

GPS-corrected and GIS-based remapping of the Kalahari Gemsbok National Park and the adjacent area in Botswana

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GPS-equipment was used to map the interior roads, major pans and the location of all windmills and solar-equipped boreholes in the Kalahari Gemsbok National Park and the adjacent areas of Botswana. The final map was generated with GIS-equipment, and supplies managers and planners with the first error-free map of the area. The major errors of previous maps are indicated.

Key words: GPS, GIS, Kalahari.

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Introduction

For ecological and other research, accurate determination of localities is often important. In an area such as the Kalahari this can be difficult and several maps have been produced to meet this need (e.g. Bothma & De Graaff 1973; Parris *et al.* 1977; Parris 1984; Bothma & Swart 1990). Each subsequent map was a notable improvement on the previous one. The Landsat-based map by Bothma & Swart (1990) was the first accurate one for the course of the Auob and the Nossob rivers. But this map, as those before it, still had one major deficiency in that the boreholes, smaller roads and tracks could still not be plotted accurately. The use of GPS equipment has made mapping of these features possible. The map produced here is the first totally dependable map of this part of the southwestern Kalahari. It should be extremely useful to future research in and management of the area.

Study area

The study was done in the southwestern part of the Kalahari basin between roughly 24°00'S–26°30'S and 20°00'E–22°00'E. It includes the whole Kalahari Gemsbok National Park and the adjacent areas of Botswana where some ecologically important pans are located.

Materials and Methods

A Sony Pyxis hand-held GPS was used to map all boreholes. This equipment has a resolution error of 90 metres. This is due to equipment resolution and the concept of selective availability for GPS data. Selective availability is a process whereby erroneous offsets to coordinate values are randomly included in satellite transmissions. This margin of error is insignificant on the mapping scale used here. Roads and tracks were mapped with readings at roughly 3 km intervals and all features such as turn-offs and T-junctions were mapped.

The longitude and latitude coordinates generated by the Pyxis, was transformed to Gauss Local Origin coordinates, using the LO 21 Personal Computer programme (J.D.J. van Rensburg). These coordinates were imported into the GIS-system, MicroStation™ PC version 4.0.3.2, in a DXF format file using a MicroStation Development Language programme. The coordinates were then digitised to create the roads, boreholes, borders and rivers by placing line strings. The output device used to generate the map on paper was a Roland DXY 1300 Pen Plotter.

The entire map is based on 404 GPS locations.

Results and discussion

The map produced here (Figure 1) is the first totally accurate map of the Kalahari Gemsbok National Park and can now be updated easily as new features are added to the park. For easy reference the coordinates for the windmills and other prominent features in two interior areas of the Kalahari Gemsbok National Park and the Nossob and Auob riverbeds are given in the Gazetteer.

Based on the map produced the following clear errors on older maps are evident: on the map of Bothma & Swart (1990) the location of the windmills at Strathmore, Nu Quap, Copeng, Lammermoor, Grasvlei and Driefendas are highly inaccurate, as is the road which links these windmills. The new tourist road between the Auob and Nossob rivers is indicated here for the first time. The road in the red dunes area between the Auob River and the Mier area to the southwest was also totally inaccurate on older maps and has now been corrected. Also in that area the windmills Tsama, Hakskeenpan, Sebobogas, Rolletjies and Pannetjie are indicated for the first time on a map.

The southwestern boundary of the park with the Mier area is also indicated accurately for the first time. Along this fence there are 64 corners which, however, are not all evident in Figure 1 because of the scale used. The location of the camp along the Auob River in which giraffes have been re-established recently, is shown here for the first time.

For the major pans in Botswana, there are several major errors in the map of Bothma & Swart (1990), where the probable location of these pans was indicated based on shape as determined from Landsat photos. The current locations are based on aerial plotting with GPS equipment following the visual identification of these pans by one of us (E.A.N. le Riche). In particular the localities for Agentwas and Kaulwe have been corrected, while those of Zonje, Klein Kanie and Kanie were confused in the map of Bothma & Swart (1990). Khaa pan is also closer to Langpan than originally indicated and the positions of Lang and Rooi Rambuka pans are reversed in Bothma & Swart (1990).

Conclusions

The current map now is the first totally accurate map for the location of the major features in the southwestern Kalahari basin. It should be a valuable aid in the future research on and management of this region.

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Gazetteer

Major pans in Botswana northeast of the Nossob River

Agemtwas	24°46'S, 20°13'E
Groot Kanie	24°21'S, 21°04'E
Kaulwe	24°33'S, 20°41'E
Khaa	24°20'S, 20°45'E
Klein Kanie	24°17'S, 21°02'E
Langpan	24°19'S, 20°45'E
Lang Rambuka	24°47'S, 20°21'E
Matorogô (Hoëkop)	24°16'S, 20°56'E
Namib	24°32'S, 21°06'E
Rooi Rambuka	24°46'S, 20°20'E
Sesatswe	24°32'S, 20°49'E
Tweeling Rambukas	24°47'S, 20°24'E
Zonje	24°21'S, 21°08'E

Windmills in the interior area of the Kalahari Gemsbok National Park west of the Auob riverbed

Groot Skrij	26°05'S, 20°11'E
Hakskeenpan	26°10'S, 20°22'E
Kafirspan	26°03'S, 20°05'E
Klein Skrij	26°09'S, 20°13'E
Pannetjie	26°23'S, 20°29'E
Rolletjies	26°18'S, 20°30'E
Sebobogas	26°13'S, 20°28'E
Tsama	26°08'S, 20°18'E

Windmills in the interior area of the Kalahari Gemsbok National Park between the Auob and Nossob rivers

Ardlamont	25°57'S, 20°35'E
Bayip	25°17'S, 20°10'E
Bitterpan 1	25°43'S, 20°24'E
Bitterpan 2	25°43'S, 20°23'E
Copeng	25°43'S, 20°09'E
Dankbaar	25°04'S, 20°06'E
Dochfour	25°52'S, 20°32'E
Driefendas	25°28'S, 20°01'E
Eland	25°46'S, 20°38'E
Gemsbok	26°21'S, 20°39'E
Gharagab	24°56'S, 20°01'E
Gnurrie	25°11'S, 20°16'E
Grasvlei	25°26'S, 20°13'E
Karib Gnoose	26°03'S, 20°45'E
Karup	25°10'S, 20°09'E
Kieliekrankie	26°11'S, 20°35'E
Kij Gamies	26°07'S, 20°39'E
Kij Garies	26°00'S, 20°40'E
Klein Stofpan	25°34'S, 20°25'E
Lammermoor	25°36'S, 20°08'E
Langstraat	26°18'S, 20°40'E
Loffiesdraai	25°06'S, 20°11'E
Moravet	25°49'S, 20°29'E
Namabies	25°41'S, 20°26'E
Nelsiespan	25°07'S, 20°14'E
Nu Quap	25°46'S, 20°12'E
O' Kuip	25°16'S, 20°01'E
Ratel	25°29'S, 20°27'E
Sewepanne	25°29'S, 20°21'E

Strathmore	25°48'S, 20°18'E
Stoffelsdraai	25°37'S, 20°21'E
Stumke's Dam	26°14'S, 20°43'E
Tierkop	26°10'S, 20°43'E
Vaalpan	25°55'S, 20°26'E

Windmills and power-equipped boreholes in the Auob riverbed of the Kalahari Gemsbok National Park

Achterlonie	26°11'S, 20°33'E
Batulama	26°06'S, 20°29'E
Craig Lockhart	25°52'S, 20°06'E
Dalkeith	25°54'S, 20°10'E
Dertiende Boorgat	25°58'S, 20°17'E
Gemsbok Plain	26°09'S, 20°32'E
Houmoed	26°20'S, 20°35'E
Kamfersboom	26°14'S, 20°34'E
Kamqua	26°01'S, 20°24'E
Mata Mata	25°46'S, 20°00'E
Monro	26°17'S, 20°35'E
Montrose	26°05'S, 20°28'E
Rooibrak	26°03'S, 20°26'E
Samevloeiing	26°25'S, 20°37'E
Sitzas	25°49'S, 20°03'E
Urikarius	26°00'S, 20°20'E
Veertiende Boorgat	25°57'S, 20°13'E

Windmills and power-equipped boreholes in the Nossob riverbed of the Kalahari Gemsbok National Park

Bedinkt	25°14'S, 20°29'E
Cheleka	25°38'S, 20°41'E
Cubitje Quap	25°22'S, 20°33'E
Dikbaardskolk	25°45'S, 20°44'E
Grootkolk	24°53'S, 20°09'E
Grootbrak	25°06'S, 20°25'E
Gunong	26°05'S, 20°50'E
Jan se draai	25°57'S, 20°49'E
Kameelsleep	25°50'S, 20°45'E
Kannaguass	24°55'S, 20°13'E
Kaspersdraai	25°35'S, 20°42'E
Kij Kij (Formerly St John's dam)	26°14'S, 20°48'E
Koedoebos (defunct)	25°04'S, 20°23'E
Kousaunt	25°09'S, 20°25'E
Kransbrak	26°01'S, 20°50'E
Kwang	25°18'S, 20°32'E
Kwang Pan	25°17'S, 20°32'E
Langklaas	25°09'S, 20°28'E
Leeuwdril	26°23'S, 20°42'E
Lekkerwater (Nossob Camp)	25°25'S, 20°36'E
Lijersdraai	25°00'S, 20°19'E
Marie se draai	25°27'S, 20°40'E
Melkvlei (Formerly Kij Kij)	26°07'S, 20°51'E
Rooikop	25°27'S, 20°37'E
Rooiputs	26°20'S, 20°44'E
Twee Rivieren	26°28'S, 20°36'E
Unie End	24°48'S, 20°02'E