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MODELLING THE DEVELOPMENT OF SOIL SALINITY ON SMALL  
FARMS IN OMAN GROWING IRRIGATED CROPS  
USING SALINE GROUNDWATER

BY

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## ABSTRACT

This thesis describes a study of 38 small farms in the Batinah region of Oman. Water is supplied by irrigation using groundwater of highly variable salinity depending on the location. The crops were either trees (date palm, mango and lime) irrigated individually via a basin (diameters ranging from 1.40 to 4.00 m) or flood-irrigated forage crops (alfalfa and Rhodes grass). Soil water salinity (0-30 cm depth) varied from less than 2 to more than 50 dS m<sup>-1</sup>, based on saturated paste EC measurements that were corrected to field capacity water content using techniques that are described. Wide ranges of soil water salinity existed within farms using similar quality irrigation water, but different management. The objective of the project was to develop a model to explain the variation between farms in soil water salinity, and thus provide a tool for optimising management practices to control soil salinisation. The management practices of particular interest in this respect are the amount and frequency of irrigation, and the sizes of irrigation basins used in the case of the tree crops. Within the farms studied, there was wide variation in each of these practices, which is likely to be an important factor influencing the observed variation in soil water salinity.

A major challenge was that the analysis had to be based on a combination of very inaccurate information about factors such as the amount and frequency of irrigation, because long-term monitoring was impractical. The objective was to study small-holder farms (rather than research stations) where there are no records kept of information such as irrigation scheduling and no monitoring of factors such as irrigation water quality. Direct measurements were limited to data from soil and irrigation water salinity surveys carried out by the South Batinah Integrated Study (MAF 1993) and the measurements that were made during (1998-1999) as part of the study.

Despite the large data uncertainties and the simplistic assumptions, a model termed IMAGE (irrigation management model) was developed that could make remarkably good predictions of soil water salinity, with 75% of locations being predicted to within 2.5 dS m<sup>-1</sup>, in the context of absolute values ranging from 1.93 to 51.1 dS m<sup>-1</sup>. Poorly-predicted sites were those with large data uncertainties, or factors such as highly permeable soils where there was large within-basin heterogeneity in infiltration and drainage. Sensitivity analyses showed there to be considerable scope for controlling soil water salinity to within acceptable limits through optimising irrigation scheduling and the size of irrigation basins relative to the size of the tree canopy.