I. INTRODUCTION

A primary objective of agriculture is to provide the food and fiber needs of humans. This need is proportional to population. The present (1990 estimate) population of 5.3 billion is expected to be 6.3 billion in 2000 and 8.5 billion in 2025 (U.N., 1990). About 90% of the global population increase will occur in the developing countries which now make up about three-fourths of the world’s total (World Bank, 1988). These increases in population will require an increase in agricultural production of about 40 to 50% by 2025, 20 and 60% increases in developed and developing countries, respectively. About two-thirds of the needed increases in food production in developing countries must come from existing crop land, mostly irrigated land, about one-fifth from increases in arable land (Alexandratos, 1988). About two-thirds of the increase in arable lands is expected to come from expansion of irrigation.

Irrigated land at present accounts for 15% of the cultivated land but produces 36% of the world’s food (Alexandratos, 1988). About three-quarters of this land (220 million ha) is in developing countries (Jensen et al., 1990). Irrigation expansion needs to be 2.25%/yr in order to meet food needs by the year 2000 (Alexandratos, 1988), but the rate of expansion has recently slowed to less than 1%/yr (CAST, 1988). This is attributed to lack of available and suitable land and water supplies for irrigation at socially and economically acceptable costs (Alexandratos, 1988). Furthermore, the overall performance of many irrigation projects has been less than expected due to inadequate operation and maintenance and to inefficient management (FAO, 1990). Typically less than 60% of the water diverted for irrigation is actually used in crop transpiration.

Poor irrigation management often results in environmental degradation, as manifested in soil salinization, water logging, erosion, water pollution, desertification, and disturbance of natural ecosystems (World Comm. Environ. Develop., 1987). Five to seven million hectares of arable land (0.3–0.5%) are being lost each year through soil degradation. A critical challenge is to halt and reverse this

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1 Parts of this Chapter have been taken from Rhoades et al. (1992) with the permission of the FAO of the United Nations.