Assessing Nitrate Leaching Hazard from Groundwater Recharge in Almonds

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PROJECT SUMMARY

Objectives for current year:

- Determine the risk of increased nitrate leaching into underlying aquifers due to artificial recharge in almond cropping systems on two contrasting soil suitability classes
- Determine nitrogen cycling efficiency at two sites over one year (initially and subsequent years if support is available) - conduct soil coring to a depth of 30 feet to determine nitrate concentration in the deep vadose zone on two contrasting soil suitability classes, a moderately good and good/excellent soil suitability sites for recharge potential, before and after recharge events to assess leaching potential to contribute to a conceptual model of nitrate loading to groundwater
- Using stable isotopic profiles of nitrogen and oxygen, determine the amount of nitrate attenuation by denitrification in the deep vadose zone

Background and Discussion:

California is in the midst of a historically unprecedented four-year drought, with similarly unprecedented reductions of surface water allocations to farmers, especially in the San Joaquin Valley. In response to the current drought, farmers, out of necessity, have increasingly turned to groundwater to offset surface water reductions and meet their irrigation needs. In addition to the baseline groundwater overdraft rate of 2 million acre feet per year since 1960, 2014/2015 saw an unprecedented increase in groundwater pumping in the amount of 11 million acre-feet[1].

Climate change forecasts predict increased precipitation variance with expected increases in flood frequency, as well as droughts[2]. Agriculture needs to capitalize on times of water excess in order to persist through times of drought. Agricultural groundwater recharge presents an innovative climate change adaptation tool for farmers to secure a long-term water supply by recharging the underlying aquifer. However, of particular concern is the potential for groundwater recharge to exacerbate nitrate contamination of already at risk aquifers. Nitrate pollution represents a human and animal health concern. Legacy nitrate below the rooting zone could be pushed further down and ultimately into aquifers used for drinking water wells. Additionally, current nitrogen management combined with groundwater banking could compound the nitrate contamination in soils with high leaching potential. If growers were to partake in future, potentially incentivized winter groundwater recharge programs it must be certain that they are in compliance with the water quality discharge requirements established by the Irrigated Lands Regulatory Program. 1) Will groundwater banking exacerbate or dilute the concentration of nitrate in groundwater? 2) What is the nitrate leaching potential in soils used for almond cropping systems? This project will address these concerns using deep soil coring techniques and stable nitrogen isotope analysis to address potential concerns associated with recharging groundwater.

Project Cooperators and Personnel:
Hannah Waterhouse – PhD student, UC Davis

[1] *Hanak, Ellen and Jeffrey Mount. "Putting California's Latest Drought in Context." ARE Update 18(5):2-5. University of California Giannini Foundation of Agricultural Economics*

[2] *'West-Wide Climate Risk Assessments: Bias-Corrected and Spatially Downscaled Surface Water Projections', Technical Memorandum No. 86- 68210-2011-01; Prepared by the U.S. Department of the Interior, Bureau of Reclamation, Technical Services Center: Denver, CO, 2011*

For More Details, Visit

- Poster location 72, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2017) at Almonds.com/ResearchDatabase
- Related projects: 15-PREC6-Smart