SADCC

SOIL AND WATER CONSERVATION

AND

LAND UTILIZATION PROGRAMME

EROSION HAZARD MAPPING:

TANZANIA

REPORT No. XX

COORDINATION UNIT

etc.

by

C.N. MUNUBI

Agriculture Department
Shinyanga

and

Prof. J.P. MSANGI
Department of Geography
University of Dar-es-Salaam

Date

FOREWORD

This report is one of a series of SADCC country reports on the Erosion Hazard Mapping of the region. It arises from a project initiated in September 1985 in the first phase of the work programme of the SADCC Coordination Unit for Soil and Water Conservation and Land Utilization, based in Lesotho. The aims of the Erosion Hazard Mapping project are:

- define main danger areas for erosion and the principal processes contributing to the hazard;
- assist the design of appropriate conservation strategies;
- give guidance in regional planning, environmental monitoring and land utilization programmes;
- provide an action-learning exercise and training forum for SADCC participants.

Erosion hazard assessment is a technique to express the natural danger of soil erosion over large areas. As such it is an appropriate exercise for the SADCC Coordination Unit which is very much concerned with land degradation problems and the safe utilization of land resources, especially soil. Details of the technique have already been published in Report No.9, "A Methodology for Erosion Hazard Mapping of the SADCC Region", April 1987. Local staff members from SADCC countries have done all the data collection and processing necessary for the national maps.

All participants at the four Erosion Hazard Workshops -- Harare, September 1985; Maseru, March 1986; Mbabane, November 1986; Lusaka, April 1987 -- as well as their departmental heads and junior staff are warmly thanked for their enthusiasm and hard work. Several of the country teams have laboured under severe manpower constraints with competing demands on their time and resources. That this project is nearing completion is a tribute to SADCC cooperative spirit. This country report was compiled from draft reports submitted by the country team under the overall technical supervision of Dr Michael Stocking.

B. Leleka

ACKNOWLEDGEMENTS

We are grateful to the Agriculture Department and the Regional Commissioner's Office, Shinyanga, for releasing one of us (CNM) to undertake the coordination of this work on behalf of the Tanzanian team for the erosion hazard mapping project.

The following persons contributed to the production of the erosion hazard map, and their efforts are gratefully acknowledged:

A. Haule, Library Assistant, Univ. Dar-es-Salaam

J. Kibona, Land Use Planning, Sinynaga

A.H. Kishimba, Assistant Commissioner of Agriculture, Land Use Planning and Soil Conservation, Dar-es-S.

J. Mjinja, Land Planning Unit, Shinyanga

P. Mtenge, Forestry Department, Shinyanga

M.A. Ngowi, Senior Artisan, Univ. Dar-es-Salaam.

C.N. Munubi
Regional Commissioner's Office
Agriculture Department
P.O. Box 852
Shinyanga

Prof. J.P. Msangi
Department of Geography
University of Dar-es-Salaam

CONTENTS

EROSION HAZARD MAPPING:

TANZANIA

OBJECTIVES

The Tanzanian team for the Erosion Hazard Mapping project set the following objectives. Firstly, we wished to produce a country map of erosion hazard which identifies the principal causes for soil erosion and land degradation and which plots these factors on a country-wide basis.

Secondly, the collected data and the finished map are intended to provide inputs to land evaluation, land use planning and, above all, soil conservation planning.

Finally, Tanzania as a member country of SADCC, wishes to make its contribution to a regional map of erosion hazard which will assist broad-scale resource planning and mutual cooperation between the countries.

DATA BASE

The four principal factors -- relief, rainfall, vegetation and soil -- were assessed for their contribution to erosion. Guidelines derived from the series of Erosion Hazard Mapping Workshops were followed closely.

Relief. Because of the large size of Tanzania, limited manpower for this project, the unavailability of a complete

coverage of maps at 1:50,000, and the daunting task of counting contour crossings for the whole country, the 1:250,000 series of topographic map sheets was utilised. However, the sheets showing contours for Kigoma, Nyonga, Dodoma, Kipembawe and Kaimoto were not available and, therefore, an alternative method was employed; namely, calculating slope from an ordinary relief map by way of triangulation. The distance between two height markers was measured and overall slope percentage calculated. This will, of course, give only a rough approximation and is a potential source of error.

Slopes ranged from zero to 74 percent, but as agreed at the Workshops an effective upper limit of 20 % was placed on the data.

Rainfall. Data on mean annual rainfall for the country were collected. Stations with an uninterrupted record of at least five years had their records tabulated. Some areas, mainly forest and/or tsetse-infested, have few rainfall records. In such cases and where no suitable rainfall station existed within the 20 x 20 km grid square, a nearby station or district headquarters was used as a source of record.

Because automatic raingauges are few in Tanzania, it was decided to use the Zimbabwe-derived equations to convert mean annual rainfall to kinetic energies. Areas prone to thunderstorm activity (e.g. Bukoba, Tukuyu, Moshi, Arusha) were distinguished from areas which have less intense rainfall and a lower kinetic energy per millimetre of rain.

Vegetation. The measurement of vegetation cover was considered as the most important and critical part of this exercise. Tanzania has a diverse range in vegetation types and contrasting land uses, all of which affect cover.

Most of the data was obtained from Regional Agricultural Reports that indicate the variety of crops grown in each district. The Tanzania Crop Calendar booklet helped in determining planting dates. Regional Veterinary Reports were consulted for livestock densities. A forestry map of the country provided information on all other vegetational coverage. Together with rainfall data, these sources enabled estimates of cover to be made for all grid squares.

Inevitably, the cover estimates are only as good as the information upon which they are based. Actual measurements of cover are needed in Tanzania to supplement and check the information.

Soil. The soils map of Tanzania, made in 1982, gave a generalized picture of soil types in the absence of more detailed local maps. The FAO soils classification was used as the basis for determining erodibility. By correlating with the ratings given in other SADCC countries and with the assistance of the Consultant to the Erosion Hazard Mapping project, the following F_b erodibility values were taken:

CODE	SOIL UNIT	F_b-VALUE
Ao	Orthic Acrisol	5.5
Ap	Plinthic Acrisol	5.5
Ah	Humic Acrisol	6
Bd	Dystric Cambisol	4
Bc	Chromic Cambisol	4
Be	Eutric Cambisol	4
Bk	Calcic Cambisol	4
Fo	Orthic Ferralsol	6
Fr	Rhodic Ferralsol	6
Gc	Calcaric Gleysol	2.5
Ge	Eutric Gleysol	2.5
Hh	Haplic Phaeozem	5.5
Hl	Luvic Phaeozem	5
I	Lithosol	3
Je	Eutric Fluvisol	4.5
Lc	Chromic Luvisol	5
Lf	Ferric Luvisol	5.5
Lo	Orthic Luvisol	5
Lv	Vertic Luvisol	4
Lp	Plinthic Luvisol	4
Lg	Gleyic Luvisol	4
Nd	Dystric Nitosol	5.5
Ne	Eutric Nitosol	5.5
Nh	Humic Nitosol	6
Od	Dystric Histosol	5
Oe	Eutric Histosol	5
Qa	Albic Arenosol	6
Qc	Cambic Arenosol	6
Sg	Gleyic Solonetz	2
So	Orthic Solonetz	2.5
To	Ochric Andosol	3.5
Tm	Mollic Andosol	4
Vp	Pellic Vertisol	5
Xc	Luvic Xerosol	3.5

These ratings, adjusted according to predominant farming systems and land use history, were used to calculate overall erodibility in each grid square. A smaller grid size and more detailed soil maps would have given greater accuracy.

A full listing of source materials is given at the end of this report.

THE MAPPING

The base map for plotting erosion hazard is the Tanzania national map at a scale of 1:2 million. Because of the large size of the country and the limited availability of manpower, we decided to use a grid size of 20 x 20 km. This made 2200 squares for the country.

After processing the values for the four factors through the SLEMSA model, erosion hazard units were noted for each square. They ranged from zero to 639, but few were in excess of 100. On the mapping, the following categories were employed:

EROSION HAZARD UNITS	CATEGORY
0 - 10	1. Very low
11 - 25	2. Low
26 - 50	3. Average
51 - 100	4. High
> 100	5. Very high

The principal factors contributing to the rating are denoted by the following codes:

s - slope

e - soil erodibility

r - rainfall erosivity

c - vegetation cover

Erosion hazard is highest in the mountainous parts of northern Tanzania such as the Usambara Mountains in Tanga Region. Localized patches of high hazard occur near Songea where rainfall energy tends to be high and cover is poor; and also to south and

west of Lake Victoria. Intermediate levels of hazard predominate inland from the coast and along Lake Tanganyika, while much of the central part of the country has low overall hazard.

It must be emphasized that the map shows erosion hazard and not actual erosion. Notable parts of Tanzania such as Tabora and Shinyanga with their long history of land (mis)use and their devastatingly high rates of erosion do not have an especially high intrinsic hazard.

USE OF THE MAP

This map will be used by various groups of people in Tanzania who are concerned with soil conservation. Several ministries and agencies are empowered with promoting agricultural development and halting the spread of soil degradation. The map should be useful in highlighting problem areas and the potentoal magnitude of individual factors contributing to the problem. Agricultural staff, foresters and natural resources professionals should all be able to benefit.

There are a number of deficiencies in the map which readers and users should appreciate. It must be understood that the grid squares which form the basic mapping unit are large and hence much detail is lost. Data sources are also sometimes unreliable. However, as a first step in plotting erosion hazard, this map will bring further attention to the serious problem of soil erosion in Tanzania.

SOURCE DOCUMENTS

"Soil Atlas of Tanzania" by S.A. Hathout

"Relief and Physical Features of Tanzania" by L. Berry (1971)

Reports on Land Use in Shinyanga, 4 volumes, by EcoSystems Ltd, Nairobi (1982-83)

"Land Resources of Mbeya Region" by C.W. Bombow-Pearse and J.A.M. Kameisho

Reports of the Tabora Integrated Rural Development Project, Land Use Component

Annual Reports, Tanzania Regional Agricultural Offices: All Tanzania, mainland (1976-1985)

Tanzania Meteorological Reports (1976-1985)

Tanzania Agricultural Calendar Booklet (1986)

"Provisional Soil Map of Tanzania" by J. Samki