

Supporting Advances in On-farm Water Use Efficiency with Satellite Data:

Integration of the NASA Satellite Irrigation Management Support (SIMS) System and the UCANR CropManage Irrigation and Nutrient Management DSS

Project Motivation and Goals

California's 77,000 farms and ranches generated more than \$50 billion in cash receipts in 2017. Like other western states, agriculture in California dedicates about 80% of diverted surface water supplies to grow food for the United States as well as for export. Growers and water managers are concerned about the impacts of drought on agriculture and the long-term sustainability of California's water resources. Cost-effective, easy to use tools are needed to help growers and water managers use data-driven approaches to both reduce crop production costs and maximize the benefits of available water supplies through further increases in on-farm water use efficiency, or "crop per drop".

To support agricultural producers and water managers in addressing these challenges, NASA, California State University Monterey Bay (CSUMB) and the University of California Agriculture and Natural Resources (UCANR) Institute are linking space-based observations, supercomputing resources, and web and mobile decision support systems for irrigation and fertilizer management. The primary goal of the effort is to reduce barriers to access to information that can increase adoption of data-driven approaches for scheduling irrigation and fertilizer applications. The project is working closely with partner growers to test and validate the data and tools being developed. The demonstration projects and field trials are being conducted in partnership with California growers, but the satellite data and technology being used can be applied to support expansion across the western U.S.

Project highlights:

- Developed a new application of satellite data to help growers accurately estimate crop water requirements
- Linking satellite data with the UCANR CropManage mobile and web applications to support data-driven irrigation and fertilizer management
- Working with growers in California to quantify the benefits of using this approach
- Field trials have shown reductions in applied water of up to 20-40% in vegetable crops while sustaining crop quality and yields

Supporting Advances in Water Use Efficiency with CropManage and NASA SIMS

The NASA Satellite Irrigation Management Support (SIMS) system provides access to satellite-derived indicators of crop condition and daily crop evapotranspiration to growers and water managers in near real-time via web-based data services. The project builds upon commonly used methods for managing irrigation, and enhances information already used by growers from agricultural weather networks, such as



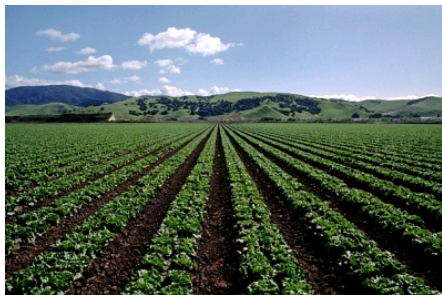
The Landsat 8 satellite

the California Irrigation Management Information System (CIMIS), operated by the California Department of Water Resources. The CropManage irrigation and nutrient management decision support system allows users to input information about irrigation and fertilizer applications, irrigation system configurations and details about the crop, and then automates data retrieval and performs the calculations necessary to provide data-driven recommendations for irrigation and fertilizer applications. The SIMS satellite data is a valuable addition to CropManage, and makes it easy for the grower or irrigator to use satellite data to track the crop

canopy development and update the CropManage recommendations to account for field-to-field variability that might differ from idealized conditions represented by the default models in CropManage.

The NASA SIMS project has also developed web and mobile data interfaces capable of delivering information on a daily basis across 8 million acres of farmland in California. The project is currently working with agricultural partners in California to test the combined system, and is deploying instruments on commercial farms as part of ongoing validation studies. Outreach and education efforts are being conducted in collaboration with UCANR and Western Growers.

Quantifying the Benefits for Irrigation Management

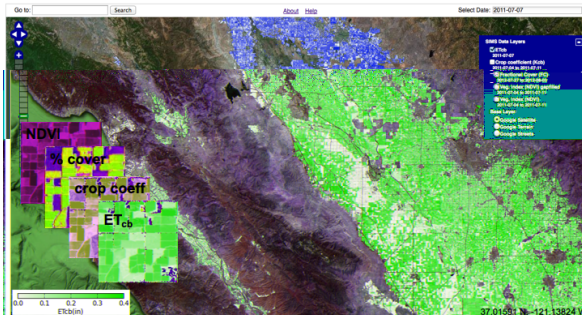


The project is conducting field trials and demonstration projects with agricultural partners, and extending the combined system to support wine grapes, almonds, tomatoes and alfalfa and other crops. Results to date for lettuce, broccoli and cabbage confirmed reductions in applied irrigation of 20-40% while sustaining crop yields and quality. Results also indicated reductions in nitrate leaching, and the

project team is working to quantify the potential co-benefits for management of nitrates and water quality in impacted watersheds. Based on past studies by CDWR, the project anticipates potential benefits to growers from \$40 to \$400 per acre resulting from improvements in water and fertilizer management.



Instrumentation deployed in a vineyard for validation studies.



SIMS data services currently provides direct access to field-level maps and data on crop canopy conditions and crop water requirements across 8 million acres of farmland in California. The SIMS satellite data is integrated into the CropManage web and mobile applications via open data services.

Project Support

The project is supported by the NASA Western Water Applications Office, the CA Department of Water Resources, and the CSU Agricultural Research Institute. It is a joint project involving NASA Ames Research Center, California State University Monterey Bay, the University of California Agriculture and Natural Resources Institute, the California Department of Water Resources, the Desert Research Institute, Western Growers Association, the USDA Agricultural Research Service, USGS, Booth Ranches, Del Monte Produce, Dole, Inc., Driscoll's, E & J. Gallo Winery, Huntington Farms, Pereira Farms, Ryan Palm Farms, Scheid Vineyards, and other partner growers.

