



How does Targeted Grazing with Small Ruminants Influence Subsequent Grazing by Mule Deer and Cattle?



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Introduction

Restoration of grass steppes invaded by one-seed juniper (*Juniperus monosperma* [Engelm. Sarg.]) and improvement of mule deer habitat are major management goals on pinyon-juniper rangelands of central New Mexico. Targeted grazing with small ruminants could be used to both suppress one seed juniper sapling encroachment and stimulate regrowth of herbaceous understory creating disturbance patches with higher quality forage for mule deer and cattle.

Basic targeted grazing principles (i.e. season, intensity, and length of grazing period) have been well researched and profusely reported in the literature. Less is known, however, about the influence of targeted grazing prescriptions on subsequent utilization of resulting vegetation patches by other ungulates particularly on rangelands that sustain sympatric grazers

Objective

The objective of this study was to monitor the effect of summer targeted grazing with sheep and goats on the subsequent utilization of the vegetation patch mosaic by cattle and mule deer during the winter, spring, summer and fall following the targeted grazing treatment.

Materials & Methods

•Randomized Complete Block Design

•Targeted grazing treatments: factorial of 2 herbivores (GA: Goats Alone vs. GM: Goats Mixed with sheep) and 2 stocking densities (LD: low stocking density vs. HD: High stocking density). Treatments applied between July and August 2006 (Table 1)

•Vegetation monitoring following treatments in August and October 2006: Juniper sapling utilization, standing herbaceous biomass, and forage quality (Table 1).

•Monitoring of mule deer and cattle presence in resulting vegetation patches in winter (71 days), spring (120 days), summer (125 days) and fall (71 days) after treatments with use of digital automated cameras equipped with infrared heat and motion detectors.

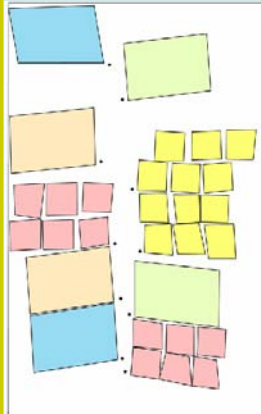
• Analysis: indices for mule deer and cattle selection of vegetation patches were analyzed using Poisson regression, and mule deer-cattle interactions in patches were analyzed using logistic regression.



Mixed group of Spanish-Boer goats with Ramboulet ewes (Mixed treatment)



Automated camera used to monitor mule deer and cattle (Above) at the mosaic of patches with herbaceous re-growth created with targeted grazing (Left: Control: blue; Goats/LD: orange; Goats/HD: pink; Mixed/LD: green; Mixed/HD: yellow).



Results

Table 1-- Grazing-related and vegetation related variables to targeted grazing with sheep and goats. Mean (± SE) values for grazing and vegetation related variables followed by a different letter differ (LSD 0.05).

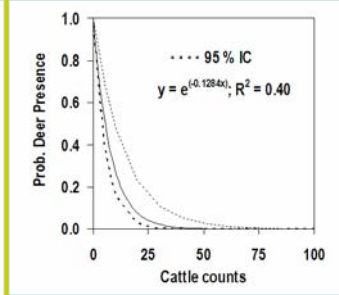
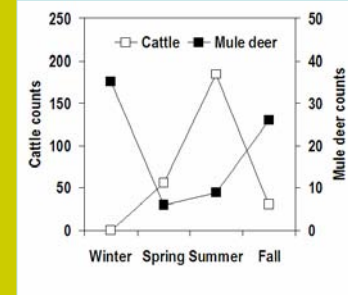
Description	Targeted grazing treatments				
	Control	Low stocking density		High stocking density	
		Mixed	Goats	Mixed	Goats
Grazing-related variables					
Stocking rate	No grazing	----- 0.3 ha AU/yr			
Stoking density	No grazing	10 m ² AU/day 30 x 20 m		60 m ² AU/day 6 x (10 x 10 m)	
Plot size	30 x 20 m				
Juniper in goat diets, %	No grazing	27.0 ± 6.9	24.4 ± 6.3	33.5 ± 0.8	27.1 ± 5.6
Herbaceous vegetation use, %	No grazing	73.5 ± 4.9 a	60.9 ± 2.8 b	66.8 ± 0.8 ab	52.1 ± 4.2 c
Juniper saplings use, %					
> 66% use	No grazing	38.2 ± 6.3	41.7 ± 2.7	52.3 ± 13.1	39.9 ± 7.0
33 – 66% use		30.5 ± 6.4	28.6 ± 5.5	32.0 ± 10.6	37.7 ± 7.7
< 33% use		31.3 ± 8.1	29.7 ± 3.4	15.7 ± 3.2	22.4 ± 7.7
Vegetation-related variables					
Standing biomass, g/m ²	211.9 ± 30.1 a	82.3 ± 24.4 b	84.6 ± 23.3 b	81.1 ± 15.2 b	117.1 ± 18.8 b
CP, %	6.0 ± 0.1 a	8.2 ± 1.0 a	9.4 ± 0.8 a	8.4 ± 0.3 a	7.9 ± 0.1 ab
TND, %	41.4 ± 1.1 b	53.3 ± 2.2 a	55.5 ± 2.4 a	52.5 ± 0.3 a	54.2 ± 2.1 a
Resulting vegetation	Ungrazed areas with high biomass and low quality forage	Single large patches with low biomass and high quality forage		Aggregated or interspaced groups of 6 small patches with low biomass and high quality forage	



Pastures showed good recovery a month after targeted grazing treatments (left). Branches of saplings with bark completely stripped (center) exhibited higher mortality. A mosaic of patches with herbaceous re-growth resulted after summer targeted grazing (Right)

Table 2--Mule deer and cattle selection for vegetation patches that resulted from previous targeted grazing with sheep and goats. Significant selection (Index > 1) or avoidance (Index < 1) for given vegetation patches is shown.

Targeted grazing treatment	Patch characteristics			Parameter estimate			Selection Index			
	Herbivore	Stocking density	Forage quantity / quality	Total Animal Counts	Estimate	SE	Mean	95% IC	Chi-Sq (χ ²)	P > χ ²
-----Mule deer-----										
Goats	High	Small	Low / High	11	0.13	0.61	1.14	0.34 - 3.78	0.04	0.83
Mixed	High	Small	Low / High	34	1.26	0.29	3.52	1.99 - 6.21	18.7	< 0.1
Goats	Low	Large	Low / High	14	0.38	0.54	1.46	0.50 - 4.24	0.48	0.49
Mixed	Low	Large	Low / High	1	-2.27	0.61	0.1	0.03 - 0.34	13.75	< 0.1
Control	Control	Ungrazed	High / Low	16	0.51	0.61	1.66	0.50 - 5.53	0.69	0.41
-----Cattle-----										
Goats	High	Small	Low / High	37	-0.19	0.44	0.83	0.35 - 1.96	0.19	0.67
Mixed	High	Small	Low / High	67	0.40	0.44	1.49	0.63 - 3.54	0.81	0.37
Goats	Low	Large	Low / High	92	0.72	0.33	2.04	1.07 - 3.92	4.64	0.03
Mixed	Low	Large	Low / High	13	-1.24	0.6	0.29	0.09 - 0.94	4.29	0.04
Control	Control	Ungrazed	High / Low	62	0.32	0.57	1.38	0.45 - 4.18	0.32	0.57
-----271-----										



Cattle and deer counts in patches differed across seasons (Left). Changes in cattle counts had a detectable influence on the probability of a patch being grazed by mule deer, which exhibited a sharp exponential decrease with the presence of cattle (Right)



Cattle selected large patches which mule deer avoided (Left) whereas deer selected small aggregated patches that were not selected by cattle (Right)

Conclusions

Targeted grazing with small ruminants to restore juniper invaded grass steppes could be used to strategically create vegetation patches tailored to mule deer and cattle preferences. Creation of mosaics of vegetation patches of varying sizes and arrangements might also serve to improve habitat for both mule deer and cattle, while minimizing competition for high quality patches.

Acknowledgements

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