

rotated around Montana. Usage is expected to increase as the number of potential instructors (school teachers, range conservationists with federal and state agencies and extension service personnel) increase. For further information, contact Natural Resources Education Project (Phone: 406-994-5380), 127 Gaines Hall, Montana State University, Bozeman, Montana 59717-0003.

It seems that the effort to upgrade existing educational material on grazing land management into an attractive,

contemporary, well-illustrated package needs to be continued. But why not also incorporate the Grazing Land Simulator into the overall educational system? Our experience confirms that it is instructive, informative, and interesting. It creates interest and clearly illustrates the importance of grazing lands and the fundamental principles of grazing land management. Without doubt, the Grazing Land Simulator is potentially valuable as an educational tool.

Pearls of Wisdom from the Conference

Multispecies Grazing: the State of the Science

Frank H. Baker

The following statements are the report of a conference held June 25-28, 1985.

Eldon White, American Sheep Producers Council. Care must be given to build upon the tried and true practices of yesterday by adding the latest technology in the area of multispecies grazing.

John Merrill, National Cattlemen's Association. Our objective is to increase biologic and economic efficiency of livestock users. The bottom line is how to select livestock to most efficiently harvest and market available forage on a sustainable basis, with minimum inputs, for a relatively stable market and for a profit. The application of good ecology and good economics will go far toward assuring the survival and success of livestock producers.

Walter Wedin, American Forage and Grasslands Council. Multispecies grazing aids in reducing insults to the environment such as soil and water loss and pesticide application. This objective can be supported by everyone.

Peter Jackson, Society for Range Management. Four cardinal rules can help achieve the real potential of multispecies grazing: (1) pick and choose carefully among the new advances in technology, (2) diversify, (3) be conservative and plan ahead, (4) work hard.

Donald Davis, Texas A&I University. If prevention and control of diseases and parasites are combined with proper management of habitat, animal losses in most cases can be minimized.

Lynn Drawe, Welder Foundation. If a rancher wants to 'have his cake and eat it too' in terms of livestock and wildlife, he

must select management goals and use available knowledge to work toward them.

Ronald H. Thill, Forest Service. The potential for combined production of timber, livestock, and wildlife in the South is unexcelled by any other region of comparable size in the country. Increasing resource demands will ultimately dictate greater reliance on integrated management strategies for southern forests.

The Multispecies Grazing Conference was developed in response to livestock producers' inquiries as to whether combining sheep with cattle would improve the economic efficiency of midwestern farms. We came together to summarize the state of the science for the benefit of U.S. livestock producers and key individuals in research and education. The interest in the subject matter and the concept motivated the following organizations to support the conference by providing travel support, speakers, and participants:

Agricultural Research Service, USDA	Oklahoma State University
American Forage and Grasslands Council	Oregon State University
American Sheep Producers Council	Radakovich Hereford Farm
Colorado State University	Rob and Bessie Welder Wildlife Foundation
Extension Service, USDA	Society for Range Management
Forest Service, USDA	Texas A&M University
Hawkeye Institute of Technology	Texas A&I University
Kerr Foundation	Texas Christian University
Iowa State University	University of Arkansas
Mississippi State University	Winrock International
National Cattlemen's Association	

The Sheep Industry Development Council provided special financial support to assist with publication and travel costs.

The 30 Conferees from key areas of the United States met at Winrock International in June 1985. They included (1)

selected livestock producers with experience in managing units using more than one species of animals, (2) scientists in the plant and animal sciences and economics, (3) education specialists, (4) leaders of cooperating organizations. The following questions served as a guide for the conferees:

- (1.) Can economic efficiency and productivity of livestock ranching and farming operations be improved in this decade by increased multispecies grazing?
- (2.) Is multispecies grazing beneficial for cattle enterprises? For sheep enterprises? For rangeland and pastures?
- (3.) Is current knowledge of multispecies grazing adequate or is lack of knowledge a constraint for designing systems for commercial operations?
- (4.) Are extension methods adequate for designing systems for commercial operations?
- (5.) Can concerned specialists develop a plan for using multispecies grazing concepts to improve the future of U.S. animal agriculture?

Relevant research data and producer experiences for both arid and humid areas of the country were reviewed, evaluated, and summarized. Both a research strategy and an education promotion strategy were developed as outputs of the conference. Summaries of the presentations and discussions are presented below.

Biological Efficiency of Rangelands—C. Wayne Cook

The biological efficiency of the range ecosystems and other ecosystems (ranches and farms) involving plants, domestic animals, and game animals, is best evaluated by measuring yield of products exported from the systems on a sustained basis. The net monetary return to the overall management of the systems (profit or loss) provides very useful data for ranchers and farmers.

The mix of plants and animals used is very important to the success of the system. The similarities (overlaps) and differences of diets of the various species of grazing animals are very important in the use of the plant materials available in the systems. The plant materials are considered in three broad categories of grass, forbs, and browse. Cattle use mainly grass, a few forbs, and a small amount of browse. Sheep also favor grass but consume much more forbs and browse than cattle. It has been estimated that there is a 35% overlap in diet between cattle and sheep. Goats consume almost as much browse as grass in their diets with forbs making up a very low percentage. Deer favor browse and forbs as major components of the diet. Thus, the manager of a livestock unit (ecosystem) should select the mix of animals for the unit based on the types and volumes of plant materials available. Animals that produce twins or triplets that grow rapidly but nurse their mothers relatively short periods are said to be highly efficient.

Multispecies Grazing Research in Texas and the Southwest—Charles A. Taylor, Jr.

Forage selection by grazing animals is influenced by the interaction of several animal and plant factors. These include forage quality and availability, animal-prehensile-grazing ability, biting or pulling materials from the plant, animal anatomy, (teeth, lips, and mouth structure), secondary plant

metabolites, topography, animal agility, physical plant properties, and animal competition.

Management practices of controlling grazing pressure and animal mixture influence diet selection, immediate and long term vegetation changes, and animal foraging. As available vegetation decreases, dietary overlap among cattle, sheep, and goats increases, particularly in drouth and dormant growth periods. Mature forage will not support high levels of animal production. Allowing animals to select the most nutritious parts of vegetative material is vital in successful production systems. Knowledge of animals and range is essential to determining the most desirable mix of grazing animals in any given ranch situation.

Cattle and Sheep Behavior on a New Mexico Range—D.M. Anderson

Cattle eat more grass and drink more water than sheep. Consumption by grazing animals is influenced by grazing time, eating rate, and bite size. Senses of sight, sound, smell, and taste influence an animal's behavior. Smell and taste influence diet selectivity. Light is a key factor in triggering daily grazing. Temperature (either high or low) reduces energy expenditure. Age, breed, and physiological factors influence dominance, travel, and intake. Pasture size, herd or flock size, forage quality, vegetative types, and physical structures influence where animals graze. The distribution of cattle and sheep in grazing pastures vary for different seasons of the year.

Multispecies Grazing on Public Lands of Utah and the Western States—James E. Bowns

Research and observations have shown that combining animal species is valuable in range management. Great potential exists for use of multispecies grazing of livestock and wildlife to maintain forage production and species diversity. Land managers should recognize the value of multispecies grazing and be encouraged to apply this concept to the public lands.

Combined Cattle and Sheep Grazing in the Intermountain Region—John Etchepare

Our ranch experiences show that combining cattle and sheep offers the most efficient way to harvest the forage available on our rangeland. Decisions on grazing management are dictated by weather, time, year, and types of forages. Sometimes cattle follow sheep through the ranges whereas at other times the reverse is true or the two are combined in the pasture. Under our multispecies program we are running more total animal units than we could with a single species. We are obtaining better economic returns, more uniform use of forages, and improved control of poisonous plants (larkspur and leafy spurge). Unfortunately, in Wyoming and Montana the gains through the use of multispecies grazing are lost or overshadowed by the ineffectiveness of the predator-control program. Predator losses must be controlled if the use of multispecies is to be used by ranchers of the region.

Multispecies Livestock Systems in New Zealand—Howard H. Meyer

New Zealand farmers use multispecies grazing to maximize profit in producing and marketing more forage through

livestock. The complementarity and ratios of species used result in the highest overall returns, even though one species may appear to be less profitable individually than another. The farmers feel that the flexibility allowed by the use of multiple species makes such systems more easily managed than the single species operations. The systems may include one species following another through a pasture (cattle after sheep or vice-versa) or grazing of the species in common. Farmers make decisions as to which strategy is most appropriate on specific pastures.

Advantages of the Multispecies Systems in New Zealand are:

1) Complementarity: this is due to the differences in preferences for plant species, ability to digest various types of forage, and the patterns of forage harvesting (grazing).

2) Improved pasture management and forage production: this influences productivity through species composition and the maintenance of the plants in a vegetative state. The use of cattle on rough terrain to control pasture growth is more economical than the use of mechanical harvesting of surplus growth.

3) Diversification and income stability: marketing multiple products tempers the volatility of the export market prices due to worldwide production patterns and international policies. Timing of sales to improve cash flow is important and easier accomplished with multiple products.

4) Parasite management: through the use of more than one livestock species, the combination of the grazing management techniques with strategic use of anthelmintics optimizes control of the internal parasites.

Disadvantages of the Multispecies Systems in New Zealand are:

(1) Increased facility costs: this is due primarily to the cost of fencing and handling facilities for the 2 species. (2) Reduced efficiency within each species: this is due to the reduced volume of each species in the operation with some loss in volume discounts on services and materials (vaccines, drenches, and supplies). (3) Labor conflicts: this can be a problem if calving and lambing occur at the same time. (4) Increased management skills: this is due to the increase in required knowledge of nutrition, diseases, breeding practices, and marketing.

Multispecies Systems for California—Robert H. Blackford, Jr.

Adding some sheep to cattle or some cattle to a band of sheep on individual range areas on our ranch has increased the carrying capacity and income returns by 15 to 20%. Our operations include 3 types of livestock ranges: (1) low foothills that we use in winter and spring, (2) mountain ranges for summer and fall, and (3) irrigated valley pastures for summer grazing. We have greater success combining sheep with mature cows and their calves than with yearling cattle. Yearlings are more playful and spooky when they encounter people and some injuries to lambs resulted. Cows without Brahma blood are more docile and better suited for the dual grazing. We needed some added fencing and corrals to combine cattle and sheep. We feel we suffered less predator problems when cows and calves were with the sheep. Some cows with new calves will chase coyotes away.

Multispecies Grazing in the Southeastern States—Hudson Glimp and J.W. Essig

The Southeast is the most rapid lamb-consumption area of the United States. Sheep numbers are rather low and cattlemen have almost no experience in sheep production. Technical constraints are not a factor limiting expansion of sheep and goat production of the area. Changing attitudes, developing market structures to take advantage of marketing opportunities, and developing the education resource base for farmers are needed to institute changes. Multispecies grazing can be an important part of the changes in the livestock industry of the region.

Adding Sheep to Cattle for Increased Profits in Virginia—S.H. Umberger, B.R. McKinnan, and A.L. Eller (abstract from a Virginia Extension leaflet.)

Many dairy and beef cattle producers in Virginia could realize greater profits from the same pasture inputs by adding sheep to their farm as a supplementary enterprise. The addition of one sheep per cow unit or equivalent animal unit without increased pasture acreage is indicated by research. This two-enterprise system improved pasture conditions and is estimated to increase economic returns per acre by 29% compared to cattle alone. It is based on (1) complementarity in grazing ability, (2) control of weeds through sheep grazing the forbs, (3) complementarity in grazing locations: sheep prefer high ground and will graze on areas where cattle manure has accumulated whereas cattle prefer lower, wetter areas. The multispecies system requires (1) improved fencing and facilities, (2) increased management skills, and (3) improved predator control compared to cattle alone.

Summary of Multispecies Research Strategies—J.L. Schuster

Multispecies grazing management evolved in regions with diverse vegetation types and suitable climates. A system involving cattle and sheep has been dominant; in the Southwest goats have been an additional component. Wildlife such as deer have generally been incidental to these systems, but recent economic pressures dictate that wildlife be included where present.

Research to provide the technology needed to implement multispecies enterprises involves interdisciplinary teams and must examine all resources of the region under consideration. The integrated systems approach required includes (1) component research to determine basic production data for soil, forage, and animal responses in different geographic regions plus the relevant sociological influences; (2) interaction research to study the relationships and interactions between components of the multispecies production systems; (3) integrated plant/animal-production systems research to develop management systems and techniques adaptable to the short-term and long-term goals of the people of the region plus the economics of the systems; and (4) technology transfer research to develop the educational and communications strategies and message components needed to inform selected audiences of physical and biological research findings and their applicability to various regions and situations.

Summary of Multispecies Education and Promotion Strategies—S.A. Ewing

Well-managed multispecies grazing allows more efficient use of land and feed resources than does single-species grazing. It thus improves the competitive position of enterprises dedicated to using ruminants for food and fiber products. This approach to land use may enhance the environment for wildlife and offers an effective means of biological control of many undesirable plant species.

Guidelines for developing programs to improve awareness of opportunities, benefits, and technology associated with multispecies grazing are:

(1) Prepare a document described as a prospectus on multi-

ple-animal species management in improved resource use in agriculture.

(2) Prepare multispecies factsheets that amplify the major points in the prospectus.

(3) Make existing and additional management documents available for interested users.

(4) Develop educational materials for:

4-H, FFA, and other youth groups.

Any interested audiences.

(5) Each state is encouraged to identify producers who have successfully adopted multispecies grazing, research, and demonstration locations, and other possibilities for 'on-site' observations, field days, and shortcourses.

Deer Management on the Bonnie Hills Ranch

Cuatro Patterson

For many years, my forefathers have managed their own livestock to make sure the ranch was run well and the herds were always improved on. They personally made sure that any inferior or nonproducing females were culled, and they would also select the finest males they could find to sire the herds.

After a considerable amount of soil erosion (which resulted in the depletion of the better grasses) occurred on our ranch, my forefathers decided to embark upon range management. With the combination of livestock and range management, they felt that they were doing their utmost as far as range economics was concerned. One of the latest management practices they have embarked upon is that of deer management.

To the generation of my great-grandfather and grandfather, deer management was an unheard of practice. When they were young men, deer management was not anticipated because there were so few deer then that the deer herd was not considered an economic factor to the livelihood of ranching.

I would like to explain how and why we are trying to have a good deer management program on our Bonnie Hills Ranch, which is located in the hill country of the Edwards Plateau in South Central Texas. Our ranch, which we acquired in 1976, has been in the family for approximately one hundred years. The ranch had been under the ownership and management of my great uncle for many years, and during this time there was virtually no deer management on the ranch. The only established hunting guidelines were to allow the killing of bucks of eight points or more, and to disallow the killing of does and spikes.

After one year on the ranch we realized that the deer herd had been neglected. This was the first step in beginning the deer management program. However, before we could solve

the problem we had to analyze it and determine the correct actions to take.

With the help of our county agent and the Texas Agricultural Extension Service, we learned that three tasks must be carried out to have an effective program. First, our herd should be within or below the carrying capacity of our range. If the herd exceeded the carrying capacity, we needed to reduce it to a proper level during the next hunting season or there would be too much competition among the bucks in the herd, resulting in poor development of antlers. Secondly, we needed to maintain a ratio of one buck to one or two does. This ratio has no magical properties; it simply allows you to carry the maximum number of deer and maintain the quality at the same time. Thirdly, the bucks taken should be only the very small and the very large. The middle age bucks should be left to grow, age, and develop massive antlers.

We began our program by making a spotlight census count each fall to determine how many deer were on the ranch and what the ratio of bucks to does was. After we had done this, we reviewed these findings with our hunters and entered into a five-year contract based on the apparent needs of our deer program.

Our census revealed that we had far too many deer for our carrying capacity. This meant that our hunters needed to kill a large number of does and inferior bucks. This was something we had never done before. In this contract with the hunters, we chose to limit the bucks killed the first two years to seven points or less. This plan would work in two ways. We would be eliminating many of the inferior bucks while leaving the larger ones to grow and serve as the herd sires. We promoted the killing of does by requiring each hunter to kill at least one doe before they could kill a buck.

A very important part of our deer management program was maintaining accurate records. We aged, weighed, and