**Condition Change: UC ANR contributed to improved water quality**

**Issue**

Poor water quality can result from a variety of point and non-point sources of pollution such as land development, land use practices, or pollutants and sediment in runoff from stormwater in urban and agricultural sites. Inefficient irrigation systems can lead to large volumes of subsurface water drainage increasing the leaching of nitrates into water. When nitrate in a public water supply reaches or exceeds 45 mg/l standard, costly measures are required to remove it. In California, multiple areas have elevated levels of nitrate contamination in groundwater including the San Joaquin Valley, Santa Ana Valley, and Salinas basins. Water quality regulations for irrigated lands in California require that growers monitor water use and nutrient discharges to limit movement of fertilizers into groundwater and surface water. In addition to managing agricultural lands, protecting water quality from rangelands is also a major concern as surface runoff and groundwater on rangelands provide important sources of municipal water for regional communities.

**Methods**

UC ANR uses applied research to better understand the impacts of agricultural and rangeland management practices on water quality and extends outreach to growers, ranchers and the public.

UC Davis Agriculture Experiment Station scientists at the UC Davis location collaborate with the California State Water Board to assess modeling tools that can be used for evaluation of assimilative capacity in groundwater basins with respect to salt and nitrates (Thomas Harter).

A collaborative group of University of California Cooperative Extension (UCCE) scientists conduct trials evaluating the use of nitrate in irrigation water for crop production, increased nitrate retention in soils, determining nitrogen uptake by vegetable crops, evaluation of nitrate immobilization in winter-fallow beds, and evaluation of improving the efficiency nitrogen fertilization in organic vegetable production systems in Monterey County. The outcome in field trials showed significant reductions in concentration and load of pesticide in agricultural runoff. If growers implement this practice they could see a greater than 95% reduction in concentration and 99% reduction in load of pesticide in agricultural runoff. Research findings are shared with growers, conservation agencies involved with water quality regulation and the State Water Control Board (Richard Smith and Michael Cahn).

Another ongoing activity is the expansion of CropManage, the online decision support software, which now provides a practical tool for growers to customize water and nitrogen applications for individual fields and minimize leaching losses of nitrate (Michael Cahn). A training program led by a partnership between UC ANR and the California Department of Food and Agriculture develops and implements irrigation and nitrogen management training for California's Certified Crop Advisors (Daniel Munk, Doug Parker and Faith Kearns).

As a result of UC ANR research and extension, participants learned and adopted practices that lead to improved water quality. Outcomes with specific indicators follow.

**Outcomes**

**Participants learned about recommended management practices for preserving water quality.**

* There were several gains in knowledge as a result of the irrigation and nitrogen management trainings:
	+ The percentage of California Certified Crop Advisors reporting they had good or complete understanding of the nitrogen cycle increased from 70% before the training to 97% after.
	+ Knowledge of irrigation practices related to nitrogen management increased from 83% before the program to 95% following the program.
	+ One participant and former Kings River Water Quality Coalition leader explained that “CCA’s and growers have never been better informed on nitrogen management issues and most growers have made significant changes to how they evaluate crop nitrogen needs.” (Daniel Munk, Doug Parker and Faith Kearns)

**Participants adopted recommended management practices for preserving water quality.**

* Several growing operations where wells have high concentrations of nitrate in their well water, are reducing their fertilizer application rates in vegetables, resulting in improved Nitrogen use efficiency. (Richard Smith and Michael Cahn)

**Science-based information was applied to water quality policy and decision-making.**

* Both the crop nutrient uptake information and studies on nitrate in irrigation water have been cited by the Central Coast Regional Water Quality Control Board and are being used to shape water quality regulations through the refinement of the agricultural discharge order(Richard Smith and Michael Cahn)
* Based on the research on nitrogen use efficiency, the nitrification inhibitor, nitrapyrin, will be registered in 2020 for use on leafy vegetables (Richard Smith).

**Change in condition: Improved water quality.**

* Several major vegetable growing operations in the Salinas Valley have adopted the CropManage approach to managing fertilizer and water in vegetables. CropManage is now used in 9% of the lettuce acreage in the Salinas Valley, and has resulted in an average of a 30% reduction in nitrogen fertilizer applied to these crops. This reduction is important because high nitrogen fertilizer application rates can lead to high nitrate concentrations in rural wells in excess of safe drinking water standards. (Michael Cahn)

These aforementioned measured outcomes lead to improved knowledge and adoption of mitigation management practices. By reducing pollutants such as nitrates from fertilizers, pesticides, and animal waste that runoff or leach from agricultural and rangelands into water supplies, UC ANR helps preserve water quality. Improved practices will enable managers to reduce pollutants, leading to more environmentally sustainable farming and ranching. Thus, UC ANR contributes to the public value of protecting California’s Natural Resources.