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CALIFORNIA STATE UNIVERSITY AGRICULTURAL RESEARCH INITIATIVE

# RESEARCH REPORT

# Researchers recommend new, more efficient approach to cattle grazing

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## Introduction

Concerns over the environmental impacts of livestock grazing have recently increased. This worries both ranchers and environmentalists, since California contains about 40 million acres of rangeland. A relatively new method of grazing called high intensity-short duration (HISD) grazing has been suggested as a way to improve rangelands. Rather than simply releasing cattle into large pastures in which the cattle can pick and choose where they walk and graze, HISD involves quickly moving cattle in succession through a series of relatively small pastures where the animal number to available feed ratio is high enough for the cattle to utilize the entire pasture. Utilization of entire pastures appears to result in a more efficient conversion of forage into animal mass per acre of range. Also, HISD rangelands have the opportunity to recover in growth and nutrient cycling functions between grazing cycles. Limited conflicting research on this grazing method gives rise for the need for this research, comparing HISD grazing to livestock exclusion. The objective of this research was to quantitatively assess the impact of HISD on natural ecosystems – particularly on the oak/woodland savanna (OWS) rangelands in California. The research focused specifically on providing detailed measurements of the following: 1) beef production, 2) pasture cover and specie diversity, 3) natural oak recruitment, and 4) forage productivity and quality.

*High intensity-short duration (HISD) grazing involves quickly moving cattle through a series of relatively small pastures.*

## Methodology

Research was conducted at Sedgwick Ranch, a 6,000-acre University of California Natural Reserve in Santa Barbara County, California, under a cooperative grazing agreement with the College of Agriculture at California Polytechnic State University, San Luis Obispo, and University of California, Santa Barbara.

Plots and Rotations: Approximately 100 cattle were rotated through 22 pastures, each approximately 12 hectares in size, and two pastures for open grazing totaling approximately 20 acres in size. For the first two years of the research cow/calf pairs were ran, but for the last year heiferettes were grazed. Sampling plots are spread throughout 13 of the 22 small pastures. In the flat savanna/grassland areas, there are 15 fenced plots to exclude grazing and 15 open plots to allow grazing – each plot measuring 50 meters by 50 meters. Each of these plots is centered on an oak tree where available, giving about 10 percent tree canopy cover and 90 percent open. In the blue oak woodlands, there are 11 excluded plots and 10 grazed plots, each measuring 25 meters by 50 meters. These plots are smaller because they were constructed to be relatively homogeneous internally in terms of slope and aspect, which would not work on the hills with a larger plot. Pairs of similar plots were chosen, of which one plot was randomly selected to be fenced and excluded from grazing.

Biomass Sampling: For biomass sampling, the method accepted by Natural Resource Conservation Service (NRCS) and Bureau of Land Management (BLM) as the standard was used. A one-foot square was thrown in a previously selected area of each plot, the average height was measured, and the grass was clipped for laboratory analysis. The clipped biomass samples were oven dried and weighed. From this dry matter weight, pounds of residual dry matter per acre, animal consumption, and forage production were calculated.

Forage Quality: The dried biomass samples were analyzed for feed quality to find the net energy of the feed. The biomass samples were micro ground through a one-millimeter screen and analyzed using an Ankom crude fiber analyzer. This analysis included an acid detergent fiber test (ADF), neutral detergent fiber test (NDF), and a lignin correction test. From the resulting data, relative feed value (RFV) can be found.

Photomonitoring: A picture was taken from the southeast corner to the northwest corner of each plot before grazing and in the grazed plots after grazing to establish photomonitoring points. Also, pictures were taken at the end of the season when the transects were done.

Transects: Transect sampling was based on the point-step method. Four transects were run through each plot, recording ground cover and plant species at 25 points on each transect, yielding 100 "hits" per plot. Five heights were also taken per transect, yielding 20 heights per plot. The transect data allows the calculation of species percentages, percent bare ground, average plant height, and specific species statistics. A one-square-foot biomass sample was also clipped on each transect to analyze in the same manner as the other biomass samples. The sampling plots were shared with another project, which had a designated "permanent vegetation" swath through the middle. If the transect fell within the permanent vegetation region, the biomass sample was taken at the preceding or following transect.

## Results

Plant Species, Cover, and Production Analysis: The number of plant species or specie diversity was greater in the grazed plots than the excluded all three years. Although specie diversity decreased in the grazed the third year, the excluded plots remained unchanged all three years. This shows that HISD grazing leads to higher plant species diversity and exclusion of grazing decreases plant specie diversity.

Bare Ground: The total bare ground was the same for both treatments the first two years, but the third year it was significantly less in the grazed than the excluded. It seems that

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bare ground has decreased each year, proving that cattle grazing does not create any more bare ground than already exists, and grazing could help to reduce bare ground.

Biomass Production: The biomass production was equal for both treatments during all three years except in the excluded plots, where it decreased each year.

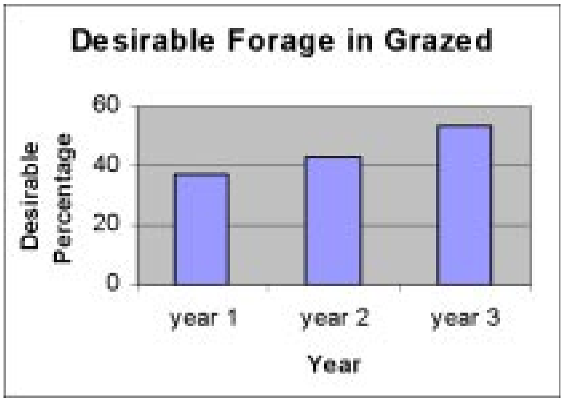


**Figure 1. Desirable forage in grazed plots**

Desirable and Undesirable Forage: The grazed plots produced more desirable forage species (Figure 1) and less undesirable forage species all three years. In the grazed, the desirable species increased each year, while undesirable decreased the third year. In the excluded, the undesirable species decreased the third year, while the desirable species remained static. This proves that HISD grazing increases the number of desirable species and decreases the number of undesirable species.

Native Grass: The amount of native species decreased drastically in the grazed plots and slightly in the excluded plots. Non-native plant species increased in the grazed plots all three years but remained the same in the excluded plot from year two to year three. The amount of native grasses remained the same between both treatments for all three years. In both treatments, the number of non-native grasses was greater in the third year.

Native Forb: The number of native forbs decreased in the grazed plots during the third year but was equal between between the two treatments all three years. The number of non-native forbs remained equal between the two treatments all three years. This data show that the HISD grazing plots were drastically affected with a decrease in native forbs.

Native Shrub: The number of native and non-native shrubs was equal between both treatments for all three years. This is because there are so few shrubs in the sampling plots, that there was no difference between the treatments. It seems that native shrubs decreased in year three compared to year two in both grazed plots and excluded plots.

Trees: The number of oak saplings was greater in the excluded plots the first year and equal between grazed and excluded the second and third year. The number of oak saplings increased each year in the grazed plots and increased the third year in the excluded plot. There were so few oak saplings encountered that only one or two could bring about a significant difference.

Acid Detergent Fiber (ADF): Growing season and dormant season ADF levels were lower in the grazed plots all three years compared to the excluded plots. The dormant season had higher ADF values, which makes sense because dormant season forage should be less digestible.

Neutral Detergent Fiber (NDF): Growing season and dormant season NDF percentages were higher in the excluded plots than the grazed for all three years. This shows that HISD grazing leads to lower NDF levels, and the levels remain low through the dormant season. This means that animals can consume more of the forages in the grazed plots.

Lignin: Lignin is a non-digestible material that is deposited into the primary and secondary cell wall as a plant matures. It gives the plant tensile strength and rigidity. As lignin increases, digestibility, intake and animal performance usually decreases and the percent of ADF and NDF increase. The lignin in the grazed and excluded was equal in both seasons for the first two years. Year one had higher lignin amounts than year two in both seasons for both treatments. This suggests that HISD grazing and exclusion do not play a role in lignin amounts in forage.

Total Digestible Nutrients (TDN): In the growing season of each year, TDN levels were higher in the grazed plots than the excluded plots. In both growing and dormant seasons for all three years, year one showed higher TDN values for both treatments. Grazing treatment seemed to have little or any effect on TDN percentages, but year and season had an effect.

Net Energy-Lacatation (NEI): In the growing season of the first year, NEI levels were higher in the grazed plots than the excluded plots. In the dormant season, year one showed higher NEI values than year two for both treatments. The growing season showed higher NEI values than the dormant season both years in the grazed and in year two in the excluded. Year and season had a substantial effect on NEI, but grazing treatment had little effect.

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Relative Feed Value: The grazed plots had unanimously higher RFV than the excluded in all three years and both seasons. During the growing season, the grazed plots in year three had a higher RFV than the grazed plots in year two, while the excluded plots were equal in the growing season each year. In the grazed plots, the growing season forages had higher RFV than the dormant forages all three years. In the excluded, the early season had an higher RFV than the late season. This means that HISD grazing produces higher quality forages than the exclusion of livestock, based on RFV.

Summary: Overall, based on this research, high-intensity short-duration grazing appears to produce higher-quality rangeland when applied to oak woodland and savanna rangeland. Specifically, HISD grazing increases plant species diversity, increases desirable forages, decreases undesirable forages and increases oak tree seedlings in the grazed areas than the excluded areas. HISD also promotes increased forage quality in the grazed areas compared to the excluded areas, with grazed plots revealing lower NDF values, lower ADF values, higher total digestible nutrients in the forage and higher relative feed values.

## Impact Statements

- This will provide information on beef production, pasture productivity and plant diversity, which will be useful to the ranching, agricultural, and scientific communities.
- The scientific evidence from this research will assist managers in making decisions about rangeland management practices.
- This research will also provide evidence that grazing is beneficial on public and private lands.
- Grazing livestock operators will have the opportunity to incorporate these data and adjust their grazing practices to newer and more advanced grazing management practices along with the ability to use the information to support livestock grazing, improve environmental and plant diversity and wildlife habitat.

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## For More Information

This research report contains summarized results of Michael Hall's study entitled "Effects of High Intensity-Short Duration and Open Cattle Grazing on Oak Woodland/Savanna Rangeland," ARI Project No. 00-3-014 (Research Focus Area: *Biodiversity*). To view and/or obtain a copy of the complete final report, or to obtain additional information about this or other research projects, visit the ARI website at *ari.calstate.edu*. For information on projects specific to Cal Poly San Luis Obispo, visit the Cal Poly ARI website at *ari.calpoly.edu*.