INFLUENCE OF A GRAZING SYSTEM AND ASPECT, NORTH VS. SOUTH, ON THE NUTRITIONAL QUALITY OF FORAGES, AND PERFORMANCE AND DISTRIBUTION OF CATTLE GRAZING FORESTED RANGELANDS

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Summary

A study was designed to determine if grazing treatment and pasture aspect has an effect on forage quality, ADG, and cattle distribution, and to determine if forage quality drives pasture preference within a mountain upland pasture. Fifty-two crossbred yearling heifers were assigned randomly to two treatments: (1) free choice, season-long access to both a grassland (south-slope aspect) pasture and a forest (north-slope aspect) pasture, riparian zone excluded; and (2) a predefined grazing system between the grassland and forest pastures, also with the riparian zone excluded. The grazing schedule for the managed system was mid-June to mid-July in the grassland pasture, mid-July to mid-September in the forest pasture, and a return to the grassland pasture mid-September to mid-October. Individual heifer weights were obtained every 28 days. Differences in animal performance between grazing systems were most pronounced during the final grazing period. In 4 of 5 years, total weight gain of managed heifers tended to be greater than the weight gain of free choice heifers. However, this difference was only significant ($P < 0.05$) in 2 of 5 years, averaging 9.1 kg. As the grazing season progressed, forage CP and IVDMD decreased ($P < 0.05$). As a result, weight gains decreased in the later periods as compared to gains early in the summer season ($P < 0.05$). Forage quality also was influenced by aspect ($P < 0.10$). Specifically, Idaho fescue (*Festuca idahoensis*) CP and IVDMD were greater for north vs. south facing aspects. Bluebunch wheatgrass (*Agropyron spicatum*) CP was higher ($P < 0.05$) for north aspects in 1 of the 2 years only. In this study, beef cattle performance and diet quality declined over time. Distribution patterns favored north aspects later in the grazing season.

Introduction

With increasing pressure for ranchers to use sustainable grazing management, grazing systems are being implemented to better utilize the plant communities present on the site and to better distribute the cattle across the landscape. It has been documented that as the grazing season advances, the energy content of grasses decreases, but levels tend to remain above requirements (Cook and Harris, 1968). Protein content of grasses tends to decrease as the season progresses, and levels usually dip below the requirements of the animal (Cook and Harris, 1968). Holechek et al. (1982a & b) observed that cattle on south exposure slopes tended to consume grasses throughout the year, whereas cattle grazing north-facing slopes had a greater diversity of grasses, forbs, and shrubs available. This, in turn, was reflected in their respective diets throughout the year. Because of influence of aspect on range vegetation diversity, the decreases of plant nutrient quality that we see may occur at different times of the year depending on site characteristics. Therefore, animal performance should be increased if a grazing system could take advantage of these possible differences.

In general, south facing slopes tend to be drier and contain more open areas, and north facing slopes are ecologically wetter and have a higher proportion of canopy cover. With these differences, forage quality and utilization by cattle would differ between north and south facing slopes (Harris, 1954; Vavra and Phillips, 1979). Because of these differences, cattle may prefer one habitat type to another.

The objectives of this study were: (1) To test the hypothesis that a managed grassland-forest grazing system would improve animal production versus the cattle grazed season-long in a mixed grassland-forest pasture; (2) To determine the seasonal forage quality in the season-long pasture and observe how this effected the cattle's preference for pasture aspect within the season-long pasture; and, (3) To observe cattle behavior on the season-long pasture and the habitat preference of cattle as influenced by season of use.

Materials and Methods

The study area was located in the Starkey Experimental Forest and Range (SEFR), located 35 km southwest of La Grande, Oregon. The pastures were located on the upland pastures on Meadow Creek. Meadow Creek is at an elevation of approximately 1,250 m above mean sea level. The average yearly precipitation is around 41.5 cm and mainly occurs in the winter and spring. On average, in 1 year out of 2, enough fall precipitation occurs to cause significant regrowth of grasses.

Beginning in mid-June, 52 yearling heifers were assigned randomly to one of two treatments, and grazing continued until mid-October. The grazing study commenced in 1982 and ended in 1986. In treatment 1, a grassland pasture and a forest pasture were used as the free choice, season-long grazing pasture. The free choice, season-long pasture was connected by a water gap to allow easy access to both pastures. The heifers were allowed free choice to decide which pasture they would graze in at any given day or time. Other than the water gap, heifers were excluded from the riparian zone. In treatment 2, the remaining grassland and forest pastures were used as the managed system of grazing. The forest and grassland pastures are of similar capacity. The managed group began on the grassland pasture in mid-June and then moved to the forest pasture in mid-July. They remained in the forest pasture until mid-September and then moved back to the grassland pasture for the remainder of the grazing season. Other than access to the creek for water, these heifers also were excluded from the riparian zone.

Heifer weights were obtained approximately every 28 days. Non-shrunk weights were taken due to the remoteness of the study area. All heifers were weighed after they had been allowed to drink in the morning to minimize the effects of water consumption/fill on heifer weights.

Holechek et al. (1982a & b) discovered that cattle on these pastures had a preference for Idaho fescue (*Festuca idahoensis*) and bluebunch wheatgrass (*Agropyron spicatum*). These plants are located in the grassland pastures and forest pastures, and they are in relatively similar abundance within aspect or habitat type. Samples were taken every week through the grazing season in 1982 and 1983 to determine crude protein and *In vitro* dry matter digestibility (IVDMD). Ten plots were clipped randomly and combined into a single sample for analysis.

Throughout the 1982 and 1983 grazing seasons, visual observations were conducted to determine the location of the heifers in the free choice pastures. Within an observation period, we recorded in which pasture heifers were located, grassland or forest. At the end of each day, total heifer hours were calculated for each pasture. Observations were conducted 4 days out of every week, and times observed were broken down into the following periods: 0500 to 1000 hr, 1000 to 1500 hr, and 1500 to 2000 hr.

Heifer performance was analyzed as a repeated measures design within year (SAS, 1997). Linear regression was used to determine the effects of season on forage quality. In addition, forage quality was analyzed using a completely randomized design and a 2x2x3 factorial arrangement of treatments contrasting year, aspect, and season within year.

Discussion

The heifers in the study showed varying gains throughout the grazing season (Table 1). In general, as the season progressed, cattle performance decreased. In 2 of the 5 years, heifers in the managed grazing system outperformed the free choice grazing system heifers by an increased total gain of 9 to 10 percent ($P < 0.05$).

When looking at heifer performance within the 28-day intervals, the variation in fill because of nonshrunk weights made it difficult to assess the true effects of the grazing treatment. However, the greatest amounts of variation of heifer weights tended to occur during the last two grazing periods. This would imply that during this time, nutritional stress is the highest and most variable.

The CP and IVDMD levels of Idaho fescue and bluebunch wheatgrass (Table 2) decreased as the season progressed ($P < 0.05$; Figures 1-4). In both years and in both pastures, the quality of the grasses was higher in the forested pasture than in the grassland pasture. The only exception was the crude protein content of Idaho fescue in 1982. In this year, the crude protein values were higher in the grassland pasture. When looking at differences between aspect, the only significant difference for bluebunch wheatgrass was for crude protein levels in 1982 ($P < 0.05$). However, all of the other values for bluebunch wheatgrass suggest the quality in the forested pasture tended to be greater than for the grassland pasture. Crude protein of Idaho fescue was significantly higher in 1982 ($P < 0.05$) and had significantly higher values of IVDMD in 1982 and 1983 ($P < 0.05$) for the forested pasture. IVDMD values of Idaho fescue over the 2 years showed two different trends. In 1982, as the season was progressing, the differences in IVDMD values between pastures became larger; but in 1983, the opposite trend was seen: differences in IVDMD values between pastures were getting smaller. These two differing trends could be due to intensity, duration, or timing of precipitation events, and/or the amount of regrowth following initial grazing of the plant.

Implications

Influence of forage quality can be a major factor in determining animal condition at the end of the grazing season. Toward the end of the grazing season, as forage quality begins to decline, animal performance declines, and variability of performance increases. Designing grazing systems that utilize forage quality calendars could increase kilograms of beef produced while keeping the stocking rate and land area the same. Grassland, south aspect slopes had their highest nutritive quality in the early season, and as the season progressed, quality dropped below animal requirements. Forested, north aspect slopes tended to have better quality later in the season and should be used at this time.

Literature Cited

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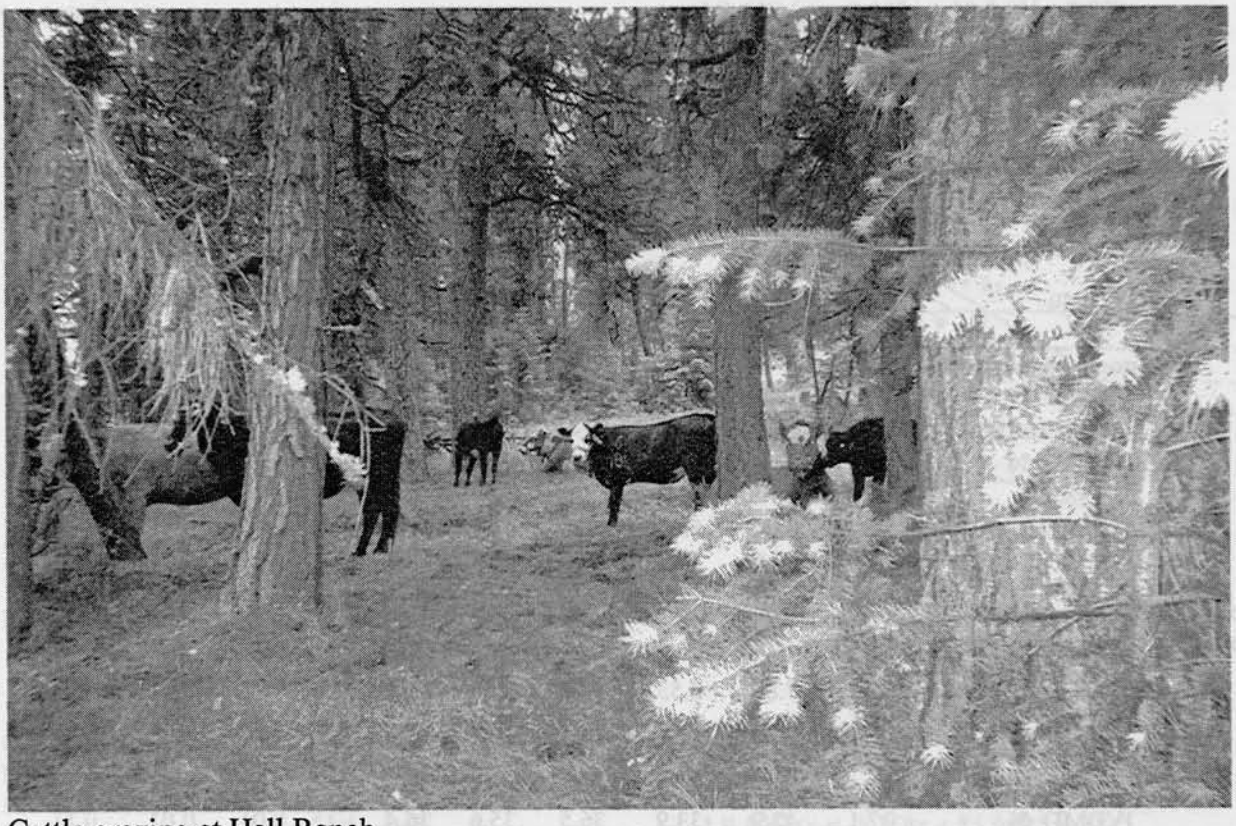

Cattle grazing at Hall Ranch

Table 1. Influence of season of use and grazing treatment on the gains of yearling heifer grazing forested rangelands in northeastern Oregon.

Year		Init. Wt. (kg)	Period gains (kg/d) 1	2	3	4	Total gain (kg)
1982	Managed	327	1.46	0.77	0.77[a]	0.38	96.4[a]
	Free choice	328	1.44	0.78	0.45[a]	0.39	88.2[a]
	SE[b]	7.97	0.05	0.05	0.09	0.04	2.34
1983	Managed	376	0.69	0.86	0.71	0.55[a]	77.7
	Free choice	376	0.68	0.80	0.71	0.29[a]	71.0
	SE	6.04	0.07	0.07	0.05	0.05	2.76
1984	Managed	334		1.34[a]	0.60[a]	0.97[a]	103[a]
	Free choice	333	0.53	1.56[a]	0.47[a]	0.73[a]	93.5[a]
	SE	4.70	0.04	0.07	0.04	0.05	2.57
1985	Managed	378	0.68[a]	0.33[a]	0.64	-0.26[a]	72.0
	Free choice	382	1.06[a]	0.54[a]	0.54	0.06[a]	68.1
	SE	5.45	0.06	0.07	0.04	0.08	2.23
1986	Managed	398	0.69	0.87[a]	0.44	-0.40[a]	49.4
	Free choice	398	0.78	0.68[a]	0.30	-0.08[a]	52.7
	SE	6.32	0.06	0.05	0.07	0.07	2.26

[a] Means within columns for specific years are different ($P < 0.05$).
[b] SE = Standard error of the mean (n = 26).

Table 2. Influence of season of use, and south (grassland) and north (forested) aspect on the nutritional quality of bluebunch wheatgrass and Idaho fescue in northeastern Oregon.

Item	Early South	Early North	Mid South	Mid North	Late South	Late North	SE[b]	Contrasts[a] Aspect	Season	Aspect x season
Bluebunch wheatgrass:										
1982:										
Crude protein, %	8.75	9.5	7.28	7.60	5.46	6.72	0.41	0.03	0.01	0.53
IVDMD, %	54.4	54.8	47.6	48.9	43.4	46.0	1.24	0.16	0.01	0.68
1983:										
Crude protein, %	7.32	8.04	5.67	6.70	4.34	4.87	0.55	0.10	0.01	0.89
IVDMD, %	50.4	50.6	42.3	45.0	36.5	40.1	1.90	0.17	0.01	0.65
Idaho fescue:										
1982:										
Crude protein, %	8.33	7.86	7.53	7.22	6.11	5.81	0.25	0.09	0.01	0.93
IVDMD, %	43.5	44.5	35.5	40.1	33.5	40.7	1.49	0.01	0.01	0.11
1983:										
Crude protein, %	6.48	7.66	5.76	7.16	6.07	6.54	0.25	0.01	0.01	0.18
IVDMD, %	37.1	42.9	33.9	36.5	35.6	36.4	1.15	0.01	0.01	0.11

[a] Preplanned contrasts evaluating aspect, season, and aspect by season interaction

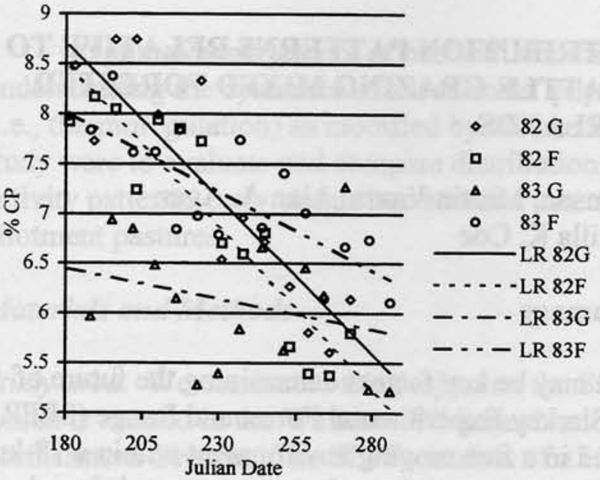

Figure 1. Influence of grassland (south) and forested (north) aspect on crude protein content of Idaho fescue.

G = Grassland
F = Forest
LR = Linear regression trend line
LR 82G ($y = -0.031x + 14.3$; $R^2 = 0.77$)
LR 82F ($y = -0.032x + 14.3$; $R^2 = 0.83$)
LR 83G ($y = -0.005x + 7.34$; $R^2 = 0.05$)
LR 83F ($y = -0.016x + 10.9$; $R^2 = 0.60$)

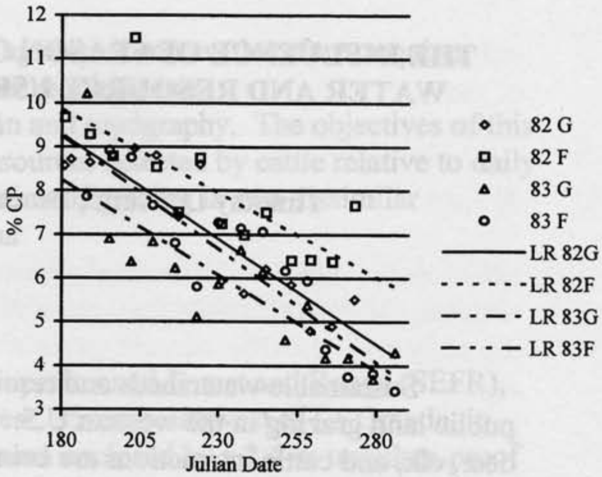

Figure 2. Influence of grassland (south) and forested (north) on the crude protein content of bluebunch wheatgrass.

G = Grassland
F = Forest
LR = Linear regression trend line
LR 82G ($y = -0.048x + 18.0$; $R^2 = 0.81$)
LR 82F ($y = -0.046x + 18.1$; $R^2 = 0.45$)
LR 83G ($y = -0.045x + 16.3$; $R^2 = 0.71$)
LR 83F ($y = -0.053x + 18.8$; $R^2 = 0.82$)

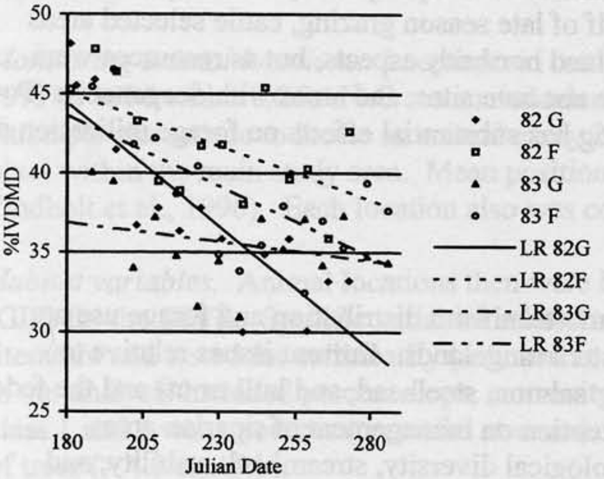

Figure 3. Influence of grassland (south) and forested (north) aspect on IVDMD content of Idaho fescue.

G = Grassland
F = Forest
LR = Linear regression trend line
LR 82G ($y = -0.156x + 72.3$; $R^2 = 0.74$)
LR 82F ($y = -0.068x + 57.4$; $R^2 = 0.34$)
LR 83G ($y = -0.024x + 41.3$; $R^2 = 0.08$)
LR 83F ($y = -0.091x + 60.2$; $R^2 = 0.46$)

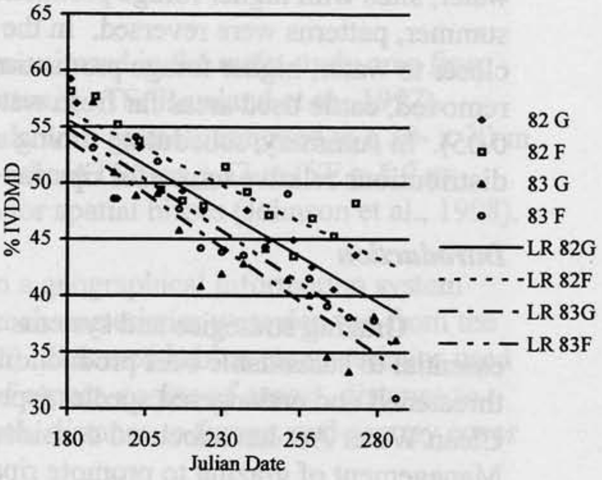

Figure 4. Influence of grassland (south) and forested (north) aspect on IVDMD content of bluebunch wheatgrass.

G = Grassland
F = Forest
LR = Linear regression trend line
LR 82G ($y = -0.168x + 85.9$; $R^2 = 0.84$)
LR 82F ($y = -0.130x + 79.9$; $R^2 = 0.74$)
LR 83G ($y = -0.194x + 88.9$; $R^2 = 0.84$)
LR 83F ($y = -0.185x + 88.3$; $R^2 = 0.79$)