

# SELECTIVE LIVESTOCK GRAZING: A TOOL FOR VEGETATION MANAGEMENT

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## SUMMARY

We report on four different projects exploring opportunities to enhance or alter forage characteristics or quality with manipulative grazing practices. These trials were designed to: 1) evaluate the potential for woody plant control by Spanish goats, 2) assess the seasonal effects of cattle grazing among newly established bitterbrush, 3) define the seasonal preferences of cattle grazing among crested wheatgrass and our native grasses, and 4) see if defoliation of Thurber's needlegrass at different times of the growing season can stimulate the production of highly nutritious regrowth. Spanish goats demonstrated little potential to affect established Wyoming big sagebrush. When herbaceous forages were dormant approximately 8 percent of their diet was derived from western juniper, suggesting they may hold some promise for controlling newly established or young trees with moderate cattle grazing, where 30 to 40 percent of available herbage was utilized. Recently established bitterbrush plants were seldom grazed when associated grasses were green and leafy. After 3 years, shrubs in early grazed pastures were twice as large as those in pastures with no livestock grazing. Cattle did graze young bitterbrush when grasses were dormant and brown, and greatly reduced shrub stature when compared with plants in non-grazed pastures. Among the eight different grasses common to the region cattle favored crested wheatgrass over native grasses early in the growing season and when grasses were flowering. After forages ceased growth and turned brown, the steers' preferences shifted to giant wildrye, but they did make more equitable use of all available grasses. Early to mid-season defoliation of Thurber's needlegrass can be used to stimulate production of high quality regrowth that may be reserved for late-season use by growing livestock or wildlife. Regrowth potential is severely limited in dry years, and managers should make grazing schedule adjustments to defer a pasture the next growing if it is heavily grazed in the early to mid-growing season.

## INTRODUCTION

Throughout history humans have attempted to manipulate vegetation to their own ends. Aborigines employed fire to alter the landscape composition, and tillage methods have been with us since the first intensive row-crop efforts. In this century selective and non-selective herbicides entered the picture and have been used for both intensive and extensive agricultural endeavors. In addition to controlling undesirable weeds or pests, we have chemicals that may be used to arrest or alter plant growth. While much of our intensive agricultural output is indeed chemical dependent, chemical usage has become prohibitively expensive and politically sensitive in the extensive rangeland settings of the western United States. Land managers are now exploring more "natural" means of manipulating vegetation. These include biological control of problem pests or weeds, controlled burns, and prescription grazing programs. The objective of this discussion is to briefly present results from some of our recent research trials that explore opportunities to manipulate the character or quality of our rangeland forages.

## **MATERIALS AND METHODS**

Four projects in the area will be reported on. These include: 1) a trial to evaluate the potential for woody plant control by Spanish goats, 2) a trial to assess the seasonal effects of cattle grazing among newly established bitterbrush, 3) trials to define the seasonal preferences of cattle grazing among crested wheatgrass and our native grasses, and 4) clipping trials on Thurber's needlegrass to see if defoliation at different times of the growing season can stimulate the production of highly nutritious regrowth.

### **Potential for woody plant control by Spanish goats**

Trials occurred on the Northern Great Basin Experimental Range on native rangeland pasture during two stages of plant growth. The objective was to assess potential impacts of goats on encroaching Wyoming big sagebrush and western juniper. The first 4-day trial occurred when all grasses and forbs were green and growing. The second was conducted after soil moisture reserves were depleted, and all grasses and forbs had stopped growing and turned brown. We measured the amount of forage available to the goats by clipping 25, 10.77 <sup>m</sup>² plots before each trial. Over 4 successive days eight goats were released in a 4.2 acre pasture each day and a technician equipped with a lap-top computer counted the number of bites each animal harvested from the first 50 plants it grazed. This generated a listing of 1,600 plants and the bites harvested from each plant for a 4-day trial.

### **Seasonal effects of cattle grazing among newly established bitterbrush**

Trials were conducted for 3 years on Bureau of Land Management property on foothill rangeland where the sagebrush and forest vegetation types come together. A wild-fire severely burned the area in 1990, and a portion of the revegetation effort was directed at reestablishing bitterbrush, a palatable shrub important to both livestock and wildlife. The vegetation was allowed 2 years to reestablish without grazing. In 1993, trials were initiated to see if grazing at different times of the year affected the cow's preference for bitterbrush or the well being of the shrubs. Levels of forage utilization were monitored by clipping 10.22 <sup>m</sup>² plots before and after the cattle grazed. Utilization of the bitterbrush was documented by measuring heights and crown diameters of 25 shrubs before and after grazing, and by checking each shrub for evidence of grazing every 2 days while cattle were present. Each trial was terminated when the level of herbaceous forage utilization approached 50 percent, or 90 to 95 percent of the shrubs had been grazed.

### **Seasonal preferences of cattle grazing among eight grasses**

Nine experimental paddocks 0.07 acres in size were established on the Northern Great Basin Experimental Range. Each paddock supported 800 plants equally divided among eight different species (100 plants of each species) planted on 2-foot spacings. Forages included: 1) Nordan crested wheatgrass, a long used and well established introduction to the region, 2) bluebunch wheatgrass, 3) Idaho fescue, 4) bottlebrush squirreltail, 5) Sandberg's bluegrass, 6) needle-and-thread grass, 7) Thurber's needlegrass, and 8) giant wildrye. Nine 2.47 acre pastures

were also established with electric fences on native rangeland to evaluate cattle preferences in settings where the availability of each forage was quite variable. Three pastures and three paddocks were grazed by steers during three different phases of the growing season. The first trials occurred when grasses were vegetative (leafy with no seed stalks visible), the second when reproductive stems were fully extended and the heads were flowering, and the last when all plants had ceased growth and turned brown (dormant). Cattle diets were quantified by following each of three steers and recording every bite harvested from each grass, on a lap-top computer. We measured available forage in each setting by clipping plants or plots before each trial.

### **Regrowth quality and quantity in Thurber's needlegrass**

One hundred fifty Thurber's needlegrass plants were transplanted to a common garden in the nursery area of the Northern Great Basin Experimental Range and allowed two growing seasons to reestablish themselves. Trials began in late April of the third- and fourth-growing seasons. At 2-week intervals, for 14 weeks, a group of eight plants was clipped to a 1-inch stubble yielding a total of seven different defoliation dates or treatments. Soil moisture was measured each time a group of plants was defoliated to see if moisture availability could be used to predict how much regrowth would occur. In both years all plants stopped growing by late July, and the regrowth was harvested from all treatments on 31 July. Regrowth samples were weighed and crude protein analyses were conducted to assess forage quality

## **RESULTS AND DISCUSSION**

### **Woody plant control by Spanish goats**

Among the various breeds of goats, Spanish goats are often regarded as browsers. At both stages of growth the goats exhibited a very diverse diet, utilizing 25 different species. Browse, however, was a minor component of their diet. When forages were actively growing forbs were the most prominent component of the diet (Table 1). Thread-stalk milk-vetch was most important at 28 percent. Yarrow ranked second at 17 percent, and clasping pepperweed was third at 9 percent. Roughly 28 percent of their diet came from grasses. Bluebunch wheatgrass ranked first at 9 percent, crested wheatgrass second at 8 percent, and Idaho fescue third at 5 percent. Less than 1 percent of their diet was taken from sagebrush, and slightly less than 1 percent was harvested from western juniper. Available herbage in these trials averaged 477 pounds per acre, and our pastures were stocked at a rate of approximately 1.6 goats/acre/month. After herbaceous forages were dormant, herbage production averaged 574 pounds per acre. The goats still relied heavily on forbs and grasses. Use of western juniper increased, however, to greater than 8 percent of total bites. Approximately half of these were juniper foliage and the remainder involved stripping bark from limbs or trunks of trees. Less than 1 percent of total bites were harvested from sagebrush.



Table 1. Percent of grasses, forbs, shrubs, and trees in diets of Spanish goats foraging in sagebrush/steppe rangeland pasture on the Northern Great Basin Experimental Range in 1993, near Burns, Oregon, at two stages of plant growth.

Growth stage of vegetation	Grasses	Forbs	Shrubs	Trees
Active growth	28.2	70.6	0.3	0.9
Dormant	34.7	56.4	0.1	8.8

Despite the fact that severe defoliation is capable of killing sagebrush, we see little evidence that goats will exert sufficient use on established shrubs to affect any significant mortality. Some suggested that we should have used heavier stocking rates and thus force goats into utilizing shrubs and trees. While we realize that animals can be forced onto nearly any diet in the absence of choice, the goal of these trials was to affect the woody component without severely impacting the desirable herbaceous forages. Their use of juniper when the forages were dormant implies that goats may have some potential to affect young trees, most likely by stripping their trunks of bark. In our holding pens the goats completely stripped the bark from the trunks of several large trees. There was sufficient cambium, however, in the inaccessible fissures of the trunks that the trees survived. In conclusion we see little opportunity to affect sagebrush and juniper in extensive rangeland pastures with light levels of stocking. Additional trials are required to determine if goats might be capable of controlling newly established juniper or sagebrush seedlings.

### Cattle grazing of newly established bitterbrush

Cattle exhibited significant seasonal differences in their rates of use on bitterbrush. When grasses were green and growing, the cattle foraged on approximately 3 percent of the shrubs each day. Our trials at this time of year were 12 to 14 days in length, and roughly 43 percent of the bitterbrush received some degree of utilization by the time trials ended (Figure 1). In this phase of our trials we achieved a 30 to 45 percent utilization level on the grasses before cattle were removed. When the grasses were dry and dormant, the rate of shrub use by cattle was about four times higher than earlier trials. Cattle grazed on approximately 12 percent of the bitterbrush plants each day, and the trials were terminated after 6 to 8 days because nearly all of the shrubs had been utilized. In the 3 years of study, the control (ungrazed by livestock), green forage (May-June), and dormant grazed (August-September) pastures received the same treatment each year. We did not rotate our grazing treatments among the pastures. After the shrubs had been under these treatments for 3 years, there was a substantial difference in sizes of bitterbrush. The largest shrubs occurred in pastures that were grazed by cattle when the grasses were leafy and green (Figure 2). These plants averaged about 1.4 cubic feet in volume. Shrubs in control pastures, that received no cattle grazing, were about 0.7 cubic feet in volume. And bitterbrush in pastures grazed when the grasses were dormant were only about 0.1 cubic feet in volume. Wintering wildlife did have access to all of these pastures; and in some years, depending on

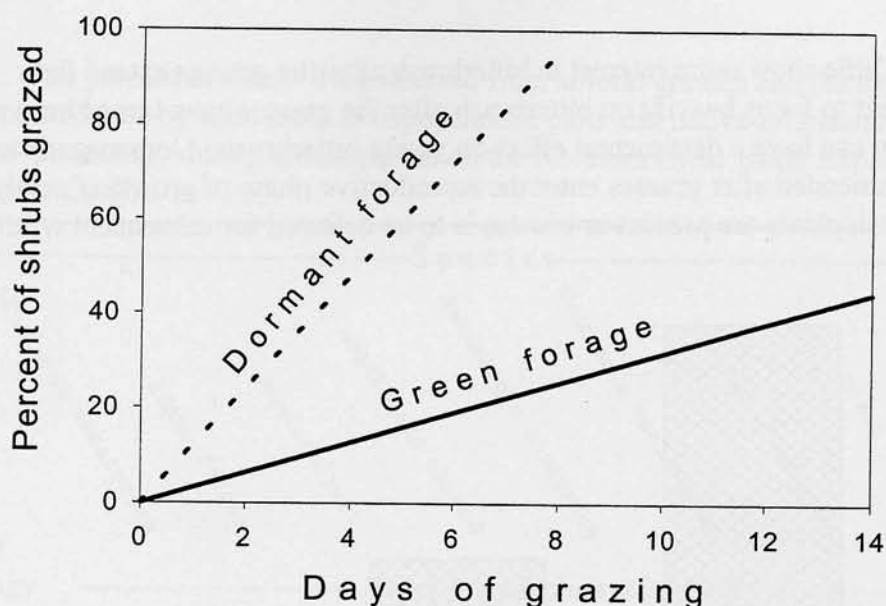


Figure 1. Percent of bitterbrush plants grazed by cattle when forages are green and growing and after herbaceous forages have gone dormant on sagebrush/forest transition range near Burns, Oregon, during 1993-1995 grazing seasons

snow pack, they did make significant use of the shrubs. On a relative scale, shrubs in pastures grazed when the grasses were green were the largest. Control and dormant grazed bitterbrush were one half and 1/12 as large, respectively.

Past research has shown that established bitterbrush is one of the few shrubs that is more productive if it is moderately browsed each year (Kituku et al. 1994). Browsed bitterbrush produces more and longer twigs than shrubs protected from grazing. This compensatory response may not occur on less productive or droughty sites, and in some years low temperatures or drought may reduce overall twig growth (Jensen and Urness 1979, Garrison 1953). Grazing trials in Utah during the early growing season have been especially successful where horses foraged among bitterbrush. Horses focus almost entirely on grasses, even with heavy stocking rates. Heavy use of the competing grasses briefly stalls grass growth and transpiration, and leaves a greater portion of the soil moisture and nutrients available for the shrubs while the grasses are initiating new growth (Urness 1981). In our trials we suspect that both the moderate use of the shrubs and the removal of leaf area from competing grasses stimulated the growth of bitterbrush. We are planning a project to investigate how moderate and heavy stocking rates affect bitterbrush in the near future.

In summary, if a manager's goal is to maximize growth and twig production of bitterbrush for winter wildlife use, we suggest that early spring cattle grazing, when grasses are green and leafy, will significantly increase plant growth over that of even protected shrubs. In addition, the leafy regrowth of the grasses may be of higher quality and also more attractive for late-season use by wildlife. Repeated spring use of a pasture can have detrimental effects on grasses, however, so a long-term management program should also include occasional growing

season deferment. Cattle show more interest in bitterbrush after the grasses extend their seedheads, and appear to focus heavily on bitterbrush after the grasses have turned brown. Late-season cattle grazing can have a detrimental effect on young bitterbrush. Unmanaged cattle grazing is not recommended after grasses enter the reproductive phase of growth if newly established bitterbrush plants are present or browse is to be deferred for subsequent wildlife use.

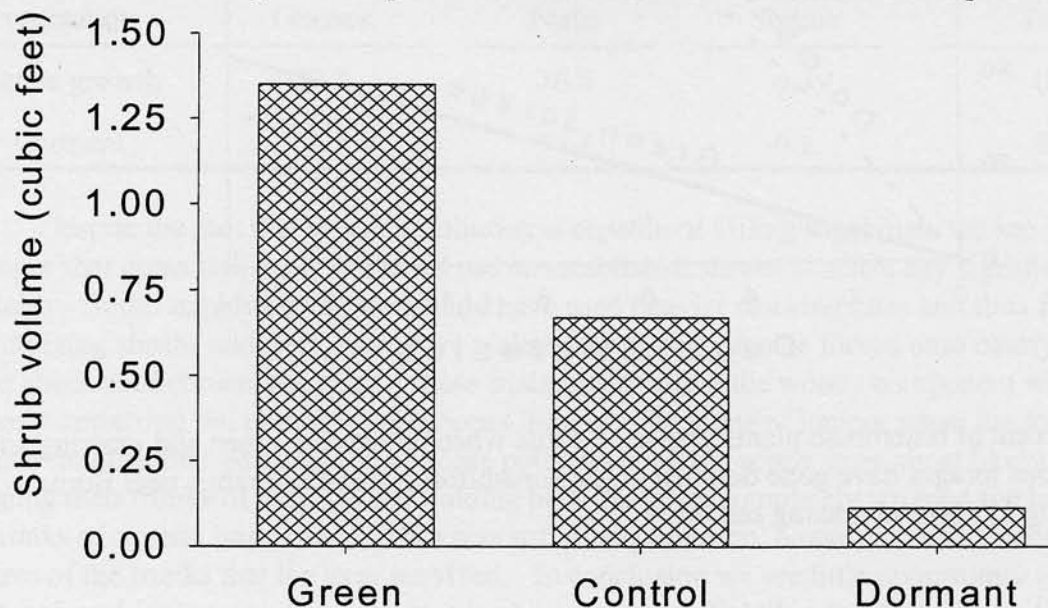


Figure 2. Volume (cubic feet) of bitterbrush on foothill rangeland near Burns, Oregon, after 3 years (1993-1995) of trials in ungrazed control pastures and pastures grazed by cattle when forages were green and leafy or dormant and brown.

### Seasonal preferences of cattle for grasses

Cattle proved to be very selective in their use of grasses, especially when all were green and actively growing. In our experimental plots, crested wheatgrass was the clear favorite (72 to 90 percent of the diet) when the grasses were in the vegetative or anthesis (flowering) stages of growth (Table 2). In those same trials, giant wildrye ranked a distant second (4 to 14 percent), with no significant differences among the remaining grasses.

During our anthesis trials in the plots, we wanted to learn more about the steers' preferences for the lower ranking grasses, so we clipped all the crested wheatgrass to ground level, removed that material, and sent the steers back in. They responded by taking 51 percent of their total bites from giant wildrye, 17 percent from bluebunch wheatgrass, 16 percent from Thurber's needlegrass, and the remaining 16 percent was about equally distributed among the remaining 4 grasses. This clearly illustrated that cattle simply shift their focus to the number two choice when a preferred forage is depleted. Although the data are not shown, the steers also began to regrazed crested wheatgrass plants in all of these trials well before any of the grasses were entirely consumed.



Table 2. The percent of steers' diets derived from several grasses and the percent of total forage contributed by each grass in experimental plots and native-rangeland pastures at three stages of phenology during grazing trials on the Northern Great Basin Experimental Range near Burns, Oregon, in 1993.

Stage of Phenology	Species								
	bluebunch wheatgrass	Idaho fescue	squirreltail	needle-and thread	Sandberg's bluegrass	Thurber's needlegrass	crested wheatgrass	giant wildrye	prairie Junegrass
	Experimental plots steer diets (%)								
Vegetative	4.6	0.7	3.6	0.9	0.4	3.7	72.0	13.8	--
Anthesis	1.4	0.6	1.2	0.7	0.9	0.8	90.4	3.8	--
Dormant	9.4	5.9	4.8	3.1	4.1	9.7	25.8	37.1	--
	Experimental plots herbage available (%)								
Vegetative	2.7	6.1	5.1	3.0	1.6	11.1	35.5	34.8	--
Anthesis	2.1	5.9	3.0	3.4	2.3	8.3	42.8	32.2	--
Dormant	0.7	1.5	2.1	5.6	0.8	5.3	62.6	21.4	--
	Rangeland pastures steer diets (%)								
Vegetative	4.3	2.1	0.0	0.0	7.9	0.4	81.0	2.4	1.4
Anthesis	20.5	15.7	0.9	1.3	1.9	0.5	27.1	9.2	22.7
Dormant	36.8	11.0	0.3	0.0	0.4	0.5	8.5	31.3	10.1
	Rangeland pastures herbage available (%)								
Vegetative	17.8	11.7	0.7	0.0	45.5	1.4	6.4	4.8	11.1
Anthesis	28.4	11.6	1.2	0.0	32.5	2.0	0.0	3.9	20.3
Dormant	42.7	9.3	0.7	0.0	22.1	3.7	0.0	2.6	17.7

When the grasses were dormant, the cattle shifted their focus to giant wildrye in the plots, and crested wheatgrass dropped to a second place ranking. More of the other forages were used than in any of the previous trials. Looking at the proportions of herbage available in the plots one could easily argue that the steers simply focused on the most available grasses in these trials (Table 2). Crested wheatgrass and giant wildrye were clearly the most productive, collectively accounting for 70 to 80 percent of the total biomass. This argument clearly fell apart, however, when we moved the steers into the rangeland pastures. When the grasses were vegetative in the

pastures, crested wheatgrass was 80 percent of the steer's diet and made up only about 6 percent of the available forage. From a steer's point of view, this was roughly the equivalent of sorting through over 1,265 plants to find 81 plants that they liked. When the grasses were in anthesis, 27 percent of their diet still came from crested wheatgrass, which we didn't even detect when we sampled available forage. Clearly the steers were seeking out crested wheatgrass. They would walk 50 to 100 yards, bypassing hundreds of other plants, to find what they wanted. Similar to the plot trials, the steers grazed from a broader array of plants when the grasses were dormant.

The primary purpose of presenting this information was to illustrate that cattle can be extremely picky grazers when they have high quality forage and the opportunity for selection. In other environments it has been observed that a few forage species often bear the brunt of the grazing load (Hurd and Pond 1958), and in many of our large but lightly stocked rangeland pastures this is often the case. Our experience suggests that if one can briefly observe animals in a representative area, he can quickly identify what the key forages might be at that time.

In closing, we suggest a number of potential management options. One is interseeding or interspersing crested wheatgrass in native rangeland pastures. The preference for crested wheatgrass might be used to lessen the grazing demands previously born by native perennials early in the grazing season. Experience has shown that such pastures must be intensively managed to prevent a build up of standing litter in the crested wheatgrass (Hilken 1984). Cattle will reject the crested wheatgrass if the plants contain a preponderance of dead stems, and out of necessity, they will again focus on the native grasses. Crested wheatgrass might also be used to encourage livestock use of less frequented regions of larger pastures. Again though, the stand should not be allowed to accumulate standing litter. Along the same lines, one might establish less palatable forages in environmentally sensitive areas to discourage persistent livestock presence. Second, if one can identify key forage species at specific times of year, especially during the early to mid growing season, livestock grazing might be used to alter the composition of a pasture by persistently affecting or avoiding a given forage. Third, our steers grazed more equitably among all of the grasses after foliage had cured. Pasture clean up of rank standing litter by cattle can probably be more easily accomplished if grazing is postponed until all the forages have cured and the animals are less selective. High stocking rates have little effect on the vigor of grasses at this time, and the animals will utilize a broader array of forages. Finally, we do not want to infer that cattle will not graze any particular forage. Given a limited selective opportunity, they will consume and do very well on many forages they do not particularly care for as long as their nutritional demands are fulfilled.

### **Regrowth quality and quantity in Thurber's needlegrass**

Initial herbage production and regrowth quantity and quality varied substantially between years (Figure 3). In both years the earliest three or four defoliations resulted in reduced total forage yields for the growing season. Precipitation was about 77 percent of average in year one, and none of the plants defoliated after 19 June produced regrowth because soil moisture was almost entirely depleted by the plants' initial growth efforts. The greatest amount of herbage production was attained by plants defoliated on 3 and 17 July (about 220 units), and consisted



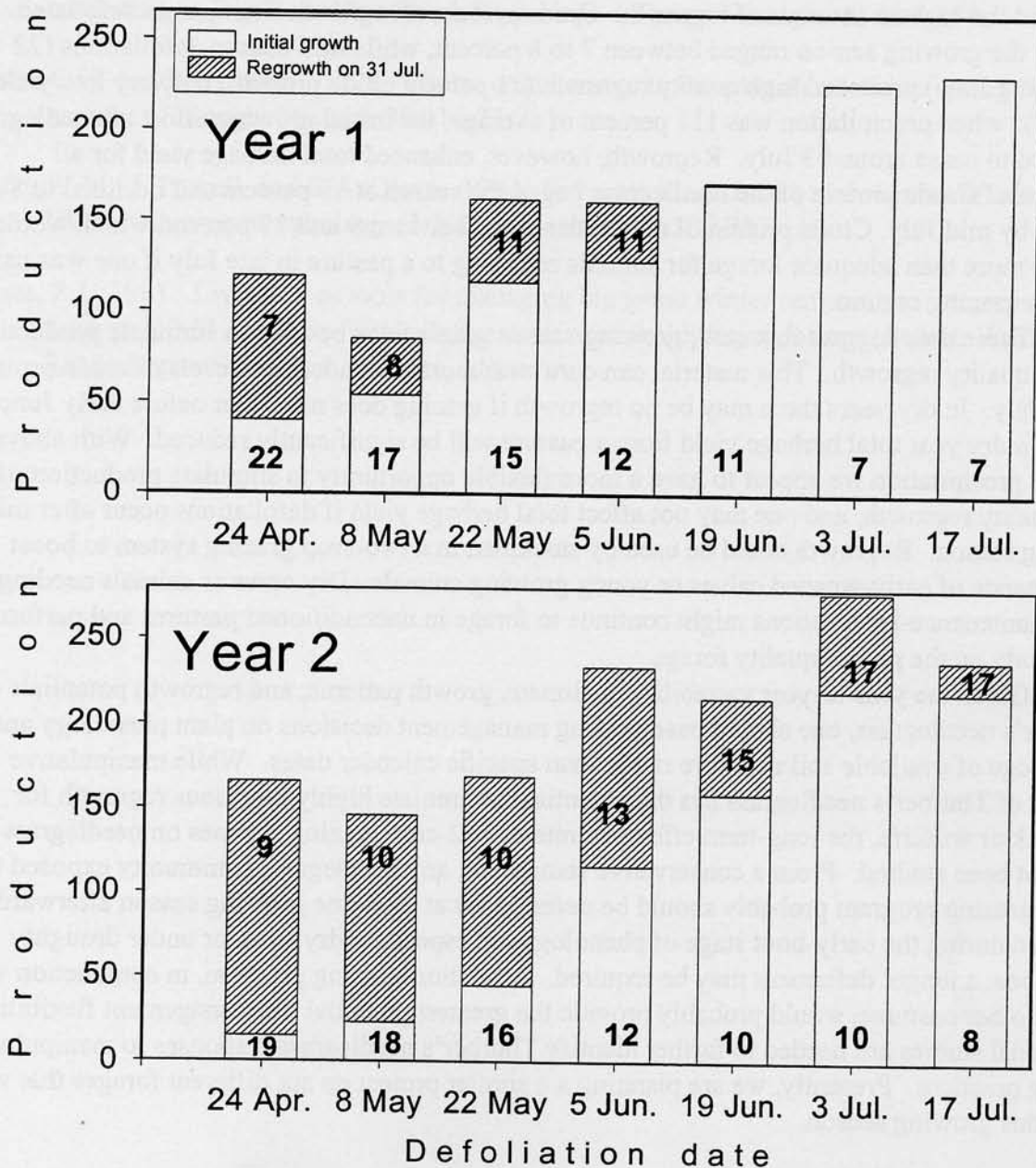


Figure 3. Biomass and crude protein content of initial growth of Thurber needlegrass harvested on seven dates during the growing season and biomass and crude protein content of subsequently produced regrowth harvested on 31 July in 1985 (year 1) and 1986 (year 2) on the Northern Great Basin Experimental Range near Burns, Oregon. Numbers within bars depict percent crude protein content of forage.

entirely of initial growth. Crude protein of needlegrass began the season at about 22 percent crude protein and declined to a marginally acceptable 7 percent level by 17 July. Regrowth was harvested from all treatments at the end of July, and the earliest defoliation dates always produced the highest amounts of regrowth. Crude protein of regrowth from plants defoliated early in the growing season ranged between 7 to 8 percent, while mid-season defoliations (22 May and 5 June) produced high quality regrowth (11 percent crude protein), but very low yields. In year 2, when precipitation was 111 percent of average, the initial growing effort of needlegrass appeared to cease around 3 July. Regrowth, however, enhanced total herbage yield for all treatments. Crude protein of the needlegrass began the season at 19 percent and declined to 8 percent by mid July. Crude protein of regrowth ranged between 9 and 17 percent, which would provide more than adequate forage for animals returning to a pasture in late July if one was using a 2-crop grazing regime.

These data suggest that early growing season grazing can be used to stimulate production of high quality regrowth. This material can cure with more than adequate levels of crude protein in late July. In dry years there may be no regrowth if grazing does not occur before early June. Also in a dry year total herbage yield from a pasture will be significantly reduced. With above average precipitation we appear to have a more flexible opportunity to stimulate production of high quality regrowth, and one may not affect total herbage yield if defoliations occur after mid-growing season. Regrowth could be used by stockmen in a two-crop grazing system to boost performance of early-weaned calves or young growing animals. Dry cows or animals needing only maintenance-level rations might continue to forage in unconditioned pastures and perform adequately on the poorer quality forage.

Given the year-to-year variability in climate, growth patterns, and regrowth potentials of Thurber's needlegrass, one should base grazing management decisions on plant phenology and knowledge of available soil moisture rather than specific calendar dates. While manipulative grazing of Thurber's needlegrass has the potential to stimulate highly nutritious regrowth for livestock or wildlife, the long-term effects of intensive 2-crop grazing regimes on needlegrass have not been studied. From a conservative standpoint, any needlegrass community exposed to a 2-crop grazing program probably should be deferred for at least one growing season afterwards. If grazed during the early-boot stage of phenology, on especially dry sites, or under droughty conditions, a longer deferment may be required. A rotation-grazing program, in conjunction with several other pastures, would probably provide the greatest potential for management flexibility. Additional studies are needed to further identify Thurber's needlegrass responses to manipulative grazing practices. Presently, we are planning a similar project on six different forages that will begin this growing season.

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