12-2003

Steens Mountain Aspen Assessment and Monitoring Final Report: submitted to Bureau of Land Management, Burns District Office and Steens-Alvord Coalition

Nick Otting

Danna Lytjen

Steens Mountain Aspen Assessment and Monitoring

Final Report

Submitted to:
Bureau of Land Management
Burns District Office
28910 Highway 20 West
Hines, Oregon 97738

and

Steens-Alvord Coalition
c/o Oregon Chapter Sierra Club
2950 SE Stark Street, Suite 110
Portland, Oregon 97214

Submitted by:
Nick Otting and Danna Lytjen
Duckfoot Survey Company
2710 Emerald Street
Eugene, Oregon 97403

December 2003

INTRODUCTION

In October 2002, the Steens-Alvord Coalition, Burns District BLM, and Duckfoot Survey Company entered into a cooperative partnership to quantitatively assess ecological integrity of selected quaking aspen (*Populus tremuloides*) stands in the Steens Mountain Cooperative Management and Protection Area (CMPA). Duckfoot Survey Company was to establish aspen study plots in the CMPA. The objectives of the study were to:
1) document aspen stand structure and examine grazing history as a potential environmental factor influencing stand structure; and
2) create an opportunity for long-term monitoring of aspen stands in the CMPA.

ASPEN ECOLOGY

Quaking aspen is the most broadly distributed tree species in North America (Fowells 1965). Sudworth (1967) noted that although aspen was distributed across the entire state of Oregon, it was not common. The Oregon State University Herbarium documents aspen in 26 of 36 Oregon counties. By far, the most extensive aspen stands in Oregon are found on Steens Mountain.

Aspen stands are particularly conspicuous on Steens Mountain landscapes between 5,600 and 7,550 feet elevation. In the subalpine zone (above 6,600 feet elevation) aspen typically occurs in pure stands in a mosaic with sagebrush grasslands, rocky areas, and meadows; in the western juniper (*Juniperus occidentalis*) vegetation zone (below 6,600 feet elevation) aspen usually occurs in mixed stands with juniper (Franklin and Dyrness 1973, Mansfield 2000).

Herbivory, fire, and climate are known to influence aspen stand structure (DeByle 1985a, DeByle 1985b, Kay 1993, Ripple and Larsen 2001). These three factors, individually or in concert, may inhibit or stimulate root sprouting and recruitment of sprouts into the tree canopy. Recent studies have addressed the influence of fire and succession on aspen in the zone of overlap between the juniper and aspen vegetation zones (Miller and Rose 1995, Wall et al. 2001).

Although aspen clones are very long-lived, individual stems are short-lived. Aspen overstories in a Rocky Mountain study averaged between 60-119 years (Jones and Schier 1985). Overstory aspen stems aged recently within the western juniper zone on Steens Mountain were between 70 and 130 years of age, and most stands were even aged (Wall et al. 2001). Aspen reproduces sexually, via seed, and asexually via root sprouts. Sexual reproduction, though currently rare, underlies the species great geographic range. Asexual regeneration enables aspen to persist through times not favorable for seedling establishment (Kay 1993, Ripple and Larsen 2001).

SURVEY METHODS

The study area consists of a band of aspen stands from the upper elevation limit of juniper, extending to the upper elevation limit of aspen. Included were most aspen stands in the area north of the North Steens Loop Road and south from the road to the north rim of Big Indian Gorge. The sampled stands lie within the headwater drainages of Fence, Mud, Little Fir, Big Bridge, Little Bridge, McCoy, and Dingle Creeks. Stands near Fish Lake and Jackman Park were also sampled (see enclosed map for stand locations).

We sampled 129 aspen stands between October 16 and 23, 2002. Stand elevations ranged from 6,370 to 8,130 feet. The two lowest elevation stands, which contained juniper seedlings and saplings, are within the zone of overlap between the juniper and aspen vegetation zones

(see images 47 and 48). The highest elevation stands contained bent, stunted krumholtz trees (see images 1 and 6). For the purposes of this study, an aspen stand was defined as a contiguous group of trees with similar overstory structure. Accordingly, a large clump of aspen with one area of closed, vigorous overstory and another area with an open, senescent overstory would be treated as two stands, with one sample plot in each stand.

This study was designed to sample selected parameters quickly, allowing a broad area and range of stand types to be included. Plots were placed entirely within the stand in a location typifying the stand. Visual estimates of cover and overstory senescence were taken in a 5.62 m radius plot (100 m^2). Cover was recorded for three crown positions: overstory, recruitment, and understory. Overstory trees were defined as equal to or greater than 75% of mature stand height; recruitment trees were equal to or greater than 2 m tall and up to 75% of mature stand height; and understory trees were less than 2 m tall (Wall et al. 2001). Recruitment trees are tall enough to be resistant to browsing by cattle, deer, or elk and are considered to have good potential to become part of the overstory. Overstory senescence was the percent of overstory trees that are dead or showing signs of decline, including many dead limbs, conks, or weeping cankers.

To determine the approximate date of initiation of the recruitment layer, stem ages were quantified for the recruitment trees on 75 plots (Table 1). One age was determined at each sampled stand. Because of the episodic root sprouting nature of aspen, it was assumed that the sampled ages reflected the ages of the recruitment layers. We tested this assumption twice, sampling five recruitment tree stems at one stand and three at another. In most stands, a recruitment tree was sampled with an increment borer or was destructively sampled by cutting it through at the base and removing a stem “cookie” from the bole. Using the method of Asherin and Mata (2001), cores and cookies were sanded with progressively finer sandpaper, stained, and annual growth rings counted using a dissecting microscope.

Table 1. Number of plots and recruitment ages determined in allotments.

Allotment	Total Plots	Plots with recruitment ages determined (n)
Fish Creek/Big Indian	23	10
Hardie Summer	27	13
Otley	67	46
Scharff	12	6

Historic grazing records for BLM allotments were obtained from Burns District BLM personnel (Burns District 2003). See Appendix A for a table of years for which grazing data were available. Survey plots were placed in four grazing allotments (Table 1). Deer and elk population histories on Steens Mountain were obtained from a local Oregon Department of Fish and Wildlife biologist (Garner 2003).

Historic precipitation records for the project area were obtained from the Fish Creek Snotel (7,900 foot elevation) , which happened to be located within one of the sampled aspen stands (NRCS 2003). Mean annual precipitation at the station is 44.4 inches; the period of record is 1979-2002. Of note is the unusually high precipitation that prevailed in two years, with water year 1984 precipitation being 64.5 inches and 1985 precipitation being 71.0 inches.

A digital image was taken at each plot to provide a visual record of stand structure (see enclosed CD for images of sampled aspen stands). A GPS device was used to record plot

location data (see Appendix B for UTM locations of plots). This location data will enable aspen stands to be relocated for future monitoring.

RESULTS

Stand Structure

Forty six stands (36% of all the sampled stands) had overstory senescence of 50% or greater. Sixty six stands (51%) had a recruitment layer cover of 25% or more. Stands were classified into three major types (Table 2):

1) "Single-tier" stands were defined as those having recruitment tree cover of 0-0.3 times that of the overstory.
2) "Two-tier" stands were defined as those having recruitment tree cover of more than 0.3-1.7 times that of the overstory.
3) "Replacement" stands were similar to two-tier stands, but the recruitment layer was replacing a senescent or sparse overstory. They were defined as stands where recruitment layer cover was over 40%, and was more than 1.7-60.0 times that of the overstory.

Some stands did not fit well into the above three types. There were 14 multi-age stands having overstory cover less than 65%, and recruitment of 0.4 to 1.0 times that of the overstory. These stands also had 5-15% cover of understory trees. Thirteen stands were classified as "krumholtz" types because the overstory stems were greatly twisted and rarely greater than large shrub size. Four sampled stands were at risk of near term die-out. Two of these, #43 and #60, had recently burned. The overstory stems were dead, and new sprouts were emerging but were being heavily browsed by cattle and elk. Two other stands, #99 and #126, have no overstory remaining and recruitment is too weak to re-establish the stand (Appendix C).

Table 2. Stand type summary, numbers of plots, and ratios of recruitment to overstory cover (R:O).

Stand Type	Number of plots (n)	R:O ratio
Single tier	45	0-0.3
Two tier	32	>0.3-1.7
Replacement	21	>1.7-60.0
Multi-age	14	0.25-1.33
Krumholtz	13	na
Nearly dead or recently burned	4	na

Stand condition varied within the categories. For example, some single-tier stands with senescent mature overstories and little recruitment may be at risk of dying out. Other single-tier stands with vigorous youthful overstories are still allocating resources to overstory stems rather than to a new recruitment cohort. The degree of detectable senescence varied within the two-tier, replacement, and multi-age stands as well. Some stands that appeared to have a vigorous, youthful overstory also had a dense recruitment layer. Closer examination often showed the overstory stems to have conks or weeping cankers, indicating that presence of the recruitment layer was likely a response to disease stress in the overstory.

Stem ages

To check variation in recruitment ages, five recruitment trees were sampled for age in one stand and three were sampled in another. Age determinations of the two stands were quite similar: 13, 14, 15, 16, and 17; and 7, 8, and 8 years. It was decided that one sample of

recruitment age per stand would be adequate for estimating the age of the recruitment layer. The distribution of recruitment ages in Fish Lake/Big Indian, Hardie Summer, and Otley allotments is shown in Figure 1. Included are the 64 recruitment ages from the period for which we have grazing histories.

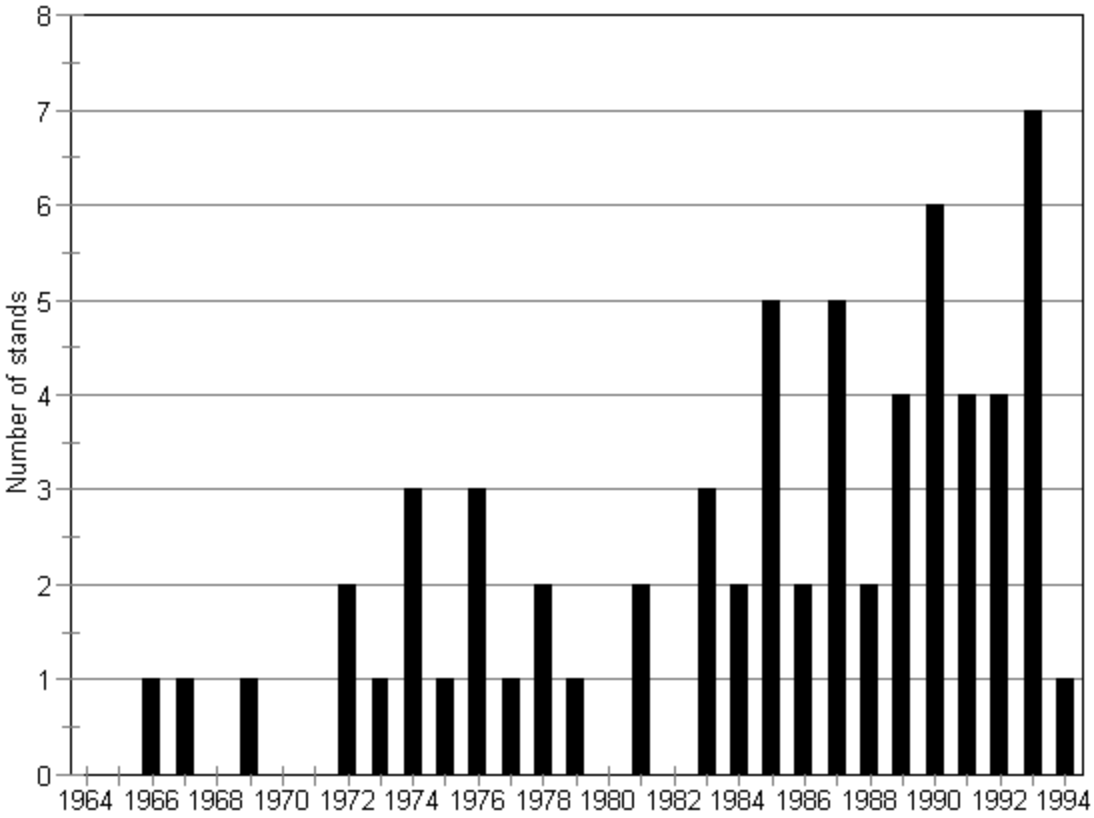

Figure 1. Date of recruitment layer initiations for aspen stands in the combined Fish Lake/Big Indian, Hardie Summer, and Otley allotments, 1964 through 1994.

Assessing the Impacts of Herbivory

Due to incomplete grazing history data, robust comparisons of grazing levels could not be made between pastures or allotments. For example, the Scharff allotment had only partial grazing history, so plots in this allotment were removed from the herbivory analysis. The available grazing history is agency billing data, which may not represent actual livestock levels on site. Fish Creek/Big Indian, Hardie Summer, and Otley allotments had continuous grazing records from 1964 to 1994. Grazing levels on these three allotments show a general decline, particularly in the mid-1980s (Figures 2A and 2B). Except for 648 to 983 AUMs of sheep during 1987 to 1993, all AUMs on the three allotments are cattle,

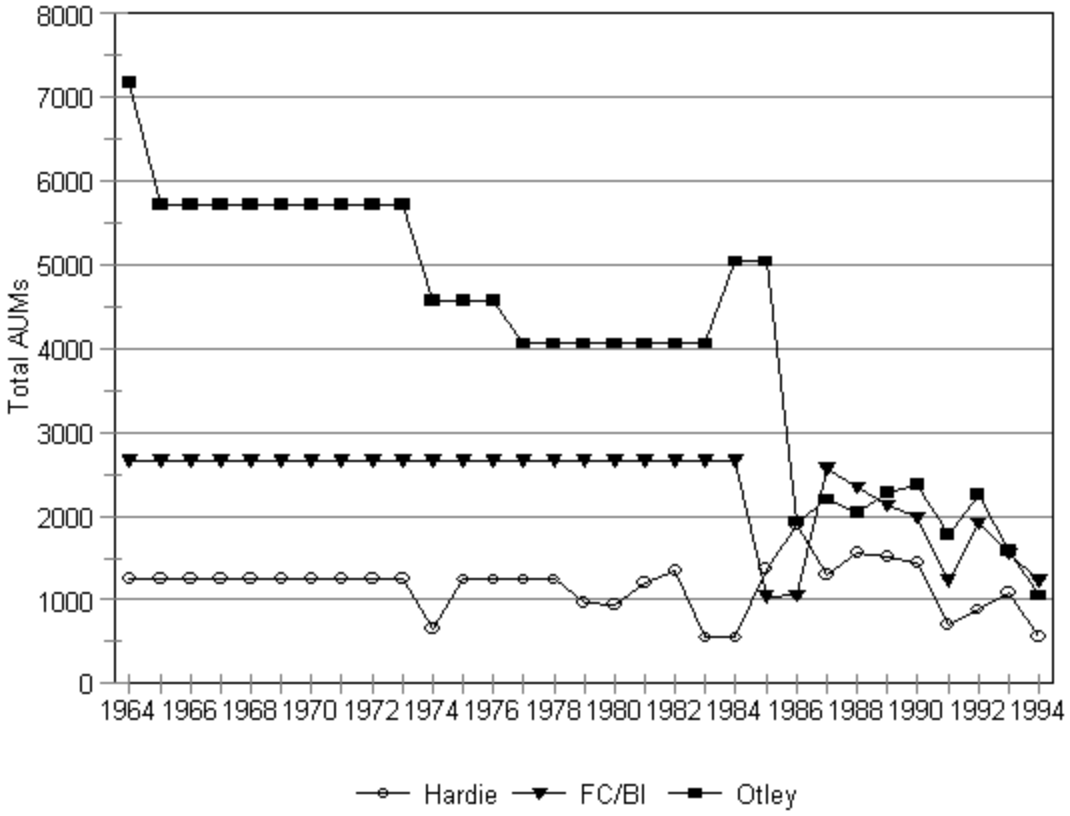

Figure 2A. Estimated total AUMs for Fish Lake/Big Indian, Hardie Summer, and Otley allotments, 1964 through 1994. (Hardie=Hardie Summer; FC/BI=Fish Creek/Big Indian)

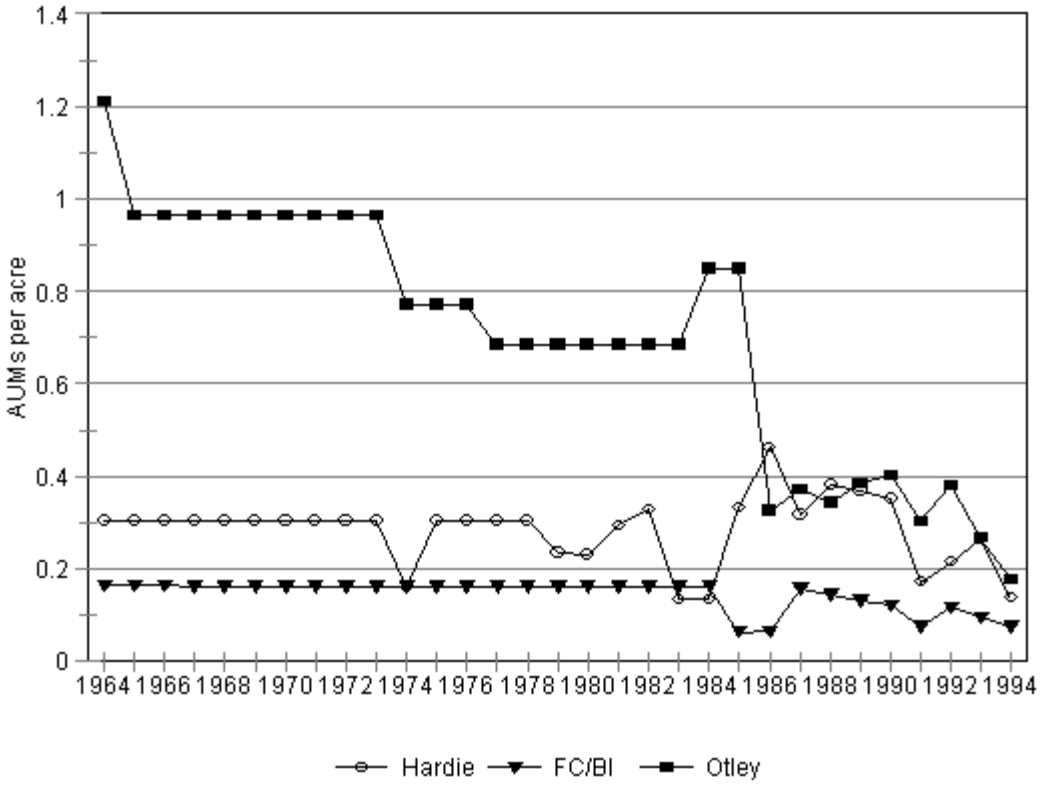

Figure 2B. Estimated AUMs per acre for Fish Lake/Big Indian, Hardie Summer, and Otley allotments, 1964 through 1994.1994. (Hardie=Hardie Summer; FC/BI=Fish Creek/Big Indian)

Historic inventories of wild ungulate populations on Steens Mountain were reported by an ODFW biologist in Hines, Oregon (Garner 2003). Deer populations were very low at the turn of the century, increasing by the 1930s, and were high through the 1950s and early 1960s, averaging approximately 15,000 animals. Deer populations have dropped since the mid 1960s, with present levels being approximately 5,000 animals. Very few elk were seen in the late 1950s, a few more in 1970s, and then numbers increased through the 1980s and 1990s. Present levels are estimated at 400-500 animals on Steens Mountain. Elk occur north of the North Loop Road; they are present in the Kiger, McCoy, and Fir Creeks drainages. Elk have not been observed in the Fish Creek drainage.

DISCUSSION

Replacement of the overstory by a recruitment layer is occurring in the majority of aspen stands. Sixty percent of the stands sampled have senescent overstories, a two-tier structure, or both. In many stands a recruitment layer is present even though there are no obvious sources of stress to the overstory. Reasons for simultaneous regeneration in a majority of stands may relate to historical changes in grazing patterns, fire history, or disease. Among single-tier stands, some are senescent and failing to regenerate. These are often in the vicinity of camps used by livestock, herders, and hunters. Other single-tier stands have vigorous overstories, and have not reached a life stage where apical dominance shifts to root sprouts.

We sampled present-day stand characteristics to assess stand condition. Equally important in understanding stand condition is the historical context of the stands. From the late 1800s to 1934 Steens Mountain was open summer range for over 100,000 sheep (Pederson 2003). The 1934 Taylor Grazing Act divided grazing lands into allotments, effectively ending the era of the most destructive sheep grazing on Steens Mountain. It is reported that sheep browse aspen more heavily than cattle, consuming up to four times more aspen sprouts (USDA 1937). Reduction of browse pressure may have resulted in a pulse of aspen root sprouts in some aspen stands. This mid-1930s pulse of recruitment, now 65-70 years old, may be the overstory trees in many present-day aspen stands on Steens Mountain. The late-1980s through early-1990s pulse of recruitment trees in our samples (Figure 1) may signal the beginning of senescence of the mid-1930s cohort.

Decreased cattle grazing since the 1980s may be aiding the recruitment event. A general decrease in AUMs on the mountain since the mid-1980s corresponded with increased initiation of recruitment layers during the same time period. The high precipitation levels in the mid-1980's may also be related to the recruitment event, although we know of no mechanism whereby two years of wet conditions would translate into such a sustained period of recruitment.

It could also be hypothesized that natural or human initiated fire on Steens Mountain could have reset regeneration during the late 1800's or early 1900's. Although fire is responsible for maintaining and stimulating growth of aspen stands, aspen forests do not readily burn (Jones and DeByle 1985). Only two small stands have burned in the recent past. In 2002 we observed other recently burned areas where wildfires burned through sagebrush and stopped at the edge of aspen stands. On Steens Mountain the combination of higher precipitation at upper elevations, active fire suppression, and fuel reduction during the many years of heavy grazing may have prevented fire from influencing stand structure during the past 70-80 years.

We observed conks (*Phellinus tremulae*), weeping cankers, and insect bore holes in 28 stands. Fungal pathogens are common in aspen, particularly in mature stands (Hinds 1985). Such pathogens may trigger a shift in apical dominance to root sprouts. Smaller diameter stems were sometimes attacked near the base by boring insects. Gnarled tree butts occurred in many regenerating stands where overstory tree trunks were straight. The cause of this phenomenon was unclear, but could be due to differences in snowpacks during establishment years.

A number of stands on Steens Mountain are in poor condition. Among these are eleven single-tier stands having no little or no regeneration. Some of these stands are long-term human camp sites or areas where cattle concentrate, often near a water source. Soils are compacted and the sparse root sprouts are heavily browsed. The two recently burned stands have 100% overstory mortality, and although the stands are root sprouting, they are heavily browsed by cattle and elk. A few high elevation stands appear to be occupying marginal sites in dry sagebrush, and the widely spaced overstory trees are dead or dying. Again, the root sprouts in these sparsely stocked stands are heavily browsed. Protection from herbivory would aid the recovery of these stands.

The above hypotheses about factors contributing to present-day stand structure in the CMPA are necessarily constrained by the limitations of available data. Grazing histories, big game population histories, and fire histories are often incomplete and encompass areas larger than the individual stands of interest. Thus, the intensity and impacts of disturbance are difficult to quantify. Given these constraints, we focused on the period for which we have direct grazing and climate data.

Our 2003 assessment of aspen stand condition provides a quantitative baseline for future monitoring. Specifically, these methods allow for assessment of stand condition and detection of key changes in stand structure over time. Regardless of the causes contributing to ongoing

recruitment, we recommend careful monitoring of overstory senescence and understory recruitment. If stand overstories are indeed becoming senescent, successful recruitment of understory sprouts may depend on limiting livestock and big game herbivory. Quantitative monitoring of aspen stands in the CMPA will provide a basis for adjustment of management practices and targets through time.

References

Asherin, L.A. and S.A. Mata. 2001. Basic tree-ring sample preparation techniques for aging aspen. pp 347-351. In: Shepperd W.D. et al., editors, Sustaining Aspen in Western Landscapes: Symposium Proceedings; 13-15 June 2000; Grand Junction, Colorado. Proceedings RMRS-P-18. Fort Collins, CO: USDA, FS, RMRS. 460 pp.

Burns District. 2003. Grazing allotment records on file at Burns District office, Burns, Oregon.

DeByle, N.V. 1985a. Animal impacts. pp 115-123. In: DeByle, N.V.; Winokur, Robert P., editors. Aspen: ecology and management in the western United States. Gen. Tech. Rep. RM-119. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 283 pp.

DeByle, N. V. 1985b. The role of fire in aspen ecology. In: Lotan, James E.; Kilgore, Bruce M.; Fisher, William C.; Mutch, Robert W., technical coordinators. Proceedings--Symposium and workshop on wilderness fire; 1983 November 15 - November 18; Missoula, MT. Gen. Tech. Rep. INT-182. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 326.

Fowells, H.A. 1965. Silvics of Forest Trees of the United States. Agricultural Handbook Number 271, U.S. department of Agriculture, Washington, D.C. 762 pp.

Franklin, J.F. and C.T. Dyrness. 1973. Natural Vegetation of Oregon and Washington. Oregon State University Press. Corvallis. 452 pp.

Garner. 2003. Personal Communication with Ron Garner, biologist, Oregon Department of Fish and Wildlife, Hines, Oregon.

Hinds, T.E. 1985. Diseases. pp 87-106. In: DeByle, N.V.; Winokur, Robert P., editors. Aspen: ecology and management in the western United States. Gen. Tech. Rep. RM-119. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 283 pp.

Jones, J.R. and G.A. Schier. 1985. Growth. pp 19-24. In: DeByle, N.V.; Winokur, Robert P., editors. Aspen: ecology and management in the western United States. Gen. Tech. Rep. RM-119. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 283 pp.

Jones, J.R. and N.V. DeByle. 1985. Fire. pp 77-81. In: DeByle, N.V.; Winokur, Robert P., editors. Aspen: ecology and management in the western United States. Gen. Tech. Rep. RM-119. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 283 pp.

Kay, Charles E. 1993. Aspen seedlings in recently burned areas of Grand Teton and Yellowstone National Parks. Northwest Science. 67(2): 94-104.

Mansfield, D.H. 2000. Flora of Steens Mountain. Oregon State University Press. Corvallis. 410 pp.

Miller, R.F. and J. Rose. 1995. Historic expansion of *Juniperus occidentalis* (western juniper) in southeastern Oregon. Great Basin Naturalist 55:37-45.

National Water and Conservation Service (NRCS). 2003. Historic precipitation data for Fish Creek Snotel (OR18G02S). Available URL: ftp://ftp.wcc.nrcs.usda.gov/data/snow/snotel/table/history/oregon/18g02s_s.txt

Pederson, C. December 2003. Steens Mountain Arboglyphs. Available URL: http://www.steensmountain.com/steens_mountain_arborglyphs.htm

Ripple, W.J. and E.J. Larsen. 2001. The role of postfire coarse woody debris in aspen regeneration. Western Journal of Applied Forestry. 16(2):61-64

Sudworth, G. B. 1967. Forest Trees of the Pacific Slope. Dover Publications, Inc., New York. 455 pp.

U.S. Department of Agriculture, Forest Service. 1937. Range plant handbook. Washington, DC. 532 p.

Wall, T.G., R.F. Miller and T. Svejcar. 2001. Juniper encroachment into aspen in the Northwest Great Basin. Journal of Range Management. 54:691-698.

APPENDIX A

Appendix A. Aspen stand locations, Oct. 2002. Map datum NAD 27 CONUS. All locations are Zone 11T

Stand	Easting	Northing
1	368248	4729573
2	368581	4729871
3	368678	4730152
4	368443	4730240
5	368428	4730310
6	368556	4730513
7	368484	4730799
8	368529	4730837
9	368659	4730857
10	368719	4731102
11	368811	4731330
12	367845	4729945
13	367878	4730342
14	367913	4730377
15	368032	4730579
16	367800	4731090
17	367839	4731040
18	367582	4730944
19	367485	4731189
20	367432	4731231
21	367502	4731553
22	367456	4731612
23	367527	4731771
24	367453	4731755
25	366937	4731327
26	367136	4731280
27	365811	4734446
28	366485	4734578
29	366857	4734417
30	367152	4733792
31	367201	4733837
32	367126	4734861
33	367308	4736101
34	367546	4735418
35	367497	4735556
36	366935	4736367
37	366845	4736328
38	362951	4734667
39	362957	4735485
40	363010	4735593
41	363177	4735875
42	363297	4736068
43	363562	4736620
44	363586	4736609
45	362984	4736178
46	362399	4736529
47	361137	4736720
48	360886	4736099
49	361136	4735888
50	361359	4735716
51	361332	4735692
52	361312	4735609
53	367197	4730525
54	366842	4730479
55	366746	4730657
56	366694	4737937
57	365281	4740044
58	365292	4739971
59	365216	4740121
60	364256	4738453
61	364973	4738212
62	365031	4738378
63	365592	4738262
64	365572	4738335
65	365544	4734833
66	365383	4734736
67	365213	4734560
68	364965	4734618
69	364643	4734854
70	364559	4734922
71	364330	4734783
72	364082	4734796
73	364039	4734870
74	363906	4735043
75	363854	4735317
76	363805	4735528
77	364174	4736133
78	364231	4736111
79	364326	4736345
80	364337	4736421
81	364758	4736550
82	364957	4736524
83	365249	4736359
84	365337	4736052
85	365440	4736002
86	366585	4731571
87	366857	4731744
88	367009	4732036
89	367205	4732053
90	366948	4732321
91	366775	4732272
92	366728	4732334
93	366788	4732535
94	366748	4732496
95	366815	4732712
96	365459	4732946
97	365259	4732911
98	364992	4733015
99	364650	4733091
100	364840	4733358
101	364332	4733850
102	364850	4729779

Appendix A (Continued)

Stand	Easting	Northing
103	364044	4730314
104	363610	4730304
105	363103	4729653
106	362801	4729578
107	362883	4729415
108	363074	4729349
109	363141	4729260
110	363299	4729267
111	363455	4729270
112	363667	4729476
113	363719	4729491
114	364096	4729130
115	364748	4728761
116	364688	4728538
117	365373	4728392
118	365341	4728441
119	361980	4734566
120	362144	4734944
121	362225	4735110
122	362199	4735252
123	362382	4735039
124	362452	4735029
125	362531	4734973
126	362366	4734535
127	364861	4734006
128	364938	4734100
129	365205	4733929

APPENDIX B

Appendix B. Grazing history data on Steens Allotments; X=data on record.

Year	Fish Creek/ Big Indian	Hardie	Otley	Scharff
1958			X	
1959			X	
1960	X		X	
1961	X		X	
1962	X		X	
1963	X		X	
1964	X	X	X	
1965	X	X	X	
1966	X	X	X	
1967	X	X	X	X
1968	X	X	X	X
1969	X	X	X	X
1970	X	X	X	X
1971	X	X	X	X
1972	X	X	X	X
1973	X	X	X	X
1974	X	X	X	X
1975	X	X	X	X
1976	X	X	X	X
1977	X	X	X	X
1978	X	X	X	X
1979	X	X	X	X
1980	X	X	X	X
1981	X	X	X	X
1982	X	X	X	X
1983	X	X	X	X
1984	X	X	X	X
1985	X	X	X	
1986	X	X	X	
1987	X	X	X	
1988	X	X	X	
1989	X	X	X	
1990	X	X	X	X
1991	X	X	X	X
1992	X	X	X	X
1993	X	X	X	X
1994	X	X	X	X
1995		X	X	X
1996		X		X
1997		X		X
1998		X		
1999		X		
2000		X		
2001		X		

APPENDIX C

Appendix C, part 1. Poor condition stands identified in 2003 survey. (Elev.=elevation; Over.=overstory; senesce.=senescence; Recruit.=recruitment; R:O=recruitment:overstory cover ratio; C/F/B=conks/fungus/borers; Krum.=krumholtz)

Stand #	Elev.	Over. senesce.	Over. cover	Recruit. cover	Under. cover	Ratio R:O	C/F/B	Krum
1	7980	100	0	25	10		yes	yes
6	8100	100	0	5	35			yes
12	7760	50	40	20	15	0.5		
16	7650	80	55	15	1	0.3		
19	7710	15	45	25	20	0.6	yes	yes
25	7550	70	30	2	0	0.1		
40	6950	60	45	10	5	0.2		
43	6940	0	0	0	40			
60	6760	0	0	0	4			
64	6930	95	35	3	1	0.1		
66	7325	90	30	40	10	1.3		
68	7280	70	60	15	15	0.3	yes	
69	7150	90	25	10	5	0.4		
70	7135	70	40	1	0	0.0		
73	7070	60	20	20	1	1.0		
77	7040	70	65	15	2	0.2		
79	6975	100	10	75	10	7.5	yes	
80	6960	75	80	2	2	0.0	yes	
96	7420	65	25	45	0	1.8	yes	
97	7410	20	35	1	1	0.0		
99	7275	95	5	10	0	2.0		
100	7365	100	3	40	1	13.3	yes	
114	7255	20	50	0	0	0.0		
117	7480	65	60	5	0	0.1	yes	
118	7480	70	60	15	2	0.3		
123	6885	5	30	0.1	0.1	0.0		
126	7070	100	1	0	0	0.0		

Appendix C, part 2. Poor condition stands and comments.

Stand	Comments
1	mature trees all dead; young trees have gnarled butts with rot and borer holes and are breaking off; heavy cattle use.
6	hilltop "postage stamp" stand consists of one dead mature tree with many sprouts, 4 of which are > 2 meters; brown leaf disease.
12	decadent stand with very patchy regeneration.
16	large senescent scattered overstory with sparse regeneration, grass, molehills, fungus on stem tips
19	stunted stand with slow growth after the first 10 years; some gnarled, lots of blowdown, overstory senescent with fawn colored fungus on bark.
25	massive old aspen with little regeneration, hunter or herder camp; soil compacted, with thistles.
40	senescent, no recruits, lots of blowdown, and cow dung
43	recently burned, small 50X100 foot stand in open area; 100% overstory mortality, sprouts heavily browsed by deer and cattle; krumholtz.
60	very recent burn; sprouts all heavily browsed by cow and elk; some protection may occur when overstory blows down or is cut down.
64	big old trees with lots of blowdown and little recruitment; heavy cattle use.
66	decadent overstory falling over, patchy regrowth is bushy with dead tips
68	decadent tall young stand with about 20% dead stems and weeping sap in the rest; regenerating.
69	decadent stand on flat below cowpond; heavy cattle use.
70	decadent (rot) stand in sagebrush, with no regeneration; clumps of 6 meter tall young trees around the perimeter are rotten and conky too.
73	big-tree old open stand with little regeneration; brown leaves
77	old slow growing stand in depression on ridge; with very little regeneration; w of fence
79	young dead/dying overstory; regen defective with deadtops/cankers
80	young stand with conks, rotten cores, and greenish bark; no recruits
96	Fish lake, short straight trees, withe open areas due to overstory death; some conks and stem borers
97	open overstory, broad full crowns with no regeneration.
99	dying 1 acre stand with only a few recruits around the perimeter, dryish site.
100	most of stand has fallen; recruits have borers, dead tops; NE of cabin/corral
107	mature stand with lots of blowdown; patchy opening with patchy recruitment
114	old senescent stand; no recruits, on ephemeral creek, heavy livestock use
117	short midslope stand, diseased, senescent, weeping cankers, conks, and insect holes; almost no regeneration
118	across (w) of fence from 117; overstory in same condition, but more regeneration
123	valley bottom giants, with almost no sprouts; above willow stand and cow pond, heavy cattle use.
126	overstory dead except for two nearly dead trees; in sagebrush on wide ridge, one recently downed has 4 browsed sprouts, 90 cm tall; clone once covered 4 acres.