Agricultural Applications of SMAP Remote Sensing

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Introduction

- SMAP stands for Soil Moisture Active Passive. It is a satellite that provides data about soil moisture.
- Soil moisture is important for farmers to monitor. The amount of water that is in the soil impacts where farms are located and how much irrigation is required to produce yield.
- Monitoring soil moisture can be costly and time consuming for farmers. Monitoring equipment can cost hundreds to thousands of dollars to buy, install, operate, and interpret.
- Remote sensing of agricultural data has started to be viewed as a useful tool for agricultural producers. The United States Department of Agriculture has started to use remote sensing data to forecast crop production and costs. There is some controversy on the precision of satellites like SMAP for agriculture information (Hill, 2018).
- **I hypothesize that SMAP data will provide accurate data that farmers can use to save money on soil moisture monitoring costs.**

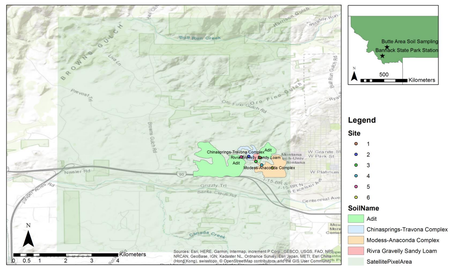

Figure 1: Location, terrain, and soil series map of Butte area soil sampling (Reichle et al., 2018) (Soil Survey Staff, 2018) (Fitzpatrick, 2012).

Methods

- Six sampling sites were chosen near Butte, MT.
- Five samples were collected from each site from June to July 2018.
- Weighed and dried the 30 samples to calculate soil moisture content.
- Conducted a soil survey to determine horizons and site characteristics.
- Acquired surface soil moisture SMAP data (Reichle et al., 2018).
- Plotted SMAP results compared to average bulk density samples.
- Regression analyses

Results

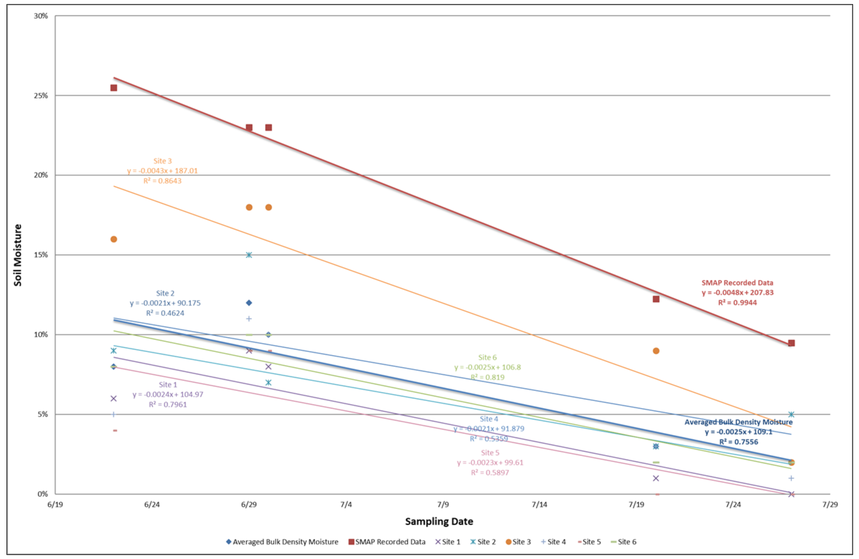

Figure 2: Individual sampling site bulk density data compared to SMAP satellite data (Reichle et al., 2018).

- SMAP data had low variance over sampling period with a 0.9944 R^2. Bannack State Park's relative comparison also displays a similar trend (Figure 1 and Figure 4).
- Bulk density sampling had low variance over sampling period with a 0.7556 R^2 (Figure 2).

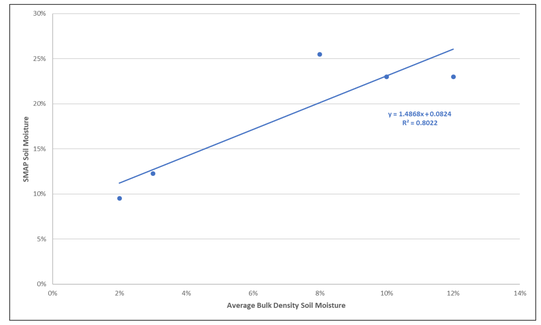

Figure 3: SMAP (Reichle et al., 2018) and averaged bulk density moisture relationship.

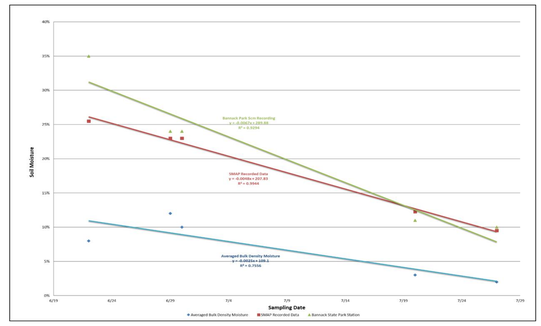

Figure 4: Soil site data average compared to SMAP satellite data (Reichle et al., 2018) and Bannack State Park recording station (Sensor Data, 2018).

Discussion & Conclusion

- Low statistical correlation (Figure 2) between SMAP and the averaged bulk density.
- Site Three had a consistently higher moisture content compared to other site locations. Site selection could be the explanation for the difference in moisture content.
- Cementing of soil in my sites could reduce the amount of infiltration and ability for water to saturate the upper layers.
- Being relatively rain shadowed, the sampling area had minimal amounts of added moisture content to soil. The data shows a nearly linear decline in moisture during the sampling period.
- The SMAP data resolution is too large compared to sampling area.
- Low statistical correlation between SMAP and Bulk density sampling.
- SMAP is not a tool for small scale agricultural operations to use as a measurement tool for their production area on a day to day basis.
- SMAP remote sensing can be a good indicator of general trends over time.

References

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