Diet composition and habitat use of the West African bushbuck *Tragelaphus scriptus scriptus* (Pallas, 1776) during the first half of the dry season

C.M.M. Smits

Department of Animal Ecology and Department of Nature Conservation and Management, Agricultural University, Wageningen, The Netherlands

Diet composition and habitat use of the West African bushbuck were investigated in three vegetation units (River, Riverine Forest, Woodland Savannah) along the Baoule River, during the first half of the dry season. Woody plants were the most frequently occurring species in faecal pellets and were thought to represent feeding in all vegetation units available to the study animals. Systematic direct observations on feeding behaviour were carried out in the River Unit only and yielded a preponderance of both woody plants and forbs. The plant species that appeared to be the staple forage species in the faecal analysis were absent in the River Unit. They were common on the Savannah and in the Riverine Forest and indicate the importance of these vegetation units as feeding areas. It is suggested that foraging on the Savannah occurs mostly at night. The vegetation types in the River Unit appear to be selected for foraging on woody plants, forbs and (or) green sedges.

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Die dieetsamestelling en habitatgebruik deur die Wes-Afrikaanse bosbok in drie veldtipes (rivier, oewerbos en savanne) langs die Baoulerivier is gedurende die eerste helfte van die droë seisoen ondersoek. Reste van houtagtige plante kom met die hoogste frekwensie voor in die misballetjies en dit is aanvaar dat dit weiding in al die veldtipes waartoe hierdie spesies toegang het, verteenwoordig. Sistematiese waarnemings op die voedingsgedrag van hierdie bok is slegs in die rivierveldtipe gedoen en daar is gevind dat houtagtige sowel as tweesaadlobbige kruidagtige plante voorkeurvoedselitems is. Die plantspesies, wat by analise van die misballetjies die stapelweidingsgewasse blyk te wees, is afwesig in die rivierveldtipe. Hulle kom egter algemeen voor in die savanne en oewerbos wat 'n aanduiding is van die belangrikheid van hierdie veldtipes as weidingsgebiede. Die aanduidings is verder dat die spesies meestal gedurende die nag op die savanne wei. Houtagtige plante, tweesaadlobbige kruidagtiges en (of) groen biesies word selektief bewei in die rivierveldtipe.

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C.M.M. Smits
Present address: Fish and Wildlife Branch,
Yukon Department of Renewable Resources,
Box 2703, Whitehorse, Y.T., Canada Y1A 2C6

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Among African antelopes, relatively little is known about the feeding ecology of the West African bushbuck (*Tragelaphus scriptus scriptus* Pallas 1776). Most previous studies of bushbuck feeding ecology have involved East and South African subspecies of bushbuck. Those studies have listed the plant species or plant groups eaten (Wilson & Child 1964; Jacobsen 1974; Simpson 1974a; Waser 1975; Okiria 1980; Odendaal 1983), or reported the types of habitat utilized (Simpson 1974b; Waser 1975; Evans 1979; Odendaal & Bigalke 1979).

From these studies, bushbuck emerge as selective browsers which feed on plants and plant parts of high nutritive value. According to Hofmann's (1973) physiological feeding typology, they should be classified as concentrate selectors. The preferred habitats appear to consist of relatively dense vegetation in the vicinity of surface water.

The present paper reports on a study of feeding habits and habitat use of the West African bushbuck. The study was part of a broader ecological survey of Boucle Du Baoule National Park and the surrounding reserves by members of the Rechèrche à Utilisation et Rehabilitation du Gibier au Sahel Project.

Study Area

The study was conducted from October 1980 to February 1981 along a 2,3 km section of the Baoule River, Mali (8°2'W/13°49'N) where it forms the boundary with Boucle Du Baoule National Park. The geology and geomorphology of the area were described by Michel (1973). The climate of the area is typical Soudanien with one rainy season. The rainy season lasts from May to October with a mean rainfall of about 800 mm and moderate temperatures; the rest of the year constitutes the dry season with virtually no precipitation and maximum temperatures of over 40°C. A more detailed description of the climate can be found in Kowal & Kassam (1978). The vegetation of the area consists of three major units: the Dry Woodland Savannah Unit, the Riverine Forest Unit, and the River Unit (river shore and dried up river bed) (Smits 1982; van Wijngaarden & Coulibaly 1982).

In the Dry Woodland Savannah Unit the common woody species are *Combretum* sp., *Pterocarpus erinaceus*, *Bombax costatum*, *Anogeissus leiocarpus*, and on erosion sites *Pterocarpus lucens*. The herb layer comprises mainly annual grasses (e.g. *Andropogon pseudapricus*, *Ctenium elegans*, *Loudetia togoensis*) and perennial grasses (e.g. *Andropogon gayanus*, *Hyparrhenia* sp.), but, as a result of fires, very few areas in and near the study area had a basal grass cover of over 10% during the period of study.

The Riverine Forest Unit extends 10–200 m from either side of the Baoule River. This unit consists of a dense vegetation of shrubs, mainly *Acacia erythrocalyx* and *Combretum micranthum*, and a large variety of emergent trees, of which *Khaya senegalensis*, *Piliostigma reticulatum* and *Anogeissus leiocarpus* are common.

The River Unit consists of spatially distinct vegetation types characterized by dominance of one or two plant species or plant groups. The principal shrubs found in these vegetation types are *Acacia ataxacantha*, *Moghania faginea*, *Phyllanthus reticulatus*, *Rotula aquatica*, *Mimosa pigra*, *Sesbania sesban* and *Saba senegalensis*, in decreasing order of abundance. The herbaceous stratum in these vegetation types consists of fairly homogenous stands of *Vetiveria nigritana*, *Pennisetum pedicellatum*, *Panicum anabaptistum* (grasses), *Cyperus* sp. (sedge), and various forbs. Unlike food plants on the Savannah, and, to a lesser extent, in the Riverine Forest, the majority of food plants in the River Unit retained their foliage during the period of study. These vegetation types, largely unavailable for bushbuck in the rainy season, gradually became available during the first few months of the dry season.

Methods

Diet composition

Direct observations

Bushbuck were sighted in all three major vegetation units. Most sightings during the preliminary sampling period however were in the River Unit during the periods 06h30–09h00 and 16h00–18h30. The study animals were observed from ranges of 50–800 m through a 32 power telescope. The observations were carried out alternately from five hides in the Riverine Forest. An attempt was made to record as many of the plants fed on during feeding periods as possible. The distance between feeding bushbuck and the observer rarely permitted identification of plant parts eaten. It was often necessary to identify correctly the food plant by checking the feeding station. A food record was counted when an individual bushbuck was observed feeding continuously from a single plant species or plant group. Statistical differences in the frequency of feeding records between the two observation periods were tested with the log-likelihood-ratio test (Sokal & Rohlf 1981).

Faecal analysis

Microhistological examination of faecal material can only give an approximate indication of dietary composition; differential digestibility of different foodstuffs will result in absolute proportions of residues in the faeces which may differ considerably from the proportion in which the foodstuffs were actually ingested (Monro 1982; Putnam 1984). The method is also subject to a number of limitations owing to errors involved in the sampling and identification of material (Monro 1982). However, faecal analysis can supply reliable qualitative data (Holechek, Vavra & Pieper 1982).

Faecal pellet groups were searched for along line transects traversing the three major vegetation units in an attempt to correlate faecal accumulation with habitat use. This method resulted in the collection of only five faecal pellet groups. The method was discarded when bushbuck were found to have favoured latrine areas in the Riverine Forest. A total of 39 faecal pellet groups were collected, 28 from the Riverine Forest Unit, six from the Dry Woodland Savannah Unit and five from the River Unit. All samples were located within 50 m from the Riverine Forest.

Slides of faecal samples were prepared following McAllister & Bornman (1972). From each sample, 100 cuticular fragments were identified by systematically traversing the slides under a microscope. Identification was facilitated by a reference collection of plant epidermal cells and an identification key (I.M.A. Heitkönig 1981, unpubl.). Fragments unidentifiable at the species level could only be classified into the broad categories: unidentifiable dicotyledons and unidentifiable monocotyledons.

Habitat use

Bushbuck appeared to be associated mostly with Riverine Forest. Sightings of bushbuck on the Savannah were very sporadic (<10), although the author and co-workers spent more time there than in the other units. Out of a total of 220,8 h of observation of the River Unit, bushbuck were seen in this unit only during 16,9 h (7,7%) (mostly 1–2 individuals at one time). All vegetation types in the River Unit, except the one dominated by *A. ataxacantha*, afforded enough visibility to predict that bushbuck would be observable if present. The *A. ataxacantha* vegetation type appeared to be utilized mostly from the visible periphery, probably owing to its impenetrable structure. However some escape routes were found through *A. ataxacantha* thickets which would have effectively hidden a bushbuck and may have introduced a visibility bias. As the bushbuck population of the study area consisted of a minimum of 29 individuals, and approximately one-third of the total surface area of the River Unit in the study area was observed from each observation site, it becomes apparent that this unit was used infrequently during daylight. These results suggest that bushbuck spent most of the daylight hours in the Riverine Forest.

Systematic data on habitat use were collected from the River Unit only in conjunction with direct observations on feeding habits.

The vegetation type within which each adult bushbuck was feeding was recorded at 1-min intervals. Groups of an adult female with juvenile(s) were treated as one adult individual in this respect as juveniles do not make an independent choice with respect to their spatial distribution (Sinclair 1977).

In order to compare the use of the various vegetation types with their availability, surface area of each unit was calculated from a vegetation map of the study area. The accumulated periods of observation from the various observation sites, as well as the distribution of vegetation types visible from these sites, differed among observation sites. Therefore, a correction incorporating observation time and size of each vegetation type was necessary in order to arrive at a measure of the expected use of the various vegetation types corresponding with a random-use distribution (Appendix). For some vegetation types, temporarily unavailable owing to water levels, a correction factor was applied, proportional with the duration of their availability.

The statistical technique evaluating preference or avoidance of a given vegetation type involved the use of a Bonferroni Z statistic (Neu, Byers & Peek 1974). The assumptions implicit in the use of this technique are met.

Results

Diet composition

Direct observations

Table 1 gives 194 feeding records collected in the River Unit.

Table 1 Feeding records of bushbuck in the River Unit, October 1980 – February 1981

Plant species	Number of records				Combined data	
	Nov.	Dec.	Jan.	Feb.	Number	%
Dicotyledons						
Woody plants						
Rotula aquatica	3	13	13	1	30	15,5
Phyllanthus reticulatus	8	13	6	2	29	14,9
Acacia ataxacantha	3	6	—	—	9	4,6
Mimosa pigra	3	2	2	1	8	4,1
Sarcocephalis latifolius	—	1	5	—	6	3,1
Combretum micranthum	1	1	—	—	2	1,0
Hippocratea africana	1	1	—	—	2	1,0
Moghania faginea	—	1	1	—	2	1,0
Saba senegalensis	—	—	1	1	2	1,0
Total woody plants	19	38	28	5	90	46,4
Forbs						
Oldenlandia corymbosa	3	2	1	—	6	3,1
Hygrophila pobeguinii	2	2	—	—	4	2,1
Unidentifiable forbs	2	20	26	2	50	25,8
Total forbs	7	24	27	2	60	30,9
Monocotyledons						
Cyperus sp.	—	19	17	3	39	20,1
Panicum anabaptistum	—	—	1	—	1	0,5
Total monocotyledons	—	19	18	3	40	20,6
Algae (unidentifiable)	—	3	1	—	4	2,1
Total	26	84	74	10	194	99,9

No significant difference was found in the frequency of feeding observations relative to the four major vegetation groups (woody plants, forbs, monocotyledons and algae) between the morning and afternoon sampling periods ($G = 3{,}572$, $p = 0{,}3115$).

Bushbuck were recorded feeding most frequently on woody plants (46,4%) and forbs (30,9%); important forage species or forage groups are *Rotula aquatica*, *Phyllanthus reticulatus* and unidentified forbs. *Cyperus* sp. was the dominant monocotyledonous forage species (20,1% of combined records). On a few occasions foraging on algae was observed from shallow water holes.

Feeding traces indicated that leaves were selected from woody plants, and leaves and immature parts from herbaceous plants. Species occurring sporadically in dense vegetation are probably underrepresented in the observations (e.g. *Hippocratea africana* and *Saba senegalensis*). Identification of forbs was in most instances confined to species occurring in single-species clumps.

Facecal analysis

Table 2 presents the results of the faecal analysis. With the exception of *Dichrostachys cinerea*, *Baissea multiflora* and dicotyledon no. 1 all species formed < 5% of total epidermal fragments when the data for all months were combined. Bushbuck fed commonly on several species of plants that seemed quantitatively less important in terms of epidermal fragments (e.g. dicotyledon no. 1, 2, 3, 4, 5, *Acacia nilotica*, *Balanites aegyptiaca*, monocotyledons). *D. cinerea* and *B. multiflora* appear to constitute the staple foods. These plant species are common in areas of Savannah adjacent to the Riverine Forest and in Riverine Forest respectively, reflecting the importance of the latter habitats for bushbuck as feeding areas. A number of species (*Pterocarpus lucens*, *Guiera senegalensis*, *Lonchocarpus laxiflorus*, *Cadaba farinosa*) occur only in the Savannah (W. van Wijngaarden, in Smits 1982).

Habitat use

Analysis of utilization and availability of vegetation types in the River Unit revealed a significant difference between observed and expected utilization (Chi-square = 1200,046, $p < 0{,}0001$) (Table 3). Homogeneous vegetation types of mature and largely dry grasses (dominated by *Pennisetum pedicellatum* and *Vetiveria nigritana*) were strongly avoided. The vegetation types dominated by respectively *Acacia ataxacantha*, forbs, *Cyperus* sp., *Moghania faginea*/*P. reticulatus*, and *Panicum anabaptistum* were preferred, while the *R. aquatica* vegetation was utilized in proportion to its occurrence.

In the vegetation types dominated by *M. faginea*/*P. reticulatus*, bushbuck fed almost exclusively on leaves of *P. reticulatus* (a shrub). In the forb vegetation type, in which some grasses also occurred, bushbuck selected forbs, while in the *Cyperus* sp. vegetation type immature, green *Cyperaceae* were preferred. Dry *Cyperaceae* appeared to be avoided. In the vegetation type dominated by the grass *P. anabaptistum* bushbuck were occasionally seen nibbling from the mature leaves of this grass, but most frequently bushbuck in this vegetation type ate forbs.

Discussion

The diet as indicated by direct observation is based on only one of the three habitat types available to bushbuck. Faecal pellet groups are evidently derived not only from the vegetation units where they were collected, but also from other vegetation units within the home range of the individual animals concerned. This view is supported by: (a) the witnessing of several individually recognizable bushbuck feeding in each vegetation unit during observational sessions, (b) the proximity of different vegetation units from each collected faecal pellet group (all three vegetation units were always within 250 m of the collected faeces), (c) the time delay between meals and defecation of material representing ingested foodstuffs. The relatively large faecal sample size of 39 should assure that faecal analysis provides a more representative indication of the diet of bushbuck in the study area. Anthony & Smith (1974) suggest minimum seasonal sample sizes of 15 for faecal analysis of ruminants. According to this method dicotyledons appear to be the most important plant group in the diet. There is evidence in the literature that monocotyledons are overrepresented (Anthony & Smith 1974; Smith & Shandruk 1979) and forbs underrepresented (Vavra, Rice & Hansen 1978; Smith & Shandruk 1979) in ruminant faeces relative to their true dietary proportions. Hence the percentage of dicotyledons in the diet of bushbuck might very well be considerably higher than was determined from faecal analysis. These findings agree with those on the subspecies of bushbuck occurring in East and South Africa (Wilson & Child 1964; Jacobsen 1974; Simpson 1974a; Waser 1975; Okiria 1980; Odendaal 1983).

Two plant species (*P. reticulatus*, *R. aquatica*) upon which bushbuck were frequently seen feeding in the River Unit were rarely or not encountered in the faecal analysis. This discrepancy may be attributable to the absence of these species outside the River Unit which would effectively dilute their occurrence in the total diet. Another explanation might be their low cell wall content (Smits 1982) by which they can be expected to survive digestion poorly (Prins,

Table 2 Number of cuticular fragments in the faeces of bushbuck collected during October 1980 – February 1981 expressed as mean percentage of total number of determined fragments in samples (a) and percentage of samples in which they occurred (b) (n = number of samples)

	November (n=10)			December (n=11)			January (n=14)			February (n=4)			Combined data (n=39)		
Plant species	a	SE	b	a	SE	b	a	SE	b	a	SE	b	a	SE	b
Dicotyledons															
Woody plants															
Dichrostachys cinerea	52,7	10,6	100,0	62,5	9,6	100,0	37,1	4,8	100,0	24,5	8,2	100,0	47,0	4,6	100,0
Baissea multiflora	16,2	9,6	40,0	1,9	0,7	45,5	19,7	5,7	92,8	35,5	21,2	100,0	15,4	4,0	66,7
Combretum nigricans	0,0	0,0	0,0	6,3	4,8	27,3	0,7	0,4	21,4	0,0	0,0	0,0	2,0	1,4	15,4
Balanites aegyptiaca	0,0	0,0	0,0	0,0	0,0	0,0	4,1	2,2	28,6	3,0	1,2	75,0	1,8	0,8	17,9
Combretum micranthum	0,4	0,4	10,0	4,9	4,9	9,1	0,3	0,2	14,3	0,0	0,0	0,0	1,6	1,4	10,3
Phyllanthus reticulatus	0,0	0,0	0,0	0,0	0,0	0,0	0,6	0,4	14,3	9,0	5,9	50,0	1,1	0,7	10,3
Acacia nilotica	0,5	0,4	20,0	1,0	0,6	27,3	0,9	0,9	14,3	0,0	0,0	0,0	0,7	0,4	17,9
Sarcocephalus latifolius	0,4	0,4	10,0	0,0	0,0	0,0	1,2	0,6	35,7	0,0	0,0	0,0	0,5	0,2	15,4
Acacia erythrocarpa	0,0	0,0	0,0	1,5	1,0	18,2	0,0	0,0	0,0	0,0	0,0	0,0	0,4	0,3	5,1
Acacia sieberiana	0,0	0,0	0,0	0,7	0,7	9,1	0,1	0,1	7,1	0,0	0,0	0,0	0,3	0,2	5,1
Acacia macrothyrsa	0,0	0,0	0,0	0,0	0,0	0,0	0,5	0,5	7,1	0,3	0,3	25,0	0,2	0,2	7,7
Lonchocarpus laxiflorus	0,8	0,6	20,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,2	0,2	5,1
Ziziphys mucronata	0,0	0,0	0,0	0,0	0,0	0,0	0,6	0,6	7,1	0,0	0,0	0,0	0,2	0,2	1,8
Guiera senegalensis	0,1	0,1	10,0	0,0	0,0	0,0	0,4	0,3	21,4	0,0	0,0	0,0	0,2	0,1	10,3
Terminalia avicennioides	0,0	0,0	0,0	0,0	0,0	0,0	0,2	0,2	14,3	0,0	0,0	0,0	0,1	0,1	5,1
Acacia ataxacantha	0,2	0,2	10,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1	2,6
Cadaba farinosa	0,0	0,0	0,0	0,2	0,1	18,2	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,0	5,1
Gardenia triacantha	0,2	0,2	10,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1	2,6
Pterocarpus lucens	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1	7,1	0,0	0,0	0,0	0,1	0,1	2,6
Terminalia laxiflora	0,2	0,2	10,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1	2,6
Courbonia virgata	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1	7,1	0,0	0,0	0,0	0,0	0,0	2,6
Total woody plants	61,8	9,9	100,0	78,8	5,8	100,0	66,6	6,5	100,0	72,3	11,2	100,0	69,4	4,0	100,0
Forbs															
Zornia glochidiata	0,4	0,4	10,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1	2,6
Ageratum conyzoides	0,0	0,0	0,0	0,3	0,3	9,1	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1	2,6
Oldenlandia corymbosa	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1	7,1	0,0	0,0	0,0	0,1	0,1	2,6
Cassia occidentalis	0,0	0,0	0,0	0,0	0,0	0,0	0,7	0,7	7,1	0,0	0,0	0,0	0,0	0,0	2,6
Total forbs	0,4	0,4	10,0	0,3	0,3	9,1	0,4	0,2	14,3	0,0	0,0	0,0	0,3	0,1	10,3
Dicotyledon no. 1[a]	5,3	4,3	20,0	5,7	4,5	18,1	15,5	6,3	50,0	8,5	8,5	25,0	9,4	3,0	30,8
Dicotyledon no. 2[a]	3,3	1,7	50,0	1,7	1,0	54,5	5,9	1,6	85,7	5,3	3,8	50,0	4,0	0,9	64,1
Dicotyledon no. 3[a]	6,1	3,0	50,0	4,0	3,7	27,3	0,1	0,1	7,1	0,0	0,0	0,0	3,1	0,8	23,1
Dicotyledon no. 4[a]	1,3	1,3	10,0	1,4	0,1	27,3	4,5	1,8	50,0	7,8	1,4	100,0	2,7	1,4	38,5
Dicotyledon no. 5[a]	3,2	1,3	60,0	1,8	0,9	36,4	1,9	0,6	57,1	2,0	2,0	25,0	2,2	0,5	48,7
Unidentifiable dicotyledons[b]	4,7	2,1	50,0	3,6	1,9	45,5	2,7	1,2	50,0	2,8	2,4	50,0	3,5	0,9	48,7
Total dicotyledons	85,4	9,8	100,0	97,3	1,6	100,0	97,6	0,6	100,0	98,3	0,8	100,0	94,4	2,6	100,0
Monocotyledons															
Cyperus sp.	1,1	0,7	30,0	0,2	0,1	18,2	0,1	0,1	7,1	0,0	0,0	0,0	0,4	0,2	15,4
Panicum anabaptistum	0,0	0,0	0,0	0,2	0,2	9,1	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1	2,6
Unidentifiable monocotyledons[b]	2,7	1,7	40,0	2,3	1,4	27,3	2,3	0,6	64,3	1,8	0,8	75,0	2,3	0,6	48,7
Total monocotyledons	3,8	2,0	40,0	2,6	1,5	45,5	2,4	0,6	64,3	1,8	0,8	75,0	2,7	0,7	53,8

[a] Frequently occurring unidentifiable species; [b] very infrequently occurring unidentifiable species.

Rooymans, Veldhuizen, Domhof & Cliné-Theil 1983) and consequently become less discernible in faeces (Johnson, Wofford & Pearson 1983).

The staple forage species appear to be *D. cinerea* and *B. multiflora*. These species occur in the Dry Woodland Savannah Unit and Riverine Forest Unit, respectively, and are absent from the River Unit (van Wijngaarden, unpubl.). As bushbuck were rarely seen feeding on the savannah during daytime, foraging on *D. cinerea* presumably occurs at night. If the high percentage of *D. cinerea* cuticular fragments in the faecal samples approximates the proportions in which the species were ingested, a considerable time must be spent feeding on the savannah. This would conform to Waser's (1975) study on bushbuck in Uganda where he found a disjunction between areas utilized at night and during the daytime. At night bushbuck ranged away from watercourses and dense thickets. This strategy of temporal habitat partitioning was also reported by Okiria (1980) for the same general area in Uganda.

The preferred vegetation types in the River Unit appear to be characterized by available woody plants, forbs and (or) green *Cyperaceae*. The apparent selection of these vegetation types for foraging reinforces the results of the faecal analysis that point to a preference for dicotyledons, particularly woody plants during the first half of the dry season.

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Table 3 Distribution of utilization by bushbuck of vegetation types in the River Unit for foraging, October 1980 – February 1981

Vegetation type (dominant species/groups)	Total surface area (m^2)	Relative availability (m^2)[a]	Proportion of total availability	Observed number of feeding records	Proportion of feeding records observed in each vegetation type (P_i)	Expected number of feeding records	Confidence interval on proportion observed ($P = 0,95$)
P. pedicellatum	8000	32509	0,256	4	0,003	335,1	$0,000 \leq P_i \leq 0,007$
A. ataxacantha	3928	22830	0,180	284	0,217	235,3	$0,186 \leq P_i \leq 0,248$
R. aquatica	1990	20096	0,158	217	0,166	207,2	$0,138 \leq P_i \leq 0,194$
V. nigritana	2035	15813	0,125	13	0,010	163,0	$0,002 \leq P_i \leq 0,017$
Forbs	3952	18162	0,143	330	0,252	187,2	$0,220 \leq P_i \leq 0,285$
Cyperus sp.	832	11245	0,089	214	0,164	115,9	$0,136 \leq P_i \leq 0,192$
M. faginea/P. reticulatus	1881	5233	0,041	218	0,167	53,9	$0,139 \leq P_i \leq 0,195$
P. anabaptistum	180	905	0,007	27	0,021	9,3	$0,010 \leq P_i \leq 0,031$

[a] Corrected according to procedures outlined

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References

ANTHONY, R.G. & SMITH, N.S. 1974. Comparison of rumen and fecal analysis to describe deer diets. *J. Wildl. Mgmt* 38: 535–540.

EVANS, P.G.H. 1979. Habitat preference of ungulates in closed savanna of central Africa. *Mammal Rev.* 9: 19–32.

HOFMANN, R.R. 1973. The ruminant stomach. Stomach structure and feeding habits of East African game ruminants. East African Literature Bureau, Nairobi.

HOLECHEK, J.L., VAVRA, M. & PIEPER, R.D. 1982. Botanical composition determination of range herbivore diets: a review. *J. Range Mgmt* 35: 309–315.

JACOBSEN, N.H.G. 1974. Distribution, home range and behaviour patterns of bushbuck in the Lutope and Sengwa Valleys, Rhodesia. *J. Sth. Afr. Wildl. Mgmt Ass.* 4: 75–93.

JOHNSON, M.K., WOFFORD, H. & PEARSON, H.A. 1983. Digestion and fragmentation influence on herbivore diet analysis. *J. Wildl. Mgmt* 47: 877–879.

KOWAL, J.M. & KASSAM, A.H. 1978. Agricultural ecology of savanna. A study of West Africa. Clarendon Press, Oxford.

MCALLISTER, H.J. & BORNMAN, C.H. 1972. Grazing preference of impala: a quantitative faecal analytical and anatomical evaluation. *Trans. Roy. Soc. S. Afr.* 40: 167–185.

MICHEL, P. 1973. Les bassins des fleuves Sénégal et Gambie; étude géomorphologique. Mémoires Orstom no. 63, Paris.

MONRO, R.H. 1982. An appraisal of some techniques used to investigate the feeding ecology of large herbivores with reference to a study on impala in the northern Transvaal. *Afr. J. Ecol.* 20: 71–80.

NEU, C.W., BYERS, C.R. & PEEK, J.M. 1974. A technique for analysis of utilisation-availability data. *J. Wildl. Mgmt* 38: 541–545.

ODENDAAL, P.B. 1983. Feeding habits and nutrition of bushbuck in the Knysna forests during winter. *S. Afr. J. Wildl. Res.* 13: 27–31.

ODENDAAL, P.B. & BIGALKE, R.C. 1979. Habitat selection by bushbuck in a disturbed environment. *S. Afr. For. J.* 108: 39–41.

OKIRIA, R. 1980. Habitat exploration by the bushbuck in Rwenzori National Park. *Afr. J. Ecol.* 18: 11–17.

PRINS, R.A., ROOYMANS, T.P., VELDHUIZEN, M., DOMHOF, M.A. & CLINE-THEIL, W. 1983. Extent of plant cell wall digestion in several species of wild ruminants kept in the zoo. *Zool. Garten N.F.*, Jena 53: 393–403.

PUTNAM, R.J. 1984. Facts from faeces. *Mammal Rev.* 14: 79–97.

SIMPSON, C.D. 1974a. Food studies of the Chobe bushbuck, *Tragelaphus scriptus ornatus* Pocock, 1900. *Arnoldia (Rhod.)* 6(32): 1–9.

SIMPSON, C.D. 1974b. Habitat preference and seasonal movements in the Chobe bushbuck, *Tragelaphus scriptus ornatus* Pocock, 1900. *Arnoldia (Rhod.)* 6(31): 1–7.

SINCLAIR, A.R.E. 1977. The African buffalo. A study of resource limitation of populations. University of Chicago Press, Chicago.

SMITH, A.D. & SHANDRUK, L.J. 1979. Comparison of fecal, rumen and utilization methods for ascertaining pronghorn diets. *J. Range Mgmt* 32: 275–279.

SMITS, C.M.M. 1982. Een socio-oecologisch onderzoek, met de nadruk op habitat- en voedselkeuze, aan bosbokken (*Tragelaphus scriptus scriptus* Pallas 1776) langs de Baoulé-rivier, Mali. M.Sc. thesis, Agricultural University, Wageningen, The Netherlands.

SOKAL, R.R. & ROHLF, F.J. 1981. Biometry. The principles and practice of statistics in biological research. 2nd. edn W.H. Freeman, San Francisco.

VAN WIJNGAARDEN, W. & COULIBALY, T. 1982. Carte de Paysages de la Region du Baoulé (Mali). RURGS Project, Department of Nature Conservation and Management, Agricultural University, Wageningen, The Netherlands; Direction des Eaux et Fôrets, Bamako, Mali.

VAVRA, M., RICE, R.W. & HANSEN, R.M. 1978. A comparison of esophageal fistula and fecal material to determine steer diets. *J. Range Mgmt* 31: 11–13.

WASER, P. 1975. Diurnal and nocturnal strategies of the bushbuck *Tragelaphus scriptus* (Pallas). *E. Afr. Wildl. J.* 13: 49–63.

WILSON, V.J. & CHILD, G.F.T. 1964. Notes on bushbuck (*Tragelaphus scriptus*) from a tsetse fly control area in northern Rhodesia. *Puku* 2: 118–128.

Appendix

Calculation of the expected (random use) distribution of use by bushbuck of the various vegetation types visible from the observation sites.

Visible from observation site no. 1

a ha of vegetation type A
b ha of vegetation type B
c ha of vegetation type C

Visible from observation site no. 2

a′ ha of vegetation type A
b′ ha of vegetation type B
d ha of vegetation type D

Assume, for example, that the observation period from site no. 1 was twice as long as the one from site no. 2. Of the expected-use distribution, vegetation type A, for example, would then comprise:

$$\frac{2a + a'}{2(a + b + c) + a' + b' + d} \times 100\%.$$

Vegetation type D, would comprise:

$$\frac{d}{2(a + b + c) + a' + b' + d} \times 100\%, \text{ etc.}$$