

ISOHYETAL RAINFALL MAP FOR THE SOUTH-EASTERN PART OF NAMIBIA

E.H. CHIVELL

National Botanical Research Institute, Private Bag 13184, Windhoek, Namibia

ABSTRACT

A vegetation survey project, with the aim of updating the 1971 Giess Vegetation Map of Namibia, was started in the south-eastern part of the country. One of the most important factors influencing the composition, density and distribution of vegetation, is rainfall. The magnitude and spatial distribution of precipitation can be shown using an isohyetal rainfall map.

A new map based on all rainfall data collected up to and including the 1995/96 rainfall season, was drawn up for the survey area. It was compared with the National Isohyetal Rainfall Map, drawn up in 1992, and the general trends were found to be the same. However, the new map clearly showed the higher rainfall phenomena in the Klein and Groot Karas Mountains.

The new isohyetal map, digitally overlaid on the satellite imagery for the same area, and used in conjunction with the field data, will serve as a useful aid for interpretation of the vegetation status.

INTRODUCTION

The Vegetation Survey Project was initiated as part of the Agro-ecological Zoning Program, in order to update and improve on the 1971 Vegetation Map of Namibia (Giess, 1971; Strohbach, 1997). The survey (field data collection on the ground) was started in the Karas and Hardap Regions during the 1997 growing season, February to April. The May 1997 satellite imagery for these regions was subsequently acquired as an aid to describing and mapping the vegetation.

From an ecological perspective, one of the most important determinants of vegetation is precipitation. It is thus important not only to note plant communities in terms of composition, density and distribution, but also to focus on patterns of precipitation in time and space, i.e. magnitude of rain (how much), spatial distribution of rain (where), and seasonal distribution of rain (when). While annual rainfall in Namibia varies greatly around the mean, the "*mean annual precipitation*" (MAP) for a point is nevertheless a very useful way to describe the magnitude and spatial distribution of rainfall.

With this in mind, it was decided to draw up an accurate isohyetal map of mean annual precipitation for the survey area, using the most recent available rainfall data.

RAINFALL

I. Definition and Measurement

Rainfall is the amount of water falling as rain over the area in a given time, and is measured in mm of depth in an instrument into which the water falls (Collins Dictionary).

Rainfall is measured using rainfall recorders or simple storage rain gauges. The gauges vary in capacity depending on whether they are daily, weekly or monthly-read. The general sample period is a day, and most rainfall measurements are the accumulated depths of water caught in a simple storage gauge over 24 hours (Shaw, 1994).

II. Rainfall Data

Although a National Isohyetal Map for Namibia exists, having been drawn up fairly recently (Department of Water Affairs 1992), an additional five years of data now exist. Thus, for the purpose of the vegetation survey in the south-eastern portion of Namibia, it was decided to draw up an updated, revised isohyetal map for the area between 24° - 29° S and 17° - 20° E. Rainfall is measured on behalf of the Namibia Meteorological Service on farms, at Mission stations and other locations. There are a total of 159 rainfall stations (open and closed) in this area, of which 116 have records of 15 years or longer.

Previous studies have shown that at least 15 years of data are required to provide a statistically acceptable estimate of the MAP. Since the 1992 National Isohyetal Map was drawn up, approximately 275 additional station-years of data have become available (up to and including 1995/96 season), including a number of newer stations which would have failed the fifteen year criteria in 1992. The implication is that not only were more station-years of data available, but also an improved spatial distribution of stations. A list of the stations for the south-eastern area, their geographical positions, length of records, and MAP is provided in Table 1.

II. Isohyetal Map Compilation

The positions of all the rainfall stations were plotted, together with their MAP values at a scale of 1:1 000 000. Those with less than 15 years of record were ignored in almost all cases. Only where a particular area was devoid of other rain gauges, was the record taken into consideration.

The lines of equal mean annual precipitation (isohyets) were manually fitted using trial and error, and interpolation. The frequently conflicting MAP values for stations often quite close to each other, makes the use of standard computer contour-drawing packages inappropriate. Consideration of factors known to influence quantity and spatial distribution, such as topography, can be taken into account when interpolating manually. The resultant map is shown at a reduced scale in Figure 1.

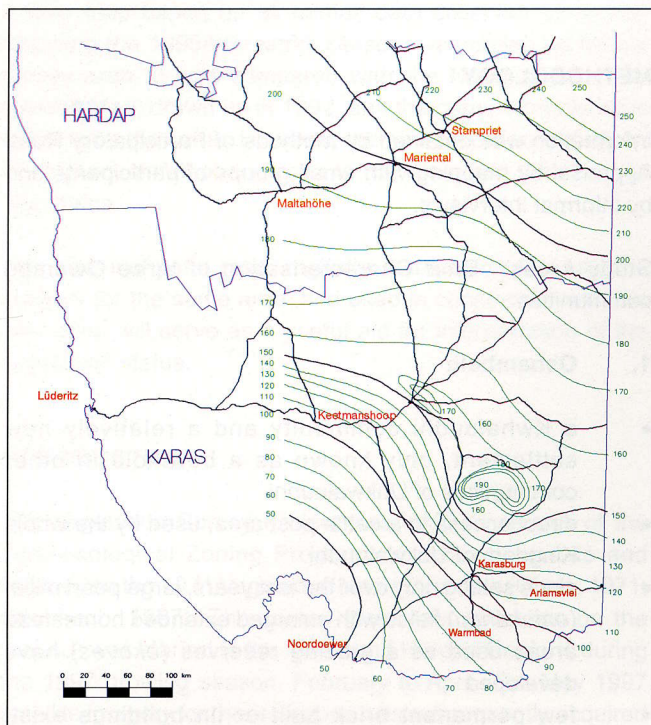


Figure 1. Isohyetal rainfall map for the south-eastern part of Namibia.

RESULTS AND DISCUSSION

The derived isohyetal map shows a trend over the area, which fits in with existing knowledge of rainfall patterns in southern

Namibia. In general, the new map does not show major differences with the 1992 map, except for the area around the Klein and Groot Karas Mountains. Here, the new isohyets support the known higher rainfall phenomena associated with that area.

Table 2 compares the MAP values of the new isohyetal map to that of the 1992 isohyetal map for a selection of localities. Of the selected localities, the values differ significantly only for the Warmbad area. This can be attributed to the fact that data for Noordoewer and other stations, not formerly available, have resulted in a shift of isohyets in this area.

The new isohyetal map has been digitised, and can be overlaid on the May 1997 satellite imagery of the south-eastern area, as an aid to visual interpretation of the vegetation status, in conjunction with the field data.

Table 2. Comparison between the new isohyetal map of south-eastern Namibia and the 1992 map

Locality	New Isohyetal Map value (mm)	1992 National Map value (mm)
Karasburg	110 - 120	110 - 120
Keetmanshoop	140 - 150	140 - 150
Mariental	190 - 200	190 - 200
Warmbad	90 - 100	70 - 80
Noordoewer	50 - 60	< 50
Maltahöhe	180 - 190	170 - 180
Stampriet	210 - 220	210 - 220

REFERENCES

- DEPARTMENT OF WATER AFFAIRS, 1992. Updated Isohyetal Rainfall Map for Namibia, Oct 1992, Internal Report, Hydrology Division, Department of Water Affairs, Windhoek.
- GISS, W. 1971. A preliminary vegetation map of South West Africa. *Dinteria* 4.
- SHAW, E.M., 1994. Hydrology in Practice. Chapman and Hall, London, UK
- SCHULZE, R.E., 1997. *Climate, Vegetation of Southern Africa*, Cambridge University Press, UK.
- STROHBACH, B.J.(ed.) 1997. Proceedings of the National Annual Agriculture Research Reporting Conference. TransNamib Training Centre, Windhoek, August 1997. Department of Agriculture and Rural Development, Windhoek.