Wyoming Agricultural Climate Network (WACNet)

Vivek Sharma1,2, Chris Nicholson3, Tony Bergantino3, Jeff Cowley4, Bret Hess2,5, and John Tanaka5–7

Introduction
Understanding the potential changes in local climate variables is critical to better understand how these changes affect agricultural and natural resource ecosystem productivity. In many cases, past, current, and future weather conditions greatly influence decisions made by producers (e.g., cattle and sheep stocking rates, irrigation, pest and disease control, land use and management). To support these decisions, the University of Wyoming, in collaboration with the Wyoming State Engineer’s Office, has developed the Wyoming Agricultural Climate Network (WACNet), a network of 26 weather stations across the state (www.wrds.uwyo.edu/WACNet/WACNet.html). Most of the stations are located in the irrigated regions of the state, including the Bighorn, Green River, and Platte River basins (Figure 1). Other stations were installed to support forest and natural resource ecosystem research. For example, the weather station at the UW-owned Rogers Research Site in southeast Wyoming near Laramie Peak was added to WACNet in 2017.

Objectives
The objectives of WACNet are to monitor and provide information on climatic conditions for agricultural and natural resource applications in Wyoming.

Materials and Methods
Figure 1 shows the location of WACNet automated weather stations across Wyoming. All monitoring stations in the program provide real-time data, including air temperature, humidity, wind speed and direction, solar radiation, and precipitation. In addition to these parameters, some stations also measure soil moisture, soil temperature, atmospheric pressure, vapor pressure deficit, and reference evapotranspiration data. All of the stations are equipped with Campbell Scientific Inc. CR1000 or CR6 data loggers and sensors. The data loggers are powered by batteries that are recharged by solar energy (Fig. 2). All of the stations are integrated into a web-based platform managed by UW’s Wyoming Water Resources Data System (WRDS). Raw data gathered by each weather station is communicated to WRDS through cell phone modem and internet. WRDS then processes and assesses all of the data for quality assurance/quality control and disseminates the information via the WACNet website.

Results and Discussion
For each WACNet station, information is recorded daily (every 15 minutes, hour, and 24 hours). Users can retrieve climate data (free of cost) summarizing information for the last seven and 30 days, both in graphical and table format from the WACNet website. Users can also download long-term climate data on both an hourly and daily timescale. For example, Figure 3 represents maximum and minimum temperatures for a 30-day period at the Heart Mountain weather station near Powell, while Figure 4 shows precipitation and soil moisture variation for 60 days at the same station.

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Contact Information
Vivek Sharma at vsharma@uwyo.edu or 307-754-2223.

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1Department of Plant Sciences; 2Powell Research and Extension Center; 3University of Wyoming Water Resources Data System; 4Wyoming State Engineer’s Office; 5Wyoming Agricultural Experiment Station; 6James C. Hageman Sustainable Agriculture Research and Extension Center; 7Department of Ecosystem Science and Management.
Figure 1. The location of WACNet automated stations across Wyoming. Most of the stations are located in irrigated areas, the highlighted areas across the map. (HPGRS=High Plains Grasslands Research Station operated by the U.S. Department of Agriculture’s Agricultural Research Service.)

Figure 2. WACNet automated weather station at Worland.

Figure 3. Maximum and minimum temperature variations earlier this year at the Heart Mountain weather station near Powell.

Figure 4. Precipitation amounts along with soil moisture at different depths at the Heart Mountain station. The vertical bars show the amount of precipitation in inches. The horizontal lines show soil moisture percentage at the following depths: lower line=5 cm depth (~2 in); middle line=10 cm depth (~4 in); and top line=30 cm depth (~12 in).