Range Conditions around Water Sources in Botswana and Kenya

Emery M. Roe

A common theme in African range management literature is that too few (or poorly distributed) livestock watering supplies can encourage overstocking and overgrazing. A related theme is that certain types of water sources are likely to cause more overstocking and overgrazing than others. So-called "permanent" water supplies, particularly boreholes and deep wells, have often been singled out as susceptible to such mismanagement. Similarly, privately held water sources are frequently said to be better managed than group or communally held ones. Recent research in Botswana and Kenya examined the relationship of water source type and the condition of the grasslands around the water supplies. The data suggest that the association of water supply and forage use is not as straightforward as has been assumed in the past.

Water Survey in Eastern Botswana

The most detailed information on this topic comes from Botswana. At the request of the Botswana Ministry of Agriculture, Cornell University in cooperation with the United States Agency for International Development (USAID) undertook a rural water supplies survey in Botswana's more heavily populated cropping and grazing areas. Part of the task was to analyze the effect of water supply type on livestock watering numbers and surrounding range condition at 12 representative localities in eastern Botswana. Monitoring was performed between October, 1979, and July, 1980. Information was gathered on livestock numbers and grazing intensities associated with a sample of between 34 to 46 watering sites in these areas.

Standardized livestock counts were taken and range scorecards were used to measure various grass and brush factors along a transect set at each watering point. Water supplies were classified in 2 broad ways: (1) physical type and (2) management type. The physical types were (a) haffirdams (large excavated pans), (b) dams, (c) boreholes and equipped wells, and (d) open wells. Classifying the water sources by management type was more difficult since "management" means different things to different people. For example, a group-operated, government borehold might in reality be managed as if it were a private borehole owned by one "big man"; and a privately owned open well might in fact be used by residents of a locality as if it were a communally held, open access facility. For this reason, each water point was classified by its (i) owner, (ii) manager, and (iii) what kind of access the members actually had to the water supply (i. e., was its access open or restricted by the imposition of fees, labour, or membership requirements). Owners and managers were futher separated into three categories: (j) private individuals or families, (jj) groups and government authorities (over half of the group water sources were initially provided by the government), and (jjj) natural and communally held water sources. Differences between types were identified through use of simple nonparametric measures.

The data analysis showed significant differences between the types of water sources and the daily livestock watering numbers, *though primarily in the dry season only.* In the dry season, a borehole-equipped well facility watered more livestock on an average daily basis than did an open well. Irrespective of whether management was defined by owner or manager, a group-government water source had significantly more average daily livestock watering units than did a private one—again only in the dry season. Both of these results support the view that large capacity, permanent water sources can encourage greater livestock watering numbers, and that privately held supplies have fewer numbers than do group-sponsored ones.

These results suggest that the grazing condition should be better around smaller-capacity supplies and privately held ones. This was not confirmed when range condition scores were compared for different water source types. It was found that the average group and government owned water facility had significantly better dry season range conditions associated with it than did the average privately owned water source. This relationship was also found, to a lesser degree, when the classification was by the type of water manager. At all transect distances monitored, the dry season range condition was better around group-government owned water points than around privately owned sources. This suggests that a privately owned water point had no better guarantee of

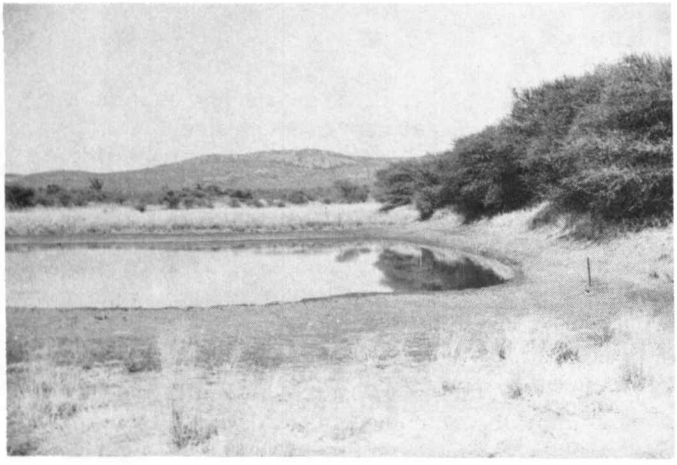
The research in Botswana was funded in part by the Government of Botswana and the U.S. Agency for International Development with the Center for International Studies, Cornell University. The reader will find a more detailed discussion of these research findings and methodology in "The Water Points Survey" by Fortmann, L. and Roe, E., 1981 Ministry of Agriculture, Gaborne, Botswana. Also, "Season and Strategy: The Changing Organization of the Rural Water Sector in Botswana" by Roe, E., and Fortmann, L., 1982. Special Series on Resource Management, Rural Development Committee, Cornell University, Itaca, New York.

The studies in Kenya was funded in part by the Government of Kenya and the U.S. Agency for International Development through their Arid and Semi-Arid Lands Project. More details on the range analysis can be found in "Water Development and Range Condition" by Kuchar, P., 1983 *In:* Appendix D6 of the Draft Final Report (Prefeasibility Study): Kitui District Water Resources Study. Louis Berger International, Inc. Ministry of Economic Planning and Development, Nairobi, Kenya.

Editor's Note: The author is advisor on arid and semiarid lands in the Government of Kenya's Ministry of Finance and Planning, Nairobi. Some of his observations and conclusions could be applied equally well to the rangelands of United States.

any less intensive grazing than a grouped owned one.

Few differences in range condition were found when contrasting the 4 physical types of water supplies. Some slight differences were noted, but overall, the physical type of water source does not appear to be particularly useful in predicting either dry season or wet season range condition around the water site. For a better prediction, one must look to how the people and livestock actually use and manage the water source.



A natural earthen pond providing water for approximately 8 months.

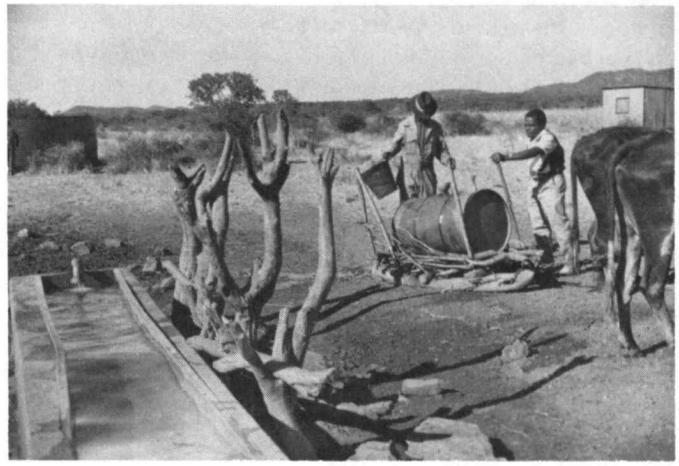
The survey found that the type of access users had to watering points best explains the differences in range condition associated with the water supplies. In particular, an average restricted-access water source had much better grazing conditions than did an average open access water facility, *especially in the wet season.* It seems that the practice in some areas of restricting livestock access to certain water supplies during the rainy season, allows the surrounding forage to rest during the period of maximum rainfall. This appears to be especially important in improving forage quality around these supplies.

It was disturbing to find that there was no one-to-one correlation between the livestock watering numbers and the quality of the surrounding grazing. There are a number of factors that intervene to work against a direct correlation. For example, it is true that open wells typically had fewer livestock watering numbers than did boreholes and equipped wells. Yet the comparatively longer use of these open wells, and the clustering around rivers in some localities, explain some of the higher incidence of overgrazing around them. Similarly, some heavily used group water supplies, particularly surface water sources, "conserve" grazing by drying up on a seasonal basis. Some boreholes, considered "permanent," shut down in the wet season as less expensive and more conveniently located puddles and pools become available. This conserves the forage around the boreholes. Clearly, if animal access can be effectively restricted at water sources during the rainy season, the forage has a better chance of improving.

Perhaps the only thing that can be said with any confidence about the link between livestock watering numbers and surrounding range conditions is that both factors are profoundingly affected by *seasonality.* These factors underline the real difficulty in Botswana of computing the *actual stocking rates* around water sources since livestock numbers, range condition, and water source management are so seasonal.

Water Resources Study in Kenya

As part of a water study by Louis Berger International, on behalf of USAID and the Government of Kenya, a separate survey was undertaken to analyze the effect of different water sources on adjacent range conditions in the central rangelands of Kitui District in eastern Kenya. Four arid or semiarid localities were chosen with 33 different water sources. Dry season index scores were taken during October, 1983, for forage stands at about 1/3 to 2/3 miles (1/2-1 km) from each water source. Nonparametric tests were used to identify range condition differences between water source types. Major types were distinguished in terms of their technology (high, medium, or low) and the degree of seasonality there (permanent or temporary).



Drinking trough supplied by diesel pumped water from a borehole.

No significant correlation was found between range condition and water source type. While some of this absence of relationship was due to the leveling effect of the dry season, it was concluded that the wholesale range impact by stock has reduced the grazing to a common base level of poor condition, irrespective of water source type. Under the circumstances, the addition of more water sources could do no more harm to the forage resource than was already done. However, the brush encroachment and dense thicket in some areas afforded substantial goat browse that was presently under utilized. Thus, if goat development was economically feasible in these areas, then the placement and management of new stock watering supplies should be set within the framework of such a program.

Policy Implications

While overall range conditions were found to be poor in both studies, it is probably in Kenya where barren landscapes chillingly illustrate how the long-term range condition is affected by the interaction of persistently high stocking rates, low rainfall, and periodic droughts. Yet both

studies describe a variety of water sources and range condition relationships that fall in different places along a continuum. At one end of the continuum are the virgin grasslands; at the other end are the abandoned and eroded plains and slopes, alive only to dust devils. While the results of both studies caution against opening up new grazing areas without sufficient forethought to water source placement and use, this is not their major policy implication. Instead, both studies indicate that the real range management challenge is the planning of water and range development for those areas that continue, to varying degrees, to be intensively grazed between the ends of this continuum.

Simple range recommendations, such as small capacity water sources or privately held ones as opposed to large capacity or communal water supplies, may be appropriate for the few new grazing areas. They are not suitable for the bulk of those cases that lie in the middle of the continuum which these studies describe. It is the middle group of cases where herd and water source management are at times indistinguishable and where the requirements of herd management almost solely set the context in which water is to be used and access regulated. Thus, an overgrazed area might still be suitable for a goat browse project. An overgrazed area might still have some viable cattle watering locations which can be closed during the wet season for subsequent dry season use. In today's Africa, discussion of new drinking water locations for many already heavily used grazing lands must start with *what* is to be the continuing use of the rangelands, *when* are the water and forage needed, and *for how long* are they needed *where*. ●

The Challenge of Integrated Brush Management in Semiarid Tropics

Linda Howell Hardesty

Shrubs and other woody plants cover more than half the earth's surface. Often they are important forage plants. In some cases they are unpalatable, noxious, or otherwise compete with more desirable plants. Undesirable woody plants, called brush, are often targets for removal from the community.

Early in the development of range management, brush eradication programs were advocated. Since the probability of completely killing any species is quite low, emphasis moved to control rather than eradication. During the 1960's the concept of management of woody plants to minimize the adverse effects of brush and enhance the positive values of shrubs developed. Brush management was a logical outgrowth of the recognition of the beneficial qualities of woody plants and the growth of system science. Today, this concept is tagged Integrated Brush Management.

The arid and semiarid tropics are ideal laboratories to test the theories of integrated brush management. They feature a rich flora, long growing season, various browsing animals, and a tradition of intentional burning to manipulate vegetation.

Northeast Brazil is typical. The climate is semiarid with only a short rainy season. The caatinga vegetation is composed of 15-30 woody species of varying forage value. Both native and cleared caatinga are grazed by cattle, sheep, goats, donkeys, and horses.

The woody vegetation periodically is cut often followed by burning and grazing of regrowth. Although no systematic brush management is practiced, my work there as part of the Small Ruminant Collaborative Research Support Program

Linda Howell Hardesty is a research associate in the Range Science Department at Utah State University doing brush management research in northeast Brazil. This research was carried out as part of the United States Agency for International Development Title XII Small Ruminants Collaborative Research Support Program in collaboration with the Empresa Brasileira de Pesquisa Agropecuaria.

Edge of a recent clearing illustrates the density of mature, intact caatinga in northeast Brazil.