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STATE OF SOIL SURVEY IN TANZANIA

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Soil Surveys are intended to provide general soil inventories for land use. With the newly developed concept of land evaluation within the Framework of Land Evaluation (FAO, 1976), soil survey interpretation has narrowed down to specific land suitability rather than general land use as provided for by the earlier soil surveys. The new approach has been adopted in Tanzania and land suitability evaluation for specific crops within the various established agro-ecological zones in the country and transfer of technology are the ultimate goal of the Soil Survey programme that have been carried out. The overall objectives of the programme are to substantially help in maximising crop yields by exploiting the vast natural land resources to their full extent, an aim which is receiving top priorities in the countries development strategies.

The soil survey programme has involved the identification of the various soils that occur throughout the country, their characterization, classification and mapping.

Identification of the existing soils and mapping have been carried out at various scales:

1. Generalized maps already produced in Tanzania include: An Experimental Pedological Map of Tanganyika by Calton (1954) at 1: 4 million; Soils of Tanzania as part of Soil Map of Africa (sheet 3) by D'hoore (1964) at 1: 5 million; Soils of Tanzania compiled from information supplied by the Agricultural Division (1967) at 1: 3 million; Soils of Tanzania by Hathout (1972) at 1: 3 million; Provisional Soils of Tanzania by J.K. Samki (1977) at 1: 2 million.

2. Low intensity surveys have produced soil maps with scales ranging from 1: 250,000 to 1: 500,000. These include surveys conducted by the Regional Intergrated Development Programmes in Mtwara/Lindi, Tanga, Tabora and Kilimanjaro regions; in the regions of Ruvuma, Shinyanga surveys are about to be commenced; low intensity surveys completed by other institutions in other areas: Rukwa au of Resource Assessment and Landuse Planning; Soils near Arusha and Monduli by the Agronomic Wheat Project; ect by the National Soil Service.

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3. Medium to high intensity surveys have covered priority areas selected by the government and various institutions and produced maps at scales 1: 50,000 and higher. Anderson (1957) surveyed in detail the area that was leased by the Tanganyika Agricultural Corporation in Kongwa and in three sample areas of the Nachingwea Tanganyika Agricultural Corporation leased land at 1: 25,000. Dodoma Capital District (2,500 sq. km), Ulyankulu refugee settlement area (540 sq. km.), Mishamo proposed refugee settlement area (1,000 sq. km.) were all surveyed by the National Soil Service in the late 1970's. Agronomic Wheat Project have also surveyed soils of Machame North Copperative Society (13.6 sq. km.), soils of Basotu Wheat farm (106 sq. km.), Karatu - Oldeani area (816 sq. km.), identified highly and moderately suitable area for wheat in Basotu and Balangida (400 sq. km.). AUSAID team has similarly completed the survey of all seedfarms in the country; these include Dabaga, Arusha, Msimba, Songea, and Kibaha.

Three systems (two of which are international) have been used for classifying the Soils in Tanzania. These are the D'hoore's Soil Map of Africa, the FAO/UNESCO Soil Map of the World Legend and the USDA Soil Taxonomy. While D'hoore's Soil Map of Africa Legend has have been used in a few occassions in Tanzania, (by Agronomic Wheat project in grouping soils used for wheat in Northern Tanzania and by the Kilimanjaro Regional Intergrated Development Programme in grouping soils of the Kilimanjaro region), FAO/UNESCO Soil Map of World Legend and the Soil Taxonomy have been widely used in the country. FAO/UNESCO System has now been adopted as the system of reference for most of the survey undertaken in Tanzania.

Problems Encountered

(i) The size of the country: Tanzania is a large country, located on the Eastern side of the African continent, with an area of 0.93 million square kilometers. It has the largest land area of any country in East Africa, with a population of over 17 million. The average population of the country is predominantly rural, Tanzania ranking very low in the World by degrees of urbanization of population. Shortage of trained manpower, funds, transport and essential facilities like base maps are major bottlenecks in Tanzania. It has therefore been difficult to undertake systematic soil survey of medium to high intensity, considering the size of the country, shortage of manpower, funds, transport, and some other essential facilities like base maps.

(ii) The diversity of climatic conditions: Rainfall and evaporation are the most important climatic elements. It is very difficult to talk of rainfall without mentioning evaporation because of the high evaporation rate. Although 750 mm. of rainfall would be regarded as adequate for crop production in certain upland parts of Tanzania, areas for the greater parts of the country with less than 750 mm. of rainfall are regarded as

marginal for crop production (this of course depends on the type of crop and seasonal distribution of rainfall). Only 20% of the country has a probability of receiving more than 750 mm. of rain. Rainfall is also the most variable of the climatic elements. It ranges from below 500 mm. to over 1500 mm. spread over 2 to 7 months (months with 100 mm. or more) and it is distributed in monomodal or bimodal pattern. In the monomodal rainfall areas the rain is distributed in the single rainy season while in the bimodal rainfall areas the rainfall is distributed during the short and long rainy seasons. Potential evapotranspiration decrease with altitude mainly attributed to variation on cloud cover with altitude.

Temperature change is not very pronounced except in the highlands. In most places variation in mean monthly temperatures range from 2-6°C. These variations are brought about by cloud cover (which reduces and increases maximum and minimum temperatures respectively) type of monsoon winds (S.E. monsoons are cooler than N.E. monsoons), rainy season (which brings cooling effect); and altitude (which reduces temperatures). Diurnal variation in temperature is least at the coast.

The climate is not well understood because of lack of sufficient climatic records: rainfall records of over 10 years exist for only 95 stations throughout Tanzania; there are far fewer records for the other climatic elements. Assessment of land suitability has been difficult because of this lack of climatic records. Accumulation of enough climatic data is necessary for the calculation of water balance during the growing season of various crops, and is a basic requirement in any land suitability evaluation.

How these problems have been met

Survey of Priority Areas

Because of the size of the country, shortage of staff and funds, it has been extremely difficult to undertake systematic soil survey of the whole country at onetime. In view of the magnitude of the work itself and the large inputs in terms of manpower, transport and equipment which are needed for a systematic survey and evaluation of the soil and land resources of the whole country, considerable time is normally required for its completion. Most institutions carrying out soil survey have therefore established priority areas where soil survey can be undertaken first.

The National Soil Service (NSS) carry out soil surveys on priority areas as determined by the government. Areas already surveyed by NSS, include Geita Cotton Project area (a World Bank financed project), Mishamo refugee settlement area, Ulyankulu settlement area; and Dodoma Capital District. The basis for selection of priority areas by NSS has been as follows:-

(i) Priorities have to be assigned in accordance with the urgency for information and the benefits likely to be obtained from the survey.

(ii) In the selection of priority survey areas, some of the factors which require consideration are potentiality of the area for agricultural development, density of population, degree of agricultural technology in use by farmers, socio-economic condition and other aspects of the infrastructure. In general terms it can be stated that areas believed to have a high percentage of arable land should be given priority over grazing, steep, hilly and mountainous areas.

(iii) It has been suggested that areas selected for survey should be distributed in a variety of agro-ecological zones to permit the formulation of soil survey, classification and land evaluation standards and procedures suitable to Tanzanian conditions. They should be areas covered by aerial photographs and adequate base maps so that the Tanzanian staff can be trained in the most modern, efficient techniques of soil survey. Preferably the network of roads should be available for field crews. In establishing priorities, it is evident that areas already covered by acceptable modern soil surveys or land-use studies should not be placed high on the list. The basic rationale of carrying out these Surveys in the regions and priority areas is that, while information for these areas can be obtained immediately for use, information for the country as a whole can also be obtained for compilation and correlation purposes at a later date.

(iv) Establishment of Ujamaa villages in a way created priority areas for soil survey. Ujamaa villages are organized communities with major objective of facilitating the optimum use of the country's land resources. With the people living and working in organized communities it is easier for the government to provide vital services to as many people as possible; peasants collective efforts are bound to yield increased output more easily.

Most of the Bilateral Rural Intergrated Regional Development Programmes have a soils component necessary for assessing the physical environment of that particular region. Such regional intergrated programmes have been established in Tanga, Tabora, Kigoma, Coast/DSM., Mtwara/Lindi, Shinyanga, Ruvuma and Kilimanjaro. Tanzania regional Soil Surveys are usually undertaken at 1: 250,000.

At international level, Tanzania is cooperating with her Eastern Africa neighbours in soil correlation studies: Tanzania is a member of the Eastern Africa Soil correlation and Land Evaluations sub-committee which meets every other year; other members of the committee are Kenya, Uganda, Ethiopia, Sudan, Zambia, Malawi, Lesotho and Botswana. The committee has already met three times. The first Eastern African Soil Correlation Sub-committee meeting was held in Nairobi Kenya in 1974 and the theme of the meeting was "Soil resources appraisal in member states",

the second meeting was held in 1976 in Adis Ababa, Ethiopia, the theme of the meeting being "Nitosols and Rhodic Ferralsols: their morphological and chemical properties, their use and management in the member states", and the theme of the third meeting held in 1978 in Lusaka, Zambia was "Land evaluation methodology with particular emphasis on physical criteria". Tanzania is now hosting the fourth meeting of the committee and the theme of the meeting is "Rating of land qualities and their conversion into land suitability with particular emphasis on soil moisture storage and climatic conditions". The FAO/UNESCO Soil Map of the World Legend has been accepted as the system of reference for the whole region.

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