



1991: 10 percent seedheads; percent cover: fescue 10, wheatgrass 2, pussytoes 1, needlegrass 1; herbage production 175 kg/ha.



1992: No seedheads; percent cover: fescue 15, pussytoes 2, Ross sedge 2, squirreltail 2; herbage production 225 kg/ha.



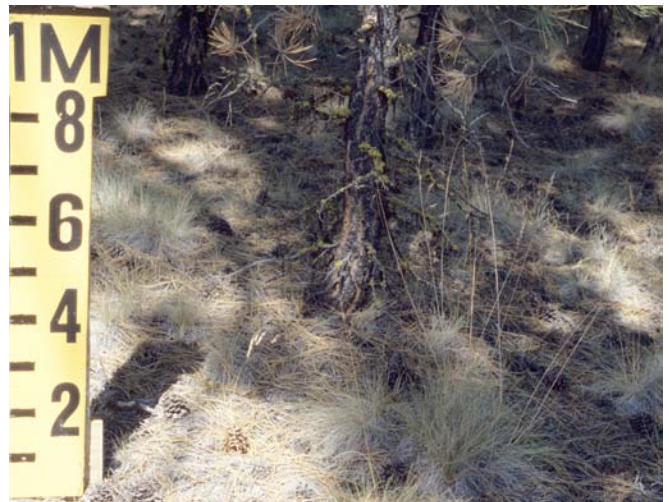
1995: No seedheads; percent cover: fescue 12, wheatgrass 2, squirreltail 2, Ross sedge 2; herbage production 225 kg/ha.



1996: No seedheads; percent cover: fescue 18, wheatgrass 2, squirreltail 4, Ross sedge 3; herbage production 300 kg/ha.



1999: 5 percent seedheads; percent cover: fescue 15, wheatgrass 3, squirreltail 2, needlegrass 2; herbage production 250 kg/ha.



2000: 10 percent seedheads; percent cover: fescue 18, wheatgrass 2, Ross sedge 2, pussytoes 1; herbage production 250 kg/ha.



1993: 10 percent seedheads; percent cover: fescue 20, wheatgrass 3, Japanese brome 6, yarrow 2; herbage production 300 kg/ha.



1994: 40 percent seedheads; percent cover: fescue 20, wheatgrass 10, yarrow 2, needlegrass 3; herbage production 350 kg/ha.



1997: 30 percent seedheads; percent cover: fescue 15, wheatgrass 2, Japanese brome 3, yarrow 2; herbage production 250 kg/ha.



1998: 10 percent seedheads; percent cover: fescue 18, wheatgrass 4, needlegrass 1, pussytoes 1; herbage production 275 kg/ha.



2001: 10 percent seedheads; percent cover: fescue 15, wheatgrass 2, pussytoes 2, needlegrass 1; herbage production 225 kg/ha.

The next few pages document a spring underburn and a precommercial thinning on this site.



2002: The stand was underburned in spring 2002. Patchy pine saplings were not thinned. Single trees in fuel-loaded areas were killed. The log in left background of 1978 was consumed.



2002: Spring underburn. Fescue (front center) was killed (white ash); some unburned fescue are green.



2004: Fescue has recovered and has abundant seedheads. Stand density is now appropriate for this savanna ponderosa pine site with its low stockability.



2004: 100 percent seedheads; percent cover: fescue 25, wheatgrass 1, Ross sedge 1, few species; herbage production 350 kg/ha.



2003: The stand was precommercially thinned to adjust stocking level in fall 2002. Slash was untreated. Fescue has greened up since the underburn in 2002.



2003: Precommercial thin, fall 2002. The cut pine sapling was only 5 cm diameter after 30 years.



2005: Some overstory trees have been harvested in the background. Fescue has several years accumulated dry foliage showing lack of livestock grazing. Most of the bitterbrush shown in 1957 and 1978 is missing, presumably owing to underburning, increasing tree canopy, and utilization by ungulates.



2005: 80 percent seedheads on older fescue; percent cover: fescue 20, some young fescue, few species; herbage production 300 kg/ha.



2006: Little change is apparent since 2004. There is scant evidence of bitterbrush reestablishment. Herbage production is between 300 and 350 kg/ha.



2006: 100 percent seedheads on all fescues; percent cover: fescue 20, wheatgrass 2. The grey patch in the front center is killed fescue, but one corner is apparently alive.

Comments

Over a 27-year period (data from table 2-203EPF-Pine/fescue):

- Seedheads were produced only 60 percent of the time. Abundant seedhead production, more than 50 percent of the bunchgrass plants flowering, only occurred 15 percent of the time. Yet abundant seedhead production has been used as an indication of good vigor and a healthy plant community (Committee on Rangeland Classification 1994, Pellant et al. 2005).

Good range condition means an end point in succession where the plant community is so competitive that earlier seral species are excluded (Committee on Rangeland Classification 1994, Pellant et al. 2005). How can maximum competition equate to maximum vigor and thus maximum seedheads? I feel they are not synonymous. Good condition has fewer seedheads than upward trend communities.

The precommercial thinning of 2002 reduced tree cover and root competition sufficiently to foster abundant seedhead production not seen in the previous 26 years.

- Herbage production averaged 262 kg/ha but varied from 150 to 350 kg/ha, a 2.25-fold difference on the same good range condition site. Production seemed to increase following precommercial thinning. Pellant et al. (2005) considered herbage production a criteria for evaluating rangeland health.
- Color of fescue varied from greenish-gray to green over the years. Inclusion of dead, gray leaves and stems tends to reduce fescue palatability to ungulates. Thus differences in August color suggest variability in dates when forage is preferred implying that a flexible grazing management system might be beneficial for ungulates.
- Change in the plant community since precommercial thinning suggests an “upward range trend” shown by plant vigor and production. On forested rangeland,

tree cover and competition can influence herbaceous vegetation at least as much as livestock.

- Savanna pine sites are a transition from grassland or sagebrush to forest. Trees can **barely** become established and grow. This site is an example. Stockability is only 14 m²/ha (Hall 2004) for a site index of 19 m. Normal yield tables suggest an average of 40 m²/ha (Meyer 1938). Compare height of saplings between 1957 and 2002: a period of 45 years, yet they are only 4 m tall, not 12 m (Meyer 1938). Saplings have stagnated and have not self-thinned. Thinning to low stand densities provides room for trees to grow and room for herbaceous vegetation to flourish.

Table 2-203EPF—Ponderosa pine/Idaho fescue. Yearly canopy cover by species, plants with seedheads per year, and statistics on total yearly herbage production, canopy cover, and ratio of production to canopy cover

Year	Canopy cover by species code ^a									Seedheads	Herb cover	Herbage production	Ratio cover/production
	FEID	PSSPS	ELELE	CARO5	ANST2	ACOC9	BRJA	ACMI2	Ratio				
	<i>Percent</i>										<i>Percent</i>	<i>kg/ha</i>	<i>Ratio</i>
1979	20	5	5								30	300	10.0
1980	15	5	2	2							24	250	10.4
1981	25	7				2				60	34	350	10.3
1982	25	2			2					10	29	300	8.8
1983	15	2		2	2						21	200	9.5
1984	15			2		2		1			20	225	11.3
1985	20		5						8		33	325	9.8
1986	12	2		1	1						18	150	9.4
1987	15	8					3			50	28	250	8.9
1988	15	2	2	2							21	200	9.5
1989	18	2	3							20	23	235	10.3
1990	20	5		2							29	300	10.3
1991	10	2			1	1				10	14	175	12.5
1992	15		2	2	2						21	225	10.7
1993	20	3						6	2	10	31	300	9.7
1994	20	10					3		2	40	35	350	10.0
1995	12	2	2	2							18	225	12.5
1996	18	2	4	3							27	300	11.1
1997	15	2						3	2	30	22	250	11.4
1998	18	4			1	1				10	24	275	11.5
1999	15	3	2					2		5	22	250	11.4
2000	18	2		2	1					10	23	250	10.9
2001	15	2			2	1				10	20	225	11.3
2004	25	1		1						100	27	350	13.0
2005	20				11					80	31	300	9.6
Mean	17.4	3.4	3.0	1.9	1.5	1.9	5.7	1.7	XXX	Mean	25.0	262	10.7
Count	25	21	9	12	8	8	3	4	15	SD	5.9	54.3	1.6
Percent	100	85	35	48	31	31	12	16	60	5% CI	2.3	21.3	0.63

Note: SD = standard deviation; CI = confidence interval.

^aSee “Species List: Codes” for plant code definitions.

Low Sagebrush/Bluebunch Wheatgrass Site: Herbage Dominance and Production

An original ecology plot, number 88, is the sampling location for this study. It was installed in 1959 to measure vegetation and soil attributes for development of range condition guides (USDA FS 1967c). The area had been sheep range that was converted to cattle range. It has not been grazed since 1950. It is located on the Emigrant Creek District, Malheur National Forest about 64-km north of Burns, Oregon. All herbage production sampling was done between August 1 and 4 each year since 1977 and is continuing.



1959: The low sagebrush/bluebunch wheatgrass community in 1959 with juniper slowly colonizing the site. The colonization is very slow as shown below and on the last pages of this section.



The soil is residual derived from flow andesite and is stony on the surface. Texture is stony silt loam. The 4-dm depth occurs in a 500-mm precipitation zone supporting ponderosa pine. Because the shallow soil's field capacity is exceeded, it becomes water logged in the winter and early spring apparently precluding pine establishment. Juniper occurs on fault lines.



1978: The first sampling season for this study showing little change in juniper density. Herbaceous vegetation is dominated by bluebunch wheatgrass. Bitterbrush occurs sporadically and is heavily hedged. Images were not available for 1986 and 2000.



1978: Percent cover: bluebunch wheatgrass 40, low sagebrush 8, Sandberg bluegrass 8, and squirreltail at 3. Wheatgrass did not produce seedheads, only bluegrass had heads. Grass was still fairly green the first of August; herbage production 350 kg/ha.



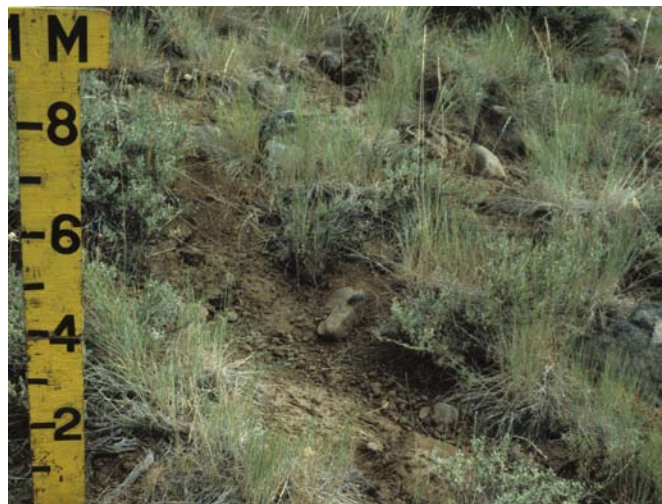
1979: No seedheads; percent cover: wheatgrass 30, bluegrass 8, low sagebrush 9; herbage production 250 kg/ha.



1980: 20 percent seedheads on wheatgrass; percent cover: wheatgrass 45, bluegrass 7, low sagebrush 8; herbage production 350 kg/ha.



1983: No seedheads; percent cover: wheatgrass 35, bluegrass 8, squirreltail 2, low sagebrush 8; herbage production 300 kg/ha.



1984: 10 percent seedheads; percent cover: wheatgrass 30, bluegrass 8, squirreltail 2, low sagebrush 7; herbage production 250 kg/ha.



1988: No seedheads; percent cover: wheatgrass 40, bluegrass 8, squirreltail 3, junegrass 2, low sagebrush 11; herbage production 350 kg/ha.

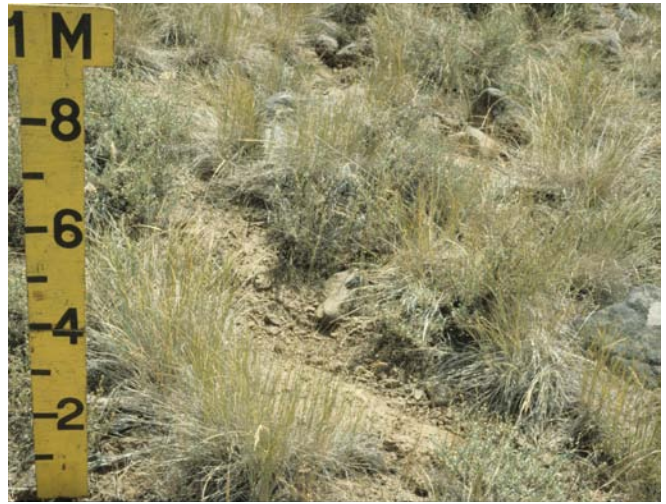


1989: No seedheads; percent cover: wheatgrass 35, bluegrass 7, junegrass 1, phlox 1, low sagebrush 11; herbage production 325 kg/ha.

Variation in Shrub and Herb Cover and Production on Ungrazed Pine and Sagebrush Sites in Eastern Oregon



1981: 60 percent seedheads; percent cover: wheatgrass 50, bluegrass 8, squirreltail 2, onion 2, low sagebrush 9; herbage production 500 kg/ha.



1982: No seedheads; percent cover: wheatgrass 45, bluegrass 6, onion 2, low sagebrush 8; herbage production 350 kg/ha.



1985: 10 percent seedheads; percent cover: wheatgrass 25, bluegrass 4, low sagebrush 8; herbage production 200 kg/ha.



1987: 10 percent seedheads; percent cover: wheatgrass 40, bluegrass 8, junegrass 4, low sagebrush 10; herbage production 400 kg/ha.



1990: 10 percent seedheads; percent cover: wheatgrass 50, bluegrass 8, squirreltail 8, needlegrass 5, low sagebrush 11; herbage production 600 kg/ha.



1991: 20 percent seedheads; percent cover: wheatgrass 45, bluegrass 10, junegrass 3, low sagebrush 11; herbage production 475 kg/ha.



1992: No seedheads; percent cover: wheatgrass 45, bluegrass 10, squirreltail 8; low sagebrush 11; herbage production 475 kg/ha.



1993: 30 percent seedheads; percent cover: wheatgrass 35, bluegrass 10, junegrass 12, squirreltail 8, low sagebrush 10; herbage production 400 kg/ha.



1996: No seedheads; percent cover: wheatgrass 35, bluegrass 8, junegrass 2, squirreltail 4, low sagebrush 5; herbage production 400 kg/ha.



1997: No seedheads; percent cover: wheatgrass 40, bluegrass 8, lomatium 2, low sagebrush 4; herbage production 425 kg/ha.



2001: 40 percent seedheads; percent cover: wheatgrass 50, bluegrass 10, junegrass 6, low sagebrush 3; herbage production 550 kg/ha.



2002: No seedheads; percent cover: wheatgrass 35, bluegrass 8, junegrass 4, low sagebrush 4; herbage production 350 kg/ha

Variation in Shrub and Herb Cover and Production on Ungrazed Pine and Sagebrush Sites in Eastern Oregon



1994: 80 percent seedheads; percent cover: wheatgrass 55, bluegrass 10, squirreltail 8, low sagebrush 8; herbage production 525 kg/ha.



1995: No seedheads; percent cover: wheatgrass 25, bluegrass 8, junegrass 2, squirreltail 2, low sagebrush 6; herbage production 300 kg/ha.



1998: No seedheads; percent cover: wheatgrass 40, bluegrass 8, onion 4, junegrass 4, low sagebrush 4; herbage production 400 kg/ha.



1999: No seedheads; percent cover: wheatgrass 35, bluegrass 6, oatgrass 2, low sagebrush 3; herbage production 325 kg/ha.



2003: 10 percent seedheads; percent cover: wheatgrass 25, bluegrass 10, phlox 2, dandelion 1, low sagebrush 6; herbage production 250 kg/ha.



2004: 30 percent seedheads; percent cover: wheatgrass 20, bluegrass 12, phlox 2, low sagebrush 6; herbage production 200 kg/ha.



2005: Juniper, low sagebrush, some bitterbrush, wheatgrass, and Sandberg bluegrass as it looks after 26 years. Note the decline in wheatgrass since 2002 and compare this image with the 1978 image.



2005: No seedheads; percent cover: wheatgrass 22, bluegrass 14, needlegrass 3, low sagebrush 7; herbage production 250 kg/ha.

Comments

Over a 26-year period (table 3-088EPF-low sagebrush/bluebunch wheatgrass):

- Seedheads were produced only 54 percent of the time. Bluegrass usually contributed most when seedhead density was low. Because best range condition suggests maximum competition, which excludes early seral species, one should question maximum seedhead production if it also implies maximum vigor (Committee on Rangeland Classification 1994, Pellant et al. 2005).
My interpretation is that this is the best condition plant community for this site potential and would produce fewer seedheads than an upward trend community.
- However, something seems to have happened starting in 2002. Cover of wheatgrass and herbage production decreased from an average of about 60 percent and 375 kg/ha, to only 42 percent and 250 kg/ha, respectively. There is no evidence of livestock overgrazing; in fact, no evidence of grazing at all. I do not have an explanation for this change in the plant community.
- Herbaceous canopy cover averaged 50 percent and varied from 29 to 83 percent, a 2.9-fold difference. This yearly variation clearly limits canopy cover as a means for evaluating range condition. When observer variability is considered, the 16 to 44 percent reported by Coles-Ritchie et al. (2004) further reduces the value of canopy cover.
- A crude estimation of herbage production may be obtained by multiplying total herbage cover by a factor of 7.3. For the 2005 example above: $22 + 14 + 3 = 39$; $39 \times 7.3 = 285$ kg/ha. Low sagebrush 7 percent cover is not counted as contributing to herbage.
- Herbage production varied from 200 to 600 kg/ha over the 26-year period, averaging 367 kg/ha, a threefold difference. Production less than 275 kg/ha occurred five times (20 percent). This yearly variation might be considered in livestock manage-

ment. Pellant et al. (2005) considered herbage production as a criteria for evaluating rangeland health. These data suggest it should be used with caution.

- Color of wheatgrass during the first four days of August varied from totally dry (1979) to bright green (1993) with all degrees of curing in between. Because curing of vegetation affects its palatability, this seasonal variation might be considered in livestock management.

Table 3-088EPF—Low sagebrush/bluebunch wheatgrass. Yearly canopy cover by species, plants with seedheads per year, and statistics on total yearly herbage canopy cover, herbage production, and ratio of production to herbage canopy cover

Year	Canopy cover by species code ^a								Seedheads	Herb cover	Herbage production	Ratio cover/ kg/ha
	PSSPS	POSE	ELELE	KOMA	ACOCO	ALAC4	PHDO3	ARAR8				
	<i>Percent</i>									<i>Percent</i>	<i>kg/ha</i>	<i>Ratio</i>
1978	40	8	5					8	10	51	350	6.7
1979	30	6						8		34	250	7.3
1980	45	6						7	10	51	350	6.9
1981	50	8	2					7	60	60	500	8.3
1982	45	6						8	2	53	350	6.6
1983	35	8	2					8		45	300	6.7
1984	30	8	2					7	10	40	250	6.3
1985	25	4						8	10	29	200	6.9
1987	40	8		4				10	10	52	400	7.7
1988	40	8		2				11		50	350	7.0
1989	35	7		3				11	1	46	325	7.1
1990	50	8	8		5			11	10	71	600	8.5
1991	45	10		3				11	20	58	475	8.2
1992	45	10	8					11		63	475	7.5
1993	35	10	8	12				10	30	65	400	6.1
1994	55	10	8	10				8	80	83	525	6.3
1995	25	8	2	2				6		37	300	8.1
1996	35	8	4	2				5		49	400	8.2
1997	40	8						4		48	425	8.9
1998	40	8		4			3	4		55	400	7.3
1999	35	6						3		41	325	7.9
2001	50	10		6				3	40	66	550	8.3
2002	35	8		4				4		47	350	7.4
2003	25	10						2	6	37	250	6.6
2004	20	12						2	6	34	200	5.9
2005	22	14			3			7	13	39	250	6.4
Mean	37.4	8.3	4.7	4.7	4.0	2.3	1.7	7.4	XXX	Mean 50.2	367.3	7.3
Count	26	26	10	11	2	3	3	26	14	SD 12.7	107.0	0.8
Percent	100	100	38	42	8	11	11	100	54	5% CI 4.9	41.1	0.3

Note: SD = standard deviation; CI = confidence interval.
^aSee "Species List: Codes" for plant code definitions.