



4-29-1998

# Vegetal change on a northern Utah foothill range in the absence of livestock grazing between 1948 and 1982

Dennis D. Austin  
*Utah State University*

Philip J. Urness  
*Utah State University*

Follow this and additional works at: <https://scholarsarchive.byu.edu/gbn>

### Recommended Citation

Austin, Dennis D. and Urness, Philip J. (1998) "Vegetal change on a northern Utah foothill range in the absence of livestock grazing between 1948 and 1982," *Great Basin Naturalist*: Vol. 58 : No. 2 , Article 6.  
Available at: <https://scholarsarchive.byu.edu/gbn/vol58/iss2/6>

This Article is brought to you for free and open access by the Western North American Naturalist Publications at BYU ScholarsArchive. It has been accepted for inclusion in Great Basin Naturalist by an authorized editor of BYU ScholarsArchive. For more information, please contact [scholarsarchive@byu.edu](mailto:scholarsarchive@byu.edu), [ellen\\_amatangelo@byu.edu](mailto:ellen_amatangelo@byu.edu).

## VEGETAL CHANGE ON A NORTHERN UTAH FOOTHILL RANGE IN THE ABSENCE OF LIVESTOCK GRAZING BETWEEN 1948 AND 1982

Dennis D. Austin<sup>1</sup> and Philip J. Urness<sup>1,2</sup>

**ABSTRACT.**—Reexamination of a semiarid foothill rangeland, first evaluated in 1948, indicated that secondary succession continues to shift toward a perennial grass-forb community formerly dominated by xeric shrubs, particularly big sagebrush (*Artemisia tridentata* spp. *vaseyana*). The direct role of livestock grazing in establishment and maintenance of shrub-dominant plant communities appears confirmed in the decline of shrubs upon cessation of livestock grazing in summer and continued browsing by mule deer in winter. The reduction of shrub forages on mule deer winter ranges is a major factor in population declines.

*Key words:* vegetation change, livestock grazing, succession, mule deer.

Evaluation of presettlement vegetation on foothill ranges in the northeastern Great Basin indicates relative dominance of herbaceous grasses and forbs over shrubs (Simpson 1876, Leopold 1950, 1959, Passey and Hugie 1962, Christensen and Johnson 1964, Hull and Hull 1974, Vale 1974). Generally, perennial grasses and forbs dominated plant communities on more mesic foothills, whereas shrubs such as Vasey's big sagebrush (*Artemisia tridentata vaseyana* [Rybd.] J. Boivin), saltbush (*Atriplex* spp. L.), and greasewood (*Sarcobatus vermiculatus* [Hook] Torr.) were more abundant on xeric and/or saline valley-floor sites at mid-19th century (Stewart 1941, Vale 1975, Urness 1976).

Rapid proliferation of livestock—cattle, horses, and sheep—after about 1860 altered this dynamic equilibrium by reducing palatable herbaceous forages and decreasing fire frequency, allowing increases in less palatable and fire-susceptible shrubs. Changes in plant communities were rapid. Shrub dominance became common on Utah foothills by the early 20th century on lands not preempted for agriculture (Julander 1962). Concurrent with the increase of shrubs on winter ranges, after hunting regulations ended excessive exploitation about 1910, mule deer (*Odocoileus hemionus* Rafinesque) populations gradually expanded (Leopold 1959, Hancock 1981).

Unless site potentials are unalterably degraded, retrogression of plant community com-

position can be halted and reversed; that is, elimination of the processes that initiated change can facilitate secondary succession proceeding back toward a condition similar to what previously existed (Ellison 1954, 1960, Robertson 1971, Rogers 1982). However, plant communities will not necessarily duplicate presettlement vegetation in Great Basin sagebrush-grass types due to introduction of adapted annual and biennial weeds such as cheatgrass (*Bromus tectorum* L.), Dyer's woad (*Isatis tinctoria* L.), and a myriad of others (Young et al. 1976, Blaisdell et al. 1982, Young and Sparks 1985:234, Burger et al. 1986).

An example of remarkably rapid secondary succession on a northern Utah foothill range was reported by Smith (1949). Land between Green and Logan canyons, Cache County, was purchased by the Utah Game and Fish Department (now Division of Wildlife Resources, DWR) in 1937 as critical deer winter range. Summer use by cattle was immediately terminated on the DWR property but not on adjacent private land. Smith measured vegetational differences that had occurred between 1937 and 1948 on the 2 parcels. This paper reports on a reexamination of the same areas in terms of available vegetation in 1982 after an additional 34 yr of deer-only use on the DWR property (deer range) and after livestock use had ceased for about 25 yr on the private (livestock range) area.

<sup>1</sup>Rangeland Resources Department, Utah State University, Logan, UT 84322-5230.

<sup>2</sup>Deceased.



### STUDY AREA

The foothills between Green and Logan canyons lie on the uppermost bench terrace of Pleistocene Lake Bonneville at about 1525 m elevation (T12N R1E Salt Lake Meridian, SW 1/4 sec. 24 and NW 1/4 sec. 25). Deer concentrate on this area as traditional winter range and, since curtailment of livestock grazing, constitute the major impact on vegetation. Smith (1949) reported the composition of plant communities under heavy summer livestock grazing was dominated by big sagebrush, but contained elements of perennial grasses and forbs putatively prominent in the presettlement condition (Hull and Hull 1974). Important grasses included Sandberg's bluegrass (*Poa secunda*) and bluebunch wheatgrass (*Elymus spicatus*); perennial forbs were arrowleaf balsamroot (*Balsamorhiza sagittata*), mulesears (*Wyethia amplexicaulis*), and one-head sunflower (*Helianthella uniflora*).

According to Erickson and Mortensen (1974), soils are limestone-derived Lithic Xerorthents on steeper slopes over 20% (Richmond series, upland very gravelly loams) and Typic Calcixerolls on slopes of 10–20% (Sterling series, gravelly loams). Aspect is west-facing. Summers are hot and dry; winters, cold and moist. Precipitation averages 468 mm annually (29-yr record), over 2/3 of which occurs between October and April. The excessively well-drained character of these gravelly or cobbly soils combined with high evaporation reduces effectiveness of precipitation during the growing season, thus resulting in dry range sites of limited productivity.

### METHODS

Because plots were not permanently marked in the original study (Smith 1949), exact relocations were impossible. However, rematch of photos allowed us to closely approximate transect sites (personal communication and onsite tour with A.D. Smith, Rangeland Resources Department, Utah State University, June 1982). The same sampling procedures for density were followed in 1948 and 1982 to assure comparable data sets:

In June, 1948, vegetation data were secured from a series of 100 square foot plots on each side of the fence, which as far as livestock are concerned, separates the area into two zones. One series of plots

was distributed along a transect roughly at right angles to the division fence. Another pair of transects was extended parallel to the fence crossing the first transect at right angles. One of these was within the deer range and the other in the cattle range. Seventy plots were delimited in each area. Vegetation data were recorded as number of individuals of each species (Smith 1949).

Because the original 1948 data were not available, statistical comparisons between years were not possible. Data between treatments in 1982 were analyzed by standard *t* test of the means.

### RESULTS AND DISCUSSION

Density changes among years, major plant species, and treatments are summarized in Table 1. This is not a complete listing, but rather a focus on important species reported in the 1948 analysis (Smith 1949). The main observations in 1948 on the livestock-excluded deer range were the increase of some perennial grasses and forbs and the simultaneous decline of shrubs, especially big sagebrush, after only 11 yr. The 1982 data demonstrated that earlier trends had continued on the deer range for arrowleaf balsamroot, bluebunch wheatgrass, and Sandberg's bluegrass. Of critical importance, big sagebrush was absent. Indeed, no evidence of dead big sagebrush plants remained on the deer range, and, without the earlier documentation, one could easily conclude big sagebrush had never been available. Moreover, in 1982 the livestock range, grazed by cattle from 1948 to 1957, appeared similar to the deer range in 1948, especially with respect to dead and live big sagebrush. It is predictable that with additional years of non-use by livestock in summer, the livestock range will progress toward vegetation composition and structure now present in the deer range.

These vegetational changes occurred in certain absence of fire, herbicidal application, re-seeding, or other range management treatments. Thus, it appears that livestock grazing of grasses and forbs during the summer growing season shifted the competition advantage to shrubs and was the primary factor driving succession toward woody plant dominance. Numerous studies support our findings that spring-summer livestock grazing maintains or improves shrub stands on big game winter ranges (Mueggler 1950, Smith and Doell 1968, Jensen et al. 1972, Harniss and Wright 1982,



TABLE 1. Number of plants found in a series of seventy 100-ft<sup>2</sup> plots on adjacent ranges grazed by deer in winter (deer range) and by livestock in summer and deer in winter (livestock range). The livestock range ceased to be grazed by livestock in 1957, and both were remeasured in 1982.

	1948				1982			
	Deer range		Livestock range		Deer range		Livestock range	
	Total plants	Number of plots upon which plants occurred	Total plants	Number of plots upon which plants occurred	Total plants	Number of plots upon which plants occurred	Total plants	Number of plots upon which plants occurred
FORBS								
<i>Achillea millefollium</i> L. <sup>a</sup>	—	15	—	36	—	11	—	29
<i>Agoseris glauca</i> (Pursh) Raf.	88	16	0	0	0	0	11	6
<i>Balsamorhiza sagittata</i> (Pursh) Nutt.	676	47	96	17	1696	70	704	53
<i>Helianthella uniflora</i> (Nutt.) T.&G.	243	31	3	3	140	26	75	11
<i>Helianthus annuus</i> L.	0	0	69	3	0	0	0	0
<i>Wyethia amplexicaulis</i> (Nutt.) Nutt.	64	1	8	5	5	2	6	4
GRASSES								
<i>Elymus spicatus</i> (Pursh) Gould	24	14	9	8	136	28	398	62
<i>Koeleria macrantha</i> (Lecleb.) Schultes	8	3	1	1	3	3	12	6
<i>Poa pratensis</i> L. <sup>a</sup>	—	3	—	2	—	2	—	11
<i>Poa secunda</i> Presl. <sup>a</sup>	1610	68	667	64	2040	68	1750	69
BROWSE								
<i>Artemisia tridentata</i> (dead) Nutt.	185	64	92	38	0 <sup>b</sup>	0	122	56
<i>Artemisia tridentata</i> (live) Nutt.	88	38	580	64	0 <sup>b</sup>	0	98	39
<i>Chrysothamnus nauseosus</i> (Pallas) Britt.	2	2	8	16	0	0	0	0
<i>Gutierrezia sarothrae</i> (Pursh) Britt. & Rushy	29	8	185	33	1 <sup>b</sup>	1	128	27

<sup>a</sup>Occurred as small patches only.  
<sup>b</sup>Numbers of plants between deer and livestock range in 1982 were significantly different ( $P < 0.05$ ).

Reiner and Urness 1982, Stevens 1986, Austin and Urness 1995). Conversely, removal of livestock grazing causes increasing grasses and forbs and decreasing shrubs (Laycock 1967, Anderson and Holte 1981, Austin et al. 1986). The net effect on foothill rangeland without livestock grazing is that single use by mule deer in winter will gradually impose successional changes that adversely affect deer habitat carrying capacity. Deer range values on this study site have greatly decreased from 1937 to 1948 to 1982.

Similar trends observed over many mule deer ranges in western United States, where summer grazing by livestock has been eliminated or greatly curtailed, give reason for concern about the future of many deer herds (Julander and Low 1976, Anderson and Holte 1981, Hancock 1981, Austin et al. 1986, Clements and Young 1997). Certainly, mule deer

herds reached peak numbers in the early 1950s and have since declined throughout the Intermountain West (Julander and Low 1976, Hancock 1981). Managed livestock grazing on foothill ranges (Anderson and Scherzinger 1975, Austin et al. 1983) is a logical managerial solution to the decline of winter range habitat and mule deer numbers.

ACKNOWLEDGMENTS

This is a contribution of Utah Division of Wildlife Resources Project W-105-R.

LITERATURE CITED

ANDERSON, J.E., AND K.E. HOLTE. 1981. Vegetation development over 25 years without grazing on sagebrush-dominated rangeland in southeastern Idaho. *Journal of Range Management* 34:25-29.



- ANDERSON, E.W., AND R.J. SCHERZINGER. 1975. Improving quality of winter forage for elk by cattle grazing. *Journal of Range Management* 28:120-125.
- AUSTIN, D.D., AND P.J. URNESS. 1995. Effects of horse grazing in spring on survival, recruitment, and winter injury damage of shrubs. *Great Basin Naturalist* 55: 267-270.
- AUSTIN, D.D., P.J. URNESS, AND L.C. FIERRO. 1983. Spring livestock grazing affects crested wheatgrass regrowth and winter use by mule deer. *Journal of Range Management* 36:589-593.
- AUSTIN, D.D., P.J. URNESS, AND R.A. RIGGS. 1986. Vegetal change in the absence of livestock grazing, mountain brush zone, Utah. *Journal of Range Management* 39: 514-517.
- BLAISDELL, J.P., R.B. MURRAY, AND E.D. MCARTHUR. 1982. Managing Intermountain rangelands-sagebrush-grass ranches. General Technical Report INT-134. USDA Forest Service, Intermountain Forest and Range Experiment Station.
- BURGER, G.V., F.H. WAGNER, AND L.D. HARRIS. 1986. Wildlife prescriptions for agricultural, range and forest landscapes. Transactions of the North American Wildlife Conference 51:573-577.
- CHRISTENSEN, E.M., AND H.B. JOHNSON. 1964. Presettlement vegetation and vegetational change in three valleys in central Utah. *Brigham Young University Science Bulletin, Biological Series IV, No. 4*.
- CLEMENTS, C.D., AND J.A. YOUNG. 1997. A viewpoint: rangeland health and mule deer habitat. *Journal of Range Management* 50:129-138.
- ELLISON, L. 1954. Subalpine vegetation of the Wasatch Plateau, Utah. *Ecological Monographs* 24:89-184.
- \_\_\_\_\_. 1960. Influence of grazing on plant succession of rangelands. *Botanical Review* 26:1-78.
- ERICKSON, A.J., AND V.L. MORTENSEN. 1974. Soil survey of Cache Valley area, Utah. USDA, Soil Conservation Service and Forest Service in cooperation with Utah Agricultural Experiment Station.
- HANCOCK, N.V. 1981. Mule deer management in Utah—past and present. Pages 2-27 in F.G. Lindzey, editor, *Mule deer workshop—proceedings*. Utah Cooperative Wildlife Research Unit, Utah State University, Logan.
- HARNISS, R.O., AND H.A. WRIGHT. 1982. Summer grazing of sagebrush-grass range by sheep. *Journal of Range Management* 35:13-17.
- HULL, A.C., JR., AND M.K. HULL. 1974. Presettlement vegetation of Cache Valley, Utah and Idaho. *Journal of Range Management* 27:27-29.
- JENSEN, C.H., A.D. SMITH, AND G.W. SCOTTER. 1972. Guidelines for grazing sheep on rangelands used by big game in winter. *Journal of Range Management* 25:346-352.
- JULANDER, O. 1962. Range management in relation to mule deer habitat and herd productivity in Utah. *Journal of Range Management* 15:278-281.
- JULANDER, O., AND J.B. LOW. 1976. A historic account and present status of mule deer in the West. Pages 3-20 in G.W. Workman and J.B. Low, editors, *Mule deer decline in the West—a symposium*. Utah State University, Logan.
- LAYCOCK, W.A. 1967. How heavy grazing and protection affect sagebrush-grass ranges. *Journal of Range Management* 20:206-213.
- LEOPOLD, A.S. 1950. Deer in relation to plant succession. *Journal of Forestry* 48:675-678.
- \_\_\_\_\_. 1959. Big game management. Pages 85-99 in *Survey of fish and game problems in Nevada*. Nevada Legislature Counsel Bureau Bulletin 36. Carson City, Nevada.
- MUEGGLER, W.F. 1950. Effects of spring and fall grazing by sheep in vegetation of the Upper Snake River Plains. *Journal of Range Management* 3:308-315.
- PASSEY, H.B., AND V.K. HUGIE. 1962. Sagebrush on relict ranges in the Snake River Plains and northern Great Basin. *Journal of Range Management* 15:273-278.
- REINER, R.J., AND P.J. URNESS. 1982. Effect of grazing horses managed as manipulators of big game winter range. *Journal of Range Management* 35:567-571.
- ROBERTSON, J.H. 1971. Changes on a sagebrush-grass range in Nevada ungrazed for 30 years. *Journal of Range Management* 24:397-400.
- ROGERS, G.F. 1982. A photographic history of vegetation change in the central Great Basin Desert. University of Utah Press, Salt Lake City.
- SIMPSON, J.H. 1876. Report of exploration across the Great Basin of the territory of Utah for a direct wagon-route from Camp Floyd to Genoa in Carson Valley in 1859. *Vintage Nevada Series* [reprint]. 1983. University of Nevada Press, Reno.
- SMITH, A.D. 1949. Effects of mule deer and livestock upon a foothill range in northern Utah. *Journal of Wildlife Management* 13:421-423.
- SMITH, A.D., AND D.D. DOELL. 1968. Guides for allocating forage between cattle and big game on big game winter range. Utah Division of Fish and Game Publication 68-11.
- STEVENS, R. 1986. Population dynamics of two sagebrush species and rubber rabbitbrush over 22 years of grazing use by three animal classes. Pages 278-285 in E.D. McArthur and B.L. Welch, compilers, *Proceedings of a symposium on biology of Artemisia and Chrysothamnus*. General Technical Report INT-200. USDA, Forest Service, Intermountain Research Station.
- STEWART, G. 1941. Historic records bearing on agricultural and grazing ecology in Utah. *Ecology* 39:362-375.
- URNES, P.J. 1976. Mule deer habitat changes resulting from livestock practices. Pages 21-35 in G.W. Workman and J.B. Low, editors, *Mule deer decline in the West—a symposium*. Utah State University, Logan.
- VALE, T.R. 1974. Sagebrush conversion projects: an element of contemporary environmental change in the western United States. *Biological Conservation* 6: 274-284.
- \_\_\_\_\_. 1975. Presettlement vegetation in the sagebrush-grass area of the Intermountain West. *Journal of Range Management* 28:32-36.
- YOUNG, J.A., AND B.A. SPARKS. 1985. Cattle in the cold desert. Utah State University Press, Logan.
- YOUNG, J.A., R.A. EVANS, AND P.T. TUELLER. 1976. Great Basin plant communities—pristine and grazed. Pages 186-215 in R. Elston, editor, *Holocene environment change in the Great Basin*. Nevada Archaeological Survey, Research Paper 6.

Received 25 November 1996  
Accepted 19 September 1997