate the latest date that a fire occurred, but unlike scar dates, cannot show the exact year of the fire. Scar dates are not without error. Errors can occur in counting rings and with establishing the exact time the tree died. Consequently closely grouped pulses of regeneration cannot be entirely separated without correlating fire scars or historical records.

[2] The scar for one of those eight fires was found on a tree just over the subwatershed boundary in the North Coquille Subwatershed. Regeneration associated with that event was found inside Tioga Creek Subwatershed.

spread stands that regenerated shortly after 1754[3] show a large fire burned over the North Coquille, the Middle Creek and the west side of the Tioga Subwatersheds. The 1754 fire destroyed much of the evidence for earlier fires on those sites where it burned. A 1741 scar in the Tioga Subwatershed, and the distribution of Middle Creek stands with birth dates in the 1740s suggest the 1754 fire was a reburn of the 1741 fire. The 1740 to 1780 fires destroyed all evidence of forests before 1754 in the Upper North Coquille Drainage except a small area on the southeast rim next to the Tioga Creek Subwatershed. Scars dating from the 1700s show fires burned on the east end of Tioga Subwatershed. However those fires were either low severity underburns or disjunct local events that did little damage to the stands existing at that time on the sampled sites.

No fires were found to occur from 1800 to 1845 in the Tioga Subwatershed. Four fires burned between 1845 and 1875 in the subwatershed. On the sites visited outside the Burnt Creek Drainage, these fires were largely under burns. The 1845 fire may have been a stand replacement event on the one Burnt Creek site known to be affected by that burn. The data, taken at face value, suggests the site supported a stand by trees up to 138 years old mixed with scattered large older trees. However, when data from a near by site is taken into account, that part of the 1845 fire may have burned through a stand composed of trees younger than 46 years with scattered old trees. In the Middle Creek Subwatershed, one or more fires resulted in a regeneration pulse lasting from 1848 to 1867. That fire or fires were stand replacing on steep south to west facing aspects with shallow soils. Elsewhere in the Middle Creek Subwatershed, the fire(s) was an underburn followed by a pulse of understory regeneration. The upper slopes and ridge tops underburned in the Upper North Coquille Drainage about 1847 $\pm$ 2 years. To the north, large fires burned between the Siletz and Siuslaw Rivers from 1845 to 1849. The worst of these fires burned more than 500,000 acres in 1849 (Morris 1934). One of these fires, most likely the 1849 fire, crossed into the Smith River System[4]. The 1867 fire in Tioga Creek area occurred within a year of the 1868 Coos Bay Fire, and given the potential for tree ring counting error, both fires could have occurred at the same time.

The most recent fire episode was from 1891 to 1942 These fires and reburns were stand replacement events in south and central part of the watershed. The affected area is locally called the Tioga Burn. These same fires also burned through the Burnt Creek Drainage. Lackland (1898) made note of burnt timber in his 1896 cadastral survey of township 27 S., range 10 W. The boundary of the Tioga Burn is traceable on a topographic map using Lackland's notes. The enclosed area corresponds with an area of unreforested burn on a 1914 vegetation map, and with young forest type islands on BLM forest type maps from the 1950s, 1960s and 1970s. In Burnt Creek, the 1891 to 1942 fire episode was really a continuation of the reburns following 1845, 1867, and 1875 fires. The 1918 fire extended beyond the Burnt Creek/ Tioga Creek Burn areas and underburned the surrounding stands that regenerated during the 1536 to 1621 fire episode event. The 1918 fire is responsible for regenerating the understory hemlock component seen in many stands in the Upper Tioga Drainage, on the south and west rim of the subwatershed and on the upper slopes in the adjacent land to the south and west of the subwatershed. The fires in 1923, 1932, and 1942 were similar to the 1918 fire in their effects on the Tioga Subwatershed and surrounding land. The areas where the 1707 to 1799 fire episode resulted in stand replacement on Tioga Subwatershed's west side appear little affected by the 1918 and later fires.

The Tioga Subwatershed fire history, to this point, is based on fire scar and tree regeneration data supplemented by survey notes and a few historical accounts. The following is based on recent historical accounts an oral history:
The 1952 Second Williams River Fire burned on the northeast rim of the Tioga Subwatershed. This fire started in a logging unit and burned both green timber and reburned an area that burned in 1936. The 1936 fire is sometimes called the First Williams River Fire and that fire may have been part of the 1936 fire complex that burned in Bandon, up across towards Powers and north of Highway 42, Brewster Rock/ Sitkum area on the East Fork Coquille River, and in the Fairview/ Blue Ridge Area.

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[3] A regeneration pulse beginning with a1754 birth date was observed in the North Coquille Subwatershed. A regeneration pulse beginning with a 1756 birth date was observed in the Tioga Creek Subwatershed.

[4] The fire history work done for the West Fork Smith River Watershed Analysis (USDI 1997) shows that fire to be a stand replacing event on the north two thirds of that subwatershed.

Fire Frequency

Fire frequency is a general term referring to the recurrence of fire in a given area over time (Agee 1993). The length of time used in this analysis to calculate fire frequency is period from the first known fire to the last fire on each site, excluding fires occurring after 1930. The year 1930 was chosen as the cut off because road construction after that time increased both fire control effectiveness and increased the risk of fire associated with logging and recreational activities.

Fire frequency is scale sensitive. This is because the larger the area the more small and medium size fires will likely be included in the sample. Fire frequencies were calculated at the site, drainage and subwatershed scales so the reader can get a sense of the relative differences at each scale. Fire frequency is also often proportional to the sample size. That is, the larger the sample size, the greater the probability all the fire events will be sampled. Several sites were under sampled due to time constraints and the calculated fire frequency probably under estimates the actual frequency on those sites. Those sites are indicated on the following tables. The under sampling issue is less of a problem at the drainage and subwatershed scale provided the intent is to determine frequency of the fire events and does not also include an objective to map fire boundaries. The medium and large size fires are more likely to be detected and represented on the drainage or subwatershed scale when individual site data are aggregated increasing the sample size.

Site fire frequencies averaged together by drainage for those sites with at least two fires in:

Burnt Creek Drainage:	33 years
Upper Tioga Creek Drainage:	267 years
Middle Tioga Creek Drainage:	108 years
Lower Tioga Creek Drainage:	56 years
All site fire frequencies averaged together for the subwatershed:	132 years

Fire frequency on the drainage scale for:

Burnt Creek Drainage for period from 1534 to 1923:	23 years
Upper Tioga Creek Drainage for period from 1558 to 1918:	72 years
Middle Tioga Creek Drainage for period from 1404 to 1918:	37 years
Lower Tioga Creek Drainage for period from 1735 to 1845:	37 years
The four drainages averaged together:	42 years

Fire frequency for the entire Tioga Subwatershed for the period from 1404 to 1923: 17 years

Fire Occurrence and the Time in Years Since the Previous Firefor Each Drainage in the Tioga Subwatershed

Fire year	Burnt Ck	Upper Tioga Ck	Middle Tioga Ck	Lower Tioga Ck	Notes
	Number position shows drainage and year of each known fire. The number is the time in years since the previous known fire in the drainage.				
1404			earliest date		
1476			72		
1534	earliest date				
1546			70		same event?
1548	14				
1558		earliest date	12		
1567	19				
1579		21			same event?
1584		5			
1606	39				
1621	15				
1707	86				
1728			170		
1735				earliest date	
1741			13		
1753	46				
1756			15	21	
1771	18				
1780			24		
1797	26	213			
1799	2			43	
1845	46		65	46	
1855			10		
1867	22		12		
1875	8				
1891	16		24		
1896	5		5		
1903	7	106			
1906			10		
1918	15	15	12		
1923	5				
1932		14	14		
1942	19				
1951		19			1952?

Fire Frequency, by Site, for Fires Occurring Before 1930

Site:	Burnt Up #1 27-9-05	Burnt Up #4 27-9-04 & 05	Burnt Offering #1 27-9-04	Beyers Nickol #1 27-9-15	Bear Wallow #2 27-9-23	Friday the 13th 27-9-24	Twin Falls #2 27-9-27	Tioga Triangle #2 27-9-17
Drainage:	Burnt Creek Drainage			Upper Tioga Creek Drainage				
Number of fires:	3 fires from 1891 to 1918	11 fires from 1534 to 1918 *	10 fires from 1548 to 1923	2 fires from 1579 to 1918**	2 fires from 1558 to 1918	1 fire in 1558	2 fires from 1584 to 1797	3 fires from 1558 to 1918
Time between fires in years:								
longest	15	138	186	339	360	>372	213	345
shortest	12	8	2	same	same	same	same	15
average	14	43	42	same	same	same ****	same****	180****

Fire Frequency, by Site, for Fires Occurring Before 1930 (cont.)

Site:	Burnt Mtn. Rd. 27-9-18	Vidourek's Vendetta 27-10-14	Tioga Tie #1 26-10-35	Mid. Coos Mtn. #1 26-10-27	Mink Hatcher #3 26-10-13	Mink Hatcher #2 26-10-13	Mink Hatcher #1 26-10-13	
Drainage:	Middle Tioga Creek Drainage				Lower Tioga Creek Drainage			
Number of fires:	3 fires from 1558 to 1906	4 fires from 1546 to 1918 *	3 fires from 1756 to 1896	8 fires from 1404 to 1867	1 fire in 1756	3 fires from 1735 to 1799	2 fires from 1756 to 1799	
Time between fires in years:								
longest	333	182	89	265	>174	43	80	
shortest	15	63	51	10	same	21	same	
average	174****	124	70	66	same	32	same	

* A 1942 fire occurred on this site but was not included in calculating fire frequency

** The 1932 and the 1951(1952?) fires were not included in calculating fire frequency

*** There was a 1944 (1942?) fire that occurred on this site but was not included in calculating fire frequency

**** The fire frequency calculated for this site is likely an under estimate because of the small sample size.

<u>Stand Replacement Fires directly affecting Tioga Subwatershed</u>

The major stand replacement fires were mostly likely in 1534 and in 1741. These fires burned on a scale larger than a subwatershed. The 1891 stand replacement fire appears to have burned on a scale larger than a drainage but smaller than a subwatershed.

Regional weather conditions may have predisposed the Tioga, adjacent subwatersheds and West Fork Smith River Subwatershed, 36 miles to the north to burn, within a year of each other. Fuel load and continuity was another factor that contributed to the severity of the 1891 Tioga Burn and the 1892 fire on the West Fork Smith River. The north end of the Tioga Burn was likely a reburn of the 1845 fire. The West Fork Smith River 1892 fire was a reburn of the 1849 fire. In both cases there were trees killed by an earlier fire that had time to cure and become heavy dry fuels. Young reproduction provided horizontal and vertical fuel continuity in the form of fine branches and needles. All three stand replacement fires were followed by reburns on most sites.

<u>Speculations on the timing and scale of fires in the 1500s and 1700s</u>

Large areas of forest, in regions characterized by infrequent high intensity fires, can be traced back to fires that burned in a few major fire years (Heinselman, 1983). Where weather information is available, we know most of these major fire years are associated with periods of severe drought. For example, the 1755-1759 were major fire years in both the Rockies and the Lake States (Heinselman, 1983). A 500-year age class is found throughout the Cascades, and the Olympic Mountains. That age class may have been initiated by fires associated with a drought period or even a short term climatic change (Franklin and Hemstrom 1981).

The 500-year age class in the Cascades, and the 400 to 450-year-old stands in the Tioga Subwatershed regenerated during the Little Ice Age. This was a period cooler drier weather in the Northern Hemisphere. The weather pattern predisposing the Lakes States and the Rockies to fires from 1755 to 1759, may have been the same predisposing factor leading to the fires occurring from 1740 to 1780 in Umpqua Resource Area, and to the 250-year age class found in both the Washington and Oregon Cascades. This invites speculation on the occurrence of these stand replacement fires, regional/ continental weather patterns, and the possibility that the acres in late succession forest varied greatly over time.

<u>Fire caused and maintained conditions on landscape</u>
The landscape patterns in the Tioga Creek Subwatershed were most influenced by fire. The longest observed periods between stand replacement fires, and consequently the oldest stands, are on the east end of the subwatershed. Those stands date from the 1500's. The most complex fire history is in the central part of the subwatershed. That area had the most recent stand replacement fire and a long history of reburns. There are old stands that also date from the 1500's in the central part of the subwatershed. Those stands have 50 to 100-year-old understories that came in after recent fires. The northwest part of the watershed has stands that came in following fires in the 1700's with understories dating from the mid-1800's. No fire history work has been done on the northeast rim of Tioga Creek Subwatershed.

Where fires were high severity burns, the affected sites regenerated to relatively uniform Douglas-fir dominated stands. Where fires were moderate to low severity, leaving a partial overstory of old growth Douglas-fir, dense even-aged understories of western hemlock regenerated. This is consistent with published observations (Hofmann 1924). The severity of the underburn, and therefore the density of the subsequent hemlock regeneration, decreases the farther one moves away from the ridge top. The most recent episode of fires burned as stand replacement events in some areas and as moderate to low severity underburn in others. This fire episode begins in 1891 followed by reburns into the 1940's. The stands that resulted from these recent fires strongly influence the pattern of shrub and herb layers. Ridge top and upper slope stands with dense understory hemlock have little in the way of a shrub or herb layer. That is due to the ability of the dense hemlock understory stands to intercept most of the sunlight before it reaches the forest floor (Deal; Farr 1994). In contrast, the Douglas-fir stands on similar slope positions with birth dates between 1920 and 1940 generally have dense shrub layers. Those shrub layers are dominated by sclerophyllous plants (salal, Oregon grape, and rhododendron). Reburns following stand replacement fires kept parts of the Tioga Subwatershed in the early stages of succession during the 1500s, 1700s and late 1800s to early 1900s. The most recent episode of stand replacement fires and reburns resulted in areas where few trees survived beyond 25 years for periods of at least 50 to 75 years. The reburn areas sometimes contained widely scattered individual and patches of older threes. In extreme cases, reburns can eliminate all trees that were on the site before the initial burn. A single fire hot enough to kill trees rarely consumes significant bole wood. Therefore single event moderate and severe fires recruit large numbers of snags. If there is a reburn after the dead bole wood has cured and fallen down into large accumulations of down material, the resulting fire is a high intensity burn consuming large wood reducing the number down wood and snags and case hardening those that remain.

Frequent reburns resulted in a stand type on some sites that is no longer maintained on the landscape. That stand type was called “timber scattering” by the land surveyors that encountered these stands during the last century. The old trees in the “timber scatterings” were highly resistant to fire because of the distance of their crowns above the fuels on the ground, and because of the thick bark that comes with age. Species was also a factor in that some species inherently are more fire resistant than others due to bark thickness, rooting characteristics, and crown architecture. The surveyors described timber scatterings as having dense brush or young tree regeneration (Lackland, 1898; Chapman, 1875). Timber scatterings were still visible as a distinct type on aerial photos taken over the Tioga Subwatershed in 1943. Superficially, a timber scattering on an aerial photo looks like an Eastern Oregon open park like stand. However, the dense brush and tree regeneration would have given the Coast Range timber scatterings a fundamentally different character when viewed on the ground[5].

The occurrence of timber scatterings and fire retarded succession is best documented in the Burnt Creek Drainage. Today, the uncut stands in the Burnt Creek Drainage are typically composed of 60 to 100-year-old trees. Scattered older trees and small stands with a well represented older component are also present. Before there was effective fire suppression, the sampled sites in this drainage had a moderate to high fire frequency going back at least as far as the 1500s. If the sampled sites, which are within 1.5 miles of each other, represent the drainage as a whole then the fire history data suggests the following: Frequent fire may have resulted in a vegetation matrix largely confined to the earlier serial stages. On this landscape there were periods of 50 to 100 years when few trees lived longer than 25 years. This matrix of grass/ shrub/ young forest contained patches of multi cohort forests and areas with "timber scattering." During those times where the matrix was dominated by sapling to pole size trees, there were probably open patches and brush fields on south to west facing ridge tops. The open areas were kept in that condition by bracken fern competition, heavy big game browse, and ground fires that killed seedlings. The brush fields were occupied by ceanothus. This landscape also had multi cohort stands in protected areas that moderated fire intensity. "Timber scatterings" were widely spaced old trees. These trees are either on protected microsites or regenerated during an atypically long period between fire events thus escaped early mortality. Their crowns were well above any ladder fuels and they have thick bark typical of old Douglas-fir trees.

Ironically, effective fire suppression has increased the risk of these old trees dying in a fire. Fire suppression has allowed younger trees to survive and grow to where the upper parts of the young trees' crowns are in contact with the lower crown of the old trees. This results in both vertical and horizontal fuel continuity. The root competition by the younger trees may also be stressing the old trees causing mortality. This is because the old trees have larger respiring biomasses relative to photosynthetic surfaces than do the younger trees. Most of the photosynthate produced by the old trees goes to respiration with little left over for root or crown expansion or for the protective chemicals to defend against insect or disease. The younger trees have more photosynthate available for producing new roots and leaf surface. Before fire suppression, frequent fire killed the young trees releasing growing space for use by the old trees.

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[5] Photographs taken from Coos Mountain Lookout in 1936 show the steep south rim of Park Creek Drainage, in the Middle Creek Subwatershed, supporting an open stand. That stand has since filled in with a dense conifer understory. Walks through a recently cut unit on that rim suggest that the former open condition allowed large colonies of columbia tiger lily, fawn lily, and iris to establish there. These plants are favored by high shade, and well-drained soils. The extent of available habitat for these plants has be reduced by the loss of open stands and timber scatterings. On the resource area, the columbia tiger lily is largely confined to road cut banks. The fawn lily is uncommon and when it is found it is usually on the edge of rock bands or adjacent to rocky ridges. The iris is more wide spread but it to is largely confined to exposed ridge top road right of ways and to plantations on Oregon grape or salal sites where big game browsing has slowed conifer seedling growth.

USDI. 1997. *West Fork Smith River Watershed Analysis*. On file Coos Bay Dist Office-BLM.
USDI. In prep. *North Fork Coquille Watershed Analysis- Fire History Appendix.* Coos Bay District Office-BLM

Attachment - Tioga Subwatershed Fire History Site by Site Description:

Note: only fires dating 1923 or before are included in calculating time between fires. After that time, road access would have increased the potential for Euro-American caused fire and also more aggressive fire control.

Sect. 05, T.27S., R.9W., Will. Mer., Burnt Up Unit 1
The site was covered in young trees at the time the unit was cut. The oldest trees were on the bench by the road and on the lower slope of the unit near the riparian zone. The youngest trees observed were midslope on the steepest ground, where there is exposed rock. The bench was covered with bracken fern. Deer brush ceanothus, madrone, ocean spray and myrtle were found on the midslope around the exposed rock. The lower slope supports hemlock/ sword fern plant association. No trees were found that predate the 1891 fire.

fire years:	years between burns:
1891	
	12
1903	
	15
1918	

Average time between documented fires: 14 years

Sect. 4 & 5, T.27S., R.9W., Will. Mer., Burnt Up Unit 4
This site supported five age classes:

- The oldest tree was rotten in the center so total age could not be determined
- 1532-1538
- 1649 (single tree)
- trees regenerated following the 1891 fire
- trees regenerated following the 1903 fire

Several fires are represented by scars only. Any regeneration that came in because of those events was destroyed by subsequent events or survived in such small numbers as to not show in the sampling. One stump from a cut snag was included in the sampling because it showed severe multiple scarring. The relative dates, from the pith, for six of those scars were determined. The absolute dates for the scars and the tree birth date were established by comparing the interval between scar dates on the snag with dated scars observed in the area. Some scar dates were adjusted to take into account the potential for counting error and the observed dates else where in the watershed.

relative dates in years from pith at cut surface	(probable date)	time between scars
186	(1843)	
		23
209	(1866)	
		9
218	(1875)	
		28
246	(1903)	
		15
261	(1918)	
		24
285	(1942)	

This one sample provided an opportunity to calculate a point fire frequency. A point frequency is the mean fire-return interval at a single point on the landscape (Agee 1993). It is 18.8 years between events over a 99 year period.

fire years:	years between burns:	notes
1534		single scar followed by regeneration
	72	
1606		
	15	
1621		
	86	
1707		
	138	
1845		
	22	
1867		
	8	
1875		
	16	
1891		
	12	
1903		
	15	
1918		
	24	
1942		

Average time between documented fires: 43 years (excluding the 1942 event).

Speculations on the stand development pattern

It is possible that the site supported an open park like stand or scattering of trees for many years. The scattering of trees condition would have been maintained by repeated fire that burned the reproduction established following the previous burn.

Sect. 04, T.27S., R.9W., Will. Mer., Burnt Offering Unit 1

fire years:	years between burns:	notes
1548		earliest birth date on the site
	19	
1567		
	186	
1753		
	18	
1771		
	26	
1797		1797 & 1799 scars stacked on one tree
	2	
1799		
	92	
1891		
	5	
1896		
	22	
1918		
	5	
1923		

Average time between documented fires: 42 years

The relative abundance of large diameter stumps and the range of distinct age classes suggests this stand was structurally similar to stands in Southwest Oregon.

Burnt Creek:

Burnt Creek discussion moved to the main body of the report.

Upper Tioga:
This area is characterized by infrequent fire. The oldest trees came in following a disturbance in or before 1558.

Sect. 15, T.27S., R.9W., Will. Mer., Beyers Nickol Unit 1
Looked for scars on two passes through the unit. Found pitch rings and abrupt changes in growth rate but no scarring other than for 20th century events. The 1951 date most likely corresponds to the second Williams River Fire.

fire years:	years between burns:	notes
1579		earliest birth date on the site
	339	
1918		actual count 1916, possible counting error
	14	
1932		
	19	
1951		

Time between documented fires that occurred before 1923: 339 years

Sect. 23, T.27S., R.9W., Will. Mer., Bear Wallow Unit 2
Found only three scars. One was on the down hill side of the tree and therefore had a low probability of being of fire origin. One was on a tree that was impossible to get a consistent count on and one dated to 1917 (likely the 1918 event). Most trees dated earlier that 1597 or later than 1896.

fire years:	years between burns:	notes:
1558		earliest birth date on the site
	360	
1918		

Time between documented fires: 360 years

Sect. 24, T.27S., R.9W., Will. Mer., Friday the 13th
This stand was almost entirely old western hemlock. The hemlock birth dates are from 1656 to 1669. The one Douglas-fir stump counted dated to 1560. Based on the tree ages found in near by units, the stand initiating fire was in or before 1558. No scars found.

No documented fires since the stand initiating event.

Sect. 27, T.27S., R.9W., Will. Mer., Twin Falls Unit 2
Data set too small to draw many conclusions. This site should be revisited and additional stumps counted. Oldest tree dates to 1584. One scar correlates in time to an event in Burnt Offering unit 1, but that is too far away to consider the same event without additional data.

Sect. 17, T.27S., R.9W., Will. Mer., Tioga Triangle Unit 2
Oldest tree dates to 1562. Based on clustering of birth dates in near by units, the stand initiating event was in or before 1558. Fire scar dates for 1903 and 1918 are adjusted to take into account other scar dates in the subwatershed and possible counting/ dating errors.

fire years:	years between burns:	notes
1558		regeneration found on several sites
	345	
1903		
	15	
1918		

Average time between documented fires: 180 years

Sect. 18, T.27S., R.9W., Will. Mer., Burnt Mountain Road

Oldest tree dates to 1558. Based on clustering of birth dates in near by units, the stand initiating event was in or before 1558. Fire scar dates for 1891 and 1906 are adjusted to take into account other scar dates in the subwatershed and possible counting/ dating errors.

fire years:	years between burns:	notes
1558		regeneration found on several sites
	333	
1891		
	15	
1906		

Average time between documented fires: 174 years

Sect. 14, T.27S., R.10W., Will. Mer., Vidourek's Vendetta

Earliest birth date is 1546. Pitch rings are often associated with scars, but pitch rings by themselves are not used as indicators or burns. However, when I did my first fire history on the adjacent Middle Creek Subwatershed, I did record the occurrence of major pitch rings and I did not have the means to remove surface pitch to find hidden scars. Pitch rings dating 1854-1856 showed up in Vaughns Creek and Park Creek to the west of Vidourek's Vendetta. Fire scars dating to 1855 also were found four miles north on the Middle Coos Mountain Unit.

fire years:	years between burns:	notes
1546		
	182	
1728		
	127	
1855		
	63	
1918		
	23	
1942		

Average time between documented fires (excluding the 1942 event): 124 years

Sect. 35, T.26S., R.10W., Will. Mer., Tioga Tie Unit 1

Found one stump that likely dated to the 1500's. It was rotten in the center and the rings therefore were uncountable. The oldest tree on the unit date to 1757. Near by units have tree birth dates clustering from 1756 to 1769. The stand replacement event occurred in or before 1756. This unit is between two sites with evidence for the 1855 fire. Clear supporting evidence was not found in this unit.

fire years:	years between burns:	notes
1756		
	89	
1845		
	51	
1896		

Average time between documented fires: 70 years

Sect. 27, T.26S., R.10W., Will. Mer., Middle Coos Mountain Unit 1
The oldest tree in the Tioga Subwatershed found so far are on this site and date to 1404. The 1741 scar date is supported by an abrupt and extreme growth reduction observed on another tree in the same unit. There is a regeneration pulse dating 1759 to 1766. Near by units have tree birth dates clustering from 1756 to 1769. The stand replacement event occurred in or before 1756. Regeneration dating 1786 and 1789 may have come in following the 1780 scar producing event observed a quarter mile away in Middle Coos Mountain unit 3, which is in the North Coquille Subwatershed.

fire years:	years between burns:	notes
1404		
	72	
1476		
	265	
1741		
	15	
1756		
	24	
1780		
	65	
1845		
	10	
1855		
	12	
1867		

Average time between documented fires: 66 years

The Hatcher Creek fire history has more in common with the North Coquille than with Tioga Creek. The North Coquille stands regenerated between 1754 and 1780. The way the birth dates tend to cluster into pulses of regeneration suggests the age structure of the North Coquille is due to a series of reburns that resulted in a mosaic of even aged stands. Similar observations were made on the Middle Creek Subwatershed sites supporting stands with birth dates from 1740 to 1780.

Sect. 13, T.26S., R.10W., Will. Mer., Mink Hatcher Unit 3
There is a regeneration pulse dating 1758 to 1764. Near by units have tree birth dates clustering from 1756 to 1769. The stand replacement event occurred in or before 1756. No evidence of other fires.

Sect. 13, T.26S., R.10W., Will. Mer., Mink Hatcher Unit 2
There is a regeneration pulse dating 1761 to 1765. Near by units have tree birth dates clustering from 1756 to 1769. The stand replacement event occurred in or before 1756. One tree, with a 1735 birth date, was found in a protected moist headwall. This suggests the fire that set the stage for the 1756 to 1769 regeneration pulse was a reburn following a fire in or before 1735. One scar was found on a tree on top a spur ridge near the southeast unit boundary.

fire years:	years between burns:	notes
1735		
	21	
1756		
	43	
1799		

Time between documented fires: 32 years

Sect. 13, T.26S., R.10W., Will. Mer., Mink Hatcher Unit 1
There is regeneration dating 1768 to 1769. Near by units have tree birth dates clustering from 1756 to 1769. The stand replacement event occurred in or before 1756. The 1845 scar date is adjusted to reflect the occurrence of scar causing events else where and to take into account possible counting error.

fire years:	years between burns:	notes
1765		
	80	
1845		

Time between documented fires: 80 years

Discussion on stand replacement fire dates

The 1534 to 1621 episode

The 1534 fire is documented in Burnt Creek by both a scar and a regeneration pulse. Douglas-fir birth dates from 1540 to 1550 are found on 4 out of the 12 sites visited for the Middle Creek Subwatershed fire history suggesting the 1534 fire was a large event.

There is no way to tell if the fires between 1546 and 1584 were all reburns of if some of them were stand replacement fires on sites that escaped the 1534 fire. The one exception is a moderate intensity burn in 1567$\pm$4 years. That fire left alive part of the previous stand, scared at least two of those trees, and was followed by a regeneration pulse. The other fires from 1546 through the 1584 are documented by regeneration pulses. The fire in or before 1558 is the most widely represented of those fires. The 1606 and 1621 fires are documented by scars on one site in Burnt Creek. Similar aged trees are found in the southeast corner of the Middle Creek Subwatershed and just south of the Tioga Subwatershed rim where the Middle Fork Brummet Creek Road intersects the Burnt Mountain Road.

The 1707 to 1799 episode

A regeneration pulse came in after 1756 in the northwest part of the Tioga Subwatershed. A regeneration pulse also occurred after 1756 in Cherry Creek Drainage of the Middle Creek Subwatershed and after 1754 in the North Coquille Subwatershed suggesting a major fire in or be 1754/56. Regeneration coming in after 1740 on Middle Creek Subwatershed and a 1741 scar in the Tioga Subwatershed suggests the 1754/56 regeneration came in after a reburn. A tree with a 1735 birth date was found on a moist protected spot surrounded by trees that regenerated after 1756 suggests an even earlier event. It is also possible that compounding errors tied to annual ring counting, estimating the years required for the tree to grow to stump height, and establishing date of tree death could lead to under estimating the scar date and/or over estimating the age of the tree assigned the 1735 birth date.

The 1780 fire is documented by a scar on the Coquille side of the boundary between the North Coquille and the Tioga Subwatersheds with regeneration on both sides of the boundary. Similar aged trees are lightly scattered through the North Coquille Subwatershed with a stand of these trees on a harsh south facing ridge top 3.5 miles northwest the Tioga-Coquille boundary site.

The 1707 and 1728 fires are indicated by scars on older trees. Based on the limited available information, these were likely local low to moderate severity fires. The scars showing fires in 1797 and 1799 events were likely low to moderate severity fires and are separated by some distance from initiated by the 1756 and 1780 burns.

The 1845 to 1855 episode

The 1845 to 1855 fires were light and occasionally moderate severity burns in the Tioga, Middle Creek, and North Coquille Subwatersheds. The 1845 to 1849 fires were large stand replacement fires farther north in the Coast Range.

The 1891 to 1942 episode

The 1891 fire was a stand replacement event. The following fires were reburns of the 1891 fire and also burned as low and occasionally moderate severity fires in the green timber. The 1918 is a particularly wide spread low to moderate severity fire.

TIOGA APPENDIX: The Range and Frequency of Stand Areas for Understory Stands Regenerated in the 1910s and 1920s inside the Tioga Subwatershed

Question: How big were understory burns areas where the disturbance was of sufficient intensity to allow successful understory regeneration but not so intense to cause stand replacement?

Data sources: The primary data source is a 2-inch to the mile overlay showing both overstory and understory stands with birth dates from 1880 to 1950. The overlay is on file at the Coos Bay District Office, North Bend, OR. The overlay, in turn, was created using type maps found in the 1950s and 1960s management atlases, also on file at the Coos Bay Office. The type maps were based on aerial photos taken in 1950.

I dot gridded the understory stands, mapped inside the subwatershed, that originated during in the 1910s and 1920s decades. The results are:

Location of each polygon by Twshp R & Sect.	**acres in each polygon**	**Location of each polygon by Twshp R & Sect.**	**acres in each polygon**
26-9-17	19	27-9-4 & 26-9-33	80
26-9-19&30	317	27-9-5&8	181
26-9-27, 28&33	253	27-9-6 & 27-10-1&12	254
26-9-29, 31&32	120	27-10-12&13	26
26-9-30&31	62	27-9-8	53
26-10-25	43	27-9-8	42
26-10-25&36	61	27-9-8&17	18
26-10-26	61	27-9-8&17	131
26-10-35	19	27-9-9	18
26-10-36	12	27-9-9	18
26-9-33	57	27-9-16	64
26-9-33	12	27-9-16	19
		total checked 7/29/96	1,940 acres

average polygon size: 1,940 total acres ÷ 24 polygons = 81 acres/ polygon

Distribution of Stand Sizes for Understory Stands
Regenerated in the 1910s and 1920s inside the Tioga Subwatershed

polygon size in acres:	0-20	21-40	41-60	61-80	81-100	101-120	121-140	141-160	161-180	181-200	200-300	301 +
number observed	8	1	4	5	0	1	1	0	0	1	2	1
% of polygons in each range	33.3%	4.2%	16.7%	20.8%	0%	4.2%	4.2%	0%	0%	4.2%	8.3%	4.2%
33% are 0 to 20 acres												
38% are 0 to 40 acres												
54% are 0 to 60 acres												
75% are 0 to 80 acres												

Acres of Understory Stands Regenerated in the 1910s and 1920s inside the Tioga Subwatershed

polygon size in acres:	0-20	21-40	41-60	61-80	81-100	101-120	121-140	141-160	161-180	181-200	200-300	301 +
total ac. in size class	135	26	195	328	0	120	131	0	0	181	507	317
% of ac. in each range	7.0%	1.3%	10%	16.9%	0%	6.2%	6.8%	0%	0%	9.3%	26.1%	16.3%
7% of the ac. are in stands of 0 to 20 ac.												
8% of the ac. are in stands 0 to 40 ac.												
18% of the ac. are in stands 0 to 60 ac.												
35% of the ac. are in stands 0 to 80 ac.												

I only looked at the 1910s and 1920s decades for the following reasons:

- There is no data for before 1880
- the land burned over from 1880 to 1909 was partially reburned in later years masking the extent of those earlier fires
- The occurrence and size of fires after the 1920s may have been influenced by fire suppression activities.

Additional observations: The understory stands with birth dates in the 1910s and 1920s are scattered over an area 9 miles north to south and 7 miles east to west. Many of these understory stands are next to stands that came in after a stand replacing event during the same two decades. In order for an understory stand to be observable in the 1950 aerial photo, the overstory had to be between 30 and 90 percent open 30 to 40 years after the disturbance that allowed the understory to become established.

Discussion: Over a twenty-year period at least 1,940 acres were burned or otherwise disturbed enough to allow an understory to establish. Additional acres of disturbance and subsequent understory regeneration may have occurred but cannot be verified because the disturbance was not severe enough to be observable on aerial photos 30 to 40 years later. The mapped understory stands average 81 acres, with 75% of the stands containing less than 80 acres each. However, the 12.5% of the stands with the largest area per stand contain 52% of the acres.

Implications for management: Use density management and/or underburning to open canopy of selected stands with the objective of regenerating an understory and in the process recruit snags from the overstory. Leave between 15% and 75% canopy closure immediately after treatment (anticipating additional mortality will drop live canopy closure to between 10 and 70%). Approximately 75% of the treatment units should be less than 80 acres with most of the units falling in the 20 acres and less or in the 40 to 70 acre ranges. Approximately 65% of the treated acres should be in units containing at least 100 contiguous acres. This does not preclude additional acres of treatment but those treatments should not be sufficiently severe as to leave a signature that will be visible on aerial photos 30 years after treatment.