

## **CHAPTER 9**

### **CONCLUSIONS AND RECOMMENDATIONS**

The implications which the foregoing results hold for range management scenarios in Botswana deserve intensive consideration by organizations responsible for developing policy for such scenarios. The distribution of borehole dependent cattle grazing in the Kalahari sandveld has led to the development of piospheres on an unprecedented scale. The daily incidence of livestock concentrations at such water points and in the immediate vicinity, as opposed to the more distant areas, implies an uneven use of the rangeland, with areas adjacent to the water point being more heavily utilized than those further away from water. This problem results in under-utilization of some areas at the expense of other. This piosphere effect, which often forms the basis of the ecological impact of livestock grazing in the Kalahari sandveld, is often overlooked.

The degree of the vegetation utilization around the water points has not however, been extensively studied and evidently needs urgent attention. Where the level of utilization is excessive, the creation of alternative permanent water sources should be considered to spread such impacts. The greater the distance from the water point, the more available herbage phytomass is usually found, implying that range use was concentrated in those areas adjacent to the water points. Such uneven utilization negatively affects areas in the immediate vicinity of the boreholes seriously and the provision of water in under-utilized areas, to attract animals, is, therefore advocated. A system, that may be suited to borehole dependent livestock, such as those found in the Kalahari sandvelds is that of rotating access to water. If rangeland in the vicinity of water points is used to any degree, some impact on the vegetation is expected, or cannot be avoided. What is probably more important is the ecological extent of such sacrifice areas around water points. The main focus should, therefore, concentrate not so much on preventing the changes around the water points, but on controlling the changes in such a means that sustainable livestock production is ensured.

Some practical approaches to minimize degradation and enhance productivity of perennial grasses around the water points are available. Data on the influence of travel distance

between water and available forage on cattle performance in Botswana are scarce. Research is, therefore, needed to evaluate how travel distance between water and forage affects the performance of animals, especially during periods of forage scarcity. The sacrifice zones are often accepted as inevitable and it is generally thought that the larger the paddock and, the longer the animals stay in the paddock, the larger the sacrifice zone. Such factors have strong negative effects on forage production, especially in free range grazing systems, where animals stay permanently on a large unfenced area. Fencing of free range grazing areas with adequate paddock size is, therefore, strongly recommended in order to avoid desertification of the Kalahari sandveld. With the development of the new agricultural policy on fencing of the communal grazing range in Botswana, information provided on range condition and utilization within piospheres, as determined by the distance livestock travel, would certainly be of great value in planning the fencing and espacement of water points.

Nutrient enrichment in the vicinity of water points can be attributed, in a large part, to the input of dung and urine. Uneven dung and urine distribution along the transect radiating from the boreholes implies that attempts should be made to distribute such an excreta over a wider area, in such a way that a centripetal movement and background impoverishment of soil nutrient levels is avoided. Soil chemical properties measured showed a consistent response between the transects, and revealed the low background fertility of the Kalahari soil with variation only being registered around the water point. An early step in any management plans, directed at managing the resource, should, therefore, aim at a more even spread of nutrients by improving the distribution of the water points.

While nutrient enrichment occurs in the vicinity of water points, a background impoverishment of soil nutrient levels over the surrounding range occurs, which is reflected in the poor nutrient value of available forage. Although it appears that little can be done about the seasonal decline in nutritional quality of the forage, a commonly used approach in livestock management systems is to supplement the natural forage, when it does not meet the nutritional requirements of the animal. This is easily achieved when livestock are kept in confinement and their nutritional requirements are known. The seasonal decline in forage quality no doubt affects the nutritional status of range animals. The extent of that effect and

the role supplementation should be determined with additional research into nutrition of livestock on rangeland.

The encouragement of plant species, which have above average levels of crude protein, by using certain grazing systems or range manipulations should be seriously encouraged. Range fertilization and especially bush management (e.g. prescribed burning, regrowth stimulation etc) may also be practical and profitable considering the economic value of the livestock in Botswana. Constant monitoring of forage production and availability should be done in conjunction with monitoring of animal numbers and their respective needs for forage so that, where necessary, destocking can be based on sound scientific grounds to maintain the correct grazing pressure.

Less selective livestock such as cattle, suffer more from a poor diet quality during dry seasons compared to selective feeders such as goats. Cattle select a poorer quality diet than goats, which select browse. If animal distribution and range condition are maintained through correct stocking rates, selective feeders should have adequate forage from which to select a diet of preferred species and adequate quality during the dry season. Less selective animals will, however, probably suffer during the dry season regardless of forage supply because abundant dry grasses will not contain enough nitrogen or phosphorus. Although, cattle certainly make use of the browse (Chapter 8), studies have indicated that the survival and maintenance of cattle, in the dry season and during drought periods, is more likely to be dependent upon the quantity, rather than quality of forage available.

Because of the differences in herbage nutrient levels due to both season and location along the transect from water, there is need to establish critical levels of some of the key nutrients with respect to their effect on livestock condition. This is especially true for cattle and sheep, which are more sensitive to limitations of both forage supply and quality because of their less selective foraging behavior. When the requirements for these minerals are known, seasonal availability of minerals in vegetation should be assessed.

The potential for competition for forage is higher throughout the year between cattle and

sheep than between goats and cattle or between goats and sheep. A reduction in cattle numbers should enhance forage availability for sheep, and vice versa, but reduction in the number of sheep or cattle would have little, or no, effect on enhancing forage availability to the goats. There appears to be relatively few goats in the area, however, and competition for browse is less than that for herbaceous plants between cattle and sheep. The combination of grazers and browsers on common range, such as that practiced in the free range grazing area, will achieve better and more efficient utilization of such range. Feeders such as goats may also be used to manipulate the woody plant canopies so that grazers have better access to herbaceous forage growing under such woody plants.

Another alternative to adjusting animal numbers, is to increase the production of preferred herbaceous and browsing plants. Since some of the most preferred grasses like P. maximum are most common on limited areas (such as those under the tree canopies) increased production of browse species appears to be practical. Bush management research should also be directed at reducing competition for preferred woody species through techniques that stimulate animals (Browse Plus) to eat more of the less preferred woody species so that species such as T. sericea and P. africanum are better utilized. There is also a need to manipulate the height and stimulate the regrowth of preferred browse species to make material more accessible to livestock and thereby increase the amount of browse available.