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Geographic Information System as an Aid to Rangeland Management in Kenya

D.J. Herlocker, S.B. Shaabani and T.L. Thurow

Natural resource management is multifaceted. Sound decisions require integration of information drawn from many sources. Often information needed by a manager is available but not realistically accessible. Sources of information are usually scattered in reference books, scientific journal articles and various difficult to access project reports and informal publications. Additional information is stored in the minds of the scientists, engineers, managers, pastoralists and farmers who have experience working with the land. Most managers do not have the time, money, contacts and expertise necessary to fully access the diverse existing information base. Consequently, management effectiveness is often limited by the accessibility of information.

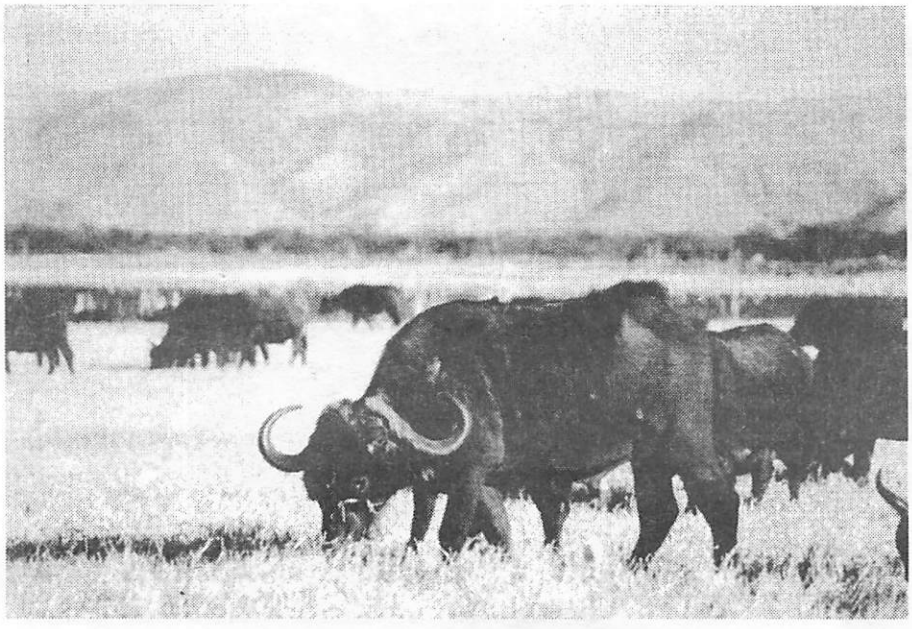
To solve this problem in Kenya, the Ministry of Agriculture, Livestock Development and Marketing (Range Management Division) and the German Agency for Technical Cooperation teamed up to produce a series of publications collectively known as the Range Management Handbook of Kenya. The objective of the Range Management Handbook is to summarize the existing information available for Kenya rangelands and, where necessary, gather data needed to fill critical information gaps. The focus of the project was nine arid and semi-arid districts of Kenya where livestock production is a primary land use. These districts occupy about 250,000 km² and approximately cover the northern half of the country.

The handbook consists of 22 parts. Volume I (two publications) discusses the history, status, potentials and constraints facing range development in Kenya and the methods used for inventories of the range resources. Volume II (twelve publications) presents the natural resource information available for each district. This includes detailed information on the districts physical characteristics, climate, landforms and soils, vegetation, and water resources. Various management considerations such as site potential, range condition, livestock marketing, pastoral land use patterns, and human ecology/culture of people living in the region are also included. Each publication is supplemented by about 20 maps illustrating resource inventory results at scales of 1:500,000 and 1:1,000,000. Volume III (nine publications) is a series of texts on special topics relevant to range management.

Range Management Handbook emphasis was placed on providing the types of information planners need to devise a solution or make a decision, rather than simply recommending specific development packages/activities for generic problems. Some management options are included as examples of potential solutions, but the reader is encouraged to craft solutions that best fit the unique nature of each situation. Therefore, the handbook is useful to a wide variety of users, ranging from administrators, planners, managers, scientists and teachers (Photos 1 and 2).

After the Range Management Handbook was published, follow-up investigations were conducted to determine how it was being put to use. There were many diverse examples of how the handbook was being used, but it was apparent some individuals had a problem integrating the information they needed to consider when making a decision. Another concern was that information on the maps would need to be updated as development took place.

To address these two concerns, information on handbook maps was digitized and entered into a Geographic Information System. One benefit of the Geographic Information System data base of Kenyan rangelands is it can be easily updated as new information becomes available. For example, if a new water point is established the water



Range site potential, and the associated environmental factors that influence it, is discussed for nine northern Kenya districts in the Range Management Handbook. (Photo: U.P. Kreuter)

Authors are, respectively, Project Manager and Technical Associate, Deutsche Gesellshaft für Technische Zusammenarbeit (GTZ), P.O. Box 47051, Nairobi, Kenya and Associate Professor, Department of Rangeland Ecology and Management, Texas A&M University, College Station, TX 77843.

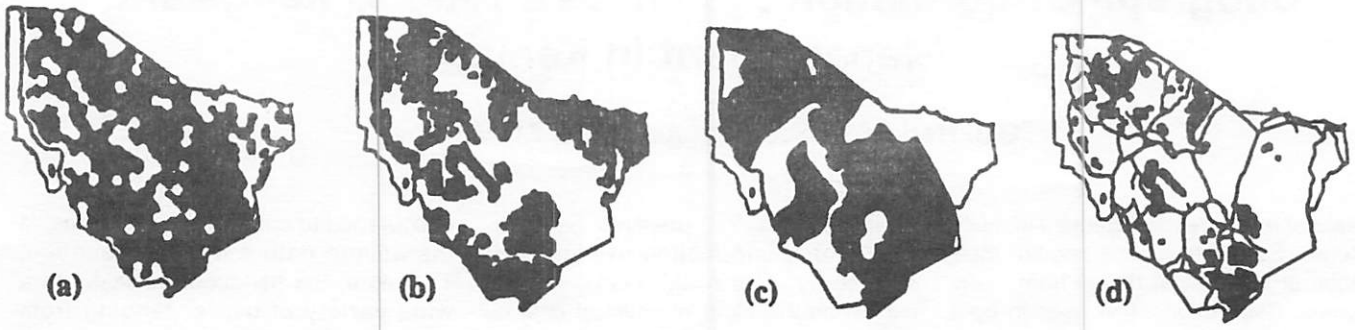


Fig. 1 *Example of how the Kenyan rangeland data base is used in a Geographic Information System to aid planning. In this simplified case, data base components from Marsabit District, Kenya are selected to illustrate factors that should be considered when siting a water point: (a) areas over 10 km from a permanent water source, (b) location of perennial grasslands, (c) location of good range condition. In (d), the Geographic Information System has formed a composite that highlights which areas share the traits of maps a, b and c and also shows the road network in the district that can be used by equipment needing to reach the sites.*

resource maps can be updated by entering the coordinates into the data base.

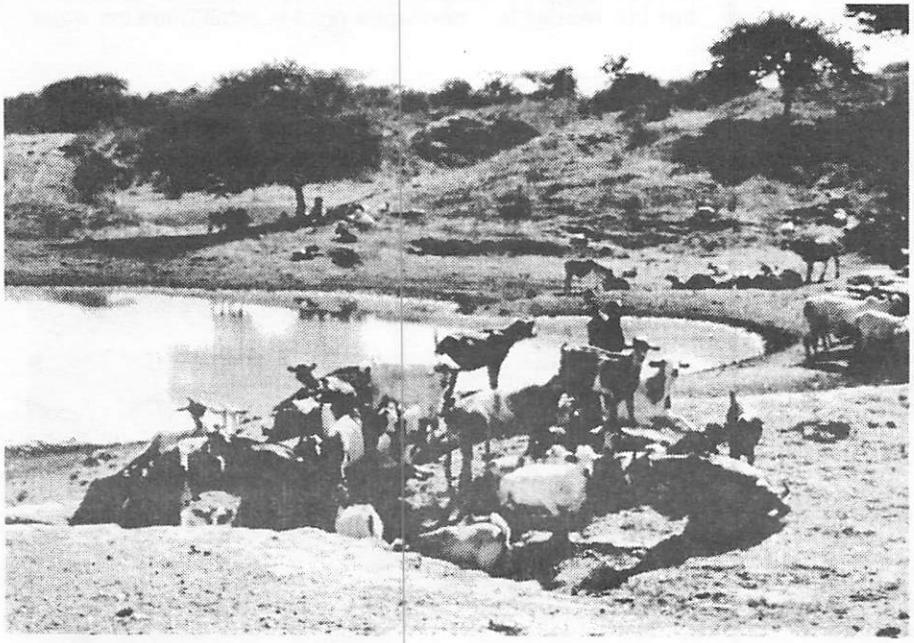
Geographic Information Systems also help people integrate information by displaying it in a way that is easily understood. For example, placement of a new water site can be ineffective or cause more harm than good if the chosen site has a vegetation type or range condition that cannot accommodate additional grazing pressure. Also, a new water source is often a highly sought after development which can result in great political pressure to place the new source in ecologically inappropriate locations. The following simplified example provides an objective rationale that can be used to aid water source placement in Marsabit District. Such a rationale can help the development agency guide community participation in a positive sense by framing the discussion of site selection within the context of ecologically acceptable locations. Information a manager would want to consider and the corresponding Geographic Information System output for Marsabit District include:

- Where is the distance to permanent water greater than 10 km? (Fig. 1a)
- Where are perennial grasslands located that could provide a source of forage throughout the year? (Fig. 1b)
- Where are the rangelands in good condition? (Fig. 1c)
- Where do these pieces of information overlap? (Fig. 1d)

Thus, Fig. 1d highlights the areas for consideration based on the criteria mapped in Figs. 1a, 1b and 1c.

The Geographic Information System also serves as a powerful education tool by helping students and professionals visualize how information needs to be integrated when making natural resource management decisions. Indeed, several universities in Kenya and the U.S.A. use the Kenya rangelands Geographic Information System data base to help illustrate planning methodology in range management laboratory exercises using personal computers equipped with appropriate software.

Range Management Handbook publications and the Information System data bases for the rangeland districts are available at cost plus postage from the Chief, Range Management Division, Ministry of Agriculture Livestock Development and Marketing, P.O. Box 34188, Nairobi Kenya or from the Range Management Handbook Project, GTZ, P.O. Box 47051, Nairobi, Kenya.



Projects, such as establishing new water points, can improve livestock production efficiency or become focal points for degradation. The Geographic Information System aids integration of factors that should be considered to maximize benefits and minimize risks associated with rangeland development decisions.