INSTITUTE FOR SOIL CLIMATE AND WATER
AGRICULTURAL RESEARCH COUNCIL

SOIL INFORMATION FOR PROPOSED MUTSHO POWER PROJECT

By

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1 INTRODUCTION

1.1 Terms of Reference

The Agricultural Research Council-Institute for Climate and Water (ARC-ISCW) was requested by Savannah Environmental to provide baseline soil information for a proposed coal-fired power station near Makhado, Limpopo Province. The aim of the survey was to describe the soils occurring in the study area and to assess the agricultural potential.

2 STUDY AREA

2.1 Location

The study area (Figure 1, red area) is located approximately 50 km south-west of Musina and 10 km south-west of Mopane in Limpopo province. Two farms, namely Du Toit 563MS and Vrienden 589MS, lying on either side of the Mopane-Waterpoort road, comprise the study area.

The area lies between latitudes 22º 38’ 45” and 22º 42’ 40” S and between longitudes 29º 47’ 15” and 29º 51’ 05” E.

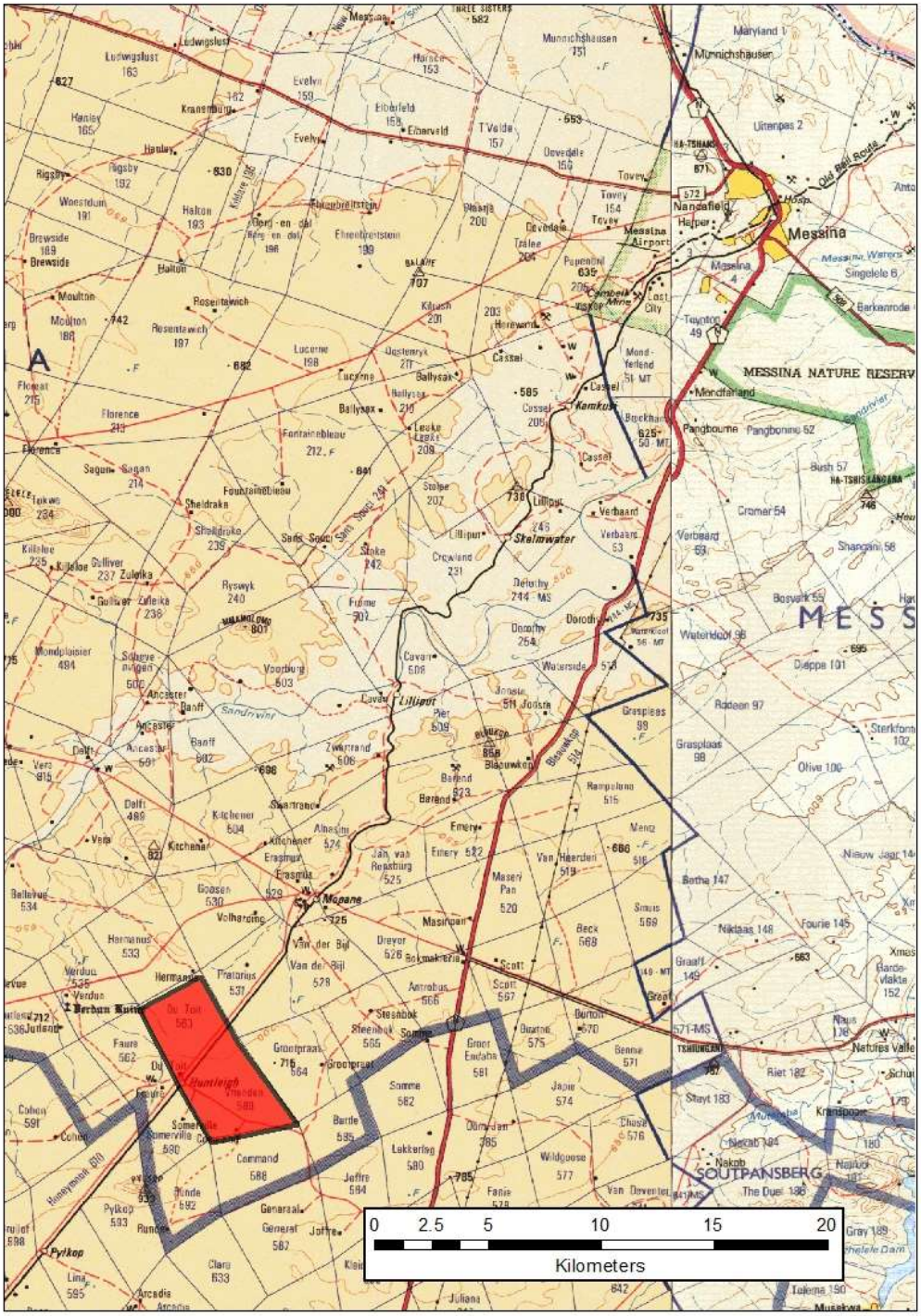

Figure 1 Location map

2.2 Site Details

The site is approximately 2 100 ha in extent, and lies at an elevation of around 700 metres above sea level, with the highest point in the south. The area is situated in virtually flat terrain, with slopes of less than 2%. Only occasional, mall, non-perennial streams occur within the area.

2.3 Climate

Climate data was obtained from the national Land Type Survey (Monnik & Malherbe, 2005).

The climate of the area can be regarded as having hot, dry to moist summers and cool, dry winters with very little frost. On average, 85% of the annual average rainfall of 315 mm falls in the growing season (October to March).

The extreme maximum temperature is 45.2°C and the extreme minimum -4.6 °C

The climatic data is given in Table 1 below.

Table 1 Climate data

Month	Rainfall (mm)	Min. Temp (°C)	Max. Temp (°C)	Average frost dates
Jan	69.7	21.0	33.5	Start date: 21/06
Feb	50.3	20.6	32.6	End date: 13/07
Mar	28.4	18.9	31.8	Frost Days: 4
Apr	18.1	15.4	29.9	
May	2.0	9.8	27.6	
Jun	3.0	5.9	24.8	
Jul	4.4	5.7	24.9	**Heat units (hrs > 10°C)**
Aug	1.1	8.5	27.1	Summer (Oct-Mar): 2905
Sep	2.9	13.1	29.9	Winter (Apr-Sept): 1564
Oct	21.0	17.0	31.5	
Nov	50.5	18.9	32.2	
Dec	64.2	20.2	33.3	
Year	**315.6**	**22.3**		

Evaporation rates are very high, around 2 800 mm yr^{-1}, which gives a climate with an extreme aridity index, as compared to the average annual rainfall.

2.4 Geology

The geology of the study area consists of marble of the Gumbu Formation in the south with arenite (sandstone) Ecca Group in the north (Geological Survey, 1988).

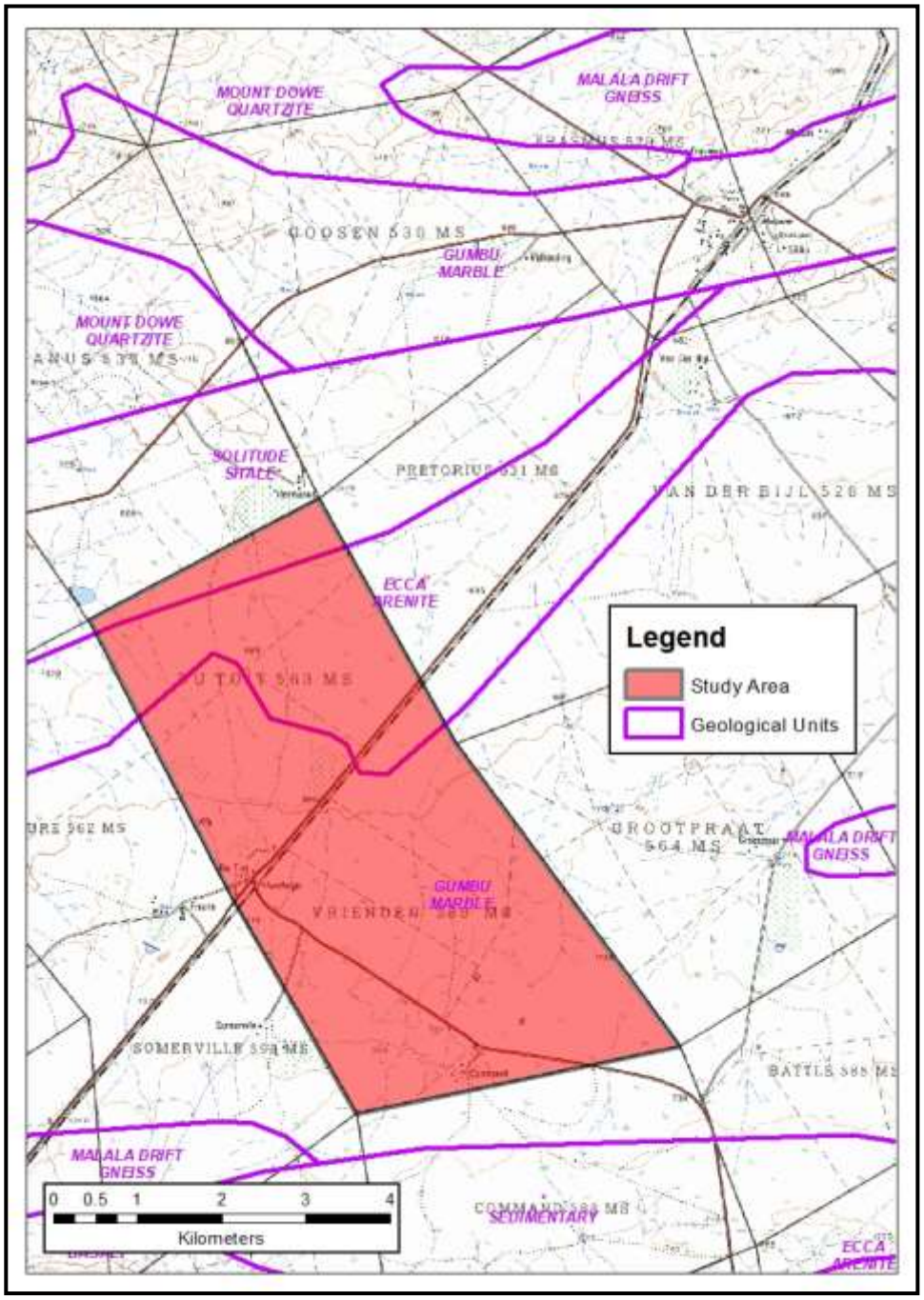

Figure 2 Geological map

3 METHODOLOGY

As far as existing soil information is concerned, the area is covered by the national Land Type Survey at a scale of 1:250 000, which has been digitized using ArcGIS. The study area falls within the map sheet 2230 Messina.

Each specific land type is a unique combination of broad soil pattern, terrain type and macroclimate. Where any of these changes, a new land type occurs.

Within any specific land type, the soil forms occurring (MacVicar *et al*, 1977) have been summarized according to their dominance, but the locality or distribution of the various soils within a land type cannot be further determined.

4 SOIL PATTERN

Within the study area, only one land type occurs, as follows:

- **Ah89** Yellow-brown and red, apedal, freely drained soils

The main characteristics of the soils occurring in the land type, as well as their broad agricultural potential, are given in Table 2.

Table 2 Soils occurring

Land Type	Dominant Soils	Depth (mm)	Description	Agric. Pot.
Ah89	Hutton 34/35/36	400-1000	Red, structureless, apedal soils on rock	High:10.5% **Med: 65.3%** Low: 24.2%
	Hutton 44/45/46	500-900	Red, structureless, apedal soils, calcareous, on rock	
	Clovelly 34/35/36	400-900	Yellow-brown, structureless, apedal soils, occasionally calcareous, on rock	

This is shown in Figure 3, with the land type boundaries shown by the thick black lines.

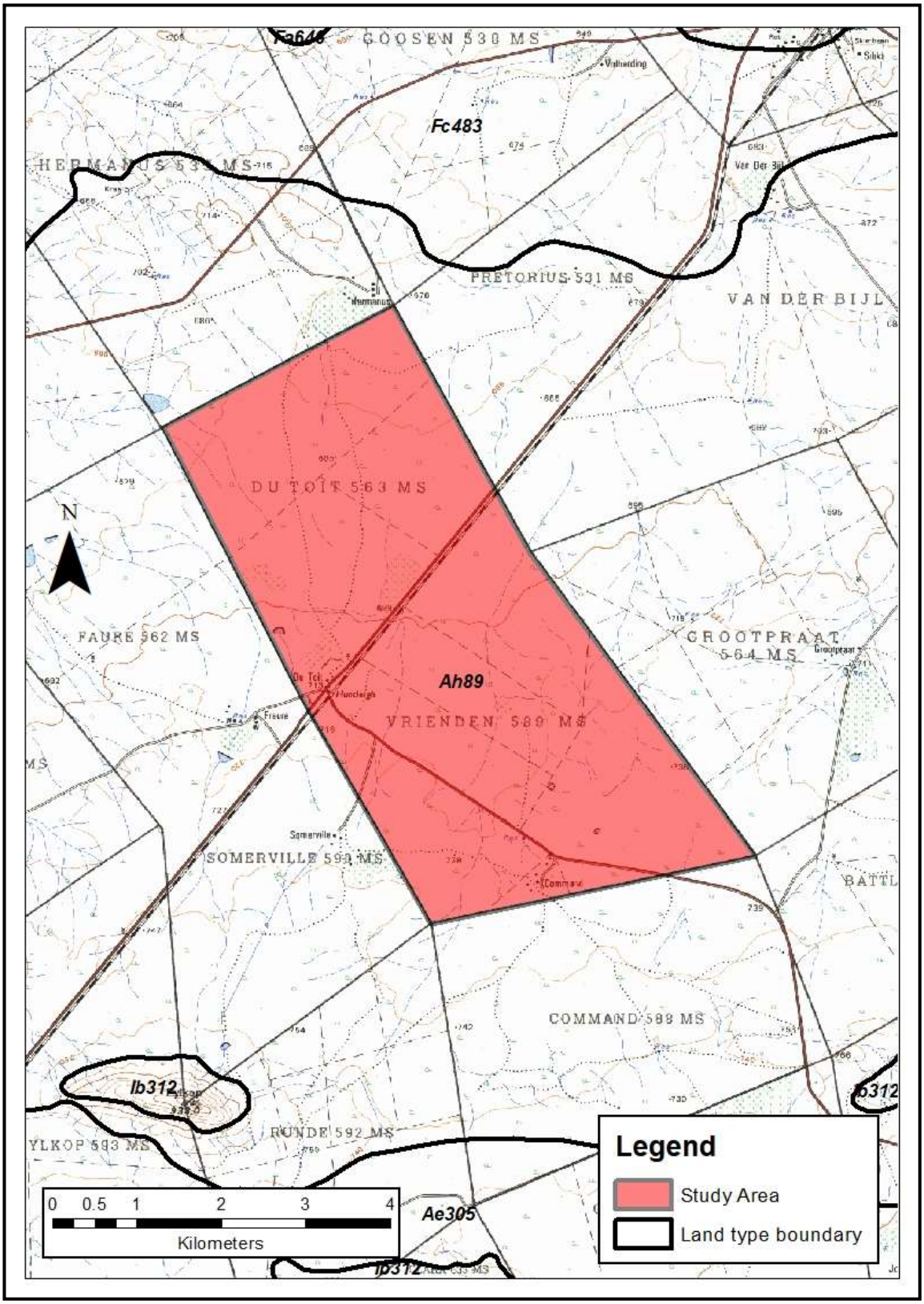

Figure 3 Land types

4.1 Agricultural Potential

The study area is dominated by moderately deep (400-1000 mm), apedal soils of the Hutton and Clovelly forms. Some of the soils are calcareous. Very few soils deeper than 900 mm occur. Some areas of shallow soils (<400 mm), with occasional surface rock, occur.

However, the main limiting factor is the dry, hot climate (Table 1). The low annual rainfall, coupled with the hot summer temperatures, means that the only practical means of cultivation would be by means of irrigation, and according to the national Land Cover database there is little or no evidence of any cultivated lands in the area, as shown by Figure 4. This map is derived from the national Land Cover database, and shows woodland, thicket and bushland as the main land use types.

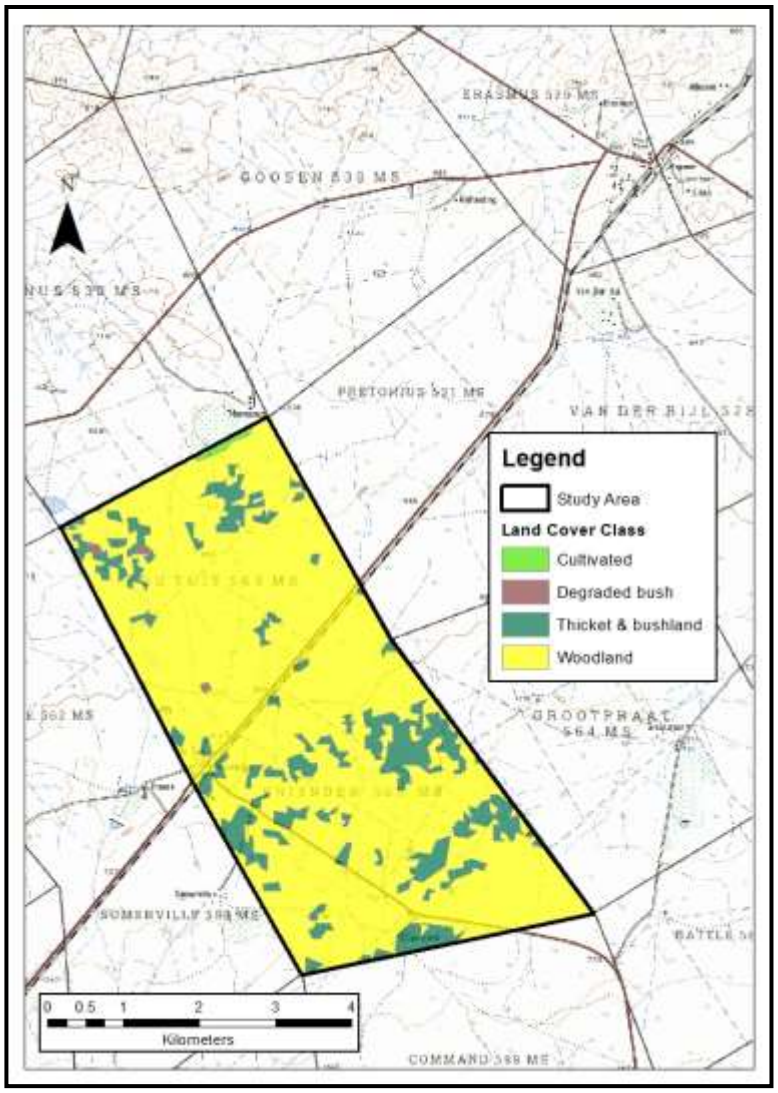

Figure 4 Land use

4.2 Erodibility

The soils do not have a high susceptibility to erosion, either by wind or water. The topsoils have a light texture but are not excessively sandy. However, normal precautions regarding soil conservation should be taken in any construction phase, so that removal of vegetation cover is kept to a minimum and where activities that occur close to any stream bed should be avoided.

Once a facility is established where sites for waste materials are established, these should be kept wet to avoid wind erosion of the surface, especially in the drier winter months.

5 IMPACTS

The main potential impact will be the loss of agricultural soil due to the establishment of permanent infrastructure, including the power station and associated waste material sites.

Table 3 Impact significance

Nature: Loss of agricultural potential		
	Without mitigation	**With mitigation**
Extent (E)	Low (2)	Low (2)
Duration (D)	Long-term (4)	Long-term (4)
Magnitude (M)	High (8)	Low (4)
Probability (P)	Highly probable (4)	Improbable (2)
Significance (E+D+M)*P	**Medium (56)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Medium
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	No	Yes
Mitigation: The main mitigation measure will be to develop the facility on low potential soils, wherever possible. In this way, the maximum amount of high potential soils can be retained for agriculture		
Cumulative impacts: Little or none foreseen at this time. If a power station is established on the site, from the soils aspect there will not be a large off-site impact. However, there could be an increased wind erosion hazard from any ash disposal facilities if not properly handled and controlled.		
Residual Risks: Little or none, as long as proper rehabilitation measures are carried out. This would include ensuring that any soils where vegetation is cleared for construction are re-vegetated as soon as possible and ensuring that no excessive surface runoff is permitted to occur.		

5 RECOMMENDATIONS

It is highly recommended that if possible the proposed project be located on soils will low agricultural potential. To this end, a more detailed field study will need to be carried out once proposed sites for infrastructure are established.

In cases where there is an excavation that needs to take place, any soil material must be stockpiled separately for future use e,g rehabilitation of ash disposal facilities or other waste areas.

REFERENCES

Geological Survey, 1988. 1:250 000 scale Geological Map of 2230 Messina. Department of Mineral and Energy Affairs, Pretoria.

MacVicar, C.N., de Villiers, J.M., Loxton, R.F, Verster, E., Lambrechts, J.J.N., Merryweather, F.R., le Roux, J., van Rooyen, T.H. & Harmse, H.J. von M., 1977. Soil classification. A binomial system for South Africa. ARC-Institute for Soil, Climate & Water, Pretoria.

Monnik, K.A. & Malherbe, J., 2005. Climate data. In: *Land types of the maps 2228 Alldays and 2230 Messina. Mem. Agric. Nat. Res. S. Afr.* No 37. ARC-Institute for Soil, Climate & Water, Pretoria