

**THE ROLE OF THE WALNUT GULCH EXPERIMENTAL WATERSHED INSTRUMENTED NETWORK  
IN SUPPORT OF THE SWRC RESEARCH PROGRAM**

**1. SWRC operates three networks of basic hydrologic instrumentation.**

- Walnut Gulch Experimental Watershed, Santa Rita Experimental Range, Upper San Pedro Basin (Fig 1.)
- Instruments – 125 load-cell rain gauges, 34 potentiometers for water level depth at flumes and stock ponds, many Capacitance and Time-Domain Reflectometry Soil Moisture and electro-mechanical met/flux sensors
- Data types - precipitation, runoff, sediment, weather, CO<sub>2</sub> flux and soil hydrology properties from 175 sites
- Scales of measurement - point to watershed, short duration to long-term
- Uses of data - analysis and modeling of semi-arid eco-hydrology, ground-truthing remote sensing, assist in management decision making across SE AZ and beyond

**2. SWRC data flow from field sites to Tucson and Database**

- All sites are equipped with programmable dataloggers that control data-sampling and data-recording
- Data collected from all sites by radio or cellular telemetry daily and data streamed to Tucson (Fig 2.)
- Watershed data from WGEW, SRER and USPB are publicly available via a web interface that allows custom searches (<http://www.tucson.ars.ag.gov/dap/>).

**3. WGEW is highly regarded as an outdoor research laboratory in part because of the infrastructure and data.**

- One of only 15 core sites worldwide selected by the International Community Earth Observing System (CEOS) for satellite product validation and calibration.
- Designated as a Global Fiducial site by the EPA as an environmentally significant site for long-term monitoring of processes associated with the causes or effects of environmental change.
- Key experimental site of the NSF SAHRA (Sustainability of semi-Arid Hydrology and Riparian Areas) Science and Technology Center, 2000-2007.

**4. WGEW instrumentation encourages collaborative research:**

- **1990 - ARS-NASA Monsoon'90 field project** – WGEW was selected because of the network of rain gauges and flumes. MON'90 established met stations at Kendall and Lucky Hills which became incorporated into basic hydrologic network
- **2003 - NASA-JPL-MOSS Project**– chose Lucky Hills and Kendall because of rainfall, runoff, meteorological and soil moisture measurements. MOSS supported establishment of soil moisture and temperature profiles at Lucky Hills and Kendall that became part of basic hydrologic network.
- **2004 - ARS-NASA SMEX'04 project** – prior upgrade of analog to digital recording at rain gauges allowed for expanded number of sensors per site. SMEX04 leveraged this and installed soil moisture sensors co-located with 19 WGEW rain gauges and 7 SRER rain gauges.
- **2005 –2007 USPP** 27 rain gauge sites established (25 with soil moisture) tied in with WGEW telemetry
- Future: next **ARS-NASA** mission 2014-2016, **Global Precipitation Monitoring Mission**

**5. Instrumented networks and field data collection are required to achieve the long term research goals of SWRC.**

- Instrumented networks support SWRC basic research
- Instrumented networks encourage collaborative research and enhance the watershed program
- Instrumented networks for long-term continuous data are necessary for scientific understanding of eco-hydrologic processes

Some of the SWRC Instrumented Sites 11/2009

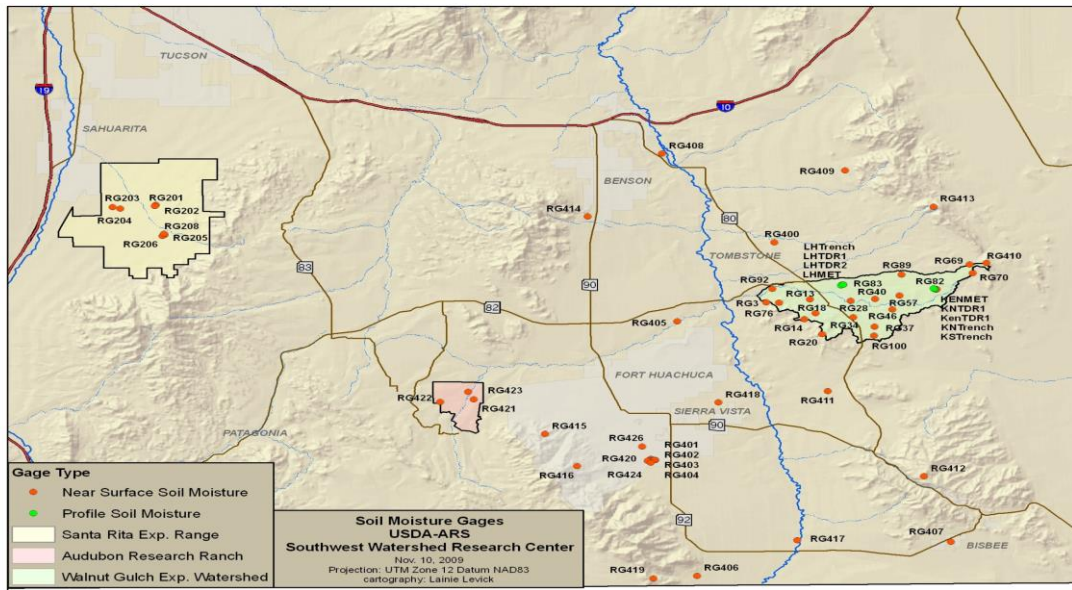


Figure 1. SWRC operates about 175 stations (not all are shown) with 560 sensors in 3 counties in SE AZ, these include 125 rain gauges (51 with co-located soil moisture) and 34 runoff structures. The primary areas of study are the Walnut Gulch Experimental Watershed, the Santa Rita Experimental Range and the Upper San Pedro River Basin.

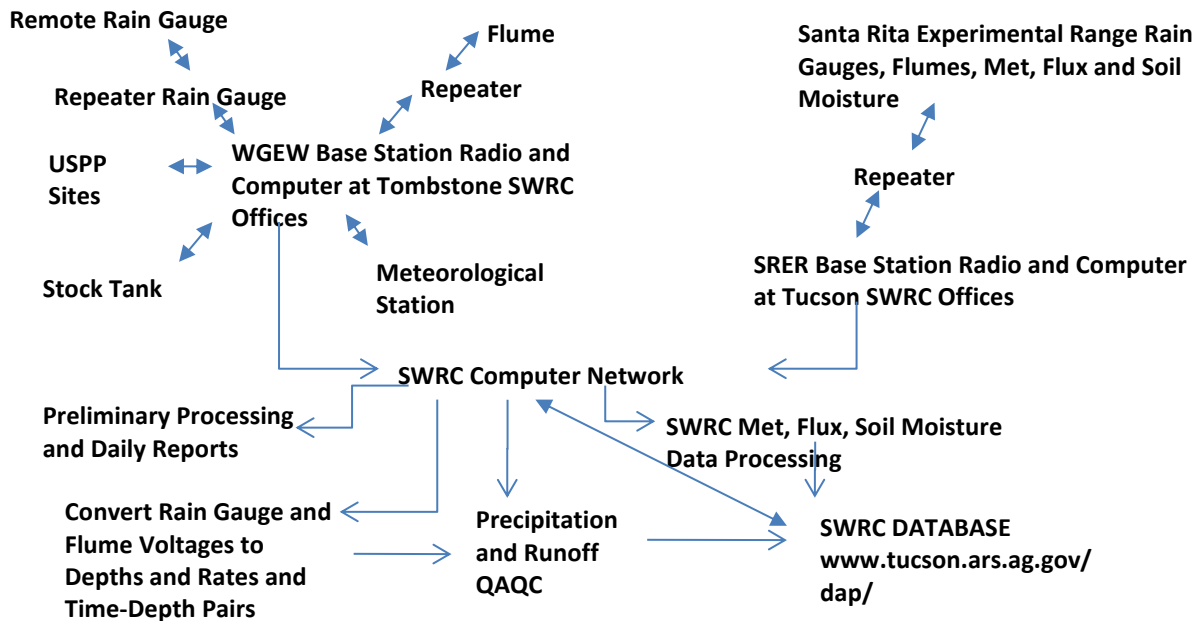


Figure 2. Schematic of 2-way radio communications for SWRC locations and data flow. Each night, just after midnight, all 175 instrumented sites are connected by radio or cellular telemetry from two central base stations, one at WGEW and one at the SWRC offices in Tucson. Because of the distance and remoteness of some of the sites, an intermediate site may be used to 'repeat' the signal between the remote site and the base station. Each station is connected in sequence and data downloaded from the station datalogger to the dedicated computer at the base station. Data are transferred from WGEW offices in Tombstone to SWRC offices in Tucson via an internet interface and preliminary reports of rainfall, runoff and maintenance items are prepared and made available on the internet by 5:30am. Precipitation, runoff and other data are further QAQC'd and archived and made publicly available at the SWRC Database, <http://www.tucson.ars.ag.gov/dap/>.