COLORADO STATE UNIVERSITY EXTENSION

AGRICULTURAL AND ENVIRONMENTAL TECHNOLOGY IN APPLIED SETTINGS

ROUTT, LARIMER, MESA, AND GUNNISON COUNTIES

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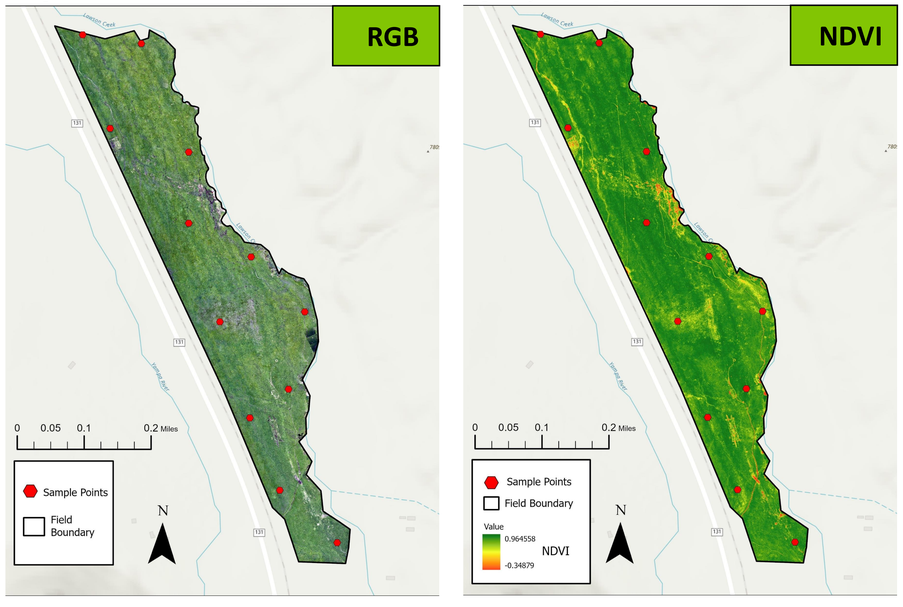
Agricultural Water Quality Program

DRONES IN AGRICULTURE

Background:
Drones can be used to collect RGB and multi-spectral imagery over a desired area. Normalized Difference Vegetation Index (NDVI) is created from individual bands to quantify vegetation greenness (Tucker & Sellers, 1986).

Goal:
Use multi-spectral data gathered by a DJI Mavic 3 drone to map pasture health and create nitrogen fertilizer management zones.

Results:
Drone imagery was captured on a mountain meadow hay grazing pasture and used to map NDVI, a common spectral index used as a proxy for crop health.

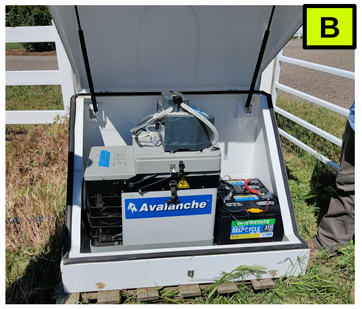


Above: Maps displaying imagery captured over a pasture in Yampa, CO

Future Work:
- Correlate spectral data to ground truth sample collection
- Use imagery and ground data to create nitrogen maps of fields
- Information collected can be used to optimize fertilizer application and protect the environment

IOT WATER SAMPLERS

A: Low-Cost IoT Sampler
- Open source
- Base price $750
- Cellular enabled (free)



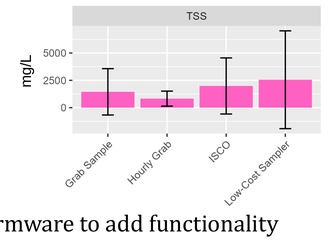
B: Commercial Sampler
- Base price $8,000
- Monitoring options
- Cellular enabled ($4000)

Background:
- Automated water samplers are used to collect water for quality analysis in environmental research
- Commercial models are cost-prohibitive for large scale research
- The AWQP developed a low-cost, IoT water sampler (LCS) to perform scalable water quality research

Goal:
Gain familiarity in the use of automated water samplers in environmental research and compare commercial and low-cost methods.

Results:
The LCS performed equally well against the commercial automated water sampler, such that it should be considered a reasonable substitute.

Right: Comparison results of total suspended solids analysis between sample methods.



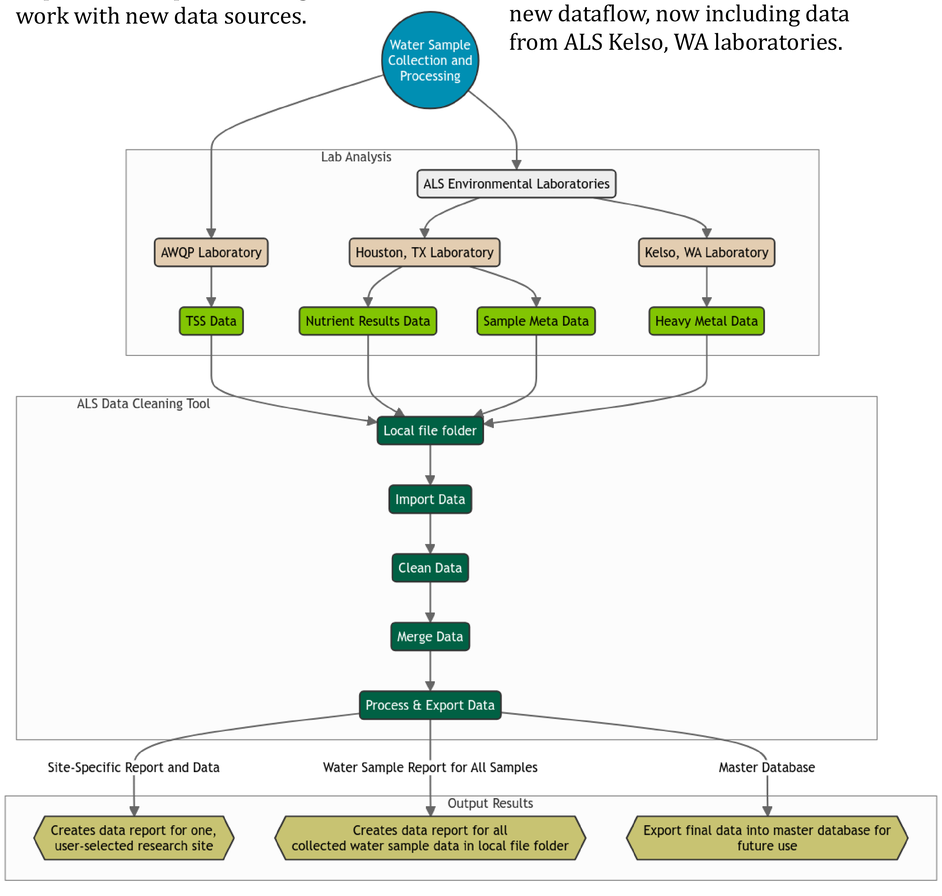
Future Work: Improve LCS firmware to add functionality

DATA ANALYSIS SOFTWARE

Background:
The ALS cleaning tool is a script written by AWQP in R Studio to gather, clean and analyze data.

Goal:
Improve and expand existing code to work with new data sources.

Results:
The below flowchart illustrates the new dataflow, now including data from ALS Kelso, WA laboratories.



Future Work: Expand code functionality in the realm of nutrient analysis and location.

LEARN MORE

AWQP Website

Lauryn's Personal Website

AWQP Low-cost IoT Sampler Code

HIGHLIGHTS

- Flew drones to map fields and collect multi-spectral data
- Learned about and utilized water samplers, collected water samples from sites across Colorado
- Assisted in improving data analysis code
- Total Suspended Solid (TSS) analysis
- Biomass and soil sampling

Above: Lauryn driving the combine harvester for the winter wheat harvest at CSU ARDEC

REFERENCES

Agricultural Water Quality Program. (2024). Agricultural Water Quality Program. Retrieved June 2, 2024, from https://agsci.colostate.edu/waterquality/

Tucker, C. J., & Sellers, P. J. (1986). Satellite remote sensing of primary production. *International Journal of Remote Sensing*, *7*(11), 1395–1416. https://doi.org/10.1080/01431168608948944

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