Problem Area I
Effective Water Management in Agriculture – Product Areas

Irrigation Scheduling Technologies for Water Productivity
Water Productivity (WP) at Multiple Scales
Irrigation Application Method Effects on WP
Dryland/Rainfed Water Management
Drainage Water Management and Control
Use of Degraded Waters

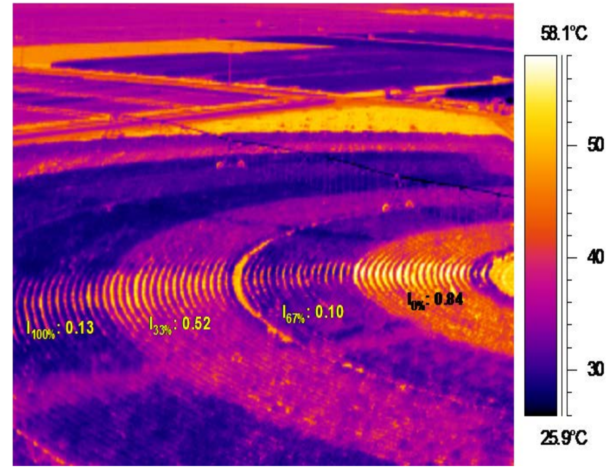
USDA
United States Department of Agriculture
Agricultural Research Service

Irrigation Scheduling Technologies for Water Productivity

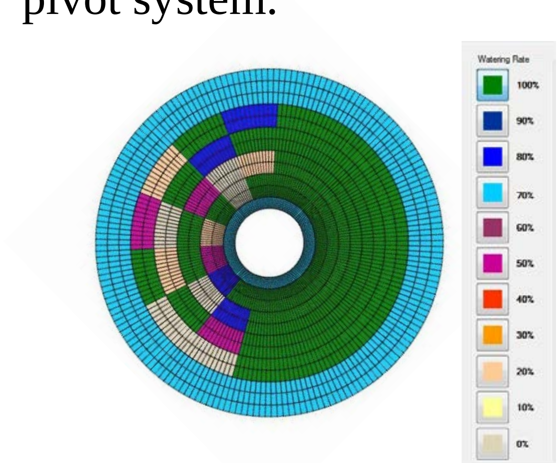
- Sensor network based irrigation management
  - Wireless sensor networks developed at **Bushland, Maricopa and Stoneville**
  - Commercialization of technology
    - **CRADA** for wireless infrared thermometer
    - **Multi-location CRADA** for patented site-specific irrigation SCADA system
    - **CRADA** for patented soil water sensor
  - Applications
    - **Ft. Collins**: Alternative canopy temperature methods for field crops
    - **Parlier**: 50% post harvest water savings in peach with IRTs
    - **Maricopa**: Multi-band N sensors reduce N application, maintain lint yields

Site-specific Irrigation Management with a Supervisory Control and Data Acquisition (SCADA) System

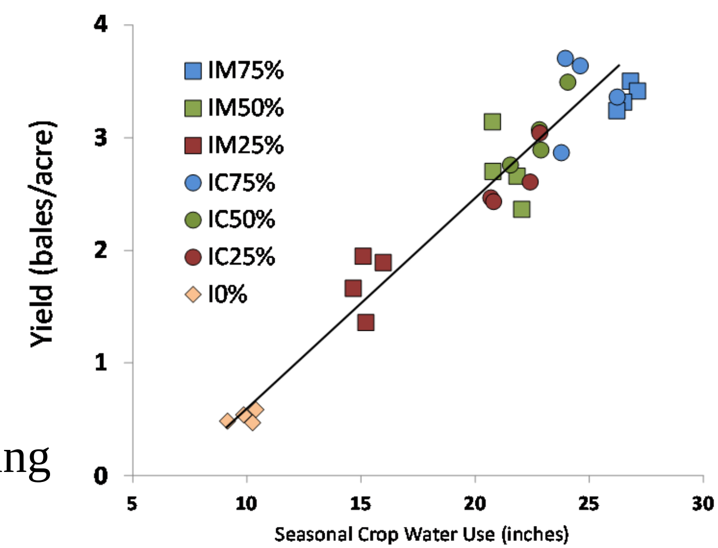
A wireless network of infrared thermometers is mounted on a variable rate irrigation center pivot system.



The SCADA system quantifies the stress level of the crop using canopy temperature and weather data.



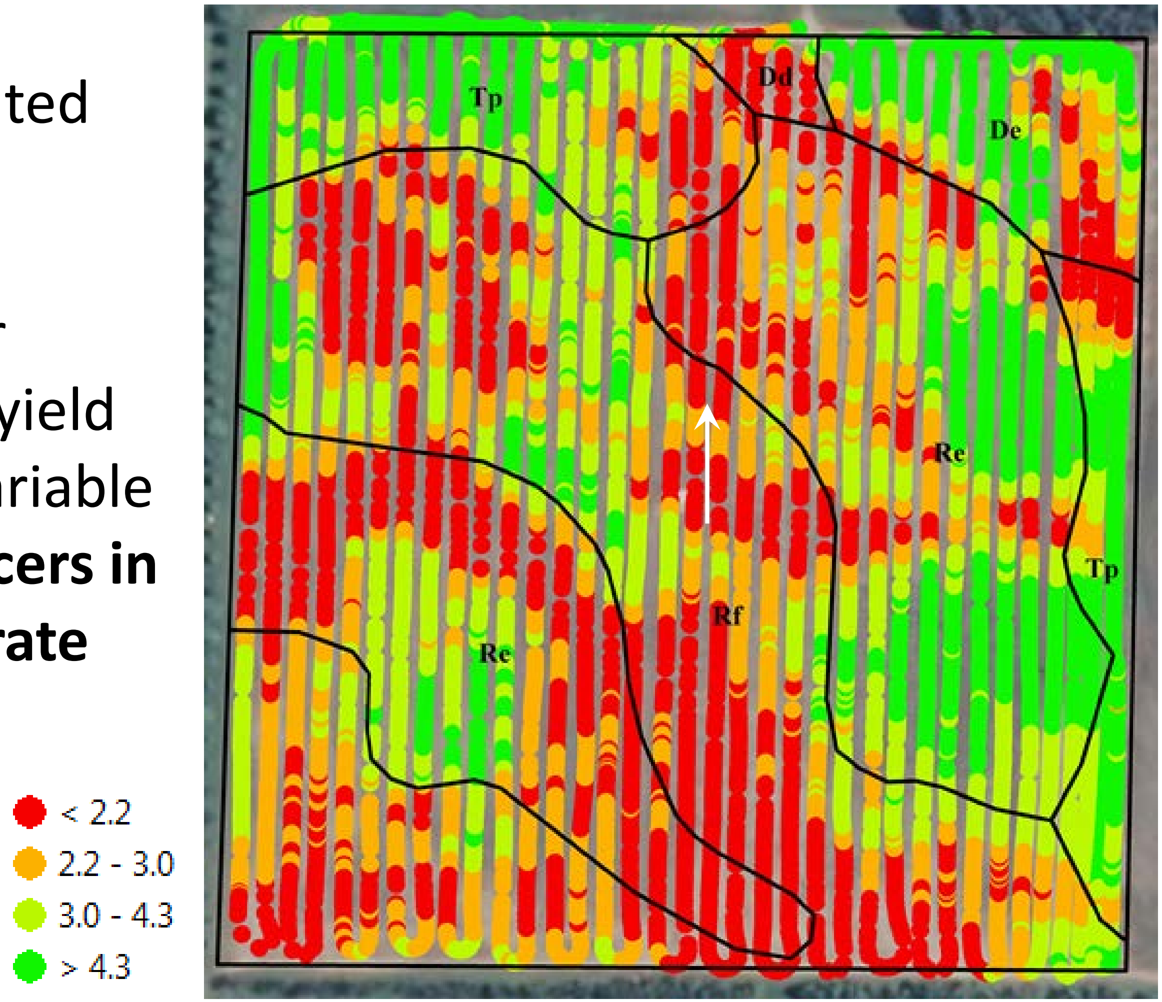
Yields and water use were similar between manual and plant feedback irrigation methods



Dynamic prescription maps are built throughout the growing season to manage irrigation using stress index thresholds.

Demonstrated impact of soil spatial variability on irrigated cotton yield and water use efficiency

Portageville: ARS and university scientists related total irrigation and soil apparent electrical conductivity, a proxy for texture, to seed cotton yield for a field with highly variable soil. Findings **aid producers in proper use of variable rate irrigation systems.**



Irrigation Scheduling Technologies for Water Productivity

- Remote sensing based tools
  - : NASA-U.S. Navy collaboration predicting cro**Parlier-Ft. Collins**p water requirements from satellite imagery – **10 million acres in CA**, TOPS (http://ecocast.arc.nasa.gov/dgw/sims/)
  - Bushland, Improved E and T partitioning with TSEB
- Modeling tools
  - **Maricopa-Ft. Collins**: Integration of dual Kc method into DSSAT models
  - **Lubbock**: Web app for cotton irrigation management balances dryland and irrigated acres

Username: Password: Login

TOPS Satellite Irrigation Management Support

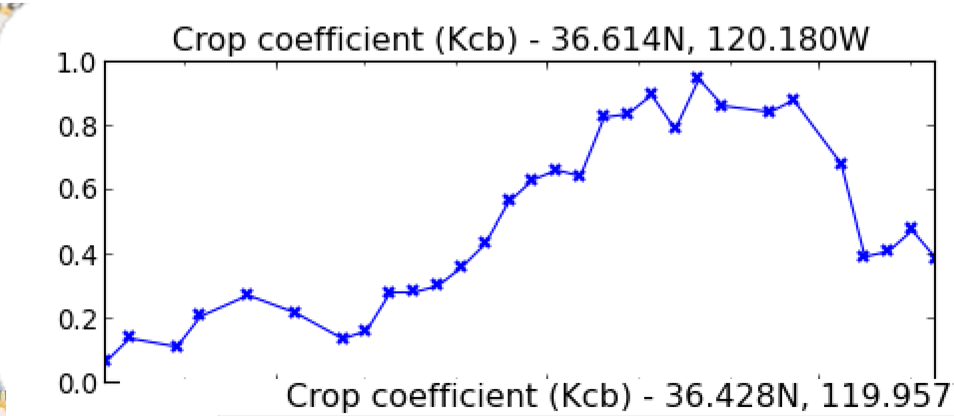
Go to: Search About Help Select Date: 2012-07-27

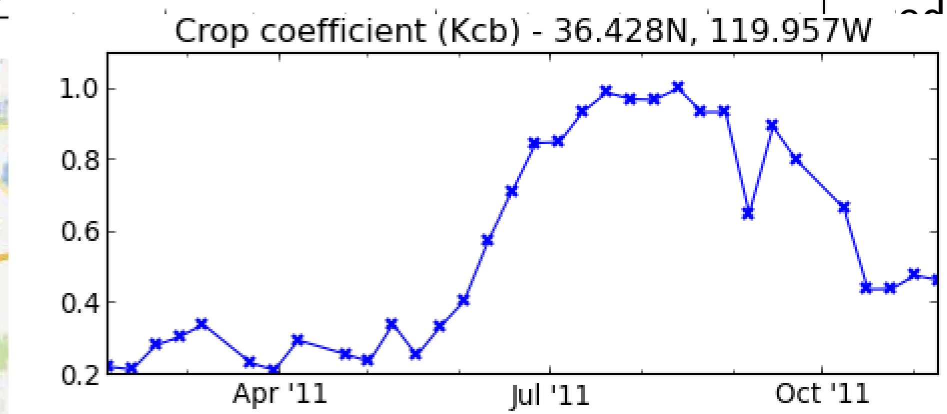
2012-07-27: 36.4460743402, -119.699392534

	current value	2010 history	2011 history	2012 history
ndvi	0.695159	graph csv	graph csv	graph csv
ndvi_GF	0.695159	graph csv	graph csv	graph csv
Fc	0.6959	graph csv	graph csv	graph csv
Kcb	0.848968	graph csv	graph csv	graph csv
ETcb	0.234216	graph csv	graph csv	graph csv
cropType	row crop			

SIMS Data Layers

- ETcb 2012-07-27
- Crop coefficient (Kcb) 2012-07-27 to 2012-08-03
- Fractional Cover (FC)





Management Support (SIMS)
's Terrestrial Observation and
s (TOPS) to merge reflectance
Landsat and MODIS satellite
rence ET estimates from the
n Management Information
rop coefficients are estimated
difference vegetation index
ps crop fractional ground
ients, and basal ET of a
-m resolution over 6 million

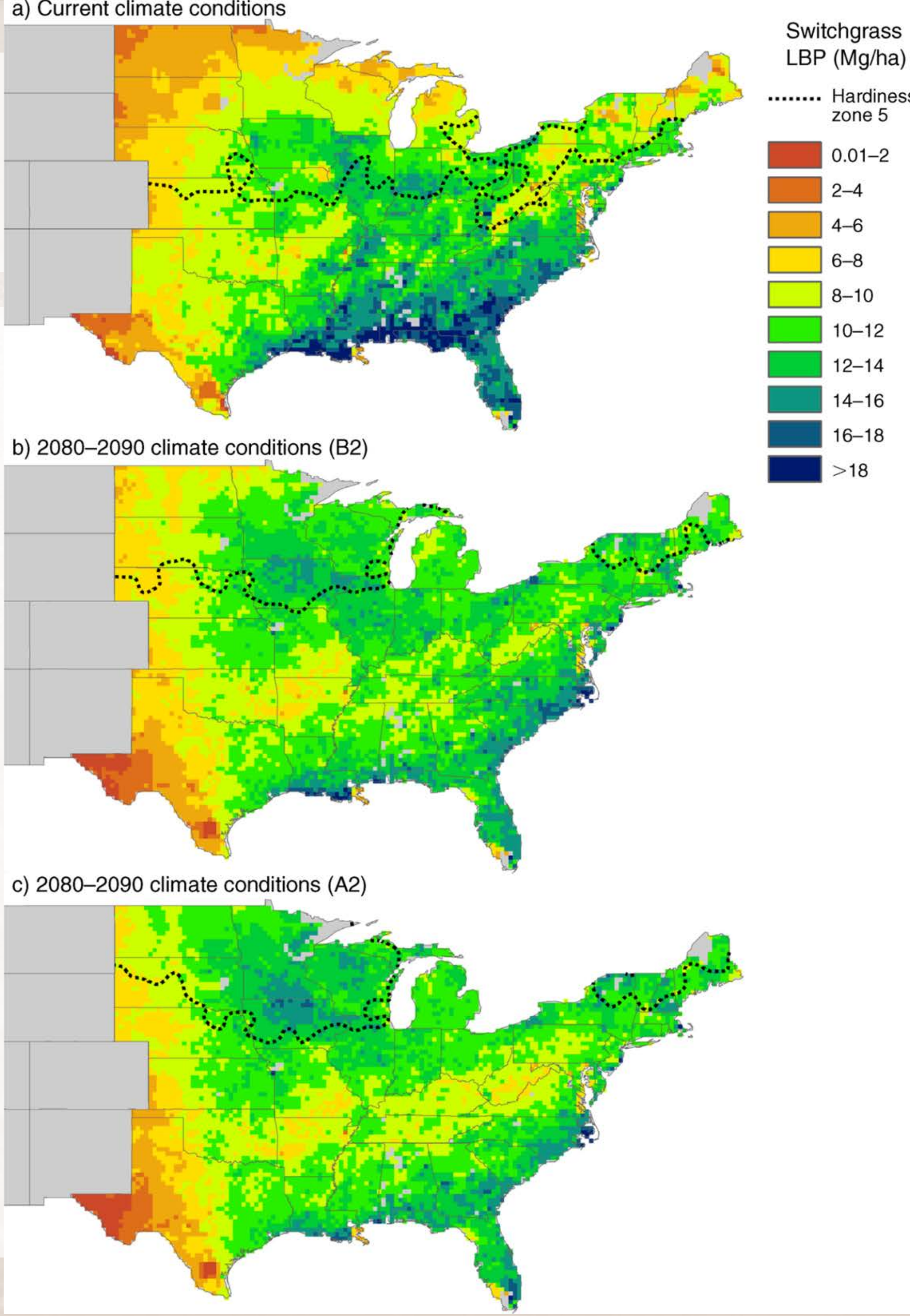
ecocast.org/dgw/sims

Water Productivity at Multiple Scales

- **Ft. Collins**: Regional simulation of Crop Water Production Functions (CWPF) by soil, irrigation type, and irrigation and N levels – **aids in crop choices**
- **Temple**: GeoAlmanac spatial forecasting of crop productivity (switchgrass, poplar, sugarcane, oilseed crops) – **U.S. Navy fuel security**
- **Ft. Collins-Maricopa**: DSSAT system model ET simulation improved, applied to deficit irrigation scenarios – **aids in deficit irrigation decisions**

GeoALMANAC

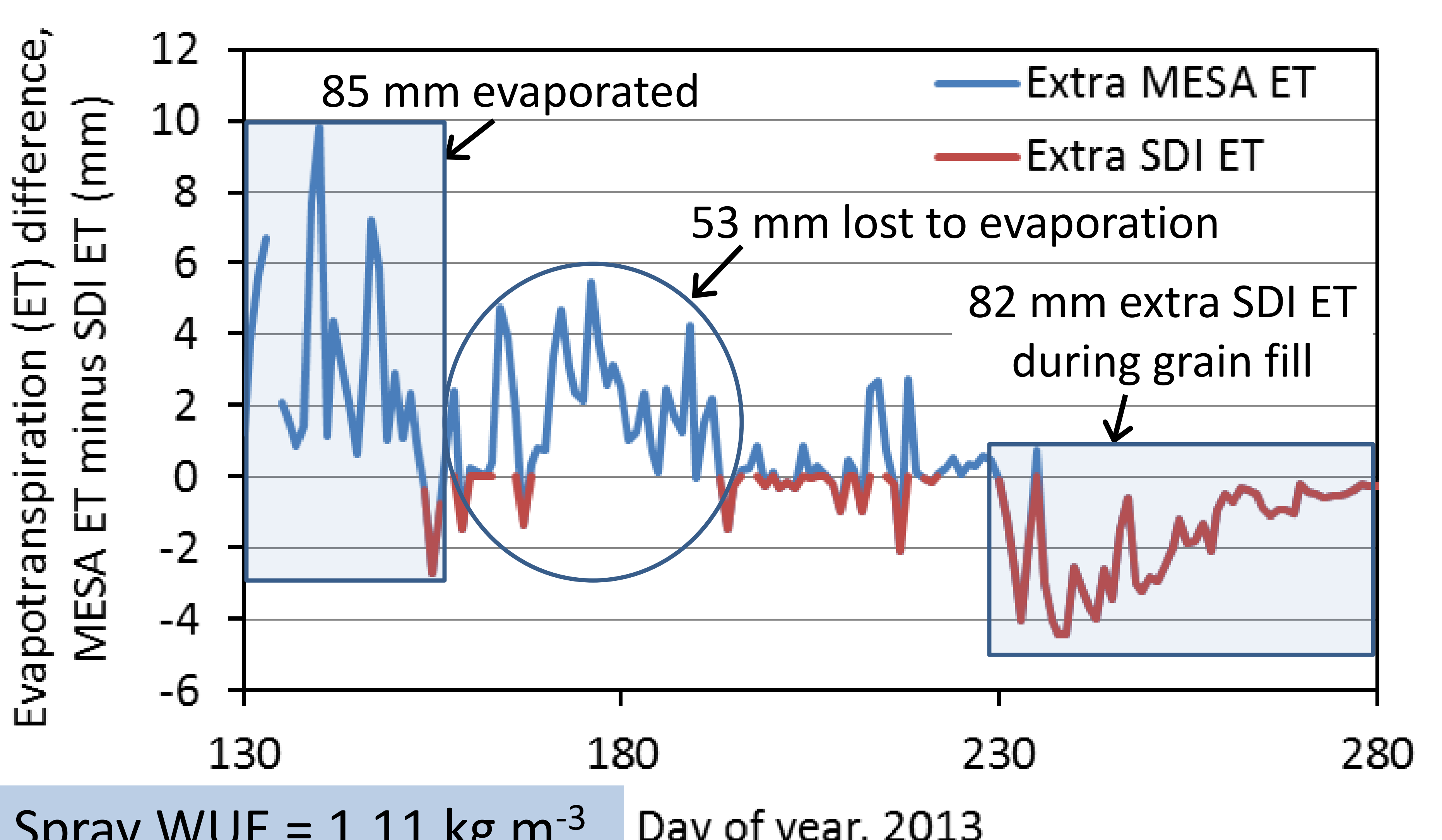
- **Temple**: Biomass potential of switchgrass
- A function of CO_2 concentration, soil type and water availability
- Climate change scenarios



Irrigation Application Methods

- **Portageville**: Showed that **center pivot irrigation of rice** on coarse-textured soil achieved yield and WUE comparable to flooded production. Affects producers in areas with soils not suitable for flood irrigation.
- **Bushland**: Subsurface drip irrigation **(SDI) increases yield and WUE** by reducing evaporation losses
- **Parlier**: Peach post-harvest water use decreased 50% by surface drip and micro-sprinklers
- 2014 Western Association of Agricultural Experiment Station Directors **Excellence in Multistate Research Award** to W-2128 Microirrigation for Sustainable Water Use project

Corn Water Use, SDI vs. MESA

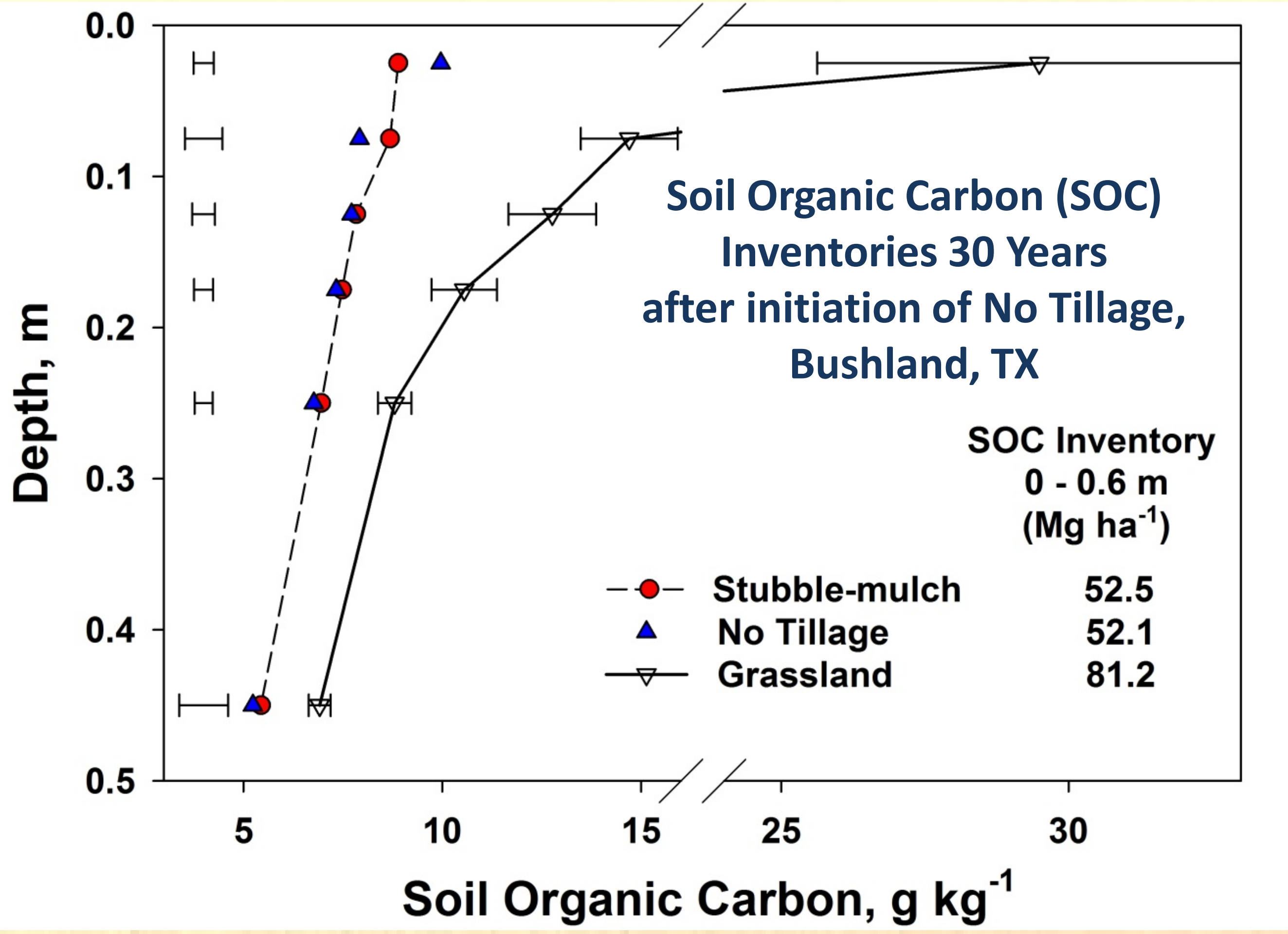


Spray WUE = 1.11 kg m^{-3}

SDI WUE = 1.62 kg m^{-3}

Dryland/Rainfed Water Management

- **Bushland: 30 years of no tillage did not increase soil organic carbon**
- **Biomass production governed the long-term changes in SOC**



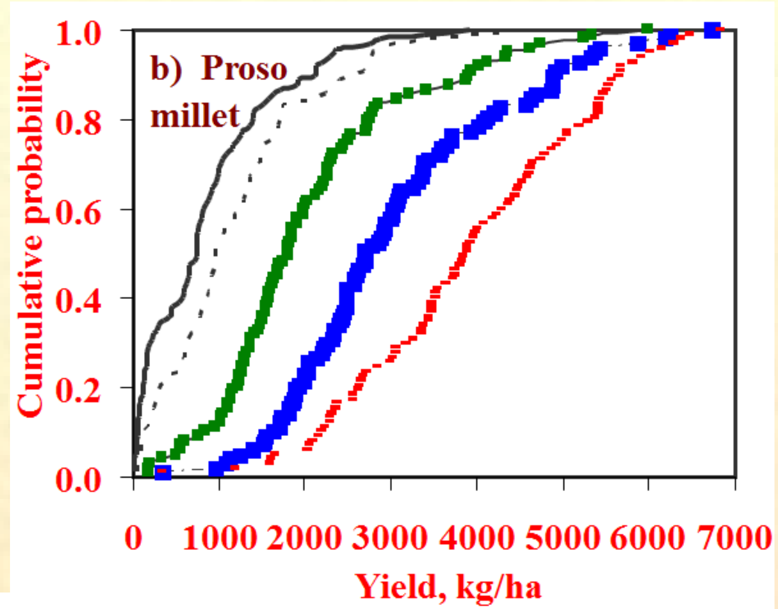
- **For this semi-arid location, increasing SOC requires improvement of WUE under dryland (or additional water via irrigation!)**

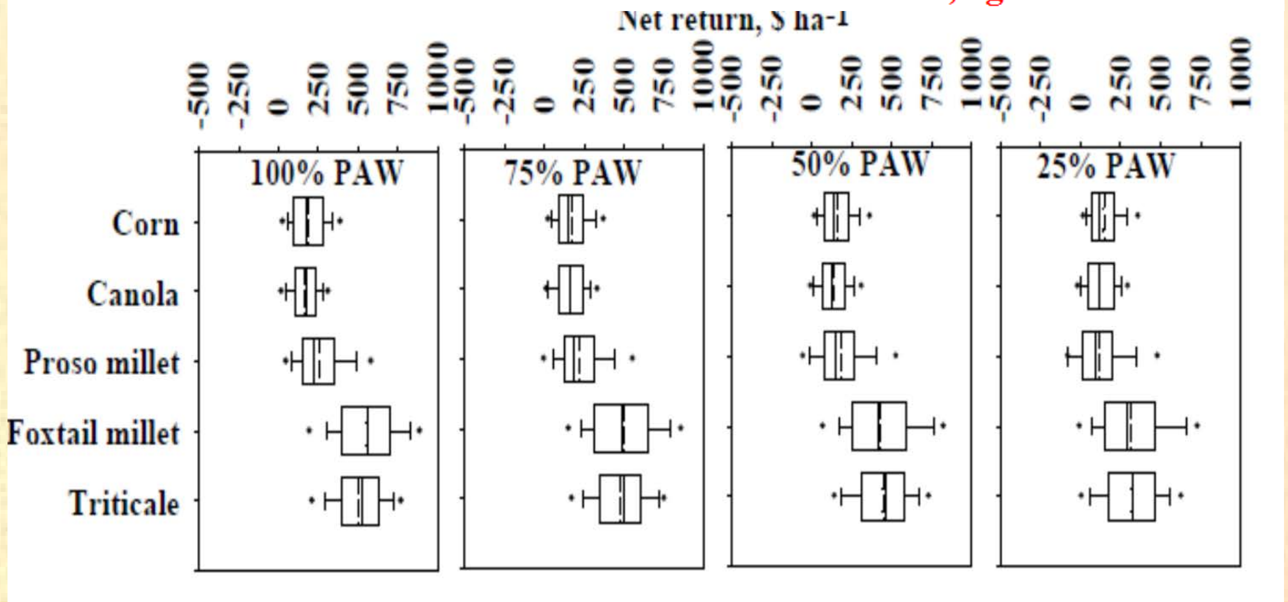
Dryland Cover Crop Water Productivity

- **Akron**: **Multi-species cover crop mixtures** were not much more productive and water use efficient than single-species.
- **Water use efficiency of the mixture was directly related to the composition of the mixture**.
- Adding more grass grain crops will improve the water use efficiency, while adding more legumes or oilseeds will decrease the water use efficiency.
- Confirmed theory of Sinclair and de Wit (1975).

Dryland Decision Support Tool

- **Ft. Collins**: **Select the right summer crop** in Wheat-Summer Crop- Fallow Rotation **based on soil water at planting**



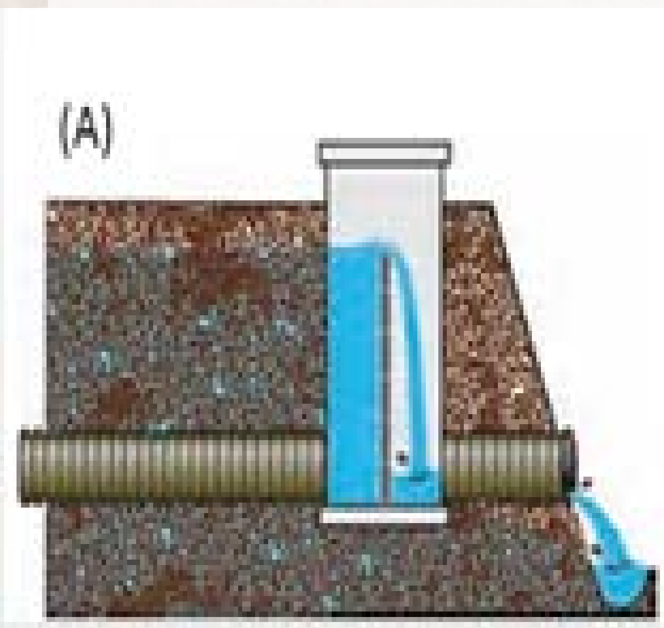


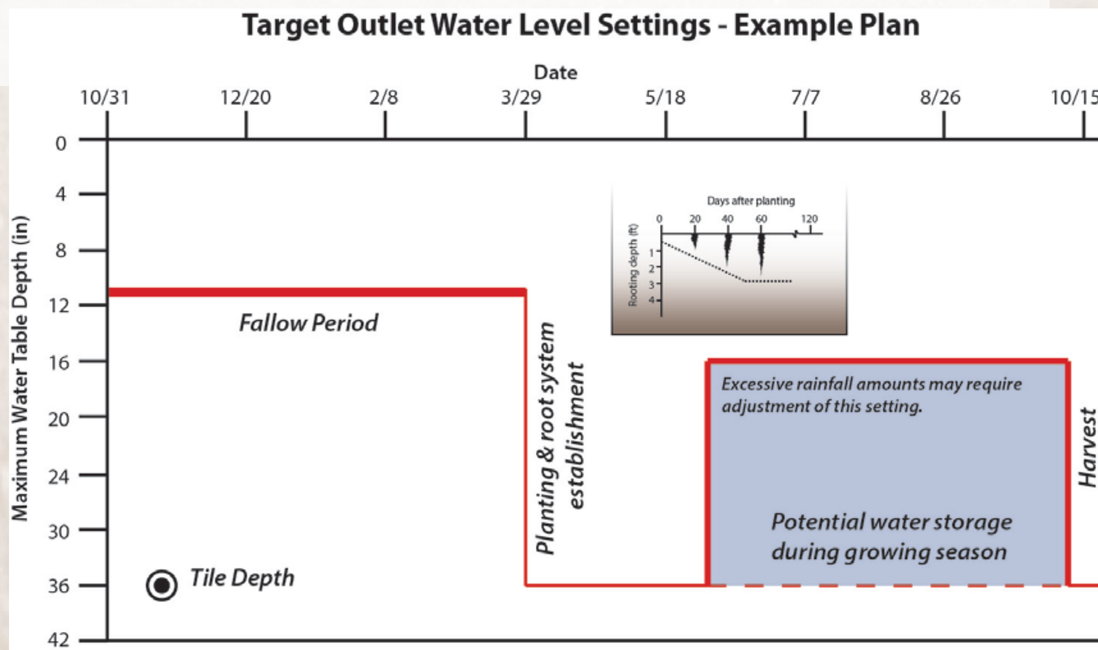
Drainage Water Management/Control

- **St. Paul**: Paradox of **too much water** and **short-term drought** requires both drainage and supplemental irrigation – economic consequences drive technological solutions.
- **Columbus**: **active drainage water management** (DWM) maintains crop water availability while **reducing nutrient loads** in outflows. Provided **NRCS** with justification for development of **national DWM adoption program**.

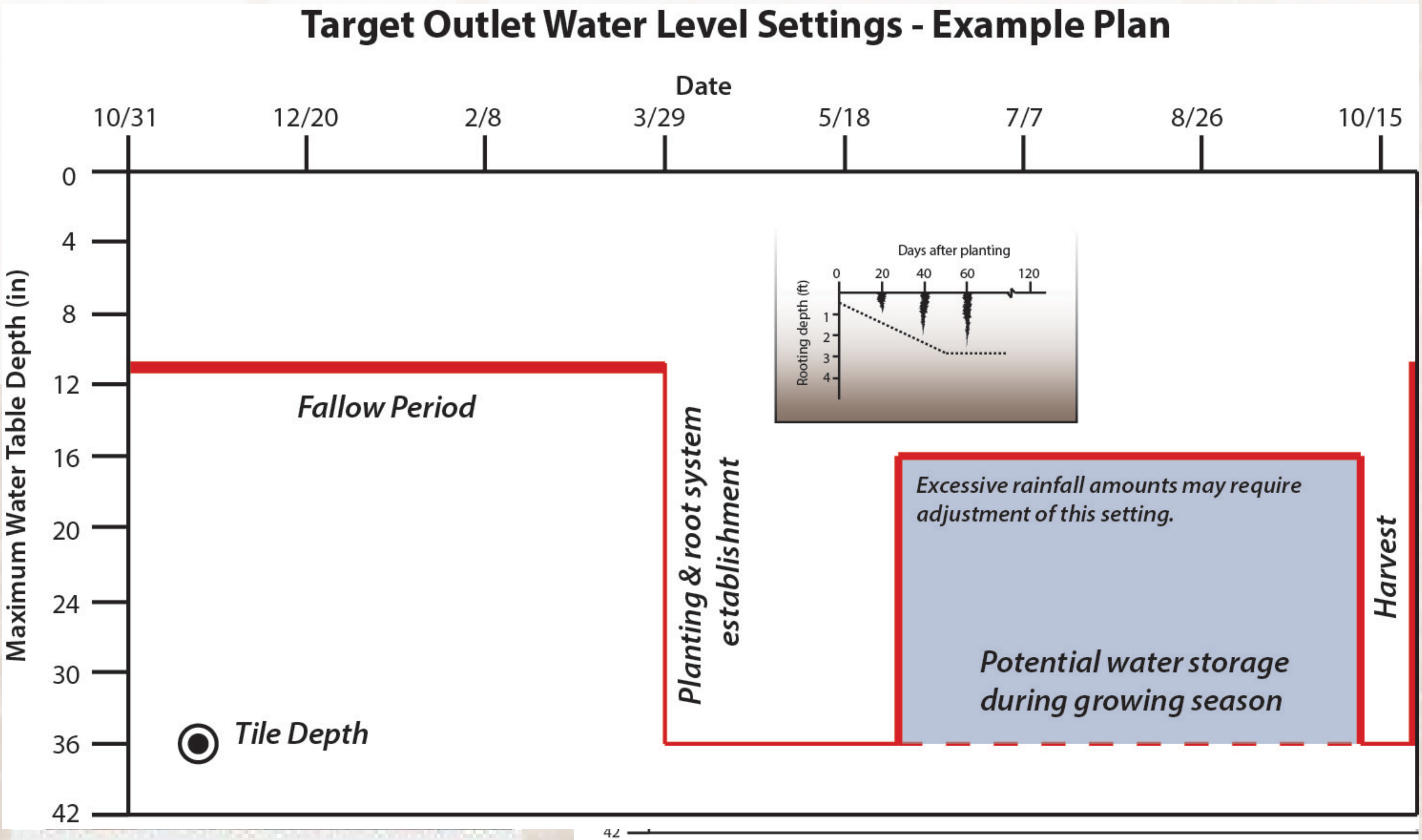
DWM Moves Forward – Cooperation with University, Industry and NRCS partners

Confirmed flow & nutrient load reduction when applying DWM.
NRCS now promotes and cost shares this practice nationally.
Most promising technology/practice available to reduce off-site delivery of agricultural nutrients.





DWM Stores Water – Avoids Drought in Growing Season – Reduces Nutrient Loading



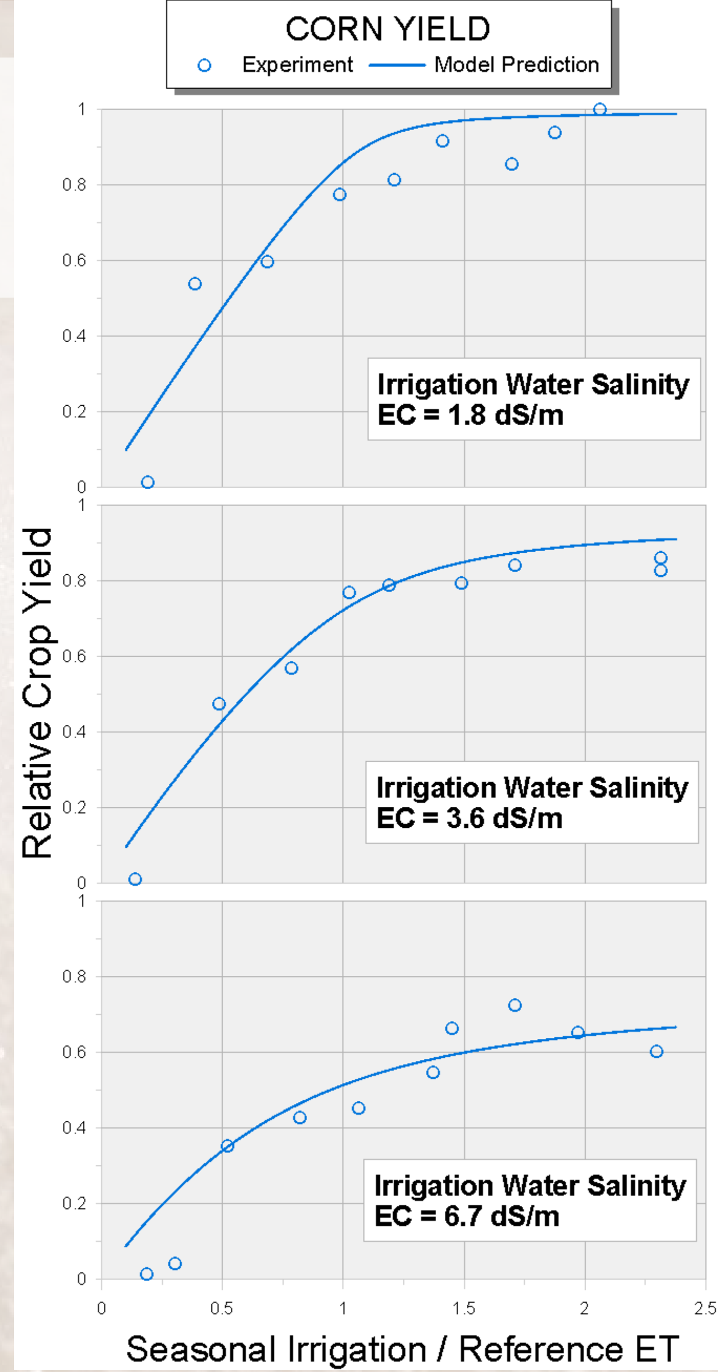
Use of Degraded Waters

- **Parlier**: Drainage waters high in Boron and Selenium successfully used to cultivate **mustard**, **opuntia** and **poplar**. Added-value, selenium enriched food products. Poplar lowers water tables.
- **Riverside**: **Regional scale salinity assessment tool** based on satellite imagery and ground truth – data assimilation
- **Riverside**: **Crop Water Production Function** simulated by water quality and irrigation rate, replaces FAO 29 and **shows use of saline water to be more productive than thought**

Using Degraded Waters

Mustard – Boron & Selenium rich drainage water
Selenium enriched food products

Poplar – lowers water table.
Grows in saline water



END

Contact:

Steve.Evett@ars.usda.gov

http://www.ars.usda.gov/research/programs/programs.htm?NP_CODE=211

Demonstrated feasibility of rice production using center pivot irrigation

ARS and university scientists in Missouri showed that **center pivot irrigated rice** on coarse-textured soil **achieved grain yields comparable to flooded production**. Research aids producers in areas throughout the world with soils not suitable for flood irrigation.