Soil moisture monitoring in grazing systems assists decision-making

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Summary

In 2013, the Barossa Improved Grazing Group (BIGG) initiated a project to monitor soil moisture in grazing systems. This involved the establishment of automatic weather stations in three local pasture paddocks and represents the first time a farming systems group in Australia has demonstrated soil moisture monitoring in pastures. Through determining the plant available water (PAW) and rate of water use in these paddocks, the project highlighted how soil moisture monitoring may be used to assist producers in making grazing management decisions. In the future, BIGG plans to further develop the soil moisture and climate data being generated from the weather stations into more useable information for producers.

Background

The BIGG is a community-driven network of five livestock production and farming groups from the Barossa region in South Australia, including sheep, beef, dairy and two local Agricultural Bureaux. The group delivers and communicates innovative projects for sustainable grazing systems while promoting natural resource management (NRM) outcomes.

During 2013 and 2014, BIGG conducted a project to monitor soil moisture in grazing systems. At the heart of the project was the establishment of demonstration weather stations located in three representative pasture paddocks throughout the Barossa region (Flaxman Valley, Keyneton and Koonunga). Each weather station comprised a sub-surface capacitance probe (Figure 1a), automatic rain gauge and sensors measuring air temperature, relative humidity and wind speed, which was connected to a solar powered telemetry unit (Figure 1b). The data output was publically available in near real-time via the BIGG website (BIGG 2016).

These weather stations represent the first time a farming systems group in Australia has demonstrated soil moisture monitoring in pastures, a practice that has proven invaluable in other agricultural industries such as horticulture and cropping. The project also highlighted how soil moisture monitoring may be used to assist producers in making grazing management decisions.

Results and Discussion

The measurement of soil moisture (between 15-85cm) throughout the project allowed PAW (the total amount of water that can be accessed by the plants) to be estimated for each pasture paddock. Significant differences in PAW capacity were determined, with Flaxman Valley estimated to be able to store 112mm of water; more than double the PAW of Keyneton (47mm), while Koonunga's was 75mm.

The PAW value, combined with an understanding of the rate which plants use the available water is critical for decision-making. To illustrate the rate of PAW use in each paddock, the available soil water capacity was graphed from the point of soil saturation (July) until near depletion (November) in 2014 (Figure 2).

The rapid use of water after August reflected the very dry spring experienced in the Barossa region, with PAW significantly exhausted by October (particularly Keyneton and Koonunga). This coupled with the dry outlook for the remainder of spring gave local producers strong reason to critically evaluate their livestock numbers and possibly sell them given the anticipated reduced pasture production. Alternatively if producers wanted to maintain their stock numbers, this information gave them an 'early signal' to seek agistment or buy in supplementary feed (given fodder tends to be more expensive if purchased later in dry periods).

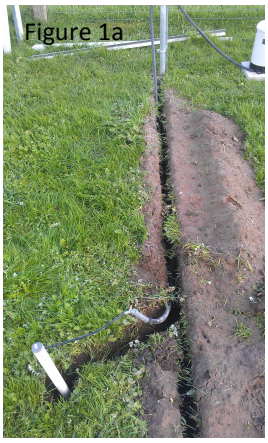

Figure 1a and 1b. The demonstration weather stations established for the project included a sub-surface capacitance probe measuring soil moisture (1a) and associated equipment measuring rainfall, air temperature, relative humidity and wind speed (1b). (Photos: B Nietschke).

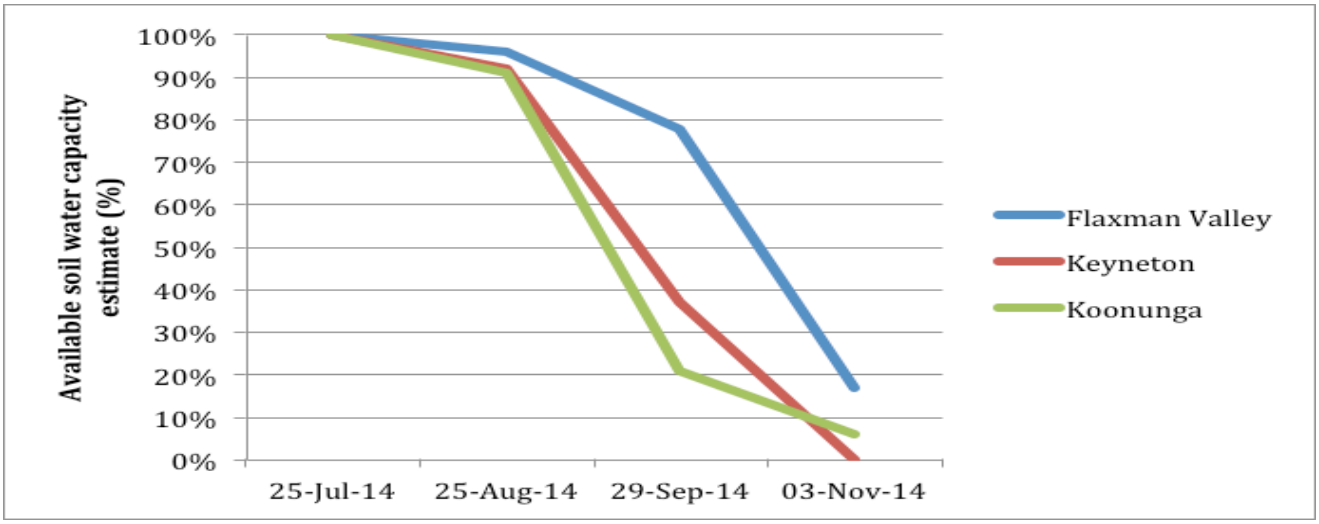

Figure 2. Change in estimated available soil water capacity of the projects three pasture paddocks that were monitored for soil moisture (July-November 2014).

An extension to using soil moisture information to assist decision making in dry periods, is the implementation of seasonal trigger points, whereby if soil moisture levels are not at desired levels by a pre-determined date(s), an action is 'triggered' to destock. The adoption of an exit strategy in this manner therefore helps producers take a proactive approach to destocking and also improves NRM outcomes by destocking before groundcover levels are compromised.

Alternatively if soil moisture levels were known to be 'above average' throughout the year, producers could use this as an opportunity to buy in stock (in the knowledge there is sufficient moisture available to produce enough pasture for the purchased stock) or sow pasture feed (in the knowledge there is sufficient moisture available to produce adequate production for grazing).

Future plans

Funding has been recently secured from Natural Resources Adelaide and Mt Lofty Ranges to continue the operation and web hosting of the weather stations until 2018. In the future BIGG would like to develop the soil moisture and climate data being generated from the weather stations into more useable information for producers, specifically pasture growth.

The use of current climate outlooks and recent weather measurements may be used to measure pasture growth rates (Rawnsley *et al.* 2015). BIGG plans to link its weather station data with weather forecasting and localised pasture monitoring information (either determined in paddock or via Pasture from Space) to model pasture growth. This tool could then be used by producers to predict pasture production for feed budgeting and stocking rates decisions.

Other applications of the climate data generated from the weather stations are to link it with forecast data to predict conditions of livestock chill and heat risk, and sheep blowfly risk.

References

Barossa Improved Grazing Group (2016). http://biggroup.org.au/project/soil-moisture-monitoring/ Accessed March 2016.

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