

BLACKFOOT CHALLENGE SOIL MOISTURE MONITORING PROJECT

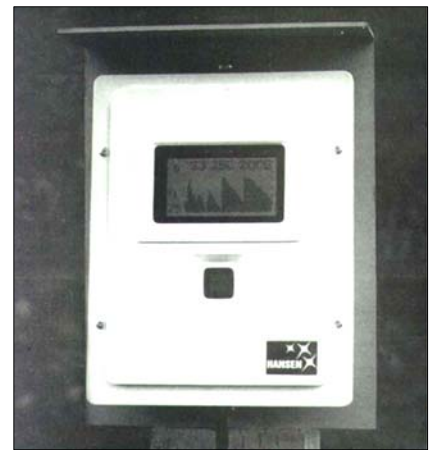
The Blackfoot Challenge --Drought Response and Water Conservation

The Blackfoot Challenge Drought Committee was formed in 2000 in response to emergency drought conditions. The committee's work has grown to include a long-term water conservation strategy for maintaining instream flows and improving water use efficiency and productivity for ranching. The Drought Committee implements an Emergency Drought Response during low flow summers and works with all water users in the Blackfoot watershed – including ranchers, anglers, floaters, homeowners, and community businesses.

Soil Moisture Monitoring Project

In 2001 the Blackfoot Drought Committee started a soil moisture monitoring pilot project in cooperation with the National Center for Appropriate Technology (NCAT).

The centerpiece of the project is the AM400 – an affordable but sophisticated data logger that records and displays soil moisture levels from up to six sensor locations in a field. The monitor automatically checks soil moisture every eight hours and displays soil moisture for the past 35 days at the push of a button. The graphical display makes it easy to see both past and current soil moisture levels. Irrigators use this information to help schedule irrigations and avoid overwatering.



Sensors are installed at various depths, allowing the irrigator to see at a glance the soil moisture levels throughout the root zone.

Soil moisture levels are displayed on the monitor in *centibars*. Centibars measure the energy that a plant must exert to extract water from the soil. As soils gradually dry out, plants must work harder to extract the remaining water and centibar measurements increase.

When readings are between 0 and 10 centibars (cb) soil is *saturated* and water uptake by plants is seriously curtailed by lack of oxygen. Somewhere between 10 and 30 cb (depending on the soil), water stops draining and the soil reaches an equilibrium condition known as *field capacity*. As soils continue to dry and the centibar numbers increase, irrigators monitor the readings. Depending on the soil type, crop, and time of year, most irrigators start watering their crops when readings are between 40 and 80 cb.

In 2001 and 2002, irrigators installed 15 soil moisture monitors from Helmville to Potomac to Seeley Lake. Monitoring took place in 14 fields affecting about 1500 acres, and also at Double Arrow Golf Course. Included in the project are 13 pivot systems, one wheel line, and the underground sprinkler system at the golf course. Cooperators grow alfalfa, grass hay, pasture, and turf. One of the monitors is installed at the Bandy Research Ranch.

The Bandy Ranch Soil Moisture Monitor

In 2002, Bandy Ranch, a Montana State University research ranch, joined the soil moisture monitoring project and installed an AM400 monitor under a new center pivot. The monitor is

mounted on a post near the tailwater ditch. Underground cable extends about 100 feet in one direction and over 150 in another direction to a total of six buried sensors. A thermistor (buried 15 inches deep) measures soil temperature and is used by the AM400 to adjust and refine soil moisture readings.

Southeast Sensors

Sensor 1 – 6 inches deep
Sensor 2 – 18 inches deep
Sensor 3 – 30 inches deep

Southwest Sensors

Sensor 4 – 6 inches deep
Sensor 5 – 18 inches deep
Sensor 6 – 30 inches deep

The Bandy Ranch saw tremendous water and energy savings in 2002, largely due to the new pivot. However, the soil moisture monitor provided Joe Broesder, the ranch manager, with valuable insights into the soil's moisture levels. The monitor showed that moisture levels were adequate when the pivot applied only an inch of water per week. At these levels, yields in the grass/alfalfa field were good and so was fall regrowth.



The addition of the Bandy Ranch to the project has increased the visibility of water conservation and management in the Blackfoot valley.

Technology Helping Irrigation Management

The assumption behind this project is that progress on irrigation management is most likely to come from locally-based projects that enable irrigators to experiment on their own and learn from each other. Irrigators are paying closer attention to their irrigation practices and are gaining the confidence to experiment with more precise water applications. Project participants are becoming more comfortable using the soil moisture monitor and with the concept of monitoring soil moisture.



The Committee expects that irrigators in this program will use soil moisture monitoring as one more tool in their drought response efforts. During drought conditions, water users voluntarily agree to reduce water use in order to maintain critical in-stream flows. Soil moisture monitoring will allow irrigators to make informed decisions on how best to use limited water supplies.

Soil moisture monitoring is useful not just as a response to water shortages but also as a tool that allows irrigators to make daily irrigation scheduling decisions during more normal water years. This not only leads to wise water use but can also result in increased crop yields, reduced fertilizer losses, and reduced runoff and associated water quality degradation.