

Measuring Precipitation at the Santa Rita Experimental Range

Summarized protocol prepared by Hector Elias, SRER Manager

Background

The precipitation records available for the Santa Rita Experimental Range (SRER) include monthly measurements at 75 rain gauges starting as early as 1922. Among the 75 gauges included in the database, only 24 are still measured regularly (Figure 1). The earliest measurements began in 1922, and 15 gauges have a record from that point to the present. Of the 24 currently measured gauges, 23 have a record of at least 50 years. The locations of the gauges were digitized from locations marked on USGS topographic maps of the SRER. The UTM coordinates represent the digitized points reprojected to the NAD83 datum using the GRS1980 spheroid (McClaran 2002).

The precipitation data, the UTM coordinates of rain gauges, the history of name changes, and records of longevity for the gauges are available for download on the SRER website (<https://cals.arizona.edu/srer/>). The website also provides the shapefile (*.shp) format, NAD 83 UTM Zone 12, and KML [keyhole markup language] file format of the rain station locations for use on Geographic Information Systems and Google Earth software, respectively. Additional resources are also provided with the data.

Measurement Protocol

The current precipitation measurement protocol at the SRER uses the 8-inch Standard Rain gauge system to collect and measure precipitation at 24 locations across the range. The frequency of measurement is monthly, and the precision is 0.01 inches.

Readings from every gauge are collected on the 1st of every month to record and report the precipitation collected for the previous month (e.g. readings collected on May 1st reflect the total precipitation fallen in the month of April).

To prevent the loss through evaporation or freezing on the precipitation collected in the rain gauge, a mixture of automotive antifreeze and engine oil is added to the cylinder and accounted for in the total weight of the cylinder.

A typical day of precipitation data collection would involve the steps described below.

Starting from SRER HQ Florida Station:

1. drive to the first closest rain gauge station (Forest station);
2. remove the funnel cap from the cylinder;
3. place the cylinder on the scale;
4. record the weight on datasheet;
5. replace the cylinder in the support structure;
6. replace the funnel cap;
7. move on to the next station.

From a logistical driving efficiency perspective, the collection route recommended is starting from SRER HQ's Florida Station on a North oriented map complete a counterclockwise loop around the range through the stations, following the order the stations are listed on the collection datasheet (Table 1).

Moreover, in the event that the cylinders are getting full or too heavy, we do the following to reset it:

1. clean cylinder with funnel cap;
2. add 1 cup undiluted antifreeze, 1 cup of water, and 2 cups of motor oil per cylinder;
3. weigh the new cylinder with liquids without funnel cup and record new weight on recharged field in datasheet.

Equipment

- SRER map with station locations
- Datasheet
- Ohaus Ranger 3000 Scale
- Mixture of automotive antifreeze and engine oil

Entering Data

Once the data has been collected from all stations, the recorded weights are entered into a running Excel spreadsheet where the weights from each station are converted to vertical inches by multiplying the weights by 0.55. The excel spreadsheet is programmed with the formulas to run the conversion calculations.

References

McClaran, Mitchel P.; Angell, Deborah L.; Wissler, Craig. 2002. Santa Rita Experimental Range digital database: user's guide. Gen. Tech. Rep. RMRS-GTR-100. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 13 p.

The map of the Santa Rita Experimental Range with Rain Gauge Stations and an example datasheet for precipitation recording are provided below.

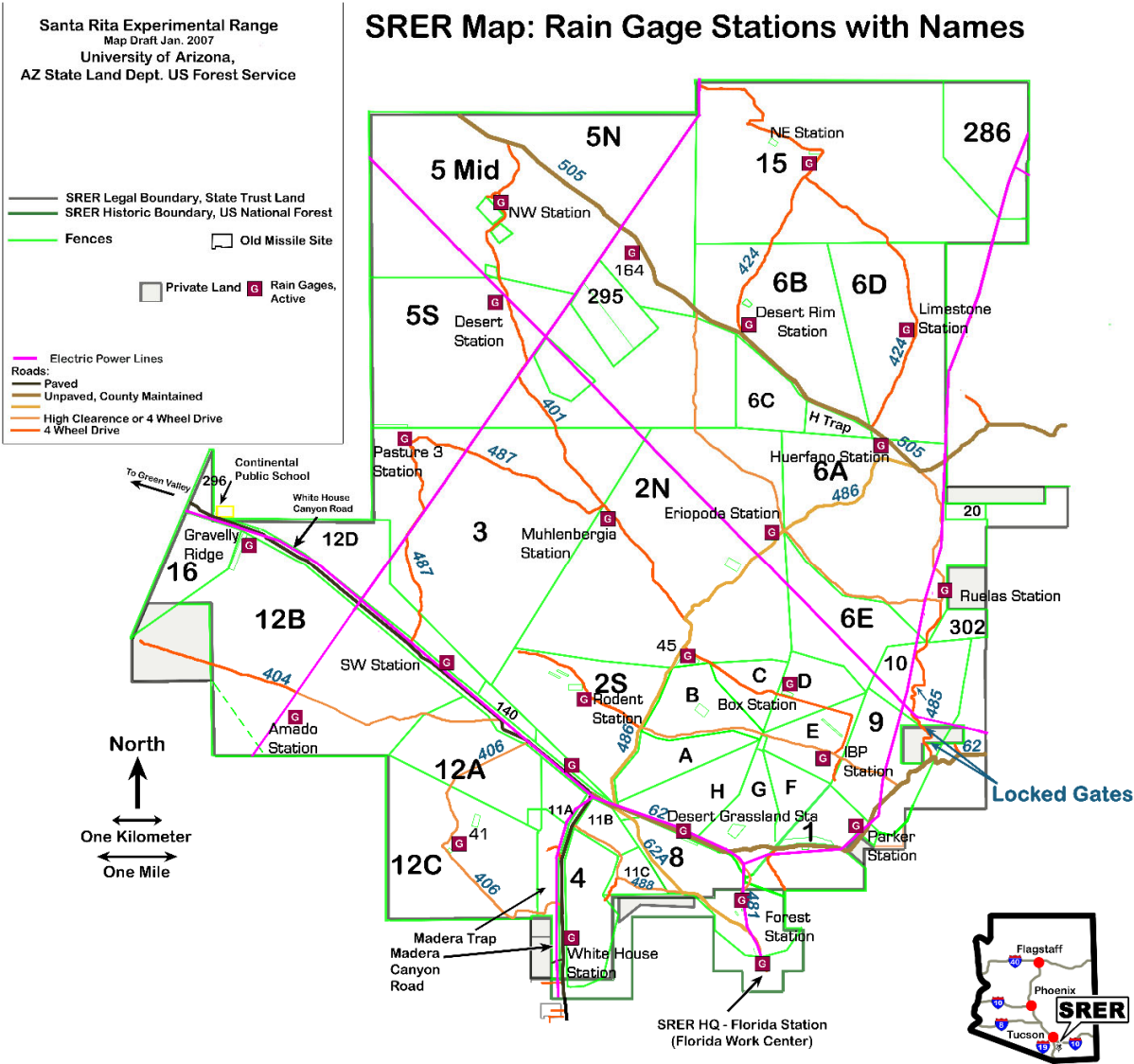


Figure 1. Map of the Santa Rita Experimental Range with Rain Gauge Stations.

Table 1. Example datasheet for precipitation recording.

0													
		shaded cells have formulas											
		Date:											
		Data collected by:											
#	Station	tare low	tare high	tare #	Weight			Recharge				Est. Wind MPH / Notes	
					tolerance	low #	high #	#	tolerance	low #	high #		#
1	Forest	14.494	14.514	14.504	0.010				0.020				~0-5
2	Desert Grassland	28.894	28.914	28.904	0.010				0.020				~0-5
3	Rodent	12.846	12.866	12.856	0.010				0.020				~0-5
4	IBP	18.606	18.626	18.616	0.010				0.020				~0-5
5	Parker	12.708	12.908	12.808	0.100				0.020				~0-5
6	Box	13.780	13.800	13.790	0.010				0.020				~0-5
7	Encl. No. 45	13.472	13.492	13.482	0.010				0.020				~0-5
8	Eriopoda	27.624	27.664	27.644	0.020				0.020				~0-5
9	Ruelas	14.552	14.572	14.562	0.010				0.020				~0-5
10	Huerfano	25.694	25.714	25.704	0.010				0.020				~0-5
11	Limestone	23.398	23.418	23.408	0.010				0.020				~0-5
12	Northeast	14.532	14.552	14.542	0.010				0.020				~0-5
13	Desert Rim	14.424	14.624	14.524	0.100				0.020				~0-5
14	Encl. No 164	21.124	21.324	21.224	0.100				0.020				~0-5
15	Northwest	14.516	14.536	14.526	0.010				0.020				~0-5
16	Desert Station	22.754	22.774	22.764	0.010				0.020				~0-5
17	Muhlenbergia	25.332	25.352	25.342	0.010				0.020				~0-5
18	Pasture 3	13.840	13.860	13.850	0.010				0.020				~0-5
19	Amado	15.402	15.422	15.412	0.010				0.020				~0-5
20	Gravelly Ridge	16.714	16.734	16.724	0.010				0.020				~0-5
21	Southwest	18.132	18.152	18.142	0.010				0.020				~0-5
22	Encl. No. 41	17.972	17.992	17.982	0.010				0.020				~0-5
23	Whitehouse	17.692	17.712	17.702	0.010				0.020				~0-5
24	Road	26.620	26.640	26.630	0.010				0.020				0-5
notes:													