SALINITY MANAGEMENT IN IRRIGATED CROPPING SYSTEMS USING ELECTROMAGNETIC REMOTE SENSING

Florence Cassel * and **Touyee Thao**
Department of Plant Science
California State University, Fresno
2415 E. San Ramon Ave. M/S AS 72, Fresno, CA 93740
(559) 278-7955 - fcasselss@csufresno.edu

Sustainability of irrigated agriculture in the Central Valley (CV) of California is threatened by increased salinization of land and water resources. Fine-textured soils, shallow clay layers, and saline high water tables result in the build-up of salts due to reduced water percolation. Salinization also stems from intensive irrigation and fertilization, use of saline water, and inadequate drainage that prevents the leaching of soluble salts. In recent years, salinization of irrigated lands has been accentuated with the long-term drought in the state and the shortage of surface water supplies, which has constrained many growers in utilizing groundwaters to satisfy crop water demands. Increase in soil salinity has been observed in many cropping systems, and particularly in orchards whose cultivation has expanded rapidly in California's CV. As an example, over the last five years, almond planting has increased by 100,000 acres and pistachio by 40,000 acres. With this increased reliance on groundwaters high in salts and the subsequent built up of salinity in many irrigated farmlands, it is essential to utilize rapid and cost-effective analytical tools to assess the extent of salinization and develop adequate management practices to sustain land quality and crop production.

Soil salinity is difficult to quantify because of important spatial and temporal variability. Traditional measurement methods, such as soil sampling, involve soil disturbances and require extensive data collection and laboratory analyses that are very slow, labor-intensive, and expensive. In addition, salinity appraisal using these methods provides measurements only at a few locations and therefore does not account for the spatial variability in conductivity often observed in agricultural lands. In contrast, the electromagnetic (EM) remote sensing technique offers a cost-effective approach of quantifying and mapping soil salinity through non-invasive and rapid measurements of soil electrical conductivity. Additionally, in combination with global positioning system and data logging capability, EM surveys can cover large geographical areas within a short period.

We applied the EM technique in various salt-affected lands of the Central Valley, where waters of different sources (surface, groundwater, drainage, recycled) and quality have been used to irrigate vegetable, field and tree cropping systems. Results of the surveys demonstrated that the EM remote sensing method could accurately and reliably describe the large spatial and temporal variability in salinity observed across the lands.

By identifying the precise locations and levels of salt loading, the EM surveys can help in the development of irrigation and soil management strategies, including leaching, blending of waters, and soil amendment applications; as well as in solution-oriented approaches toward site-specific crop selection.