CHAPTER 7
HERBACEOUS BIOMASS ASSESSMENT

INTRODUCTION

Biomass is defined by Trollope *et al.* (1990) as the total amount of living material present in a specific area at any given time. It is usually expressed in kg per ha. The biomass production of the herbaceous layer is invaluable in monitoring the amount of herbage available to herbivores. It can be related to animal performance (Alder and Richards 1962) and can serve as an indication of the grazing capacity and stocking rate of an area (Castle 1976; Bransby, Matches and Krause 1977; Bransby and Tainton 1977). Biomass production can also be used to estimate the fuel loads of the grass layer (Trollope 1980). Fire is an important tool in veld management, especially for the removal of excess dead plant material and the control of encroachers (Trollope 1980; Van Wilgen and Willis 1988). Information on the available fuel loads makes accurate predictions possible on the regularity of expected veld fires (Van Wilgen and Willis 1988). It also gives an indication of the ability of an area to carry a fire at a given time (Trollope, Potgieter and Zambatis 1989).

Considerable research has been devoted to methods to estimate herbage yield. Consequently a multitude of techniques have been developed. Herbage yield has been estimated with various instruments, including a power-driven sheep-shearing head (Alder and Richards 1962), various electronic instruments (Campbell, Phillips and O'Reilly 1962; Back 1968), a radio frequency bridge (Nichols 1973), disc instruments (Castle 1976; Bransby *et al.* 1977; Bransby and Tainton 1977; Trollope and Potgieter 1986), and a spectral reflectance instrument (Boutton and Tieszen 1983). Other widely used methods are the dry-weight-rank method ('t Mannetjie and Haydock 1963), the comparative yield method (Haydock and Shaw 1975), and the key grass species method for assessing veld condition. The latter also gives an estimate of the fuel potential for burning (Trollope *et al.* 1989; Trollope 1990).

The disc-pasture meter (Castle 1977; Bransby and Tainton 1977; Bransby *et al.* 1977; Trollope and Potgieter 1986) provides an objective, accurate, inexpensive and rapid estimate of herbage yield (Bransby and Tainton 1977; Bransby *et al.* 1977; Danckwerts and Trollope 1980; Hardy and Mentis 1985; Trollope and Potgieter 1986). The disc-pasture meter is used to determine mean settling heights for each management unit that then provides estimates of herbage yield. Various linear regression equations have been developed to determine dry matter yield from total biomass estimates derived with a disc pasture meter. Trollope and

Potgieter (1986) developed a regression equation for the southern regions and the mopane shrubveld in the central and northern regions of the Kruger National Park. In areas where no regression equations have been developed, prior calibration of the disc pasture meter is essential (Trollope and Potgieter 1986). Trollope and Potgieter (1986) describe calibration of the disc pasture meter for the bushveld areas of southern Africa. Danckwerts and Trollope (1980) and Hardy and Mentis (1985) evaluated the efficiency of disc meter sampling and found it to be efficient for measuring herbaceous biomass. Hardy and Mentis (1985) recommend the use of the disc pasture meter for biomass production estimation because it is a non-destructive procedure.

In the formulation of resource inventories for natural areas, estimates of herbage yield are therefore extremely useful in terms of pasture, game and fire management. The aims of the herbaceous biomass assessment are to:

- Obtain an estimate of the available herbaceous biomass in each homogeneous management unit.
- Determine the ability of the veld to carry a fire.
- Aid in the determination of the need for a burn.

METHODS

Herbage yield was estimated in the present study with the disc pasture meter because it is a rapid, non-destructive method and is fairly efficient for measuring herbaceous biomass (Bransby and Tainton 1977; Bransby *et al.* 1977; Danckwerts and Trollope 1980; Hardy and Mentis 1985; Trollope and Potgieter 1986). Moreover, it has already been calibrated for the mopane veld (Trollope and Potgieter 1986). The technique was applied as described and used by Castle (1976), Bransby and Tainton (1977), Bransby *et al.* (1977), Danckwerts and Trollope (1980), Danckwerts (1982a), Downing and Marshall (1983), Hardy and Mentis (1985), Trollope and Potgieter (1986), Wentzel, Bothma and Van Rooyen (1991) and Van Heerden (1992).

Selection of sample sites

Sample sites were placed in exactly the same position as for the herbaceous assessment (Chapter 6). The plots were placed in a north-south direction and 100 readings were taken in two parallel line transects, each 100 m long. The settling height of the disc was recorded at 2 m intervals.

Measurement of settling height

The central rod of the pasture meter was held perpendicular to the ground surface and the sleeve with the attached disc was released onto the grass sward from a standard height of 0.6 m above the ground level (Bransby and Tainton 1977). The settling height of the disc was read off the rod from a position corresponding with the upper end of the sleeve. In grass swards more sensitive to compression the sleeve with the attached disc was placed gently on the sward surface and allowed to settle until a constant height was reached or for a maximum settling time of 15 seconds. Care was taken on uneven ground that the lower end of the rod was not placed in a hole or on top of a mound or tuft of grass.

Calculation of herbage yield

The mean settling height of the disc was determined for each management unit. This was substituted into the regression equation calculated by Trollope and Potgieter (1986). Since the disc pasture meter was calibrated for the mopane shrubveld of the northern Kruger National Park, the regression equation of Trollope and Potgieter (1986) was used in the study area.

RESULTS AND DISCUSSION

The dry mean herbaceous biomass of the six management units (Chapter 5) of Sango Ranch is presented as a histogram in Figure 90. The mean estimated herbaceous biomass of Sango Ranch is high at 3 457 kg per ha. The highest recorded biomass of 8 551 kg per ha was recorded in management unit 3 and the lowest of 1 520 kg per ha in management unit 2. The highest mean estimated biomass of 5 092 kg per ha was recorded in the *Combretum apiculatum* Woodland Management Unit. The lowest average estimated biomass of 1 502 kg per ha was recorded in the *Colophospermum mopane* Woodland Management Unit. Herbaceous biomass does, however, vary considerably in these two management units. Some areas in the *Colophospermum mopane* Woodland Management Unit have a high herbaceous biomass of 2 000 to 4 000 kg per ha. Of interest are the low estimates recorded in the *Colophospermum mopane* Woodland Management Unit. Several authors have commented on the poor grass cover in the mopane woodland areas of southern Africa (Timberlake 1995).

In southeastern Zimbabwe, Kelly (1973, *In:* Walker 1976b), obtained a dry mean herbaceous biomass estimate of 1 690 kg per ha. In the Nylsvley Nature Reserve of the Northern Province of South Africa, Grunow and Bosch (1978) obtained herbaceous biomass estimates of 623 to 1 033 kg per ha. Pieterse and Grunow (1985) recorded a herbaceous biomass of 1 600 to 2 500 kg per ha at the Mara

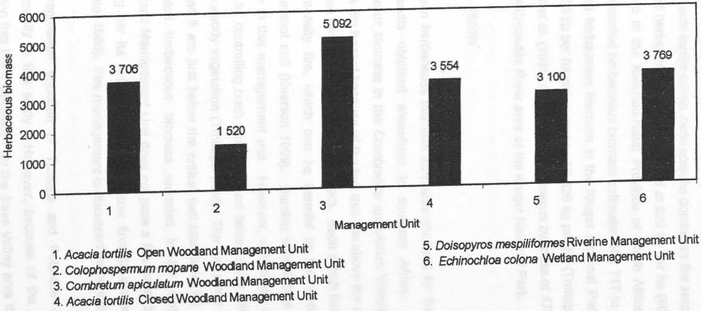

Figure 90. The average herbaceous biomass (kg per ha) of the management units of Sango Ranch, Save Valley Conservancy, Zimbabwe. The mean herbaceous biomass is 3 457 kg per ha.

Research Station in the Northern Province of South Africa. Van Heerden (1992) obtained herbaceous biomass figures of 256 to 1 287 kg per ha for the Lissataba Game Ranch of the Northern Province of South Africa. Herbaceous biomass estimates for the Doornpoort Experimental Game Ranch in the Gauteng Province of South Africa, varied from 1 960 to 4 600 kg per ha (Smith 1992). Estimated herbaceous biomass figures in the Eastern Cape and Kwazulu-Natal Provinces of South Africa varied from 2 000 to 3 500 kg per ha (Danckwerts and Trollope 1980; Hardy and Mentis 1985). In the Tugela Dry Valley Bushveld, Kwazulu-Natal, where *Acacia tortilis* subsp. *heteracantha* dominates the secondary succession, the estimated herbaceous biomass peaked at 830 kg per ha (Milton 1983). In the Tall Grassveld of the Kwazulu-Natal Province of South Africa, Morris and Tainton (1996) recorded herbaceous biomass estimates of 1 717 to 6 591 kg per ha. The estimated herbaceous biomass in the Kruger National Park varied between 187 and 8 600 kg per ha with a mean of 3 826 kg per ha (Trollope and Potgieter 1986). Wentzel *et al.* (1991) recorded a herbaceous biomass of 470 to 2 357 kg per ha in the Sabi-Crocodile River area of the Kruger National Park.

CONCLUSION

The mean herbaceous biomass estimates obtained for Sango Ranch are in line with results obtained elsewhere in southern Africa. The high estimated herbaceous biomass in the *Combretum apiculatum* Woodland Management Unit poses a fire hazard because of the fact that it is above the critical fuel load of 4000 kg per ha for intense fires (Trollope 1990). Such a high biomass will easily carry a high intensity fire, which can be harmful to the woody component of this management unit (Everson 1999). Burning should thus be done with extreme caution in this management unit. However, a biomass of >4 000 kg per ha is useful for controlling bush encroachment because the hot fire which it generates will kill woody vegetation (Trollope 1990). The fuel loads in management units 1, 4, 5 and 6 are just below the critical fuel load level for intense fires. The low estimated herbaceous biomass recorded in the *Colophospermum mopane* Woodland Management Unit does not pose a fire threat because a fuel load of 1 500 kg per ha and less does not allow fires to spread readily (Trollope and Potgieter 1986). Fire management is discussed in more detail in Chapter 11.

The regression equation of Trollope and Potgieter (1986) has been used successfully in this study. However, because of the fact that no regression equation has been calculated for the Save Valley area it is recommended that a calibration be carried out by using the method of Trollope *et al.* (1989) . This calibration will then more accurately describe the variations in herbaceous biomass in the area.