

A visual assessment of vegetation structure for the Kruger National Park

A. C. KEMP, K. S. BEGG, G. A. BENN and P. CHADWICK

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Vegetation structure was assessed visually for 1045 of the 1093 quadrats (2.5' x 2.5', ca. 4 x 4 km) that cover the Kruger National Park. Vegetation categories recorded were: woody vegetation (broad-leaved, mopane, fine-leaved, mixed, riparian, treeless, scrub, bushes and trees); ground cover (grass, grassless and open areas); and emergent large trees (baobab, live and dead). The results are available as grid maps or as files on the Internet. The categories were selected for their relevance to bird distribution but can be applied to other organisms.

Keywords: vegetation structure, Kruger National Park, vegetation mapping, avian habitats, GIS.

A.C. Kemp, Transvaal Museum, P. O. Box 413, Pretoria, 0001 Republic of South Africa; K. S. Begg, G.A. Benn and P. Chadwick, Percy FitzPatrick Institute of African Ornithology, University of Cape Town, Rondebosch, 7700 Republic of South Africa. (Current addresses: Begg, Honey Badger Project, Kalahari Gemsbok National Park, P/Bag X5890, Upington, 8803 Republic of South Africa; Benn & Chadwick, Natal Parks Board, P. O. Box 662, Pietermaritzburg, 3200 Republic of South Africa).

Introduction

We describe the overall vegetation structure of the Kruger National Park (KNP) for the first time. We present a systematic visual assessment, at a scale of ca. 4 x 4 km quadrats, that was conducted while we searched the KNP for uncommon birds and their nests. Data that we provide for the first time includes spatial distributions of: woody riparian vegetation; baobab trees; areas with no woody cover; extent of ground cover; proportions of emergent live and dead trees; and proportions of scrub, bush and tree cover. We chose categories applicable to avian studies which have already been applied successfully to rare small birds (Hurford *et al.* 1996) and sparsely distributed large birds (Kemp *pers. obs.*). They may also apply to other organisms.

Various other habitat categories in the KNP have already been recorded and mapped, many at the same spatial scale. These include topographical and human-imposed features (Harmse *et al.* 1972, 1974), geological formations (Barton *et al.* 1986; Brandt 1948; Bristow 1980, 1986; Bristow & Venter 1986; Cleverly & Bristow 1979; Schutte 1974, 1982, 1986; Schutte & Clublely-Armstrong 1982; Venter & Bristow 1986), soil types (Venter 1981; Webber 1979), soil-plant relationships (Fraser *et al.* 1987), plant communities (Acocks 1975; Coetzee 1983; Gertenbach 1978; Van der Schijff 1957; Van Rooyen 1978; Van Wyk 1973; Venter & Gertenbach 1986), trees (Codd 1951; Van Wyk 1973), grasses (Trollope *et al.* 1989), rainfall patterns (Gertenbach 1980) and a combination of features expressed as landscapes (Gertenbach 1983).

Study area and methods

The KNP comprises an area of approximately 20 000 km² in north-eastern South Africa (within 22°S–26°S, 31°E–32°E). The altitude is generally <500 m a.s.l. with an average annual summer rainfall ranging from 750 mm in the southwest to 450 mm in the northeast (Gertenbach 1980). The landscapes are on undulating granitic and basaltic soils which support various forms of wooded savanna (Gertenbach 1983). The area is dissected and drained by a few perennial rivers and by numerous seasonal water-courses.

Categories of vegetation structure were assessed visually for 1045 of the 1093 quadrats (2.5' latitude x 2.5' longitude, ca. 4 km x 4 km) that occur within or overlap the boundaries of the KNP (Fig. 1). This grid system is the basis for most habitat and faunal recording by the KNP authorities. The region north of the Olifants River (52 % of quadrats, $n = 571$) was assessed between January and May 1991 and the region to the south (48 % of quadrats, $n = 522$) between January and May 1992. The majority of assessments were recorded under the direction of a single observer (KSB) to minimize observer bias. An estimate of the accuracy achieved for each square was also recorded, on a scale of 1 (least accurate) to 5 (most accurate) (Fig. 1). Of the 48 quadrats that were not visited, most just overlapped the borders and only a few were within the KNP.

Each quadrat was assessed from as prominent a vantage point as possible and, where feasible, by travel through the quadrat by vehicle or on foot. For the 48 quadrats not assessed (Fig. 1), data from the most appropriate neighbouring quadrat were used, based on similarities already mapped such as topography, plant community or landscape.

The following categories of vegetation structure were recorded:

- 1) Woody vegetation. Percentage of quadrat area, to the nearest 5%, dominated by broad-leaved *Combretum-Terminalia* woodland, mopane *Colophospermum mopane* woodland, fine-leaved *Acacia-Albizia-Dichrostachys* woodland, mixed woodland, riparian woodland or open areas lacking woody vegetation. Within each woody vegetation category, the percentage scrub (<2 m high), bushes (2–4 m high) or trees (>4 m high) was also estimated to the nearest 5%. From the latter data it was possible to estimate the overall percentage of scrub, bush and tree cover for each quadrat, independent of the type of woody cover.
- 2) Ground cover. Grass (and forb) cover was estimated as present (0–25 %), occasional (26–50 %), frequent (51–75 %) or extensive (76–100 %). Small patches that lacked grass cover

were categorized as present, occasional, frequent or extensive. Areas of extensive open patches, greater than 100 m² and lacking any ground cover, were also noted as present or absent.

- 3) Emergent large trees. Presence of emergent baobab *Adansonia digitata* trees was recorded, and abundance of emergent live and dead trees was classed on a scale of 0–5 (0 = no emergent trees, 1 = 1–50 trees, 2 = 51–100, 3 = 101–200, 4 = 201–400, 5 = >401).

We also recorded some topographic features that could be compared with existing maps as a cross-check on our procedures. These included the percentage of quadrat area classified as flat, undulating (with highest points of equivalent altitude), hilly (with some high points well above others), water-course depressions, rocky outcrops, or rock cliffs.

The geographical information system (GIS) programme ARC/INFO (version 6.1.1, Environmental Systems Research Institute, Redlands, California) was used for analysis and mapping.

Results

The results were prepared as maps and data files that represent our assessment for each of the vegetation categories described (see Appendix).

Discussion

The range and density of a species is determined primarily by its habitat preference. This is also essential information to understand its population ecology and conservation. Assessment of habitat preference is most difficult, biologically, for rare or sparsely distributed organisms and, logistically, at a large scale. However, if habitat preference can be documented, then it can be used to predict the range and relative abundance of a species. Such predictions are testable and can be refined by more detailed studies.

Our assessment of vegetation structure over the whole KNP was done by two field observers over ten months. The accuracy of our results can be compared with those habitat categories that have already been mapped. For example, besides the topo-

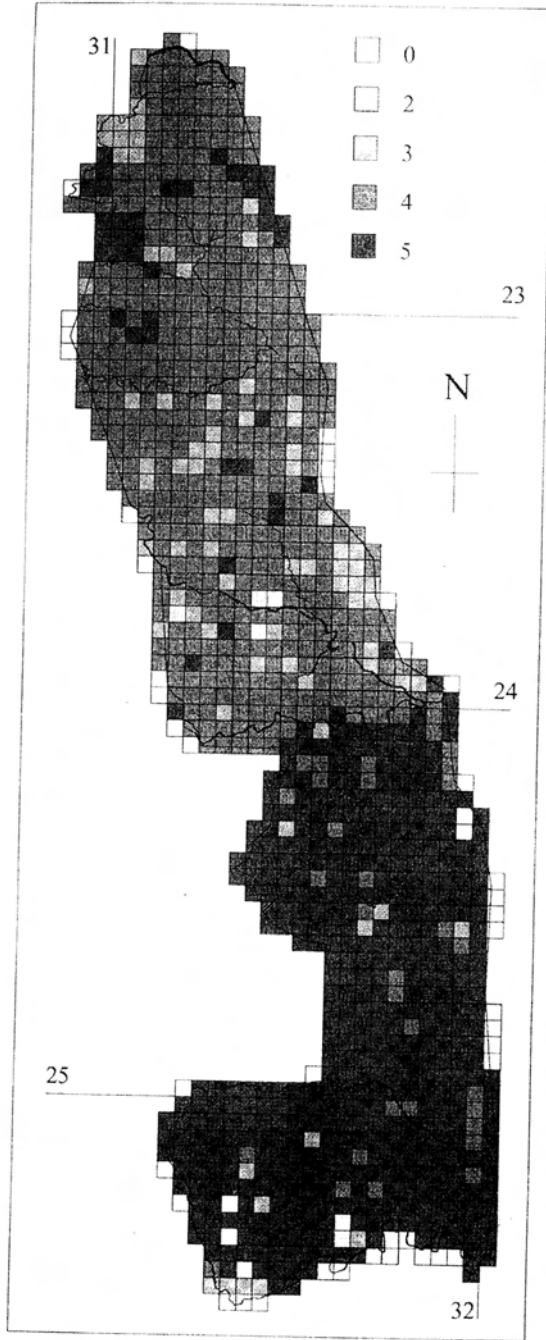


Fig. 1. Accuracy index for visual assessment of vegetation structure in each 2.5' x 2.5' quadrat of the Kruger National Park. 0 = quadrats that were not visited, accuracy on a scale of 1 (least accurate) to 5 (most accurate).

graphical features, the distribution of mopane, broad-leaved, fine-leaved and other woody plant associations agree well with published maps of major vegetation communities (Gertenbach 1983).

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APPENDIX I

Fifteen maps of vegetation structure for the Kruger National Park, estimated visually to the nearest 5% for each 2.5' x 2.5' quadrat, are available. They can be obtained from the Transvaal Museum of natural history as monochrome photocopies in A4 format (see senior author's address), or as graphics and data files on the Internet (<http://www-tm.up.ac.za/knmpmaps>). The raw data are stored on computer at the FitzPatrick Institute (University of Cape Town) and at the Transvaal Museum (Pretoria).

- Map 1: Percentage classes at 20 % intervals for the extent of woody broad-leaved *Combretum-Terminalia* vegetation.
- Map 2. Percentage classes at 20 % intervals for the extent of woody mopane *Colophospermum* vegetation.
- Map 3. Percentage classes at 20 % intervals for the extent of woody fine-leaved *Acacia-Albizzia-Dichrostachys* vegetation.
- Map 4. Percentage classes at 20 % intervals for the extent of woody mixed vegetation.
- Map 5. Percentage classes at 20 % intervals for the extent of woody riparian vegetation.
- Map 6. Percentage classes at 20 % intervals for the extent of open areas devoid of woody vegetation.

- Map 7. Percentage classes at 20 % intervals for the extent of woody scrub vegetation.
- Map 8. Percentage classes at 20 % intervals for the extent of woody bush vegetation.
- Map 9. Percentage classes at 20 % intervals for the extent of woody tree vegetation.
- Map 10. Classes at 25 % intervals for the extent of grass cover.
- Map 11. Classes for the extent of bare, grassless areas.
- Map 12. Presence of extensive open, grassless patches.
- Map 13. Presence of emergent baobab trees.
- Map 14. Classes at intervals of 50–100 for the number of emergent large live trees.
- Map 15. Classes at intervals of 50–100 for the number of emergent large dead trees.

Topographical maps, estimated by the same procedure, can also be provided for:

- Percentage classes at 20 % intervals for the extent of flat topography.
- Percentage classes at 20 % intervals for the extent of undulating topography.
- Percentage classes at 20 % intervals for the extent of hilly topography.
- Presence of watercourse depressions.
- Presence of prominent rocky outcrops.
- Presence of prominent rock cliffs.