Russell Ranch Field Site

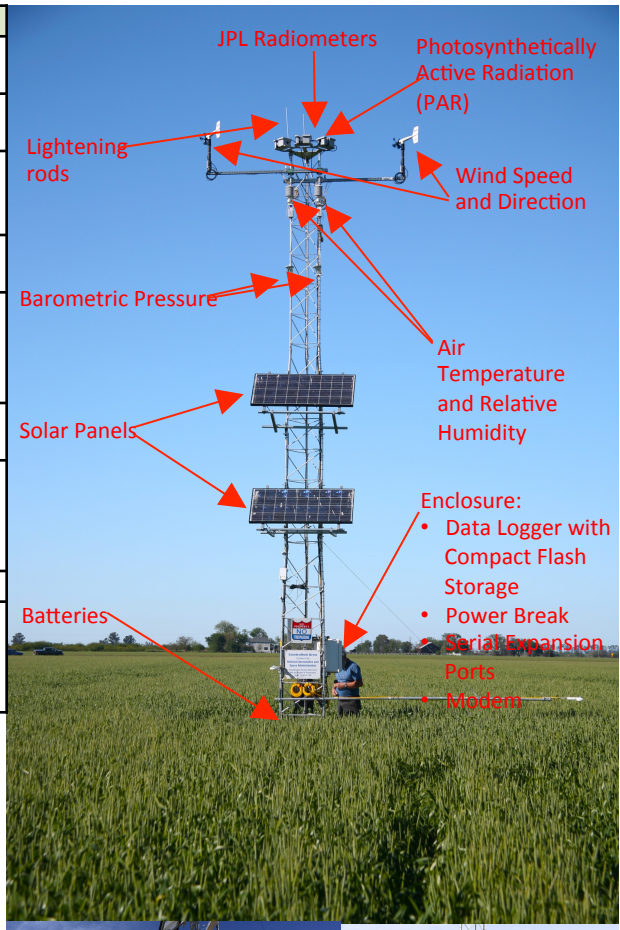
Kerry Cawse-Nicholson, Simon Hook, Gerardo Rivera, Nathan Healey
Jet Propulsion Laboratory, California Institute of Technology.

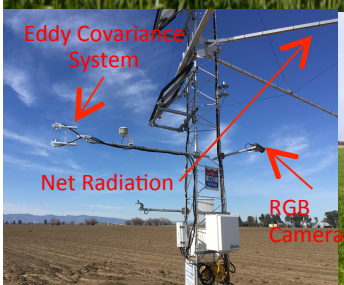
Summary Sheet

The Russell Ranch Sustainable Agriculture Facility is a unique 300-acre (1.2 km2) facility near the UC Davis campus dedicated to investigating irrigated and dry land agriculture in a Mediterranean climate under different irrigation, nutrient, and crop rotation regimes. Among Russell Ranch's ongoing experiments is a 100-year study referred to as the Century Experiment, formerly the Long Term Research in Agricultural Sustainability (LTRAS), which is comprised of a grid of 72 one-acre (4046.86 m2) plots. LTRAS is an exploration of the long-term impacts of crop rotation, farming systems (conventional, organic and mixed) and inputs of water, nitrogen, carbon and other elements on agricultural sustainability. Sustainability is indicated by long-term trends in yield, profitability, resource-use efficiency (such as water or energy) and environmental impacts. LTRAS has monitored changes in crop and soil properties, greenhouse gas emissions, exotic and invasive species (weed) ecology and economic indicators since 1993. The Sustainable Agriculture Farming Systems (SAFS) (http://safs.ucdavis.edu) project joined with LTRAS in 2003.

As part of a recent collaborative effort between the Jet Propulsion Laboratory (JPL) and the UC Davis, Russell Ranch (RR) Sustainable Agricultural Facility, JPL has deployed two permanent 30 foot (9.14 m) tower systems at two separate locations within agricultural plots at the RR facility. The towers support a set of instruments that collect thermal properties of the surface, as well as incident, reflected, and emitted light/energy from the atmosphere, crop foliage, and soil. These measurements will be related to crop health, productivity, and water and nutrient status.

Instrument/Sensor	Data Collected
Wind speed indicator	The values are in counts and are converted to meters per second (ms^{-1})
Wind direction indicator	The values are in counts and are converted to degrees with respect to magnetic north
Air Temperatures with Gill radiation shield	The values are in counts and are converted to degrees Celsius (the air temperatures and relative humidity sensor are integrated together)
Relative Humidity (RH)	The values are in counts and are converted to percent
Barometric Pressure with Pressure Port	The values are in counts and are converted to hectopascals or millibars (hPa or mBar). The pressure port is used to prevent any errors in pressure due to wind over the sensor
Li-COR Photosynthetically Active Radiation (PAR) sensor	Sensor measures Photosynthetic Photon Flux Density (PPFD) in both natural and artificial light
Net Radiometer	Incoming solar radiation (short wave), reflected solar radiation, incoming far infrared radiation (long wave), outgoing far infrared radiation, sky temperature and ground temperature
JPL-built Radiometer	Land surface temperature
Eddy Covariance System	Air temperature, sonic air temperature, barometric pressure, absolute carbon dioxide and water vapor densities and the orthogonal wind components (three-dimensional)





Calibration and Validation Activities

The ECOsystem **S**paceborne **T**hermal **R**adiometer **E**xperiment on **S**pace **S**tation (ECOSTRESS) will measure the temperature of plants and use that information to better understand how much water plants need and how they respond to stress.

ECOSTRESS will address three overarching science questions:

- How is the terrestrial biosphere responding to changes in water availability?
- How do changes in diurnal vegetation water stress impact the global carbon cycle?
- Can agricultural vulnerability be reduced through advanced monitoring of agricultural water consumptive use and improved drought estimation?

© 2017 California Institute of Technology. Government sponsorship acknowledged.