Sustainable Ecosystems under Land Retirement

Wesley W. Wallender
Department of Land, Air and Water Resources
University of California, Davis

The retired land area in the western San Joaquin valley can be developed as wildlife habitat to improve the ecological system without any serious negative consequences under certain combination of soil type and shallow water table conditions.

Use of intensive irrigation in arid and semi-arid areas usually leads to gradual salinization of the soil detrimental to crop-yields. The salinization problem is mitigated by applying irrigation in excess of crop requirements, which leaches the excess salt load to the groundwater. Lack of appropriate natural or man made drainage systems to dispose off this excessive saline recharge to the groundwater leads to a gradual rise in the water table eventually encroaching upon the root zone. This may ultimately make the land unfit for any productive economic activity. The abandoned land may even lead to desertification with adverse environ-mental consequences. In closed drainage basins, land retirement has been proposed as a management tool to address this problem. Land retirement essentially entails intentionally discontinuing irrigation of selected farmlands with the expectation that the shallow water table beneath those lands should drop and the root zone salinity level should decrease.

In the San Joaquin Valley of California, intensive irrigation in conjunction with a shallow underlying layer of clay, known as the Corcoran clay layer, and absence of a drainage system caused the root zone to become highly saline and shallow water table to rise. Land retirement would remove from production those farmlands contributing the poorest quality subsurface drain water. Based on numerical models results, it was expected that with land retirement of substantial irrigated lands with poor drainage characteristics, beneath which lies shallow groundwater with high salt load, the shallow water table beneath those lands should drop. A part of the retired lands could also be used for wildlife habitat. A potential negative side of the land retirement option that has to be considered is that in certain evapotranspiration enabling soil and water table conditions, water will be drawn upwards and evaporated, leaving a deposit of salts on the surface and in the root zone. The deposits of salt on the surface may then be wind blown to adjacent areas creating a potential environmental hazard.

Using field results from the Land Retirement Demonstration Project at the Tranquillity site in western Fresno County, operated by the U.S. Department of the Interior, principles of mass balance in a control volume, the HYDRUS-1D Software Package for Simulating the One-Dimensional Movement of Water, Heat, and Multiple Solutes in Variably-Saturated Media, and PEST, a model-independent parameter optimizer, we have investigated the processes of soil water and salinity movement in the root zone and the deep vadose zone. Various combinations of evapotranspiration, soil water retention properties, water table condition and top and bottom boundary conditions yield different results. We show that it is feasible to use Land Retirement to decrease shallow water table and soil water salinity and develop native plants as a means to facilitate habitat restoration for certain combinations of soil and bottom

boundary condition. In certain other combinations of factors, land retirement may not be the best option available.

Professional Presentations

Singh, Purnendu, Wallender Wesley, Land Retirement as a Habitat Restoration Tool, AGU Fall Meeting, Poster Presentation, San Francisco, CA, December 2007.

Collaborative Efforts

Collaborative contributions from Stephen L. Lee, and Beatrice A Olsen of the Land Retirement Demonstration Project resulted in a site visit to the project's demonstration site in western Fresno County. Groundwater quality data and the groundwater level data from the Tranquillity site for the period 1999-2004 were also provided by Stephen L. Lee.

Gerald D. Robbins Jr., Bureau of Reclamation, Project Manager, Mid-Pacific Region has provided the maps in jpg format showing the proposed land retirement area.

For further information please contact:

Wesley W. Wallender
wwwallender@ ucdavis.edu
(530) 752-0688
enthusiasm.ucdavis.edu