Landsat-based remapping of the south-western Kalahari

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Landsat-4 remote sensing is used to construct distortion-free maps of the almost trackless southern Kalahari Desert. These maps show the geography of natural pans, riverbeds and artificial water holes, and are improved versions of previous maps. The maps are essential for ecological and ethological studies and for the overall management of the area.

Key words: Landsat, map, Kalahari Desert.

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Introduction

In vast, almost trackless areas, ecological studies have to rely on distinct landmarks for the notation of localities. For game the pans and riverbeds of the southern Kalahari especially are important features, for example, Child & Le Riche (1969), Smithers (1971), Child (1972), Parris & Child (1973), Lancaster (1974, 1978), and Parris (1976). Similarly, the artificial watering points, especially in the Kalahari Gemsbok National Park, are important features (Child & Le Riche 1969; Mills & Retief 1984; and Knight, Knight-Eloff & Bornman 1988).

The mapping of the southern Kalahari is therefore important both from a research and a wildlife management point of view. Maps of the area should also be as accurate as possible, especially so with regard to the geographic distribution of the rivers, pans and other water resources. The current paper sets out to provide such a source.

Previous maps of the various habitats of the Kalahari Gemsbok National Park (Bothma & De Graaff 1973) and of the rivers, pans and equipped boreholes of the southern Kalahari (Parris, Bothma, Waanders & Boshoff 1977; Parris 1984) all suffered in accuracy to some degree because they were all based wholly or at least partially on low-level aerial photographs which are known to contain peripheral image distortion. In the map drawn by Bothma & De Graaff (1973) for example, 601 individual, but partially overlapping, low-level aerial photographs of the Kalahari area involved, were used.

The current paper provides the first detailed maps of the areas involved which are wholly based on computer-based, distortion-corrected remote-sensing satellite images and are thus regarded as the most accurate current source of data on the geographic distribution of the rivers and pans of the southern Kalahari.

Study area

The study comprises that portion of the south-western part of the Kalahari basin between 24°S and 27°S and between 20°E and 22°E. It includes two contiguous parks, the Gemsbok National Park (Botswana) and the Kalahari Gemsbok National Park (South Africa) which share the Nossob riverbed as a common boundary.

Materials and methods

Two maps were produced, one covering the entire area (Fig. 1) and another of the Kalahari Gemsbok National Park only (Fig. 2). The latter shows details especially of the artificial water holes (boreholes). The mapping scales used were chosen to show the major features clearly without producing maps too large or small to be used practically in the field.

A single composite, distortion-free and true-north orientated satellite image on a scale of 1:300 000 was obtained using seven individual Landsat-4 MSS images. The Landsat orbit height was 700 km, and the Landsat-4 satellite circled over the same area of the globe once very 18 days. The photography took place on 16 June 1988 at 09:20 on a cloudless day and comprised the following seven MSS (multiple spectral scanner) images: 187-76; 188-76, 189-76, 186-77, 187-77, 188-77 and 189-77, each with an object resolution of 30 m in cross section. Each image covered a land surface area of 185 km x 185 km. From these seven images a single mosaic image of enhanced quality was compiled by the Satellite Remote Sensing Centre of the CSIR at Hartbeeshoek. The image was orientated to true north but as it was large and in false colour, the original image is not included in this paper.

From the mosaic image it was possible to trace the course of the Auob and Nossob riverbeds and the location of the various pans accurately. Further details on other features, such as the boreholes, were based on aerial reconnaissance with a Cessna 206 aircraft, personal discussions with Mr. E.A.N. le Riche, Warden of the Kalahari Gemsbok National Park, and by using published data on the geology of the area (Malherbe 1984). Other features were obtained from existing maps (Bothma & De Graaff 1973; Parris *et al.* 1977; and Parris 1984).

The scale of the final maps produced here (Figs. 1, 2) was reduced in size from the original image scale of 1:300 000 to make them publishable and of practical use in the field. The positions of the coordinates were taken from South Africa 1:250 000 Topographic Sheets.

The x-symbols on the roads have no significance other than serving to highlight the roads relative to other map features.

Results

The resulting two maps, one of the entire study area (Fig. 1) and another of the Kalahari Gemsbok National Park only (Fig. 2), contain the most up to date information and differ from their predecessors in the following known respects:In Fig. 1 the geographic position of most pans are shown more accurately relative to the earlier maps of Bothma & De Graaff (1973), Parris *et al.* (1977), and Parris (1984), which relied heavily on ordinary aerial photography, because of the use of an image with minimal distortion. The same is true for the two river courses involved here. The location of some windmills in the park have been changed to correct errors in earlier maps. This especially involves the windmills Bedinkt and Langklaas. The name KijKij has reverted to the windmill formerly known as St John's Dam, while the former KijKij now reverts to its original name of Melkvlei. It is most important for researchers to keep this in mind when working with location references predating this paper or when using site locations in the park predating 1988.

Conclusion

The current maps will enable researchers to plot localities more accurately than before especially in relation to the various windmills, major pans and the two riverbeds. The maps can thus be more useful to researchers and wildlife managers than previous detailed maps of the area, but it should be emphasised again that any errors discovered are to be pointed out for future correction.

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