USING NAMIBIAN DATA TO ILLUSTRATE VULNERABILITY OF AN AREA TO DROUGHT

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INTRODUCTION

Vulnerability to drought is a very broad concept. It can be applied to a country, a family or a farming enterprise. Some countries may be vulnerable to drought in terms of food self-sufficiency because they are net importers of basic foods. On the other hand, this same country may be totally invulnerable to drought because its balance of payments and the Gross Domestic Product (GDP) of its citizens are such that there is household food security, e.a. they can buy all necessary foods on the world market. An urban household which does not produce any food, but its income is in the supertax bracket may find droughts like annoying mosquitoes, the price of food goes up but they can still afford it comfortably.

A subsistence farming enterprise is generally more vulnerable to droughts because its income and even household food security might be jeopardized by drought. The management of any farming enterprise has much to do with its vulnerability to drought. It will determine the effect of below-normal rainfall on its productivity and profit.

These are all real factors that are mentioned in this introduction and are real issues in the planning for drought. To illustrate an area's vulnerability to drought, it was decided to concentrate on the rainfall regime of any area and its contribution to drought vulnerability.

NAMIBIAN RAINFALL REGIME

Namibia is an arid country, probably the driest country in Africa, south of the Sahara. It also has deserts on its eastern (Kalahari) and western edges (Namib). The Namib is a true desert with mean annual rainfall less than 20 mm in places and mostly below 50 mm. The Kalahari stretches over three southern African countries, i.e. Namibia, Botswana and South Africa and is actually not a true desert but a semi-desert with mean annual rainfall in the 150 - 350 mm range. The mean annual rainfall for Namibia is about 270 mm and ranges from less than 20 mm in the Namib Desert to more than 700 mm at Katima Mulilo in the Caprivi Strip. The distribution of land area receiving different categories of rainfall is shown in Table 1.

Table 1. Distribution of land area receiving different categories of rainfall

RAINFALL (mm)	PERCENTAGE OF LAND SURFACE (%)
<100	22
100 – 300	33
300 – 500	37
> 500	8

These are usually the statements that are made to illustrate that Namibia is very vulnerable to drought. Unfortunately people making these statements still have drought and aridity confused in their minds but for the cognoscenti, such confusion does not (or should not) exist.

The inter-annual variability of rainfall, as well as the intra-seasonal variability, usually causes vulnerability to drought due to the rainfall regime. The variability from year to year affects all farming enterprises, while the within-season variability usually plays havoc with dryland crop production since a relatively short dry period during a particularly vulnerable growth period might wipe out an entire crop while the total seasonal rainfall might be above-normal.

INTER-ANNUAL VARIABILITY

To illustrate the range in inter-annual variability, and thus vulnerability, let us look at the actual variability for selected rainfall stations in Namibia. These were selected to be examples for different rainfall regimes in Namibia. Namibia's rainfall generally decreases from the northeast to the southwest. The stations selected are shown in Table 2.

The standard deviation (SD) and coefficient of variation (CV) were calculated for these stations and the results are given in Table 3.

The standard deviation steadily increases with increasing mean annual rainfall, while the coefficient of variation in turn steadily decreases. The CV values stay high (30% or more) except for Outjo and Rundu. The map of the coefficient of variation indicates the spatial variation in this parameter. According to this map the western and southern parts of Namibia are much more vulnerable to droughts than the northeast. In general, the lower the annual rainfall, the greater the vulnerability. Of course it is not only the coefficient of variation that effects vulnerability, but also the absolute values of the deviations, which tend to grow larger as the rainfall increases, thus making even the rainier parts of Namibia still vulnerable to droughts, especially since the crop growing areas, both commercial and subsistence, are situated in these parts of Namibia. The monthly variations are much larger than the annual variations and during the rainiest months of January to March, Rundu, which has an annual coefficient of variation below 30%, has coefficients of variation of 55.7, 59.2 and 68.8 %, respectively.

Another way of illustrating the vulnerability (variation) is to plot the annual rainfall against time (figure 1).

Table 2. Stations selected for analysis of inter-annual variability

STATION	LATITUDE	LONGITUDE	MEAN ANNUAL RAIN (MM)	MEDIAN ANNUAL RAIN (MM)
Diaz Point	26°38'S	15°06'E	18.1	14.0
Aus	26°41'S	16°19'E	91.1	85.5
Keetmanshoop	26°32'S	18°07'E	159.6	150.8
Aroab	26°47'S	19°39'E	167.8	147.5
Mariental	24°37'S	17°58'E	202.0	184.5
Aranos	24°08'S	19°07'E	205.3	198.5
Rohrbeck	24°08'S	18°28'E	206.1	166.3
Tsumis	23°43'S	17°12'E	217.6	188.9
Beenbreck	23°28'S	17°56'E	255.7	243.9
Abochaibis	22°39'S	16°18'E	279.0	265.0
Dordabis	22°56'S	17°41'E	310.9	300.2
Windhoek	22°34'S	17°06'E	353.5	325.6
Hochfeld	21°39'S	17°52'E	405.8	395.0
Omatjenne	20°24'S	16°29'E	429.7	399.9
Outjo	20°07'S	16°09'E	427.2	424.2
Otjiwarongo	20°27'S	16°40'E	457.1	446.9
Otavi	19°38'S	17°20'E	528.1	501.6
Grootfontein	19°36'S	18°08'E	542.5	515.0
Rundu	17°55'S	19°46'E	573.7	594.6
Katima Mulilo	17°28'S	24°15'E	669.1	625.2

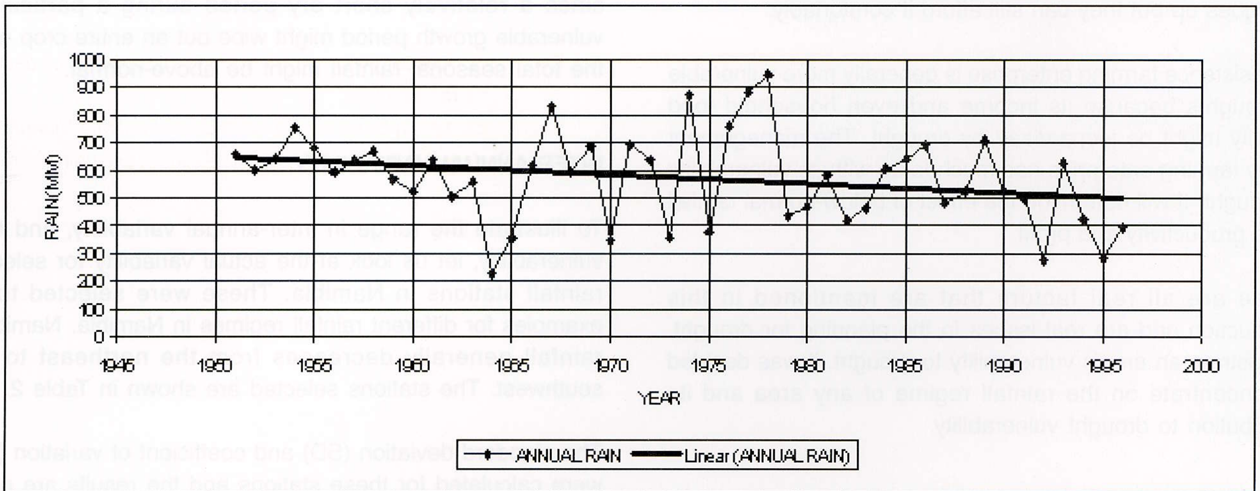
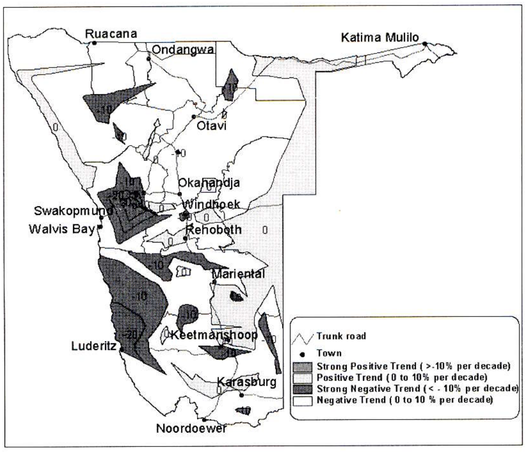


Figure 1. The annual rainfall for Rundu plotted against time.

Table 3. Results of standard deviation (SD) and coefficient of variation (CV) that were calculated for the different stations

STATION	SD (mm)	CV (%)
Diaz Point	15.6	85.9
Aus	54.2	59.5
Keetmanshoop	97.7	61.2
Aroab	99.2	59.1
Mariental	113.4	55.2
Aranos	125.5	62.1
Rohrbeck	113.0	54.8
Tsumis	141.6	65.1
Beenbreck	125.8	49.2
Abochaibis	120.1	43.0
Dordabis	125.0	40.2
Windhoek	143.4	40.6
Hochfeld	153.4	37.8
Omatjenne	154.9	36.0
Outjo	127.4	29.8
Otjiwarongo	188.7	41.3
Otavi	164.3	31.1
Grootfontein	175.9	32.4
Rundu	163.1	28.4
Katima Mulilo	220.7	33.0

This figure shows us how the year-to-year fluctuations have varied during the past. During the 1950's to early 1960's the variation was quite small but after 1963 the variation looks quite alarming. During the 1970's, which are reckoned as good years, the annual variation was quite large and only damped during the 1980's with larger variations again during the 1990's. The trend line was also drawn in and it is obvious that the high rainfall during the late 1960s and 1970's tends to make it negative for the whole period. A trend study for the last half-century has been done recently and shows large, spatially cohesive areas of Namibia which showed negative and positive trends and a few places with no trend at all. This is shown in map 1. One can assume that a negative trend would tend to make any area more vulnerable than a positive trend. The trends are much smaller than the coefficient of variation – mostly less than 10% of the median value per decade. Another factor is the length of period used in trend analysis. Windhoek, which has more than 100 years of rainfall records, showed a definite negative trend during the last half-century, but for the whole century it showed no trend whatsoever. The author is of the opinion that the good rains during the 1960's and especially 1970's have tended to influence all trend analyses.



Map 1. Trend in annual rainfall (% of median per decade).

CONCLUSION

Vulnerability to drought is a combination of many factors and is dependent upon the area, farming enterprise, farmer or household. In the context of the major physical cause of drought, lack of rainfall, a few ideas have been presented which can give an indication of how it influences drought vulnerability. The types of analyses and maps are a useful tool in the sensitizing of farmers and governments to how these factors occur in their area. This will help all role players in the assessment of drought planning on all scales. Only by knowing what the rainfall regime in a particular area is like, can planning be done in a sensible way. Showing the variation and how it occurred in the past can at least persuade farmers and governments not to be too optimistic about rainfall. Farmers and government officials tend to have the NIMBY (not in my back yard) attitude to drought and when it comes, are quite unprepared.

Seasonal-to-inter-annual rainfall forecasts are becoming more commonplace nowadays, but there are still many pitfalls in the interpretation and use of these forecasts.

ACKNOWLEDGEMENTS

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REFERENCES

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