SECTION 2

Selection of the Climatic Scenarios

2.1. Introduction

In this section we describe the most important characteristics of Ecuadorian highland climate and construct plausible scenarios of short-term climatic variability and long-term climatic change for the central highlands. These scenarios will then be used in subsequent sections of this case study to estimate (a) the effects of climatic variability on barley yields (Section 4), and on crop zones (Section 6), and (b) the possible effects of long-term climatic changes on ecological zones (Section 7). We will be focusing here on variations in precipitation. Variability of temperature and frost risk will be discussed in more detail in Section 5.

2.2. Climatic Characteristics of Ecuador

Ecuador is located within the zone of influence of the intertropical convergence zone (ITCZ) and is therefore affected by changing amounts of uplift and rainfall and humidity characteristics as the ITCZ moves northward and southward during the year. In the highlands, the influence of the ITCZ and associated lowland air masses is supplemented by local convectional processes affected by solar position and topography (Frere *et al.*, 1975; Johnson, 1976; Pourrut, 1983).

In general, the Amazon basin portion of Ecuador is always under the influence of moist tropical air masses and has no pronounced dry season; usually all months receive at least 250 mm of precipitation. The coast is strikingly dissimilar. In April, May and June the ITCZ retreats to the north, to approximately 10° N. Then dry air masses from the south influence the coast until December. Dryness may be further enhanced by atmospheric flow from the east (below the 300 mb level), placing the region in the Andean rain shadow. Another factor is the temperature of ocean water off the Ecuadorian coast. From June to December much of the Ecuadorian coast is affected by the cool Peru or Humboldt Current flowing from the south, which contributes to aridity. Beginning at the end of December, warmer waters from the north penetrate southward, displacing the Peru Current to the west and promoting convection.

M. L. Parry et al. (eds.), *The Impact of Climatic Variations on Agriculture*

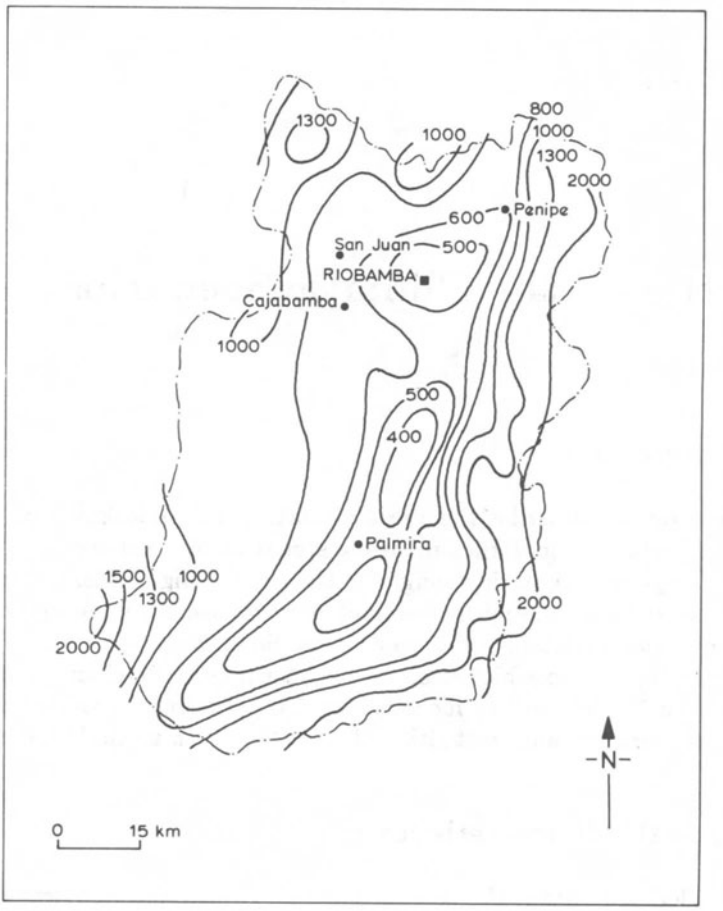

Figure 2.1. Chimborazo Province, with locations of meteorological stations mentioned in text and values of mean annual rainfall (mm).

Occasionally rainfall is affected by squall lines associated with cold fronts from the south (Diego Del Alcazon, personal communication).

Highland rainfall patterns are related to topographic context (*Figure 2.1*). Where wind patterns are favorable and topographic barriers do not intervene, lowland conditions may influence rainfall in the highlands. Where topographic barriers do intervene, orographic rainfall on the outer flanks gives way to rain shadows on the inner flanks and valley interiors. Localized circulation cells may also be set up with uplift on basin flanks and subsidence in the basin interiors. Convection is an important cause of rainfall at stations such as Quito, where the highest percentage of rainfall occurs from noon to 4 pm when temperatures are highest (Ferdon, 1950).