REAL TIME DATA TIPPING BUCKET RAIN GAUGE

Sustainable Southwest Beef
knowledge and tools for ranch and rangeland resilience

What is Precision Ranching?

Precision ranching involves the use of smart sensors for automated monitoring of livestock, stock tanks and drinkers, rainfall, and forage growth. Precision systems are fairly common in intensive animal agriculture but their use in extensive ranching operations is still in its infancy. As sensor technologies, wireless data transmission networks, and sophisticated data analytics tools become more common and less expensive, new and exciting opportunities to develop robust and relatively low cost Precision Ranching systems are rapidly emerging. Long-range wide area networks (LoRaWAN) are systems that use long-range radio frequency communication to transmit small packets of data from several moving or stationary sensors in real-time. The method is among less expensive options to collect and transmit data from large areas of rangeland and are highly suitable for use in remote locations and on extensive ranching systems.

Benefits of Real Time Data Rain Gauges

A well calibrated user-friendly precision ranching system could aid ranchers in making rapid decisions to address issues of forage shortage and sustainability. Real time information about precipitation events on different parts of a ranch could help a rancher make more informed decisions about vegetation growth potential and subsequent grazing plans. A precision ranching system might also help reduce the financial and environmental costs of ranching and increase the operational efficiency of rangeland cow-calf systems. For example, real time data rain gauges provide information about precipitation events, that can vary pasture by pasture, in a dashboard interface a rancher can access from a computer or smartphone. This remote data access could eliminate, or at least reduce, the need to drive to traditional rain gauges spread across a large area, potentially saving time and fuel and reducing wear and tear on vehicles and greenhouse gas emissions.

Real time data tipping bucket rain gauge installed near a holding pen.

Common Applications

- Monitoring precipitation remotely
- Precipitation trend tracking
- Pasture level precipitation monitoring

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How does it all work?

Rain gauges are installed on a stable structure that won't be interfered with by cows (vibrations from a cow rubbing on it can cause the tipping bucket inside the device to trigger and record a phantom "rainfall event"). The gauges use LoRaWAN (radio frequency communication) to send data long-range to receiver stations placed strategically across the ranch to maximize coverage. Each receiver station then uses WiFi or cell-service to send the data to a centralized server and dashboard that processes and prepares the data to be viewed in real time. A smartphone or computer app displays the collected precipitation data from every connected rain gauge.

So it does need internet/cell-service?

While the gauges don't need internet/cell-service to send data to the receiver stations, the receiver stations do need internet, WiFi, or cell-service to send data to the network server before it's accessible on the dashboard app. The rain gauge doesn't need to be in an area of internet or cell service, but the receiver station does.

What infrastructure do I need?

You will need: 1) smart rain gauge; 2) one or more solar-powered receiver stations; 3) a cloud-based network server (cellular, Ethernet, satellite, or Wi-Fi); and 4) either a cell phone or internet-enabled computer to access the data on the dashboard application. Apart from the rain gauge itself, this is the same set-up needed for other complimentary real-time data devices (ultrasonic water level sensor, GPS collar) and one system can support all three simultaneously.

How many receiver stations would I need?

It really depends on the ranch size and terrain. Generally somewhere in the neighborhood of 3-5 strategically placed stations. Current receiver station designs being tested include a trailer mounted design and a tripod mounted design. Both allow the receivers to be moved around to find the best coverage for your specific needs.

How much does it cost?

As with any new technology, costs are changing all the time as the market grows. The current* figures are: rain gauge: $1,143/unit; solar-powered portable receiver station: $2,600 to $5,000 each; data storage and processing subscription: one payment of $2,300 for up to 7 receiver stations and 200 sensors, plus an annual fee of $290 per receiver station. Sensors serviced can be mix & match (see above note on infrastructure).

*At the time of document preparation: August 2022.

Photos of typical receiver stations (also called gateways). Left is trailer mounted, right is tripod mounted:

DIGITAL RANCHING: COMPONENTS AND FLOW

DATA TO DECISIONS