Grazing and Land Management Strategies for Hardwood Rangelands[1]

Melvin R. George[2]

Abstract: Annual rangelands produce 84 percent of California's range forage which are used all year by sedentary ranching operations and seasonally by migratory operations. Environmental policy, energy and water costs may reduce traditional summer forage sources, resulting in increased grazing pressure on hardwood and annual rangelands. However, the landowner's production goals and society's environmental quality goals can still be attained by subdividing the ranch into management units based on the land's productive potential and resource value and by intensifying grazing management. Pasture subdivision and increased control over grazing time and space has the potential to increase ranch productivity and profitability while facilitating protection of critical areas such as oak regeneration sites, riparian areas, and wildlife habitat.

Most hardwood rangelands and associated annual grasslands are privately owned and produce 84 percent of California's range forage (Forest and Rangeland Resources Assessment Program 1988). These rangelands are the yearlong forage base for many livestock operations. Others make use of high elevation public and private range and pasture or foothill and valley irrigated pastures during the summer (Oltjen and others 1982).

Changes in public land grazing policy and energy costs may reduce the annual migration to high elevation pastures; and higher water costs may reduce the use of irrigated pasture. This will increase pressure on the hardwood and annual grass cover types, creating conflict with society's hardwood conservation goals.

Attempts to solve hardwood rangeland problems have taken a reductionist approach. However, there are problems relating to the management of hardwood rangeland systems which are not amenable to reductionism. The problem of poor oak regeneration on hardwood rangeland illustrates how resolution of some rangeland problems depends on their being seen within the context of a whole ranch. The biological causes of poor oak regeneration or declining wildlife populations are complex. Reductionist research is providing an understanding of the biology of the problem; technological research suggests some potential solutions. This in itself does not solve the problem. A systems approach must place the solution of oak regeneration in a whole ranch context that considers ranch production goals as well as society's hardwood conservation goals. Researchers use systems analysis to highlight deficiencies in the existing system, thus providing research direction. Ranch managers can use systems analysis to develop new tactics for engineering sustainable ranch systems using information generated from reductionist and technological research.

This paper reports how a few ranchers on hardwood rangelands are engineering new ranch systems that require more intensive management of land and grazing and how intensive management of privately owned hardwood rangelands can provide multiple goods and services. Livestock production, oak regeneration, and wildlife habitat objectives need not be conflicting. Planned grazing and land use management can facilitate the rancher's production objectives as well as society's hardwood conservation objectives.

In 1982 we began documenting productivity and management changes on ranches that have instituted intensive grazing management practices. The first ranch was on hardwood savanna in southern Tehama County (George and others 1989). Currently we are monitoring three ranches on hardwood rangelands as part of a case study of controlled grazing funded by the California Energy Commission. These ranches are in Glenn, Alameda, and Santa Barbara counties. Additionally intensive grazing management research is in progress at the University of California's Hopland and Sierra Field Stations.

The objective of this report is to review the benefits that may accrue if traditional extensive range management practices are replaced with more intensive practices that:

1. control livestock so that grazing becomes a controlled management practice.
2. divide the ranch into management units according to the land's productive potential and resource value.

Subdividing the ranch into several pastures or management units facilitates planned grazing management and planned ranch land use. Subdivision is usually achieved using fences. New Zealand fence technology that makes use of permanent and portable, electric and non-electric fences facilitates this subdivision, frequently at lower cost than traditional fencing (Broussard and Gates 1988, George and others 1989).

Ranch subdivision must be thoroughly planned to meet ranch goals. Therefore, prior to purchasing and building fences a ranch plan should be developed. The ranch plan should set goals, inventory resources, select viable management practices, and identify monitoring needs to keep the ranch on course toward its goals. Production goals describe short- and long-term strategies for achieving profitability and sustainability. Environmental quality goals describe the desired ranch landscape required to reach production goals while protecting or enhancing environmental quality. The resource inventory describes the ranch's current status as well as capabilities and constraints.

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[2]Extension Range and Pasture Specialist, Agronomy and Range Science Department, University of California, Davis.

INTENSIVE GRAZING MANAGEMENT

While most foothill and coastal ranches are subdivided into a few to several pastures, intensive control of grazing is seldom practiced. Seasonal or yearlong continuous grazing of foothill grasslands is traditional. However, it has also been common to graze different pastures seasonally. Research at the San Joaquin Experimental Range (Bentley and Talbot 1951) suggested that moderate grazing gave the most efficient cattle production, while maintaining satisfactory herbage production. Close grazing reduced range forage production as well as efficiency of cattle production. The effects of grazing intensity were apparent in winter growth of forage and in the yield of mature herbage. The effects of grazing intensity on plant vigor were less apparent during the spring. Differences in grazing during the current season partially obscured the effects of past grazing use. However, differences in forage yield and composition were still apparent in the spring. Currently, grazing management of hardwood range and annual grasslands emphasizes maintenance of adequate residue and efficient utilization of forage to encourage desired forage species and to ensure adequate soil protection (Clawson and others 1982).

Although annual plants do not survive from one growing season to the next, their management in one year can influence productivity the following year. Light to moderate grazing intensities that leave high amounts of dry forage residue in the fall tend to result in more desired forage species during the following growing season. Research has shown that heavy grazing left low amounts of dry residue which tended to produce undesirable species (Heady 1956, Heady 1961, Hooper and Heady 1970, Evans and Young 1970, Bartolome and others 1980). As grazing intensity increased, dry forage residue transferred to the following growing season decreased. As dry forage residues from the previous season increased, forage levels in January increased (Bentley and Talbot 1951).

Specialized grazing management systems adapted to hardwood range and annual grasslands generally have not been used nor have they been the subject of extensive research. Heady (1961) provided extensive circumstantial evidence from the literature to support yearlong grazing as the way to manage annual range. He also showed lamb weaning weights from continuously grazed pastures to be better than those from deferred rotation. However, this was a comparison of continuous grazing to a three pasture deferred rotation where a different pasture was used during each third of the grazing season. In the 1980s the results of this study were cited as evidence that time controlled rotational grazing (Voisin 1959) would have no production advantage over continuous grazing. However, time controlled grazing (TCG) is very different from the deferred grazing used in Heady's study.

During the 1980s a small number of ranchers began to subdivide their pastures and rotationally graze following the concepts developed by Voisin (1959). His grazing rotation principles are based on two simple rules: a) rest periods should vary with pasture growth rate; and, b) individual paddocks should be grazed for no longer than 3-10 days. During periods of slow pasture growth rests are long (60-90 days), and during periods of rapid growth rests are shorter (20 to 30 days).

Several changes in ranch productivity have been documented in our controlled grazing case study. The following production improvements have been documented: increased stocking rate has resulted in increased animal productivity (kg/ha), hay feeding has been reduced during fall and winter, less dependence on hay feeding during the current drought, weed populations have been reduced, and predator losses have been reduced. Increased gross income, reduced variable costs, reduced overhead costs, and improved operational efficiency are associated with these benefits.

Increased Production

Livestock production (kg/ha) can be increased in two basic ways: 1) increased animal performance, or 2) increased stocking rate. Table 1 shows the increased levels of production that have been documented on two ranches in northern California following the implementation of TCG. Table 2 compares pasture subdivision costs and production changes on rangelands with those of traditional range improvements.

Table 1—*Estimated material costs for fence and water development, and production improvements for annual range determined from ranch records.*

	Costs ($/Ha)				Livestock Production (Kg/Ha)			
Pasture Type	Fence	Water	Total	Total Amortized*	Before CGS**	After CGS**	Difference	Stock Type
Annual Range	12.5	0	12.5	2.30	28	54	26	Calves
Annual Range	12.5	0	12.5	2.30	56	84	28	Stocker

*Costs amortized over 10 years @ 13 pct.
**CGS = Controlled Grazing System.

Table 2—*Comparison of pasture subdivision to other common range improvements using conservative estimates of improvement life, costs and production increases.*

Practice	Life (yrs)	Cost ($/Ha)	Amortized Cost ($/Ha/yr)	Production Increase (pct)	Return (kg/Ha)
None	—	—	—	—	56
Subdivision	10	25	4.60	30 - 100	84
Legume Seeding	20	125	17.80	50 - 100	84
Nitrogen Fertilization	2	62	37.50	50 - 100	84

Winter Feeding

Preliminary ranch analyses and observations have suggested that winter feeding can be reduced under TCG. Winter feed costs are one of the larger variable costs on hardwood rangeland livestock systems. Willoughby (1958 and 1959) showed that animal performance increased as forage level increased to 1250 kg/ha. Therefore, increases in forage level due to grazing management may improve animal performance and decrease winter supplemental feeding. Winter forage on offer usually increases as grazing intensity decreases. Bentley and Talbot (1951) showed that winter cow weight gain increased as grazing intensity decreased (table 3). Over a nine year period the average starting date of the winter grazing season was January 29 and the average ending date was March 21. Observation and measurement of winter forage levels indicated that stock in a rotation usually move to a higher forage level than that found in their current pasture. This would suggest that there may be an opportunity to reduce winter supplemental feed with TCG. Limited information from one ranch indicated that winter hay feeding decreased from 450 kg/cow to 91 kg/cow after implementation of TCG. Three ranches that implemented TCG just before or during the current drought appear to have maintained their cow herd with less hay feeding than their neighbors. While these observations are encouraging, only long-term monitoring can substantiate the effect of TCG on ranch operations and profitability.

Weed Control

Pasture weeds are the number one complaint of many pasture owners. Several ranchers have witnessed decreases in pasture weeds following implementation of TCG. Unfortunately, we have not documented these apparent declines in plants such as sour dock, foxtail, and even thistles; however, we have documented a decline in medusahead (*Taeniatherum asperum*) on hardwood range two years after implementation of TCG (table 4). Medusahead declined from 45 percent of the species composition to ten percent, and the heavy litter associated with medusahead patches was reduced (George and others 1989). Studies are currently underway to develop a grazing prescription for managing yellow starthistle (Thomsen and others 1989).

Reduced Predation

One sheep ranch in Solano County, several in Mendocino County, and one in Humboldt County have reduced coyote predation through the use of electric fencing. Jones and others (1990) reported reduced lamb losses when early weaned lambs were grazed in small intensively managed pastures. Pratt (1987) reports sufficient decline in lamb losses following addition of three offset electrified wires to an existing fence to pay for the fence in one year (table 5). Another sheep producer uses a Great

Table 3—*Nine year average winter beef cow gains on foothill rangeland grazed for an average of 51 days ending on March 21 (Bentley and Talbot 1951).*

Grazing Intensity	Grazable Hectares	Grazable Hectares per A.U.*	Gain (kg)
Close	42	2.2	20.7
Moderate to close	54	2.3	29.8
Moderate	65	3.3	53.3
Light to moderate	82	4.2	48.2
Light	103	5.2	45.7
Light	73	3.7	50.3

*Animal Units

Table 4—*Change in species composition (pct) from 1984 to 1986 for four transects in medusahead infestations and one transect in a small ungrazed exclosure.*

Composition	Medusahead 1984	Medusahead 1986		Exclosure 1984	Exclosure 1986
Bare Ground	1	8		0	0
Litter	16	25		16	18
Medusahead	45	10	*	8	10
Soft Chess	17	23		16	
Wild Oats	4	0		34	22
Annual Ryegrass	2	5			
Annual Fescue	1	2			
Ripgut Brome	0	0		22	44
Annual Legumes	4	4			
Filaree	10	13			
Other Forbes	2	6	**	4	6
Sample size (n)	4	4		1	1

* ($p<0.01$)
** ($p<0.05$)

Table 5—*Sheep (no.) and financial ($) losses due to coyote predation before and after installation of electric fencing in 1985 (Pratt 1987).*

	1984-85	1985-86	1986-87
Ewes*			0
Lambs**			0

*$35.00 each
**Avg. 43 kg. @ $1.54/kg.

Pyrennes guard dog to supplement the electric fences. The concentration of the sheep that occurs in a TCG prevented the dog and sheep from being separated and thus less effective.

INTENSIVE LAND MANAGEMENT

Pasture subdivision can have multiple pervasive effects on the ranch system. It facilitates improved grazing management, but more importantly, it facilitates focused management of the whole ranch landscape to achieve a variety of production and environmental quality goals. Subdividing the ranch into management units allows the manager to use each unit to its "highest and best use" for reaching ranch goals. Grazing can then be planned to facilitate management of these units to achieve goals and production targets for each unit. The following improvements in ranch land use management have been documented in the controlled grazing case study: revegetation of gullies, controlled access to riparian areas, increased cover adjacent to riparian areas, increased vigor of native perennial grasses.

While no single ranch has implemented all of these practices, the following are examples of opportunities that could be implemented:

1. Develop riparian pastures that can be managed for riparian values.
2. Develop oak regeneration pastures that will be managed for oaks.
3. Graze some pastures less heavily to leave cover and nesting habitat for wildlife.
4. Thin oaks from some pastures to increase forage production.
5. Seed legumes and fertilize to increase forage production and quality.
6. Mob stock some pastures at strategic times to manage weed species.
7. Use a mix of continuous and rotational grazing to meet animal performance and forage utilization targets and to reduce supplemental feeding.
8. Develop agroforestry pastures where biomass or Christmas trees and forage are produced.
9. Develop perennial grass pastures (native or introduced) to lengthen the green forage season.

This all appears complicated, but ranch planning and planned grazing coupled with ranch monitoring can bring managerial control to this complex process. To help ranchers and landowners plan, Cooperative Extension's Ranch Resource Management Project funded by the Renewable Resources Extension Act and the California Energy Commission has delivered short courses on ranch planning and grazing management to seventeen counties in the last two and a half years. These courses will be conducted in additional counties in 1990-91 and new short courses are under development.

CONCLUSION

California's range livestock industry has adjusted to external pressures throughout its history. Now and in the coming decades grazing management will become more intensive in response to environmental and economic concerns. Changes in grazing and ranch management practices to increase production efficiency will be essential as California's red meat products compete for world markets. Likewise, producers will adjust their grazing and related range operational practices to reduce environmental impacts voluntarily or in response to local, state, and federal regulations.

REFERENCES

Bartolome, J.W.; Stroud, M.C.; Heady, H.F. 1980. Influence of natural mulch on forage production on differing California annual range sites. Journal of Range Management 33:4-8.

Bentley, J.R.; Talbot, M.W. 1951. Efficient use of annual plants on cattle ranges in the California foothills. Circ. 870. U.S. Department of Agriculture, 52 p.

Broussard, Kevin R.; Gates, Roger N. 1988. Comparative costs of fence construction. Rangelands 10:224-226.

Clawson, W.J.; McDougald, N.K.; Duncan, D.A. 1982. Guidelines for residue management on annual range. Cooperative Extension, Division of Agricultural Science, University of California Leaflet No. 21327. 3 p.

Evans, R.A.; Young, J.A. 1970. Plant litter and establishment of alien annual weed species in rangeland communities. Weed Science 18:697-703.

Forest and Rangeland Resources Assessment Program (FRRAP). 1988. California's forests and rangelands growing conflict over changing uses. Sacramento: Calif. Dept. of Forestry and Fire Protection; 103-106.

George, Melvin R.; Knight, Ronald S.; Sands, Peter B.; Demment, Montague W. 1989. Intensive grazing increases beef production. California Agriculture 43:16-19.

Heady, H.F. 1956. Evaluation and measurement of the California annual type. Journal of Range Management 9:25-27.

Heady, H.F. 1961. Continuous vs. specialized grazing systems: A review and application to the California annual type. Journal of Range Management 14:182-193.

Hooper, J.F.; Heady, H.F. 1970. An economic analysis of optimum rates of grazing in the California annual-type grassland. Journal of Range Management 23:307-311.

Jones, M.B.; Demment, Montague W.; Dally, Martin R.; Vaughn, Charles E. 1990. California Agriculture 44(5):38-39.

Oltjen, J.W.; Bywater, A.C.; Benson, C.R.; Clawson, W.J. 1982. An analysis of the California beef cattle industry. Beef Cattle Industry. Cooperative Extension, Division of Agricultural Science, University of California. 26 p.

Pratt, David. 1987. Electric fences for predator control. University of California, Cooperative Extension, Solano County. 2 p.

Thomsen, Craig D.; Williams, W.; George, Melvin R. 1989. Managing yellow starthistle on rangeland. California Agriculture 43:4-7.

Voisin, Andre. 1959. Grass productivity. New York: Philosophical Library Inc., New York. 353 p.

Willoughby, W.M. 1958. A relationship between pasture availability and animal production. Proc. Australia Society of Animal Production 2: 42-45.

Willoughby, W.M. 1959. Limitations to animal production imposed by seasonal fluctuations in pasture and by management procedures. Australia Journal of Agriculture Research 10:248-268.