

REFERENCES

- Belovsky, G. E. & Jordan, P. A. 1981. Sodium dynamics and adaptations of a
- Acocks, J. P. H. 1975. Veld types of South Africa. Mem. bot. Surv. S. Afr. 40:1-128.
- Belovsky, G. E. & Slade, J. B. 1986. Time budgets, grassland herbivores: body
- ARC (Agricultural Research Council). 1965. The nutrient requirements of farm livestock. 2 Ruminants. Agricultural Research Council, London.
- Ben Shahr, R & Fairall, N. 1987. Comparison of the diurnal activity patterns
- Attwell, C. A. M. 1980. Age determination of the blue wildebeest Connochaetes taurinus in Zululand. S. Afr. J. Zool. 15: 121-130.
- Berry, H. H. 1982. The wildebeest problem in the Etosha National Park
- Attwell, C. A. M. 1982. Population ecology of the blue wildebeest Connochaetes taurinus taurinus in Zululand, South Africa. Afr. J. Ecol. 20 : 147-168.
- Berry, H. H. & Louw, G. N. 1982a. Seasonal nutritive status of wildebeest in the
- Attwell, C. A. M. & Hanks, J. 1980. Reproduction of the blue wildebeest Connochaetes taurinus taurinus in Zululand, South Africa. Saug. Milt. 28: 264-281.
- Berry, H. H. & Louw, G. N. 1982b. Nutritional measurements in a population of free ranging wildebeest in Etosha National Park. Madoqua 13: 101-125
- Beckman, J. H. & Prins, H. H. T. 1989. Feeding strategies of sedentary large herbivores in East Africa, with emphasis on the African buffalo, Syncerus caffer. Afr. J. Ecol. 27: 129-147.
- demand in the Etosha National Park. Madoqua 13: 141-150.
- Bell, R. H. V. 1971. A grazing ecosystem in the Serengeti. Scient. Am. 225: 86-93.
- Berry, H. H., Siegfried, W. R. & Crowe, T. M. 1982. Activity periods in a population of free ranging wildebeest Connochaetes taurinus at Etosha National
- Bell, R. H. V. 1982. The effect of soil nutrient availability on community structure in African ecosystems. In: The ecology of tropical savannas, Eds B. J. Huntley & B. H. Walker, pp. 193-216, Springer-Verlag, Berlin.
- habits of the springbok. Zool. Afr. 7: 333-359.
- Belovsky, G. E. 1986. Optimal foraging and community structure: implications for a guild of generalist herbivores. Oecologia (Berl.) 70 : 35-52.
- Orchard, E., Scoggins, B. A., Wright, R. D., Myers, K. & Junqueira, C. L. 1968. Physiological, morphological, and behavioural adaptations to a sodium deficient environment

Belovsky, G. E. & Jordan, P. A. 1981. Sodium dynamics and adaptations of a moose population. J. Mammal. 62: 613-621.

Belovsky, G. E. & Slade, J. B. 1986. Time budgets grassland herbivores : body size similarities. Oecologia (Berl.) 70 : 53-62.

Ben Shahr, R & Fairall, N. 1987. Comparison of the diurnal activity patterns of blue wildebeest and red hartebeest. S. Afr. J. Wildl. Res. 17: 49-54.

Berry, H. H. 1982. The wildebeest problem in the Etosha National Park : a synthesis. Madoqua 13: 151-157.

Berry, H. H. & Louw, G. N. 1982a. Seasonal nutritive status of wildebeest in the Etosha National Park. Madoqua 13: 127-139.

Berry, H. H. & Louw, G. N. 1982b. Nutritional measurements in a population of free ranging wildebeest in Etosha National Park. Madoqua 13: 101-125.

Berry, H. H. & Louw, G. N. 1982c. Nutritional balance between grassland productivity and large herbivore demand in the Etosha National Park. Madoqua 13: 141-150.

Berry, H. H., Siegfried, W. R. & Crowe, T. M. 1982. Activity periods in a population of free ranging wildebeest Connochaetes taurinus at Etosha National Park. Z. Tierpsychol. 59: 229-246.

Bigalke, R. C. 1972. Observations on the behaviour and feeding habits of the springbok. Zool. Afr. 7: 333-359.

Blair-West, J. R., Coghlan, J. P., Denton, D. A., Nelson, J. F., Orchard, E., Scoggins, B. A., Wright, R. D., Myers, K. & Junqueira, C. L. 1968. Physiological, morphological, and behavioural adaptations to a sodium deficient environment

by wild native Australian and introduced species of animals. Nature, Lond. 217: 922-928.

Boocock, C & Van Straten, D. J. 1962. Notes on the geology and hydrology of the Central Kalahari Region, Bechuanaland Protectorate. Tran. geol. Soc. S. Afr. 65: 125-171.

Bothma, J. du P. & De Graaff, G. 1973. A habitat map of the Kalahari Gemsbok National Park. Koedoe 16: 181-188.

Bothma, J. Du P. & Mills, M. G. L. 1977. Ungulate abundance in the Nossob river valley, Kalahari Desert. Proc. xiii Int. Congress of Game Biologists., Atlanta Georgia, USA.

Bray, R. H. & Kartz, L. T. 1945. Determination of total, organic and available forms of phosphorus in soils. Soil Sci. 59: 39-45.

Bremen, H. & De Wit, C. T. 1983. Rangeland productivity and exploitation of the Sahel. Science 221: 1341-1347. S. Afr. Wildlife J. 9: 125-142

Burnham, K. P., Anderson, D. R. & Laake, J. L. 1980. Estimation of density from line transect sampling of biological populations. Wildl. Monogr. 72 : 1-202.

Clutton-Brock, T. H., Guinness, F. E & Albon, S. D. 1982. Red deer. Behaviour

Burt, W. H. 1943. Territoriality and home range concepts as applied to mammals. J. Mammal. 24: 346-352.

Clutton-Brock, T. H., Albon, S. D. & Guinness, F. E. 1982. Competition between

Buyts, A. J. 1980. Soil analyses. FSSA Publication No 74. Fertilizer Society of South Africa. Pretoria.

Clutton-Brock, T. H., Guinness, F. E & Albon, S. D. 1984. Individuals and

Campbell, A. 1981. A comment on Kalahari wildlife and the Khukwe fence.

Botsw. Notes Rec. 13: 111-117. 90.

- Caughley, G. 1977. Analysis of vertebrate populations. John Wiley & Sons, New York.
- Caughley, G. & Grice, D. 1982. A correction factor for counting emus from the air, and its application to counts in Western Australia. Aust. Wildl. Res. 9: 253-259.
- Caughley, G. & Krebs, C. J. 1983. Are big mammals simply little mammals writ large. Oecologia (Berl.) 59: 7-18.
- Caughley, J., Bayliss, P. & Giles J. 1984. Trends in kangaroo numbers in western New South Wales and their relation to rainfall. Aust. Wildl. Res. 11: 415-422.
- Child, G. & Le Riche, J. D. 1969. Recent springbok treks in south-western Botswana. Mammalia 33: 499-504.
- Child, G., Parris R. & Le Riche, E. 1971. Use of mineralised water by Kalahari wildlife and its effect on habitat. E. Afr. Wildlife J. 9: 125-142.
- Church, D. C. 1979. Digestive physiology and nutrition of ruminants, Volume 2 - Nutrition. Oxford Press, Oregon.
- Clutton-Brock, T. H., Guinness, F. E & Albon, S. D. 1982. Red deer. Behaviour and ecology of the two sexes. University of Chicago Press, Chicago.
- Clutton-Brock, T. H., Albon, S. D. & Guinness, F. E. 1982. Competition between female relatives in a matrilocal mammal. Nature, Lond. 320: 178-180.
- Clutton-Brock, T. H., Guinness, F. E & Albon, S. D. 1984. Individuals and populations: the effects of social behaviour on population dynamics in deer. Proc. R. Soc. Edinb. 82B: 275-290.

Dieckmann, R. C. 1980. The ecology and breeding biology of the gemsbok, *Oryx*
Coe, M. J., Cumming, D. H. & Phillipson, J. 1976. Biomass and production of
large African herbivores in relation to rainfall and primary production.
Oecologia (Berl.) 22: 341-354.

Dreyer, H. van A. 1987. Die gebruik van water en soutlekke deur die groot
Cooke, H. B. S. 1972. The fossil mammal fauna of Africa. In: Evolution,
mammals and southern continents, pp. 89-130, eds A. Keast, F. Erk & B. Glass,
State University of New York Press, Albany.

Du Preez, J. S. & Grobler, I. D. 1977. Drinking times and behaviour at
Cooper, S. M. & Owen-Smith, N. 1985. Condensed tannins deter feeding by
browsing ungulates in a South African savanna. Oecologia (Berlin) 67: 142-146.

Du Toit, J. T. 1990. Feeding-height stratification among African browsing
Coughenour, M. B., Coppock, D. L. & Ellis, J. E. 1990. Herbaceous forage
variability in an arid pastoral region of Kenya : importance of topographic and
rainfall gradients. J. Arid Environ. 19: 147-159.

Cumming, D. H. M. 1982. The influence of large herbivores on savanna
structure in Africa. In: The ecology of tropical savannas, Eds B. J. Huntley &
B. H. Walker, pp. 217-245, Springer-Verlag, Berlin.

Estes, R. D. 1969. Territorial behaviour of the wildebeest (*Connochaetes*
Demment, M. W. & Van Soest, P. J. 1985. A nutritional explanation for body-
size patterns of ruminant and non-ruminant herbivores. Am. Nat. 125 : 641-672.

Fancy, S. G., Pank, L. F., Whitten, K. R. & Regelin, W. L. 1989. Seasonal
Deskmukh, I. K. 1984. A common relationship between precipitation and
grassland peak biomass for East and southern Africa. Afr. J. Ecol. 22: 181-186.

DHV Consulting Engineers. 1980. Country-wide animal and range assessment
project. Final Report to Dept. Wildlife, National Parks & Tourism, Botswana.
DHV Consulting Engineers, Amersfoort.

Festa-Bianchet, M. 1988. Seasonal range selection in bighorn sheep: conflicts
between forage quality, forage quantity, and predator avoidance. Oecologia
(Berl.) 75: 580-586.

- Dieckmann, R. C. 1980. The ecology and breeding biology of the gemsbok, Oryx gazella gazella (Linnaeus, 1758), in the Hester Malan nature reserve. Unpublished M. Sc. thesis. University of Pretoria, Pretoria.
- Dreyer, H. van A. 1987. Die gebruik van water en soutlekke deur die groter hoefdiere in die Kalahari-gemsbok Nasionale Park. Unpublished M. Sc. thesis, University of Stellenbosch.
- Du Preez, J. S. & Grobler, I. D. 1977. Drinking times and behaviour at waterholes of some game species in Etosha National Park. Madoqua 10: 61-69.
- Du Toit, J. T. 1990. Feeding-height stratification among African browsing ruminants. Afr. J. Ecol. 28: 55-61.
- Eloff, F. 1966. Range extension of the blue wildebeest. Koedoe 9: 34-36.
- Estes, R. D. 1966. Behaviour and life history of the wildebeest (Connochaetes taurinus Burchell). Nature, Lond. 212: 999-1000.
- Estes, R. D. 1969. Territorial behaviour of the wildebeest (Connochaetes taurinus, Burchell 1823). Z. Tierpsychol. 26: 284-370.
- Fancy, S. G., Pank, L. F., Whitten, K. R. & Regelin, W. L. 1989. Seasonal movements of caribou in arctic Alaska as determined from satellite. Can. J. Zool. 67: 644-650.
- Ferrar, A. & Walker, B. H. 1974. An analysis of herbivore/habitat relationships in Kyle National Park, Rhodesia. Jl. sthn. Afr. Wildl. Mgmt. Ass. 4: 137-147.
- Festa-Bianchet, M. 1988. Seasonal range selection in bighorn sheep: conflicts between forage quality, forage quantity, and predator avoidance. Oecologia (Berl.) 75: 580-586.

- Field, C. R. 1975. Climate and the food habits of ungulates on Galana Ranch. E. Afr. Wildl. J. 13: 203-220.
- Finch, C. R. 1972. The food habits of wild ungulates in Uganda by analyses of stomach contents. E. Afr. Wildl. J. 10: 17-42.
- Fryxell, J. M. 1987a. Food limitation and demography of a migratory antelope, the white-eared kob. Oecologia (Berl.) 73: 83-91.
- Fryxell, J. M. 1987b. Seasonal reproduction of white eared kob in Boma National Park, Sudan. Afr. J. Ecol. 25: 117-124.
- Fryxell, J. M. & Sinclair, A. R. E. 1988a. Seasonal migration by white-eared kob in relation to resources. Afr. J. Ecol. 26: 17-31.
- Fryxell, J. M. & Sinclair, A. R. E. 1988b. Causes and consequences of migration by large herbivores. Trends Ecol. Evol. 3: 237-241.
- Fryxell, J. M., Greever, J. & Sinclair, A. R. E. 1988. Why are migratory ungulates so abundant. Am. Nat. 131: 781-798.
- Giddings, S. R. 1990. Water metabolism in the gemsbok Oryx gazella (Linnaeus). Unpublished M. Sc. thesis. University of Pretoria, Pretoria.
- Gordon, I. J. & Illius, A. W. 1989. Resource partitioning by ungulates on the isle of Rhum. Oecologia (Berl.) 79: 383-389.
- Gordon, M. S., Bartholomew, G. A., Grinnell, A. D., Jorgensen, C. B. & White, F. N. 1977. Animal Physiology: Principles and Adaptations. 3rd edition, Macmillan, New York.

- Green, R. A. & Bear, G. D. 1990. Seasonal cycles and daily activity patterns of rocky mountain elk. J. Wildl. Mgmt 54: 272-279.
- Gwynne, M. D. & Bell, R. H. V. 1968. Selection of grazing components by grazing ungulates in the Serengeti National Park. Nature, Lond. 220: 390-393.
- Hamilton, W. J., Buskirk, R. & Buskirk, W. H. 1977. Intersexual dominance and differential mortality of gemsbok Oryx gazella at Namib desert waterholes. Madoqua 10: 5-19.
- Hairston, N. G., Smith, F. E. & Slobodkin, L. B. 1960. Community structure, population control, and competition. Am. Nat. 94: 421-425.
- Haydock, K. P. & Shaw, N. H. 1975. The comparative yield method for estimating dry matter yield of pasture. J. Exp. Agric. Anim. Husb. 15: 663-670.
- Hilborn, R. & Sinclair, A. R. E. 1979. A simulation of the wildebeest population, other ungulates, and their predators. In : Serengeti. Dynamics of an ecosystem, Eds A. R. E Sinclair & M. Norton-Griffiths, University of Chicago Press, Chicago.
- Hofmann, R. R. 1973. The ruminant stomach (stomach structure and feeding habits of East African game ruminants). East Afr. Monogr. Biol. 2: 1-364.
- Hofmann, R. R. 1989. Evolutionary steps of ecophysiological adaptation and diversification of ruminants : a comparative view of their digestive system. Oecologia (Berl.) 78: 443-457.
- Hofmann, R. R. & Stewart, D. R. M. 1972. Grazer or browser: a classification based on the stomach structure and feeding habits of East African ruminants. Mammalia 36: 226-240.

- Hofmeyr, M. D. 1981. Thermal physiology of selected African ungulates with emphasis on the physical properties of the pelage. Unpublished Ph. D. Thesis, University of Cape Town. pp. 871-881. IUCN, Morges, Switzerland.
- Hofmeyr, M. D. 1985. Thermoregulation, pelage conductance and renal function in the desert-adapted springbok, Antidorcas marsupialis. J. Arid Environ. 13: 137-151. Sinclair & M. Norton-Griffiths, pp. 130-163, University of Chicago Press, Chicago.
- Hone, J. 1988. A test of the accuracy of line and strip transect estimates in aerial survey. Aust. Wildl. Res. 15: 493-497.
- Horwitz, W. 1970. Official methods of analysis of the association of clinical agricultural chemists. 9th edition, Benjamin Franklin Sta., Washington.
- Houston, D. C. 1979. The adaptations of scavengers. In: Serengeti. Dynamics of an ecosystem, pp. 263-286, eds A. R. E. Sinclair & M. Norton-Griffiths, University of Chicago Press, Chicago.
- Huntley, B. J. 1982. Southern African savannas. In: The ecology of tropical savannas, pp. 101-119, eds B. J. Huntley & B. H. Walker, Springer-Verlag, Berlin.
- Illius, A. W. & Gordon, I. J. 1987. The allometry of food intake in grazing ruminants. J. Anim. Ecol. 56: 989-999.
- Janis, C. & Erhardt, D. 1988. Correlation of relative muzzle width and relative incisor width with dietary preference in ungulates. Zool. J. Linn. Soc. 92: 267-284.
- Jarman, P. J. 1974. The social organisation of antelope in relation to their ecology. Behaviour 48:215-267.

- Jarman, P. J. & Jarman, M. V. 1974. Impala behaviour and its relevance to management. In: The behaviour of ungulates and its relevance to management, Eds V. Geist & I. Walther, pp. 871-881, IUCN, Mages, Switzerland.
- Jarman, P. J. & Sinclair, A. R. E. 1979. Feeding strategy and the pattern of resource partitioning in ungulates. In: Serengeti. Dynamics of an ecosystem, Eds A. R. E. Sinclair & M. Norton-Griffiths, pp. 130-163, University of Chicago Press, Chicago.
- Jennrich, R. I. & Turner, F. B. 1969. Measurements of non-circular home range. J. Theor. Biol. 22: 227-237.
- Kleiber, M. 1961. The fire of life. John Wiley & Sons, New York.
- Klein, D. 1968. The introduction and crash of reindeer on St Matthew island. J. Wildl. Mgmt. 32:250-367.
- Knight M. H. 1990. The 1989 aerial surveys of the Kalahari Gemsbok National Park (South Africa) and Gemsbok National Park (Botswana). Internal Report, National Parks Board, Pretoria.
- Knight M. H., Knight-Eloff, A. K. & Bornmann, J. J. 1988. The importance of borehole water and lick sites to Kalahari ungulates. J. Arid Environ. 15: 269-281.
- Kreulen, D. A. 1985. Lick use by large herbivores: a review of benefits and banes of soil consumption. Mammal. Rev. 15: 107-123.
- Kreulen, D. A. & Jager, T. 1984. The significance of soil ingestion in the utilization of arid rangelands by large herbivores, with special reference to natural licks on the Kalahari pans. In: Herbivore nutrition in the subtropics and tropics, Eds F. M. C. Gilchrist & R. I. Mackie, pp. 204-221, Science Press, Johannesburg.

- Laake, J. L., Burnham, K. P. & Anderson, D. R. 1980. Users manual for program TRANSECT. Utah State University Press, Logan.
- La Gory, K. E. 1986. Habitat, group size and the behaviour of white-tailed deer. Behaviour 98 :168-179.
- Lamprey, H. F. 1963. Ecological separation of the large mammal species in the Tarangire Game Reserve, Tanganyika. E. Afr. Wild. J. 1: 63-92.
- Lehner, P. N. 1979. Handbook of ethological methods. Garland Press, New York.
- Le Houerou, H. N. & Hoste, C. H. 1977. Rangeland production and annual rainfall relations in the Mediterranean basin and the African Sahelo-Sudanese Zone. J. Range Mgmt. 30: 181-189.
- Leistner, O. A. 1967. The plant ecology of the southern Kalahari.1 Mem. bot. Surv. S. Afr. 38: 1-172.
- Leistner, O. A. & Werger, M. J. A. 1973. Southern Kalahari phytosociology. Vegetatio 28: 353:397.
- Le Roux, C. J. G. 1979. The grazing capacity of the plains in the Etosha National Park. Proc. Grassld Soc. S. Afr. 14: 89-93.
- Leuthold, W. 1977. African ungulates. A comparative review of their ethology and behavioural ecology. Springer-Verlag, Berlin.
- Lewis, J. G. 1977. Game domestication for animal production in Kenya: activity patterns of eland, oryx, buffalo, and zebu cattle. J. agric. Sci. Camb. 89: 551-563.

Lewis, J. G. 1978. Game domestication for animal production in Kenya: shade behaviour and factors affecting the herding of eland, oryx, buffalo and zebu cattle. J. agric. Sci. Camb. 90: 587-595. Press, London.

Louw, G. N. 1984. Water deprivation in herbivores under arid conditions. In: Herbivore nutrition in the subtropics and tropics, Eds F. M. C. Gilchrist & R. I. Mackie, pp. 106-126. Science Press, Johannesburg.

Louw, G. N. & Seely, M. K. 1982. Ecology of desert animals. Longman, London.

Lovegrove, B. G. & Knight-Eloff, A. K. 1989. Soil and burrower temperatures and the resource characteristics of the social mole-rat Cryptomys damarensis (Bathyergidae) in the Kalahari desert. J. Zool., Lond. 216: 403-416.

Ludlow, M. M., Stobbs, T. H., Davis, R. & Charles-Edwards, D. A. 1982. Effect of sward structure of two tropical grasses with contrasting canopies on light distribution, net photosynthesis and size of bite harvested by grazing cattle. Aust. J. Agric. Res. 33: 187-201.

Maddock, L. 1979. The 'migration' and grazing succession. In: Serengeti. Dynamics of an ecosystem, Eds A. R. E. Sinclair & M. Norton-Griffiths, pp. 104-129, University of Chicago Press, Chicago.

Malo, A. R. & Nicholson, S. E. 1990. A study of rainfall and vegetation dynamics in the African Sahel using normalized difference vegetation index. J. Arid Environ. 19: 1-24.

Maloiy, G. M. O. & Hopcraft, D. 1971. Thermoregulation and water relations of two East African antelopes: the hartebeest and impala. Comp. Biochem. Physiol. 38A: 525-534.

Maloiy, G. M. O., MacFarlane, W. V. & Shkolnik, A. 1979. Mammalian Herbivores. In: Comparative physiology of osmoregulation in animals, Ed. G. M. O. Maloiy, pp. 185-210, Academic Press, London.

McNaughton, S. J. 1983. Serengeti grassland ecology: the role of composite
Marsh, H. & Sinclair, D. F. 1989. Correcting for visibility bias in strip transect aerial surveys of aquatic fauna. J. Wildl. Mgmt. 53: 1017-1024.

Mason, D. 1986. Monitoring of ungulate population structure in the Kruger National Park -- report on a survey during August, September and October 1985. Internal Report, National Parks Board, Skukuza.

McNaughton, S. J. 1988. Mineral nutrition and spatial concentrations of African
Mattson, W. J. 1980. Herbivory in relation to plant nitrogen content. Ann. Rev. Ecol. Syst. 11: 119-161.

McNaughton, S. J. & Georgiadas, N. J. 1986. Ecology of African grazing and
May, R. M. 1989. Detecting density dependence in imaginary worlds. Nature, Lond. 338: 16-17.

McNaughton, S. J., Ruess, R. W. & Seagle, S. W. 1988. Large mammals and
McCullough, D. R. 1979. The George Reserve deer herd. University of Michigan Press, Markham.

McNaughton, S. J., Tarfanta, J. L., McNaughton, M. M. & Davis, R. H. 1985
McCullough, D. R., Hirth, D. H. & Newhouse, S. J. 1989. Resource partitioning between sexes in white-tailed deer. J. Wildl. Mgmt. 53: 277-283.

McDowell, L., Conrad, J. H. & Ellis, G. L. 1984. Mineral deficiencies and imbalances and their diagnosis. In: Herbivore nutrition in the subtropics and tropics, Eds F. M. C. Gilchrist & R. I. Mackie, pp. 67-88, Science Press, Johannesburg.

McInnes, M. L., Vavra, M. & Krueger, W. C. 1983. A comparison of four methods used to determine the diets of large herbivores. J. Range Mgmt. 36: 302-306.

McInnes, M. L., Vavra, M. & Krueger, W. C. 1983. A comparison of four methods used to determine the diets of large herbivores. J. Range Mgmt. 36: 302-306.
McInnes, M. L., Vavra, M. & Krueger, W. C. 1983. A comparison of four methods used to determine the diets of large herbivores. J. Range Mgmt. 36: 302-306.

- McNaughton, S. J. 1976. Serengeti migratory wildebeest: facilitation of energy flow by grazing. Science 191: 92-94.
- McNaughton, S. J. 1983. Serengeti grassland ecology: the role of composite environmental factors and contingency in community organisation. Ecol. Monogr. 53: 291-320.
- McNaughton, S. J. 1985. Ecology of grazing ecosystem : The Serengeti. Ecol. Monogr. 55:259-294.
- McNaughton, S. J. 1988. Mineral nutrition and spatial concentrations of African ungulates. Nature, Lond. 334: 343-345.
- McNaughton, S. J. & Georgiadis, N. J. 1986. Ecology of African grazing and browsing mammals. Ann. Rev. Ecol. Syst. 17: 39-65.
- McNaughton, S. J., Ruess, R. W. & Seagle, S. W. 1988. Large mammals and process dynamics in African ecosystems. Bioscience 38: 794-800.
- McNaughton, S. J., Tarrants, J. L., McNaughton, M. M. & Davis R. H. 1985. Silica as a defense against herbivory and a growth promotor in African grasses. Ecology 66: 528-535.
- Mills, M. G. L. 1984. Prey selection and feeding habits of the large carnivores in the southern Kalahari. Koedoe suppl. 281-294.
- Mills, M. G. L. & Retief, P. F. 1984a. The response of ungulates to rainfall along the riverbeds of the southern Kalahari 1972-1982. Koedoe suppl. 129-141.
- Mills, M. G. L. & Retief, P. F. 1984b. The effect of windmill closure on the movement pattern of ungulates along the Auob riverbed. Koedoe suppl. 107-118.

- Moen, A. N. 1973. Wildlife ecology, an analytical approach. Freeman, San Francisco.
- Mohr, C. O. 1947. Table of equivalent populations of North American small mammals. Am. Midl. Nat. 37 :223-249.
- Müller, M. A. N. 1984. The grasses of South West Africa/ Namibia. Directorate Agriculture & Forestry, Windhoek.
- NCR. 1974. Nutrients and toxic substances in water for livestock and poultry. National Academy Sciences, Washington D. C..
- Neu, C. W., Byers, C. R. & Peck, J. M. 1974. Technique for analysis of utilization-availability data. J. Wildl. Mgmt. 38: 541-545.
- Ngwamotsoko, K. T. 1985. Large animals and land resources of western central Kalahari, Botswana. Unpublished M. Sc. thesis, University of New England, Australia.
- Novellie, P. 1983. Feeding ecology of kudu. Unpublished D. Sc. thesis, University of Pretoria.
- Noy-Meir, I. 1973. Desert ecosystems: environment and producers. Ann. Rev. Ecol. Syst. 4: 25-51.
- Odum, E. P. 1971. Fundamentals of ecology. W. B. Saunders, Philadelphia.
- Owaga, M. L. 1975. The feeding ecology of wildebeest and zebra on the Athi-Kautei Plains. E. Afr. Wildlife J. 13: 375-383.
- Owaga, M. L. 1980. Primary productivity and herbage utilization by herbivores in Kaputei Plains, Kenya. Afr. J. Ecol. 18: 1-5.

- Owen-Smith, N. 1982. Factors influencing the consumption of plant products by large herbivores. In: The ecology of tropical savannas, Eds B. J. Huntley & B. H. Walker, pp. 359-404, Springer-Verlag, Berlin.
- Owen-Smith, N. 1985. Niche separation among African ungulates. In: Species and speciation, Ed. E. S. Vrba, pp 167-171, Transvaal Museum Monograph, Transvaal Museum, Pretoria.
- Owen-Smith, N. 1988. Megaherbivores. The influence of very large body size on ecology. Cambridge University Press, Cambridge.
- Owen-Smith, N. & Cooper, S. M. 1987. Nutritional ecology of a browsing ruminant the kudu (Tragelaphus strepsiceros) through the seasonal cycle. J. Zool., Lond. 219: 29-43.
- Parris, R. & Child, G. 1973. The importance of pans to wildlife in the Kalahari and the effect of human settlement on these areas. Jl. sthn Afr. Wildl. Mgmt. Ass. 3: 1-8.
- Pellew, R. A. 1983. The feeding ecology of a selective browser, the giraffe (Giraffe camelopardalis tippelskirchi). J. Zool., Lond. 202: 57-81.
- Pennycuik, C. J. 1979. Energy costs of locomotion and the concept of 'foraging radius'. In: Serengeti. Dynamics of an ecosystem, Eds A. R. E. Sinclair & M. Norton-Griffiths, pp. 164-184, University of Chicago Press, Chicago.
- Pennycuik, C. J. & Western, D. 1972. An investigation of some sources of bias in aerial transect sampling of large mammal populations. E. Afr. Wild. J. 10: 175-191.
- Pennycuik, L. 1975. Movements of the migratory wildebeest population in the Serengeti area between 1960 and 1973. E. Afr. Wild. J. 13: 65-87.

- Phillipson, J. 1975. Rainfall primary production and 'carrying capacity' of Tsavo National Park (East), Kenya. E. Afr. Wildl. J. 13: 171-201.
- Pollock, K. H. & Kendall, W. L. 1987. Visibility biases in aerial surveys: a review of estimation procedures. J. Wildl. Mgmt. 51: 502-510.
- Priddel, D. 1986. The diurnal and seasonal patterns of grazing of the red kangaroo, Macropus rufus and the western grey kangaroo, M. fuliginosus. Aust. Wildl. Res. 13: 113-120.
- Pulliam, H. R. & Caraco, T. 1984. Living in groups: Is there an optimal group size. In: Behavioural ecology. An evolutionary approach, Eds. J. R. Krebs. & N. B. Davies, pp. 122-137, Blackwell Scientific Publications, Oxford.
- Pyke, G. H., Pulliam, H. R. & Charnov, E. L. 1977. Optimal foraging : a selective review of theory and tests. O. Rev. Biol. 52: 137-154.
- Robbins, C. T. 1983. Wildlife feeding and nutrition. Academic Press, New York.
- Root, A. 1972. Fringe-eared oryx digging for tubers in Tsavo National Park (East). E. Afr. Wildl. J. 10: 155-157.
- Sala, O. E., Parton, W. J., Joyce, L. A. & Lauenroth, W. K. 1988. Primary production of the central grassland region of the United States. Ecology 69: 40-45.
- SAS. 1986. SAS programmes. 6th edition. SAS Institute Inc. Cary, North Carolina, USA.
- Saunders, D. H. 1964. Exploring the potential of Rhodesian Soils. Proc. Trans. Rhod. scient. Ass. 50: 16-28.

- Phillipson, J. 1975. Rainfall primary production and 'carrying capacity' of Tsavo National Park (East), Kenya. E. Afr. Wildl. J. 13: 171-201.
- Pollock, K. H. & Kendall, W. L. 1987. Visibility biases in aerial surveys: a review of estimation procedures. J. Wildl. Mgmt. 51: 502-510.
- Priddel, D. 1986. The diurnal and seasonal patterns of grazing of the red kangaroo, Macropus rufus and the western grey kangaroo, M. fuliginosus. Aust. Wildl. Res. 13: 113-120.
- Pulliam, H. R. & Caraco, T. 1984. Living in groups: Is there an optimal group size. In: Behavioural ecology. An evolutionary approach, Eds. J. R. Krebs. & N. B. Davies, pp. 122-137, Blackwell Scientific Publications, Oxford.
- Pyke, G. H., Pulliam, H. R. & Charnov, E. L. 1977. Optimal foraging : a selective review of theory and tests. O. Rev. Biol. 52: 137-154.
- Robbins, C. T. 1983. Wildlife feeding and nutrition. Academic Press, New York.
- Root, A. 1972. Fringe-eared oryx digging for tubers in Tsavo National Park (East). E. Afr. Wildl. J. 10: 155-157.
- Sala, O. E., Parton, W. J., Joyce, L. A. & Lauenroth, W. K. 1988. Primary production of the central grassland region of the United States. Ecology 69: 40-45.
- SAS. 1986. SAS programmes. 6th edition. SAS Institute Inc. Cary, North Carolina, USA.
- Saunders, D. H. 1964. Exploring the potential of Rhodesian Soils. Proc. Trans. Rhod. scient. Ass. 50: 16-28.

- Schmidt-Nielsen, K. 1964. Desert animals: physiological problems of heat and water. Oxford University Press, Fair Lawn, N.J. Norton-Griffiths, pp. 82-103. University of Chicago Press, Chicago.
- Schoener, T. W. 1986. Resource partitioning. In: Community ecology: pattern and process, Ed. J. Kikkawa, pp. 91-126, Blackwell, London. and their effects on community function. In: Tropical savannas, Ed. P. Bourliere, pp. 401-426.
- Seber, G. H. F. 1982. The estimation of animal abundance and related parameters. 2nd edition. Macmillan Co. Inc., New York.
- Sinclair, A. R. E. 1985. Does interspecific competition or predation shape the
- Seely, M. K. 1978. Grassland productivity : The desert end of the curve. S. Afr. J. Sci. 74: 295-298.
- Sinclair, A. R. E. & Duncan, P. 1975. Indices of condition in tropical ruminants.
- Seely, M. K. & Louw, G. N. 1980. First approximation of the effects of rainfall on the ecology and energetics of a Namib Desert dune ecosystem. J. Arid Environ. 3: 25-54. & Fryxell, J. M. 1985. The Sahel of Africa: ecology of a disaster. Can. J. Zool. 63: 987-994.
- Siebert, M. L. 1985. Analities handleiding. NIWR Internal Publication, Pretoria.
- A. R. E. Dublin H. & Borner, M. 1985. Population regulation of Serengeti wildebeest: a test of the food hypothesis. Oecologia (Berl.) 65: 266-
- Siegel, S. 1956. Nonparametric statistics for the behavioural sciences. McGraw-Hill, Kogakusha, Dusseldorf.
- Skarpe, C. 1986. Plant community structure in relation to grazing and
- Sinclair, A. R. E. 1974. The natural regulation of buffalo populations in East Africa III. Reproduction, recruitment and growth. E. Afr. Wildl. J. 12 : 169-183.
- Sinclair, A. R. E. 1975. The resource limitation of trophic levels in tropical grassland ecosystems. J. Anim. Ecol. 44: 497-520. the Kalahari, Botswana. J. Arid Environ. 11: 147-164.
- Sinclair, A. R. E. 1977. The African buffalo. A study of resource limitation of populations. University of Chicago Press, Chicago. Studies of the southern African subregion. 2nd edition, University of Pretoria, Pretoria.

- Sinclair, A. R. E. 1979. The eruption of the ruminants. In: Serengeti. Dynamics of an ecosystem, Eds A. R. E. Sinclair & M. Norton-Griffiths, pp. 82-103, University of Chicago Press, Chicago.
- Sinclair, A. R. E. 1983. The adaptation of African ungulates and their effects on community function. In: Tropical savannas, Ed. F. Bourliere, pp. 401-426, Elsevier Scientific Publ. Co., Amsterdam.
- Sinclair, A. R. E. 1985. Does interspecific competition or predation shape the African ungulate community? J. Anim. Ecol. 54: 899-918.
- Sinclair, A. R. E. & Duncan, P. 1975. Indices of condition in tropical ruminants. E. Afr. Wildl. J. 10: 143-149.
- Sinclair, A. R. E. & Fryxell, J. M. 1985. The Sahel of Africa: ecology of a disaster. Can. J. Zool. 63: 987-994.
- Sinclair, A. R. E., Dublin H. & Borner, M. 1985. Population regulation of Serengeti wildebeest: a test of the food hypothesis. Oecologia (Berl.) 65: 266-268.
- Skarpe, C. 1986. Plant community structure in relation to grazing and environmental changes along a north-south transect in the western Kalahari. Vegetatio 68: 3-18.
- Skarpe, C. & Bergström, R. 1986. Nutrient content and digestibility of forage plants in relation to plant phenology and rainfall in the Kalahari, Botswana. J. Arid Environ. 11: 147-164.
- Skinner, J. D. & Smithers, R. H. N. 1990. The mammals of the southern African subregion. 2nd edition, University of Pretoria, Pretoria.

Smith, R. 1983. The laboratory manual for the determination of metals in Water and waste water via atomic absorption spectrophotometry. CSIR Technical Guide K63, Pretoria.

Smithers, R. H. N. 1983. The mammals of the southern African subregion. University of Pretoria, Pretoria.

Smuts, G. L. 1978. Interrelationships between predators, prey, and their environment. Bioscience 28: 316-320.

Sokal, R. R. & Rohlf, F. J. 1982. Biometry: the principle and practise of statistics in biological research. W. H. Freeman, San Francisco.

Southwell, C. J. 1984. Variability in grouping in the Eastern Grey Kangaroo, Macropus giganteus I: Group density and group size. Aust. Wildl. Res. 11 :423-435.

Stanley-Price, M. 1978. The nutritional ecology of Coke's hartebeest (Alcelaphus buselaphus cokei) in Kenya. J. Appl. Ecol. 15: 33-49.

Stanley-Price, M. 1986. The reintroduction of the Arabian oryx Oryx leucoryx. Int. Zoo Yb. 24: 179-188.

Talbot, L. M. & Talbot, M. H. 1963. Food preferences of some East African wild ungulates. E. Afr. agric. For. J. 27: 131-138.

Tankersley, N. G. & Gasaway, W. C. 1983. Mineral lick use by moose in Alaska. Can. J. Zool. 61: 2242-2249.

Taylor, C. R. 1968. The minimum water requirements of some east African bovids. Symp. Zool. Soc. Lond. 21: 195-206.

- Taylor, C. R. 1970a. Strategies of temperature regulation: effect on evaporation in East African ungulates. Am. J. Physiol. 219: 1131-1135.
- Taylor, C. R. 1970b. Dehydration and heat: effects on temperature regulation of East African ungulates. Am. J. Physiol. 219: 1136-1139.
- Tyson, P. D. 1986. Climatic change and variability in southern Africa. Oxford University Press, Cape Town.
- Van der Walt, P. T., Retief, P. F., Le Riche, E. A. N., Mills, M. G. L. & De Graaf, G. 1984. Features of habitat selection by larger herbivorous mammals and the ostrich in the southern Kalahari conservation areas. Koedoe suppl. 119-128.
- Van Rooyen, T. N. 1984. The soils of the Kalahari Gemsbok National Park. Koedoe suppl. 45-62.
- Van Soest, P. J. 1964. Symposium on nutrition of forage and pastures: new chemical procedures for evaluating forages. J. Anim. Sci. 23: 838-845.
- Van Soest, P. J. 1982. Nutritional ecology of the ruminant. O & B Books, Corvallis, Oregon, USA.
- Van Wyk, P. & Le Riche, E. A. N. 1984. The Kalahari Gemsbok National Park, 1931-1981. Koedoe suppl. 21-31.
- Verme, L. J. 1965. Reproduction studies on penned white-tailed deer. J. Wildl. Mgmt. 29: 74-79.
- Wacher, T. 1986. The ecology and social organisation of fringe-eared oryx on the Galana Ranch, Kenya. Unpublished Ph. D. thesis, University of Oxford.

- Wacher, T. 1988. Social organization and ranging behaviour in the Hippotraginae. In: Conservation and biology of desert antelopes, Eds A. Dixon & D. Jones, pp. 102-113, Christopher Helm, London.
- Walker, B. H., Ludwig, D., Holling, C. S. & Peterman, R. M. 1981. Stability of semi-arid savanna grazing systems. J. Ecol. 69: 473-498.
- Waterman, P. G., Mbi, C. N., Mc Key, D. B. & Gartlan, J. S. 1980. African rainforest vegetation and rumen microbes-phenolic compounds and nutrients as correlates of digestibility. Oecologia (Berl.) 47: 22-33.
- Watts, T. J. & Schemitz, S. D. 1985. Mineral lick use and movement in a remnant desert bighorn sheep population. J. Wildl. Mgmt. 49: 994-996.
- Weir, J. S. 1969. Chemical Properties and occurrence on Kalahari sand of salt licks created by elephant. J. Zool., Lond. 158: 293-310.
- Weir, J. S. 1972. Spatial distribution of elephants in an African national park in relation to environmental sodium. Oikos 23: 1-13. pp. 114-118. Christopher Helm, London.
- Werger, M. J. A. 1978. Vegetation structure in the southern Kalahari. J. Ecol. 66: 933-941.
- Western, D. 1975. Water availability and its influence on the structure and dynamics of a savannah large mammal community. E. Afr. Wildlife J. 13: 265-286.
- White, G. C. 1987. Analysis of biotelemetry data - a primer. Unpublished manuscript, University of Fort Collins, Fort Collins.
- White, T. C. R. 1978. The importance of a relative food shortage of food in animal ecology. Oecologia (Berlin) 33: 71-86.

Williamson, D. T. 1987. Plant underground storage organs as a source of moisture for Kalahari wildlife. Afr. J. Ecol. 25 : 63-64.

Williamson, D. T. & Mbano, B. 1988. Wildebeest mortality during 1983 at lake Xau, Botswana. Afr. J. Ecol. 26 : 341-344.

Williamson, D. T. & Williamson, J. E. 1981. An assessment of the impact of fences on the large herbivore biomass in the Kalahari. Botsw. Notes and Rec. 13 : 107-110.

Williamson, D. T. & Williamson, J. E. 1985. Botswana's fences and the depletion of Kalahari wildlife. Parks 10: 5-7.

Williamson, D. T. & Williamson, J. E. 1986. Kalahari ungulate movement study. Final report to Frankfurt Zoological Society and WWF/IUCN.

Williamson, D. T. & Williamson, J. E. 1988. Habitat use and ranging behaviour of Kalahari gemsbok (Oryx gazella Linnaeus, 1758). In: Conservation and biology of desert antelopes, Eds A. Dixon & D. Jones, pp. 114-118, Christopher Helm, London.

Williamson, D. T., Williamson, J. E. & Ngwamotsoko, K. T. 1988. Wildebeest in the Kalahari. Afr. J. Ecol. 26 : 269-280.

Zar, J. H. 1984. Biostatistical analysis. 2nd Edn, Prentice-Hall International, London.

Species	Percentage adults	Percentage juveniles	Total number scored
Springbok	69,3	30,7	18633
Wildebeest	71,5	28,5	1374
Gemsbok	82,5	17,5	1845
Hartebeest	78,9	21,1	157