Riparian Grazing Strategies and their Impact on Riparian Health

Theresa A. Becchetti, Kenneth W. Tate,
Edward R. Atwill, David F. Lile,
Don L. Lancaster, Neil McDougald,
Sheila Barry, Roger S. Ingram, Holly A. George,
Wayne J. Jensen, William E. Frost, Royce Larsen,
Ralph Phillips, Mark Horny, John Harper,
Gary G. Markegard, Stephanie Larson,
Rick Delmas, James Farley, Larry Forero

UCCE Rangeland Watershed Group

Theresa Becchetti presented the initial results of research aimed at establishing what the interaction between cattle grazing, plants, stream bottoms, habitat, and fisheries actually is. Riparian grazing strategies and their impact on riparian health has been an issue for some time; and a good deal of literature has been published, with reviews of the literature conducted in the 1990's (Allen-Diaz et al. 1999, Belsky et al. 1999, Larsen et al. 1998, Rhinne 1999). After a review of this literature base researchers noted that some critical study components had been left undefined such as the stocking rates, physical characteristics, and the grazing system utilized for previous research. The experiments tended to compare "grazing" to "no grazing" a scheme that does not tend to provide enough information for land managers to make well informed decisions. Researchers also noticed that there was sparse information pertaining to direct links between grazing and adjacent fisheries; an important relationship. In sum, the preceding literature seemed to be lacking a toolbox of tested, site-specific grazing recommendations for land managers to utilize. Therefore, instead of using small plots, the current research identified the need to look at the landscape through a data driven, management scale project with the goal of identifying feasible grazing management strategies that can be utilized by land managers, and enhance riparian resources.

The riparian grazing project includes several objectives. The first was to complete a cross-sectional survey of California's rangeland riparian areas. Next, researchers sought to identify grazing management practices and site characteristics associated with high and low "riparian health scores." Researchers synthesized the data for site-specific recommendations. They of course, desire to publish and extend the information gathered. Furthermore, researchers utilized the sites to develop a set of case studies. Initially the sites were visited only once, and as previous research has demonstrated, there are often significant changes to an area between years. Therefore, a subset of research sites has been selected that will be much more manageable than the whole to observe changes to the system over time rather than just a snapshot. Study sites were established throughout California from Modoc County and Eureka in the north, south to San Diego, around the Bay Area, and along the Central Coast. The sites were located predominantly in the mountains and foothills and not on the valley floor.

Three visual assessment worksheets were utilized as survey tools; two habitat driven, one developed by the EPA and the other by NRCS, and one based on hydrologic condition, developed by the BLM. Researchers also put together a site characterization worksheet that looks at all the different components that could potentially pertain to various site-specific details; the goal of the worksheet was to get as site-specific as possible. Researchers also utilized a 130 question management survey that aims to gather as much information as possible from managers about the site, its history, and present use. Again the goal was to get as site-specific as possible.

The two habitat driven assessments from the EPA and NRCS utilized similar characteristics such as: the presence of large woody debris, undercut banks, the condition of gravels and cobbles on the stream bottom, and pools to rate the sites. The BLM's hydrologic function worksheet was more concerned with bank stability than with habitat features. For example, it gets at whether the creek has become too wide and shallow without proper flow, or whether the creek has become entrenched without access to its traditional floodplain to access the health of a system. The site characterization worksheet recorded such important physical details as width and depth of creek, flow, bankfull width and depth, whether it is flood prone, and a whole subset of site-specific characteristics, as well as the dominant vegetation, which included the top four species present in the riparian area as well as the adjacent upland. Two hundred and twenty-one grazed sites were evaluated utilizing 25 habitat questions, 17 hydrologic function questions, 65 site characterization covariates, and 130 management questions to tease out exactly what has been going on in the pasture or allotment. Approximately 100 ungrazed sites were also evaluated.

A Pearson correlation was used to compare the NRCS, EPA, and BLM worksheets. The EPA and NRCS worksheets were pretty well correlated yielding an r-value of 0.81, this was expected as they utilize similar visual habitat characteristics. The BLM worksheet was not nearly as well correlated with either the NRCS or EPA worksheets; this result was also expected because the BLM worksheet focuses on hydrologic function, while the other two are more concerned with habitat. Therefore, researchers decided to omit the NRCS worksheet and solely utilized the final outcome score from the EPA's worksheet and the BLM designation. Researchers also determined which out of the 65 covariates looked at had a significant impact on the outcome of the habitat scores. Entrenchment, substrate, and % canopy were the covariates found to have a significant impact on the final rating of all three habitat worksheets used in the study. Rosgen stream morphology components were utilized as the first cut site-specific covariate, since this system captures some of the most important variables when classifying streams that were found to be significant across all three worksheets; such has the entrenchment ratio for level I streams and the above plus substrate size parameter pertaining to level II streams in the Rosgen system. The Rosgen system classifies streams with a letter designation A through G. A-streams have limited flood plains and tend to be found in the mountains and foothills, B-streams are similar but with easier access. C and E-streams tend to be found in mountain meadows, have large floodplains, and lots of meanders. G-streams are degraded, and F-streams are degraded, but rebuilding. To determine how best to obtain site-specific results, EPA habitat scores were compared to Rosgen stream classifications. A, B, C, and E-streams that are considered healthy and stable systems under Rosgen classification were significantly different from and scored

higher with the EPA worksheet than the F and G-streams considered unhealthy under the Rosgen system. As a result the Rosgen characteristics were utilized for gathering site-specific data.

In order to be as site-specific as possible, current management practices (as person days per year) were examined at increasing levels of detail. At the most inclusive, least site-specific level I analysis all 128 grazed sites were included in the data set. From there the data set was divided based on whether the site was a perennial system with a summer growing season in the mountains or an annual grassland in the foothills with a winter growing season for the level II analysis. Finally, those two data subsets were each further divided into another two data subsets based on the Rosgen stream classification type. Since A and B-streams are very similar they were clumped together and separated from C and E-streams, also very similar, for level III analysis; the most exclusive, site-specific level of analysis.

A and B-streams are characterized by steep gradients, a limited floodplain, bedrock and boulders, and contain limited herbaceous vegetation. C and E-streams on the other hand are characterized by a limited gradient (.5-1% slopes), large floodplains, and lots of meanders; streams typical of mountain meadow systems with a lot more herbaceous vegetation and access for livestock compared with A and B-streams.

Out of the 130 management survey questions, researchers pulled out the questions that seemed the most relevant to yield answers that managers could utilize in their toolbox. The most important of these independent variables were; Growing Season Grazing (Early, Late, or Entire Season, Dormant Season), Stock Density (Number of head per acre), Animal Unit per Acre per Year (No. of animals/acre/year), Rest Provided (Yes/No), Rest Between Grazing (Days), Frequency (Number of times per year pasture is grazed), Herding (Man Days per Year), Off-Site Attractant Provided (Yes/No), Off-Site Attractant Time (Man Days per Year), and Fencing (Yes/No).

Results from the level I analysis showed that habitat scores were negatively associated with increased stock density and increased grazing frequency. The level I analysis also yielded results illustrating that habitat scores were positively associated with more rest between grazing, more herding, and more time spent utilizing off-site attractants.

As noted earlier, the level II analysis is somewhat more site-specific with less variation between sites. The level II analysis pertaining to summer growing, mountain systems illustrated that habitat scores were positively associated with more rest between grazing, more herding, and more time spent utilizing off-site attractants. The level II analysis pertaining to winter growing annual grassland systems illustrated that habitat scores are negatively associated with higher stock densities. The difference between data subsets is likely a consequence of the fact that foothill pastures tend to be smaller in acreage than mountain pasture allotments, and contain different types of riparian systems.

The level III analysis is the most site-specific analysis performed. In the case of the summer growing A and B-stream sites the sample size of eight was too small to draw any conclusions;

the minimum sample size for this study was set at twenty. Summer growing C and E-streams, on the other hand, yielded results similar to the level II analysis, but the relationships were stronger, as the level of analysis was more site-specific! For these sites, habitat scores were positively associated with more rest between grazing, more herding, and increased time spent utilizing off-site attractants. The model demonstrates that yes, some of these practices do work! A logistic two-tailed T-test was performed to see whether the aforementioned management practices were also positively associated with higher BLM hydraulic functioning ratings. The statistics showed that herding, but not rest between grazing nor time spent utilizing off-site attractants, was significant in determining the outcome of the BLMs' hydraulic functioning rating. However, whether an off-site attractant was utilized at all or not was demonstrated to be significant in determining the BLM's hydraulic function rating. Furthermore, when the EPA's habitat scores are compared to the days of rest between grazing and time spent herding; increased time spent herding results in consistently higher habitat scores.

In the case of the level III analysis pertaining to winter growing, foothill systems with A and B-streams, no variables were significantly associated with higher habitat scores. This makes sense because these streams tend to have a lot of exposed rock and very little herbaceous cover, and are therefore essentially bulletproof to the impact of cattle. Winter growing season, foothill systems with C or E-streams demonstrated that habitat scores are negatively associated with increased stock density. However, this variable was not significant to the outcome of the hydraulic function rating. It is intuitive that in these systems increased stock density would be negatively associated with higher habitat scores.

Time spent utilizing off-site attractants was found to be significant across all three levels of analysis. Furthermore, as site-specificity increased so did the coefficients and R-squared values. As a result the research demonstrates that managers can receive "more bang for their buck" when recommendations are as site-specific as possible, and treat each pasture as an individual rather than simply looking at averages.

In conclusion, underlying factors interact with management regimes; more site-specific recommendations appear better, the Rosgen system did a good job of capturing these. However, researchers are identifying feasible grazing management practices that can be or are being implemented that are associated with higher habitat scores.