SECTION 3

The Effects on Agroclimatic Zones and Agricultural Production

3.1. Introduction

All climatic elements, whether singly or in combination, affect crop and animal production. The climatic elements of greatest significance to agricultural production in Kenya are rainfall, temperature and evapotranspiration. The balance between rainfall and evapotranspiration is particularly important. Characterization of an area based on climatic parameters relevant to agriculture (i.e., agroclimatic) is a useful practical exercise. The resulting agroclimatic zones indicate which areas are climatically suitable for different crops. Additional information on the length and intensity of the rainy and dry periods and on soil characteristics is necessary to designate agroclimatic zones.

There have been several attempts to characterize agricultural site potential in Kenya, based on the ecological factors of climate, soils and vegetation. The first maps of ecological zones based on the natural vegetation were interpreted in terms of site potential for agriculture (Edwards, 1940 and 1956). Pratt and Gwynne's (1977) work on Kenya was similarly based on vegetation, but included climatic terms in the keys. Pratt *et al.* (1966) calculated moisture indices according to the Thornthwaite (1948) system. The moisture indices were used in conjunction with vegetation to define and delimit ecoclimatic zones in Kenya. Woodhead (1970), on the other hand, calculated and mapped an available water index (AWI) for many stations in Kenya and equated the AWI with the ecological zones of Pratt *et al.* (1966). Pant and Rwamdusya (1971) and Obasi and Kiangi (1977) calculated water balance components, which they used to arrive at the distribution of climatic zones in Kenya. Sombroek *et al.* (1982), at the Kenya Soil Survey (KSS), used the r/Eo ratio (where r = average annual rainfall and Eo = average annual potential evaporation) and mean annual temperature to arrive at moisture availability and temperature zones for Kenya. The r/Eo ratio is similar to Woodhead's (1970) AWI. The agroclimatic zones of

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Sombroek *et al.* were further developed by Jaetzold and Schmidt (1983) by using a water balance crop production model to define and map the agroecological zones that appear in their *Farm Management Handbook of Kenya.* The agroecological zones are overlain on a map of soil types and characteristics. The work of Jaetzold and Schmidt provides additional information for the assessment of potential agricultural production in Kenya.

A major disadvantage of most of the (agro) climatic zonation systems outlined in the preceding paragraph is that they are based on average climatic data. This means, for instance, that the agroclimatic zone boundaries as depicted in the KSS and other similar works are the means of a large number of years. For agricultural planning strategies, it is necessary to examine the shift from year to year (or season to season) of the agroclimatic zone boundaries. This section describes a simple method for examining the seasonal shifts in agroclimatic zones for the three districts of this case study.

3.2. Agroclimatic Zones of Central and Eastern Kenya

The two previous sections discussed the agroclimatic zones and climate of central and eastern Kenya. The rationale for and derivation of the agroclimatic zones will now be considered in more detail.

The most important controls of the weather and climate in the case study area are: (a) the ITCZ; (b) altitude; and (c) aspect. Rainfall increases toward the higher elevations, while potential evaporation decreases. The major characteristics of climate that affect plant growth are: (1) the balance between rainfall and evaporation, and (2) temperature. With regard to rainfall, the length and intensity of the rainy and dry seasons and their variation from year to year are of particular importance. In the three districts the average annual rainfall ranges from 500 mm to 2300 mm; the average potential evaporation, from less than 1200 mm to 2500 mm; and average annual temperatures, from 10 °C to 30 °C. More details on the spatial patterns of evaporation are found in the *National Atlas of Kenya* and in the work of Woodhead (1968). Clearly, there are many different types of rainfall distributions and agroclimatic zones within the study area.

Since 1973, the Kenya Soil Survey has used the r/Eo ratio (average annual rainfall/average annual potential evaporation from pan A measurements) when delimiting the agroclimatic zones for their 1:100 000 reconnaissance soil surveys. The same method with some modifications has been used to delimit moisture availability zones for the national map of the agroclimatic zones. The purpose of the agroclimatic zone map, according to Sombroeck *et al.* (1982; p. 43), is "to provide a tool for assessing which areas are climatically suitable for various land use alternatives with particular emphasis on the suitability for crops or crop varieties". The agroclimatic map has been overlain on a soils map, and temperature zones were defined to indicate agroecological zones, although the three maps are not otherwise related.