A Database Approach for Soil Salinity Mapping and Generalization from Remotely Sensed Data and Geographic Information System

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ABSTRACT

The understanding of the energy interaction with soil surface is crucial to the successful interpretation of remote sensing data as well as vegetation in the planted areas, therefore a better understanding of some physico-chemical characteristics of saline soils may be important to improve the study of soil salinity in arid region using remotely sensed data. Deserts with different surface conditions and weathered materials may show a great variability in soil surface reflectance. These heterogenity and simillarities between the surface condition and land cover / land use types may prevent a very high classification accuracy. The spectral reflectance characteristics of the plants in arid region may be a good indicator of salinity. Because the plant leaves may affected by various kinds of stresses as well as by the nutrient and salinity, due to change of leaf internal and external structure under these conditions. Spectral reflectance characteristics of non healthy vegetation is different from healthy vegetation. When leaves are senescent, their light reflectance usually increases markedly in the green visible light wavelength region, because of the chlorophyll degradation.

The decrease in near infrared light reflectance, however is not nearly as great as the increase in the reflectance of the visible. The salt precipitation on the leaves of some halophytic plants may increase plant reflectance. Plants are sometimes good indicators of conditions that occur below the soil surface, therefore salinity and its severity may be apparent from some plant species. Townshend et al. (1989), used Landsat TM data to formulate a dynamic process-based model to delimit processes in the Chott el. Djerid, in which the contributions of dissolved salts, surface run-off and aeolian processes, and their changes over time are evaluated.

Electrical conductivity and concentration of the chloride anion (Cl-) are two important criteria in the evaluation of soil salinity. Because the laboratory analysis of soluble Cl- and Na+ is more expensive and time consuming than that of EC, the relationship between EC with Cl- and Na+ may have a practical value for salinity estimation. Because Cl- and Na+ are predominant, the dominant soluble salts are sodium chloride (NaCl). Sodium sulphate is of second importance and magnesium and calcium chloride are of the third importance which is dark in color and has a high content of hygroscopic salts. Cooke et al. (1993) stated that,

because of the great solubility of NaCl it is taken further down slope, and it characterizes the soil nearest to a playa, while the other salts are deposited to higher altitudes. There is no foolproof conversion factor that can be used to compare EC at different soil water ratios. The solubility of salts may vary with increasing dilution. However, the relationship between ECp, EC (1:5) and ECe is useful to estimate ECe as a conventional method of soil salinity measurement from EC (1:5) and ECp.

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