

MS Defense - Lucia Zuniga

Transformation of the hyper-arid desert soils in Arequipa Peru during four decades of irrigated agriculture.

Abstract: The increase in global population, changing food and goods consumption patterns, and expansion of irrigated agriculture have drastically increased the global demand for fresh water. In many parts of the world there are significant spatial and temporal variations between the demand for water for irrigation and cities and its availability, leading to severe water scarcity. In some of these places a large percentage of national populations rely on sources of water like glacial melt, distant high mountain precipitation, and snow pack which are also disappearing at an alarming rate do to a warming regional climate. In the nation of Peru these challenges converge. 65 % of Peru's 35 million people live where there is only 5% of the nation's water supply. Over the past 40 years Peru has led some of the largest scale water management projects on earth to convert infertile coastal desert soils into irrigated agricultural land but these efforts can come at a severe local cost with impacts to ground water quality, salination of the soil, toxic concentrations of trace metals due to evaporation, and overuse of fertilizer and pesticides. This thesis presents a study to assess how drip irrigation impacts desert soil chemistry within one of Peru's largest desert irrigation projects in the southern district of Arequipa. We explored a chronosequence of drip irrigation in vineyards of 9-, 16- and 35- years. Results showed that both soil carbon and salinity accumulated progressively over time, but that spatial accumulation patterns were influenced by proximity to the irrigation drip line. By 35 years, salinity levels exceeded what would be tolerances for most agricultural crops. Trace metals, such Mn, Zn, and Ni, increased with time of irrigation along with Fe, present in the highest concentrations, seemingly controlling the patterns due to co-precipitation. No trace metals, however, were found in quantities that would exceed Peru's limits for agricultural soils. While drip irrigation is considered a water conservation strategy, and widely promoted in the region over high water volume furrow irrigation techniques, its use may accelerate localized negative impacts to surface soil health. These progressive changes highlight the need for effective monitoring and salinity mitigation strategies in the region. This project is part of the bilateral technical program between Purdue University and Universidad Nacional San Agustín (UNSA) called the Arequipa Nexus Institute for Food, Water, Energy and the Environment.

Topic: Lucia Zuniga's MS thesis defense - public presentation

Time: Oct 6, 2020 11:00 AM America/Indiana/Indianapolis

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