Geophysical Research Abstracts
Vol. 18, EGU2016-728, 2016
EGU General Assembly 2016

Soil degradation in farmlands of California's San Joaquin Valley resulting from drought-induced land-use changes

Elia Scudiero, Todd Skaggs, Ray Anderson, and Dennis Corwin
USDA-ARS, U.S. Salinity Laboratory, Riverside, United States (elia.scudiero@ars.usda.gov)

Irrigation in California's Central Valley (USA) has decreased significantly due to water shortages resulting from the current drought, which began in 2010. In particular, fallow fields in the west side of the San Joaquin Valley (WSJV), which is the southwest portion of the Central Valley, increased from around 12% in the years before the drought (2007-2010) to 20-25% in the following years (2011-2015). We monitored and mapped drought-induced edaphic changes in salinity at two scales: (i) field scale (32.4-ha field in Kings County) and (ii) water district scale (2400 ha at -former- Broadview Water District in Fresno County). At both scales drought-induced land-use changes (i.e. shift from irrigated agriculture to fallow) drastically decreased soil quality by increasing salinity (and sodicity), especially in the root-zone (top 1.2 m).

The field study monitors the spatial (three dimensions) changes of soil salinity (and sodicity) in the root-zone during 10 years of irrigation with drainage water followed by 4 years of no applied irrigation water (only rainfall) due to drought conditions. Changes of salinity (and other edaphic properties), through the soil profile (down to 1.2 m, at 0.3-m increments), were monitored and modeled using geospatial apparent electrical conductivity measurements and extensive soil sampling in 1999, 2002, 2004, 2009, 2011, and 2013. Results indicate that when irrigation was applied, salts were leached from the root-zone causing a remarkable improvement in soil quality. However, in less than two years after termination of irrigation, salinity in the soil profile returned to original levels or higher across the field.

At larger spatial scales the effect of drought-induced land-use change on root-zone salinity is also evident. Up to spring 2006, lands in Broadview Water District (BWD) were used for irrigated agriculture. Water rights were then sold and the farmland was retired. Soil quality decreased since land retirement, especially during the drought years. Root-zone soil salinity was mapped in 1991 using geospatial apparent electrical conductivity measurements and extensive soil sampling and in 2013 using recent root-zone remote sensing salinity map for the WSJV (developed and published by the U.S. Salinity Laboratory, USDA-ARS), which was calibrated and (independently) validated, including fields from the BWD. Results reveal dramatic increases in soil salinity for all the fields that were originally non-saline and slightly-saline in 1991. Additionally, time-series analysis of very-high resolution ortho-imagery (from Google Earth and USGS) suggests that surface soil quality drastically decreased especially during the drought years.

Our research shows how terminating irrigation in California's Central Valley can lead to substantial soil salinization in a very short time. Salinization in WSJV due to the termination of irrigation is a consequence of the complex multi-scale interaction of geomorphologic, topographic, and anthropogenic factors requiring yearly monitoring to adequately assess the impacts of drought for use in field- and basin-scale water management decisions. Among other concerns, increased salinity and sodicity affect vegetation growth and may lead to increased soil erosion and very-fine dust formation creating health and environmental hazards.