

CHAPTER 3

THE ENVIRONMENTAL SITUATION OF SMALL- SCALE IRRIGATION IN

3.1 Introduction

This chapter describes some of selected issues all the Nkomazi's environmental issues and this refers to the physical factors such as topography, climate, soils as well as the water related issues.

3.2 Physical Factors

3.2.1 Locality

The survey area is called Nkomazi situated in the Southern lowveld of Mpumalanga province. This low-lying piece of land is confined to the eastern border of the province and comprises of land west of the Lebombo Mountains and east of the Drakensberg foothill, extending from the Kingdom of Swaziland in the south to the Crocodile River in north and it consists of an area of 3500 km² (Dany, 1998).

The Komati River is one of the rivers in the Inkomati Water Management Area and is sub-catchments of the Inkomati River Catchment. This water management area falls almost entirely within the province of Mpumalanga. The catchment extends from the origin in the Transvaal Plateau west of Carolina to the Lebombo Mountain Range at Komatipoort in the east. The total catchment area of the Komati River and its tributaries (under which the Lomati with 1,493km²) is approximately 11,210 km² (MBB, 2000).

3.2.2 Climate

The topography of this area results in a myriad of micro-climatic regions and therefore it is needed to give as much data as possible of the production factors that are involved in agricultural production. Except for the northern boundary the lowveld is shut in by mountain chains, which play an important role in the prevailing climatic conditions, namely rainfall and temperature. The climate of the lowveld is sub-tropical.

The long-term meteorological data used in this study is obtained from the stations listed in Table: 3.1.

Table 3.1 Location of meteorological stations in this survey area

| STATIONS | LATITUDE (<i>degr. min.</i>) | LONGITUDE (<i>degr. min.</i>) | ALTITUDE (<i>Metres</i>) |
|-----------------------------|--|---|--------------------------------------|
| Vergelgen (Malelane) | 25°30' | 31° 30' | 369 |
| Kaalrug (Malelane) | 25°37' | 31° 37' | 390 |
| Hoechst (Malelane) | 25°38' | 31° 38' | 272 |
| Tenbosch (Komatipoort) | 25°24' | 31° 58' | 189 |
| Coopersdal (Komatipoort) | 25°38' | 31° 57' | 200 |

The variation in data is a reflection of the variation in topography and particularly in the altitude.

The precipitation of the lowveld area varies from as high as 855 mm at Kaalrug to as low as 581mm at Vergelegen. Normally, the rainfall season falls between October and May, peaking in January, February. During this period, namely October to May, almost 90% of the annual precipitation is received (Fig.3.1).

3.2.2.1 Rainfall

The rainy season coincides with the summer months – September to April. The winters are generally dry, but fairly severe droughts are experienced during the summer months. (90% of the rainfall fall during October and May, these variation in rainfall figures are reflected in Table 3.2) .The rainfall, which is rather erratic, generally occurs in thunderstorms and heavy down pours, causing high run-off, notwithstanding the fact that the soils are light textured and generally well covered with grass-and bush-vegetation.

Table 3.2 Average long-term rainfalls during October-May (90% of the total rainfall)

| | Vergelgen | Kaalrug | Hoechst | Tenbosh | Coopersdal |
|-----------------------------------|-----------|---------|---------|---------|------------|
| <i>Average rainfall (OCT-MAY)</i> | 539.2 | 781.2 | 729.2 | 537.5 | 589.2 |

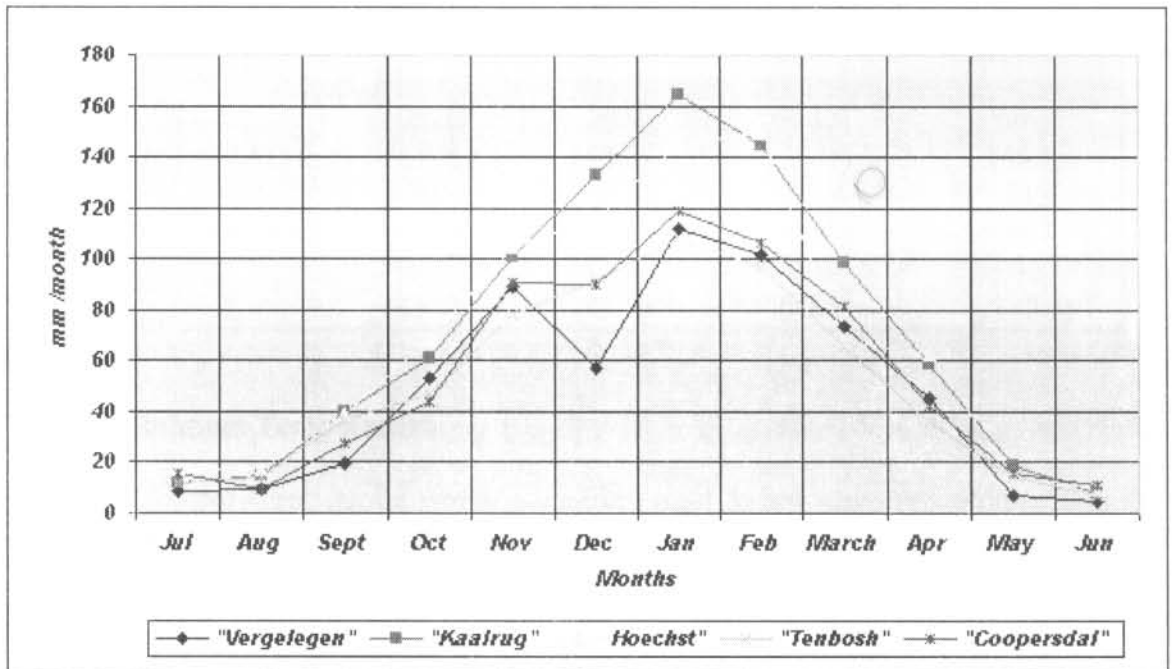


Figure 3.1 Monthly Rainfall Distribution in Nkomazi (2000)

Hailstorms are of rare occurrence, but can result in severe crop damage.

3.2.2.2 Temperature

The average daily temperatures of the lowveld throughout the year are of the highest in the Republic of South Africa. The summers are extremely hot with mild to hot winters.

(a) Maximum Temperature

The maximum temperature in the Lowveld varies from hot, in the East, to very hot in the summer time, and mild to hot during winter. During November, December and January the highest temperatures sometimes above 40°C are recorded with an average maximum temperature above 30°C during the same period. (Table 3.3)

Table 3.3. Average daily and maximum temperature during November-January. (°C)

| Month | Vergelgen | Kaalrug | Hoechst | Tenbosh | Coopersdal |
|---------------|-----------|---------|---------|---------|------------|
| NOV | 29 | 28.3 | 29.4 | 30 | 30.1 |
| <i>(High)</i> | (40.4) | (43.4) | (40.7) | (41) | (40.5) |
| DEC | 30.5 | 30 | 30.9 | 31.6 | 31.6 |
| <i>(High)</i> | (41.7) | (45.5) | (41.6) | (41) | (40.7) |
| JAN | 30.7 | 30.2 | 31.6 | 32 | 32 |
| <i>(High)</i> | (41.6) | (43.4) | (42.9) | (42.5) | (42.5) |

(b) Minimum Temperature

Minimum temperatures during winter vary from mild to hot when proceeding from West to East. The coldest months in the Lowveld are June, July and August, with the rare occurrence of frost during about 3 to 5 nights during the winter season (Table 3.4.). Because of these mild winters it is possible to cultivate most of the tropical and sub-tropical crops and this fact gives the area a high agricultural potential (NOWAC, 1997).

Table 3.4 Average minimum daily temperatures during June-August

| Month | Vergelgen | Kaalrug | Hoechst | Tenbosh | Coopersdal |
|---------------|-----------|---------|---------|---------|------------|
| June | 9.8 | 11.6 | 7 | 8.8 | 8.4 |
| July | 9.8 | 11 | 7.4 | 9.1 | 8.9 |
| August | 11.9 | 13.3 | 10.4 | 11.2 | 11.5 |

(c) Frost

Frost is generally absent except near perennial streams where it occurs in a very mild form during June and July causing a certain amount of damage to tropical crops.

3.2.2.3 Humidity

Humidity is one of the important factors that must be considered when selecting a crop that is suitable for this region. Maximum humidity is recorded early in the morning (8h.00) the highest maximum humidity is recorded from November to May. A maximum of 90% and higher is recorded during this period. Minimum humidity is recorded at 14h.00. The lowest minimum humidity is recorded from May to September, when the humidity comes down to 40%.

3.2.2.4 *Topography and physical system*

Nkomazi region is situated on the high plateau grasslands of the middleveld, which roll eastwards for over hundred kilometres. In the northeast, it rises towards mountain peaks and then terminates in an immense and breathtaking escarpment. In other places, this escarpment plunges hundred of metres down to the low-lying area known as the lowveld. Looking down from the Drakensberg, the Lowveld appears to be monotonous level stretch of bush-covered country, but in reality it consists of gentle undulating ridges drained by well-defined watercourses. Rocky outcrops break the monotony of this section of gentle undulations; sometimes the outcrops consist of big solid granite boulders (South Africa local government Yearbook 2000)

The elevation above sea level rises from 189m along the Lebombo Mountains to 369m at the foothills of the Drakensberg at Malelane.

3.2.2.5 *Geology*

Practically, archaic granite and gneiss rock with prominent outcrops of granite blocks cover the entire stretch of country comprising the lowveld. Sandwiched between the archaic granite on the west and the rhyolites of the Lebombo Mountains, on the east are four narrow parallel strips of the Eca and the Beaufort series¹, the cave Sandstone and the Amygdalooidal Basalt (Klausner and Reid, 1979)

3.2.2.6 *The soils*

The soil types in the study area vary tremendously, from highly suitable for irrigation purposes to very unsuitable. The most important soil types are shown in Table 3.5, which also shows the geological origin and gives indication of their agricultural usefulness.

With the tremendous variation in soil types, it can be assumed that a significant degree of production variation in sugar cane between the different projects can be attributed to soil types.

The main limitations of the soil in Nkomazi, are the soil's depths as well as its texture. At some farms, the soil is not deeper than 20cm, and they are normally sandy to clay. Many soils have a high content of rocks, they have a high Mg and Ca⁺ content and a pH higher than 7 (SASA, 2000).

With careful management, it is possible however to get good returns of the soils. The limitations restrict choice alternative uses and sometimes the intensity of crop production. (MBB, 2000; BKS, 1997).

¹ Beaufort as (Bath, Valois and lancing soils with 35%-60% slopes), Eca as (Eliery, Chippewa and Aldens soils:0-8% slopes † Source: Klausner and Reid ,1979}

Table 3.5 The main soil types found on irrigation projects in Nkomazi and their parent material

| Dominant Parent material | Soil Types | Remarks |
|--|--------------------------------------|----------------------------------|
| ◆ <i>BEAUFORT SERIES</i> ¹ <i>Swaziland Basic Rock</i> | <u>RED SOILS</u> | |
| | 1 Hutton | ○ Very good Irrigation soils |
| | 2 Shortlands | Very good Irrigation Soils |
| | | |
| | <u>BLACK BLOCKY STRUCTURED SOILS</u> | |
| | 1 Arcadia | Marginal soils for irrigation |
| 2 Rensburg | Marginal soils for irrigation | |
| 3 Milkwood | Marginal soils for irrigation | |
| ● <i>ECA SERIES</i> ¹ Granite | <u>GREY COARSE&FINE SANDS</u> | |
| | 1 Glenrosa | Marginal soils shallow in places |
| | 2 Cartref | Marginal soils shallow in places |
| | 3 Sterkspruit | Marginal –poor drainage |
| | 4 Estcourt | Totally unsuited for irrigation |
| | 5 Longlands | Marginal-poor drainage |
| | 6 Kroonstad | Marginal poor drainage |
| | 7 Katspruit | Totally unsuited for irrigation |
| | 8 Mayo | Marginal soils shallow in places |
| | 9 Hutton | High Quality irrigation soils |

Source: Stoch (1976)

3.2.2.7 Vegetation

The bush-clad expanse is overgrown mainly by deciduous, interspersed by evergreen trees, Reeds and evergreen trees cover the banks of the rivers. On the western and central sections of the Lowveld west of the Lebombo Mountains and south of the Crocodile River is found a fairly dense growth of dry thorn forest consisting mainly of the Acacia species. The dominant veld type being Knob-thorn (*Acacia nigrescens*)

/Marula (*Sclerocarya birra*), veld, especially on the basalt and dolorite strips of Lebombo Mountains. The dominant grasses found here belong to the genera Themeda, Panicum, Urochloa, digitaria, Hypharenia and Cymbopogon.

The dominant veld type on the Granite section is known as Silver Terminalia (*Terminalia seracea*) / Sickle Bush (*Dichrostachus cinera*). The dominant grasses found here belong to the following genera viz. Hyphethelia (*Thatching grass*), This veld type is normally associated with a sandy. (South African local government Yearbook, 2000)

3.2.2.8 Water

The supply of water for irrigation is a function of accessible water sources, the quantity of water that is available from these sources and the quality of that water (Thompson, Spiess and Krider, 1980).

The quantity and timing of potential water deliveries affect planning and selection of farm irrigation systems and cropping systems, because the available flow from the source may be inadequate to enable full irrigation of all crops throughout the year. When the quantity of water is limited, appropriate cropping cycles may be needed in order to optimise economic returns.

The availability of a reliable source of water is a pre-requisite for the successful production of all major crops in the project area. Several streams and rivers of which the Lomati and Komati rivers are the most prominent traverse the Nkomazi region. A development plan for water resources was formulated during the 1980's by South Africa and Swaziland to make provision for increasing demands.

Two treaties were concluded in 1992 to establish the Joint Water Commission (JWC) and to proceed with the implementation of Phase 1 of the development plan. Lake Matsamo (Driekoppies) with a capacity of 251 million cubic meters was completed during 1997. Lake Matsamo stabilised the supply of irrigation water to projects from the Lomati River.

Other projects are depending on water from the Mbambiso dam (10 million cubic meters) as well as four weirs and off-channel storage (13,3 million cubic meters) that were constructed in the Komati as an integrated part of the NIEP*. With the completion of the Maguga dam with a storage capacity of 332 million cubic meters during 2001, the water supply of existing and planned irrigation projects in the Nkomazi will be stabilised.

The agreement between the Governments of South Africa and the former KaNngwane made provision for an allocation of sufficient water to develop 7500 hectares of irrigation water. (NOWAC, 1997)

3.3 Social structure in Nkomazi

3.2.1 General history

The only inhabitants known of 2000 years ago were a Karanga group from Zimbabwe that mined ochre in the area. In the middle of the 18th century, the Swazi people occupied present Swaziland (KaNgwane)². At the time, Sotho speaking tribes living in the area occupied by the Ngwane moved to the north of Swaziland.

During the beginning of the 19th century, more people of different groups entered the area. Europeans avoided the Lowveld. Apart from a few expeditions, the European settlers arrived in the second half of the 19th century, looking for gold. In 1894 a railway line was built between Pretoria and Lourenco Marques (now Maputo). Virtually, all the commercial farms in the area are less than 100 years old and most of them much younger.

After World War II, veterans were allocated farms in the region. During the 1950's, there were only few farms. The major increase came after 1965 when Transvaal Sugar Limited, or Transvaal Suiker Beperk (TSB) was founded and electricity was brought to the area. In the 1980's there were still vast stretches of bushveld. Along the rivers there was some development. Tared roads are very new. With the expansion of the commercial agriculture, came the expulsion of the north. Initially, farms were allocated for commercial farmers in the southern areas, but since it was far from the markets and the railroad, they moved to the northern part near Komatipoort and Malelane and more people were evicted. In 1977, the KaNgwane homeland was set-aside for the Swazi people of South Africa. In 1984, it got self-governing status by promulgation of the KaNgwane legislative Assembly (MBB, 1994). The KaNgwane territory consisted of four regions; Nsikazi, Mweti, Mlondozi and Nkomazi. The Nkomazi region falls totally within the lower Komati catchment. This area was highly populated, poor and remained underdeveloped as compared to the 'white' South Africa. About 95% of the total population of the lower Komati lives in the homeland

3.2.1 Nkomazi region

The homeland history has caused the present high population density, living in semi-rural areas in large townships. There are no 'real' cities in the area. Unemployment is very high in the Nkomazi region. Over 33% are unemployed, some 20% are active in the informal sector and 47% is formally employed. (1995 data of statistical macro-economic review of DBSA in NOWAC, 1997).

In the Nkomazi region 48% of the households have no fixed annual income and 80,1% of the households have a fixed income of less than R 5,000 (idem, 1997). This however gives a distorted image. The informal sector including day labour is not included in the survey. Since 1995, NIEP has created jobs in the area. It is still true, however that many people are unemployed and the situation might have worsen in other sectors than agriculture. There is a large percentage of male absenteeism due to migration labour, which is to many households a very important source of income.

²The original name of Swaziland was KaNgwane: "land of the Ngwane" and Swazi's were bakaNgwane

Water services and sanitation are very new in the area. Domestic water was not supplied to the homesteads in Nkomazi during the apartheid era. Presently, many villages have a water services system and more are under construction (NOWAC, 1997).

The general economic situation in Nkomazi area still much lower than in the rest of South Africa. This is accentuated within farming sector where tremendous differences have been observed in farming income. White farmers are generally high educated and managing agricultural enterprises, which comprise several hundreds of hectares and employ many people, grow a variety of crops for exportation and sometime for the local market.

On the contrary, the black farmers are almost without exception small-scale farmers with 2-20 hectares, with an average of 6 ha. All of them are sugar cane farmers; mostly their farm is part of a larger irrigation scheme. These farmers are in general not trained farmers and do not have access to the networks of the commercial farmers.

3.2.2 The sugar production system in Nkomazi

Fifteen percent of South Africa's sugar cane is cultivated in the Nkomazi / Onderberg Region. The other 85% are grown in Kwazulu Natal. The Nkomazi region is the only region where sugar cane is intensively irrigated. Yields are higher on average than in the rest of the country. The cane is processed in two sugar mills; one at Malelane (1965) and a new mill, built in 1997 to allow for expansion of the sugar area. Transvaal Suiker Beperk (Transvaal Sugar Beperk, TSB) owns both mills. About 41% of total delivery to the Komatipoort mill come from small-scale agriculture, the rest from commercial farms, estates and miller estates.

The total area under sugar cane has expanded, mainly through the NIEP (Nkomazi Irrigation Expansion Program or project). The sucrose percentage increases slightly due to better practices and varieties and was 13,8% on average. The average plot is considerably larger in Nkomazi than in Kwazulu Natal, 7-9ha compared to 2 ha in KZN. In Nkomazi where average yield per hectare is 40-50t in KZN, while it is on average 90t and the recoverable value is higher in most instances. In Nkomazi, the harvest is done every 24 months, while in KZN the cycle is 12-24 months (Pienaar, TSB public officer, Farmer's weekly, 2002)

3.2.3 Infrastructure in Nkomazi

The survey area is called Nkomazi region and it comprises two locations: Komatipoort and Malelane. Komatipoort is located at 102 km from Nelspruit and 56km from Malelane while Malelane cane supply is at 60km from Nelspruit.

The survey area has very good network of roads. The main road (N4) from Gauteng to Mozambique (Maputo harbour) and the Kruger National Park goes through this area, with links also to Swaziland and Richards Bay. The Maputo Corridor project will further develop the infrastructures and be very beneficial for farmers in providing additional outlets for the marketing of their produce.

Two major railroads from Gauteng to Maputo harbour and from the Richards Bay harbour link this area with international markets