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Spatial Analysis of Irrigation Efficiencies for the State of California

Principal Investigators:

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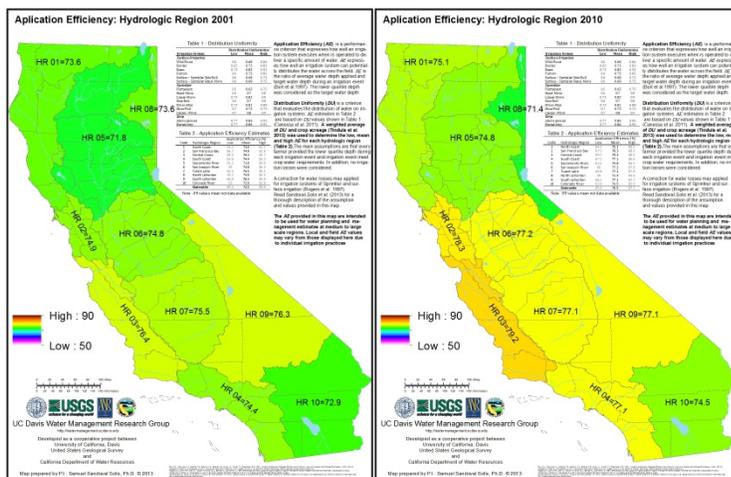
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Project Summary

Analyzing the application efficiency of irrigation systems is important to identify enhancements already achieved and potential places where improvements can be made. Application Efficiency (AE) is a performance criterion that expresses how well an irrigation system performs when is operated to deliver a specific amount of water. AE is defined as the ratio of the average water depth applied and the target water depth during an irrigation event. The average water depth is the average height of water applied in a field during an irrigation event. The target water depth is the desired water to be supplied in a field during an irrigation event. For this research, the target water depth is the low quartile depth, which is the average of the depths in the sections of the field that receives less water than the rest of the field (percentile < 0.25).

Five irrigation surveys have been conducted in California: in 1972, 1980, 1991, 2001, and 2010. These surveys have improved the understanding and trends of the irrigations methods used and the types of crops grown in California. The two main goals of this project are to: (1) combine the irrigation surveys of 2001 and 2010 with theoretical AE values to estimate the spatial AE for different crops and hydrologic regions and (2) create the California Irrigation Information System (CALIIS) to store and display this analysis (Figure 1). The target audience for the AE estimated is regional/state water planners as well as large scale water resources modelers.



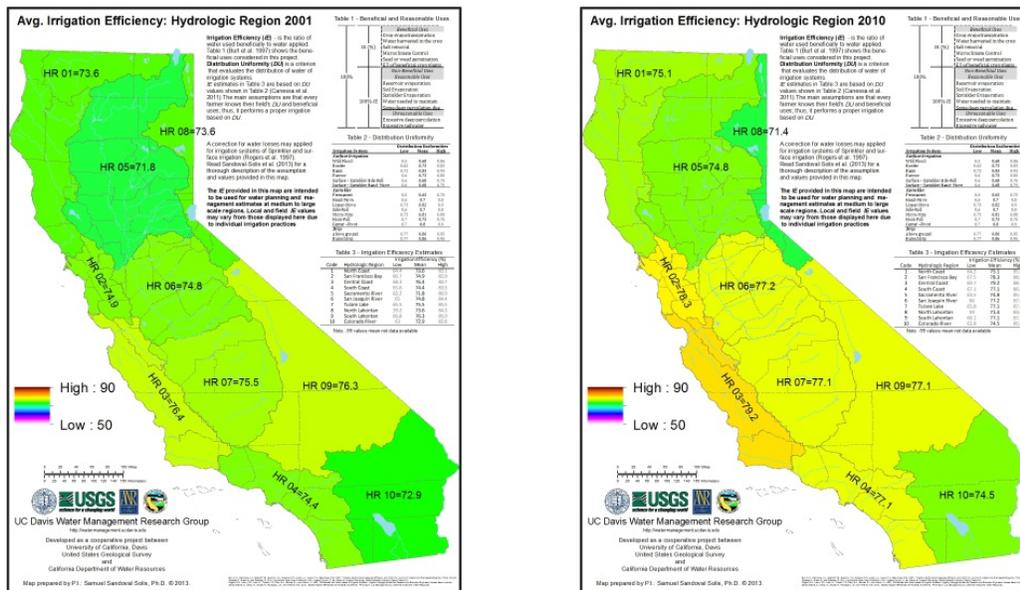
Overall Application Efficiencies by Hydrologic Region.

An extensive literature analysis was done to understand the relationship between AE and Distribution Uniformity (DU). A set of theoretical DU was used as AE considering the following assumptions: (a) irrigation surveys are representative samples of the population, (b) every farmer knew their irrigation system's DU and water requirements for their crops, (c) all farmers supplied exclusively the low quartile depth as the target water depth, and (d) water losses from the irrigation system were not considered. These assumptions allowed the use of DU as AE values.

Results show that AE improved 2.0% statewide from 2001 to 2010. AE improved in all hydrologic regions of California, except in North Lahontan with a slight decrease of 0.7% region wide. San

Francisco Bay, Sacramento River, and Central Coast were the hydrologic regions with highest increase in AE, 3.4%, 3.0% and 2.8% respectively. Similarly, for all crops the AE improved from 2001 to 2010, with highest AE values in vineyards, tomato, subtropical trees, pistachio, and almond. At least 12 crops improved their AE by 2% or more from 2001 to 2010: cotton, other field crops, cucurbit, onion and garlic, tomato-fresh, tomato process, other truck crops, almonds and pistachio, other deciduous, subtropical trees, turf grass and landscape, and vineyards.

The CALIIS provides a series of maps, by hydrologic region, for an overall irrigation efficiency estimated for the whole region, as well as for 20 different crops for 2 years, 2001 and 2010. These are the first application efficiency estimations for the whole state of California.



Overall Irrigation Efficiency estimated by region

Information Transfer/Outreach Program

Four main information transfer activities were undertaken for this project:

1. A report was developed to describe the procedure to estimate application efficiencies for the state of California.
2. A geographic information system was built, named California Irrigation Information System (CALIIS) to store the data and results.
3. A series of 42 maps were developed to present the different application efficiencies across 10 hydrologic regions in California, for 20 different crops for two years, 2001 and 2010.
4. A website was created to make available all the previous information through internet (<http://watermanagement.ucdavis.edu/research/application-efficiency>)