IGEM Grant Report

☐ Progress (due January 1) ☐ Annual (due July 31) **X Final (due August 31)**

IGEM Grant #: *IGEM26-008* Principal Investigator: *Mary Everett*
Project Title: *Turning Data into Action: Stress Testing the SCARECRO Sensing System*
Submission Date: *8/17/26* Primary Institution: *University of Idaho*

Section 1: Project and its goals

The goal of the project was finish up development work on the SCARECRO system and stress test it in the field to determine it's ability to function as a useful agricultural sensor product. The goals of the project were to finish system integration (and ensure the dashboards reflected actual needs), write system stress tests so the system could be evaluated for uptime (both in the field equipment and the decision support tool),upgrade the existing systems and deploy a new system to the UI Experimental Forest, conduct a reliability experiment for the deployments, and document the project results.

Section 2: Summary of accomplishments and future plans

The LoRaWAN hardware redesign of the Data Gator was successfully finished for SCARECRO integration, and the new printed circuit boards were ordered. The dashboard visualizations were 95% finished: a heat stress-specific dashboard that was planned is still yet to be 100% completed but should be finished by the end of the summer.

System stress tests script writing ended up being unnecessary as the data could be pulled directly from the database. The test period was adjusted to May – July to better encapsulate data after a hardware issue in Sandpoint. For both locations, the database experienced no meaningful downtime. For the vineyard, there was approximately 12 hours of downtime total during the project period due to one overloaded request error. For the organic orchard, the dashboard had no downtime. Overall, cloud components were highly reliable for the experimental period. For the infield sensors, the reliability rate was lower. Two gateways were selected as test cases for the vineyard as they had the most active sensors attached. One gateway had 77.7% message throughput, the other 81.74% (passing). The first gateway had an outage period at the beginning of the month that likely accounts for the differential. Due to an antenna issue, the apple orchard gateway was not fixed until May 28, 2026. After fixing, the message rate was 72% for the remaining days, which is below the desired rate. Overall, only 1 out of the 3 gateways made the 80% reporting target, which requires improvement. The project's source code is documented on Github and freely available.

The sensor data collected by the system proved useful for the vineyard stakeholder in assessing site-specific heat stress. The system mapped heat stress trends as part of a what-if analysis for purchasing a vine mister. It quantified the number of stress events and co-occurrence with high humidity to weigh mister interventions against the potential to introduce disease pressure from added moisture.

One goal not accomplished during the period was deployment of a unit to the UI

Experimental Forest. This is still planned for the future, but did not occur in the spring/summer due to the extremely busy schedule of the Experimental Forest during this period. It is still planned to be accomplished, ideally in Fall 2026. Overall, the system successfully collected, stored, and visualized relevant information for stakeholders to make growing decisions. However, the reliability of the gateways in 2 of out of 3 cases was 3-8% below expectation.

Section 3: Summary of budget expenditures
Please see attached budget expenditure report. A total of 127,900 was budgeted, of which 122,089.58 was spent. The 5,700.42 underspent was primarily in the personnel category (4.577.31), while there was slight underspending in travel (153.91) and other direct costs (969.20). Undergraduate research hours were not completely used during the project period, which accounts for most of the remaining budget.

Section 4: Economic development/impact
Due to the SCARECRO system efforts, UI became part of the project team in an NSF SBIR project proposal submission for the Rhyzosphere company (currently awaiting results). The project team also participated in the NSF Regional I-Corps program, and formed an equipment partnership with the SignalFire company via this effort. The project team conducted a heat stress study for Laurel Grove Wine Farm (grant industry partner), which created a what-if analysis for a vineyard mister purchase. The mister study and LoRa Data Gator integration were presented for publication at the International Conference on Precision Agriculture in July 2026. Finally, 3 undergraduate researchers received external funding via one UI research grant and 2 NSF EPSCoR programs for projects related to the SCARECRO system.

Section 5: Participants
This project engaged 3 undergraduate students, 3 graduate students, 2 staff members, and 2 faculty members during the grant period. The undergraduate students worked primarily on decision support tools for temperature monitoring and water monitoring. The graduate students finished developing the LoRa integration and completed equipment upgrades, site visits, and data analysis from the sensor records. The staff and faculty members assisted on the applications side of development and provided mentoring and feedback.

Section 6: Long-term sustainability plan
We have submitted 2 USDA NIFA grants related to the project and are still waiting to hear back on the decision. An NSF FutureCore grant on the system is planned for submission in Fall 2026. We are also planning to continue work with the Rhyzosphere company on agriculture data and are awaiting a pre-proposal decision from the NSF. We have a meeting with the Idaho Water Resources Research Institute in September to discuss expanding the utility of the system to water research.

Section 7: Please see attached report.

IGEM Expenditure Report

IGEM Grant #IGEM26-008 Principal Investigator Mary Everett

Submission Date: 8/17/26 Primary Institution University of Idaho

Expenditure Report

Personnel:
Budgeted: 99,229.33
Spent: 94,652.17
Remaining: 4,577.31
Description: The personnel category was spent on 3 undergraduate students, 3 graduate students, 1 staff member, and 1 faculty member during the grant period. The undergraduate students worked on front-end dashboard development, which resulted in improved decision support tools especially in real-time status updates, temperature monitoring, and water monitoring. The graduate students finished developing the LoRaWAN integration into the Data Gator module, conducted equipment upgrades and site visits, and conducted data analysis from the sensor records. The graduate students also joined the PI in participating in the I-Corps Regional Plus program to better understand the needs of stakeholders in the agriculture industry. The staff and faculty member assisted on the applications side of development, granting access to sites as well as giving insights and feedback on the site instrumentation. This category is underspent; not all hours were used by the undergraduate researchers during the school year.

Equipment:
Budgeted: 0
Spent: 0

Travel:
Budgeted: 1,890.67
Spent: 1,736.76
Remaining: 153.91
Description: The travel budget was not 100% spent due to slight travel plan differences. Over the grant period, several trips were undertaken: multiple to the Sandpoint Organic Agriculture Center (fixing equipment, checking on weather stations), and one to Laurel Grove Wine Farm, where previous equipment was fixed and new equipment (dendrometers and new temperature/humidity sensors) were installed. The major change from this category is the lack of trips to the UI Experimental Forest. As of this report writing date, we are still awaiting clearance and a site visit to deploy the sensor unit.

Participant Support:
Budgeted: 22,280.00
Spent: 22,280.00
Remaining: 0
Description: The participant support category was completely used on two graduate

student assistants during the 2026-2027 school year. This category covered their tuition for the academic year.

Other Direct Costs:
Budgeted: 4,500
Spent: 3,530.80
Remaining: 969.20
Description: The other direct costs category was set aside for publication charges and materials and supplies for the grant period. The materials and supplies were ordered primarily for improving/upgrading existing equipment, finishing out the LoRaWAN integration into the Data Gator module, and ordering supplies for the Experimental Forest equipment build. This category was slightly underspent; partly due to the fact that no journal publication happened during the time period. However, the results were published via two conference papers and 1 conference poster in Summer 2026 at the International Conference on Precision Agriculture. Since there is no associated journal fee with this conference's proceedings, not all funds in this category were needed.

Total Budget: 127,900.00
Total Spent Budget: 122,089.58
Total Underspent Budget: 5,700.42
Description: A total of 5,700.42 was underspent during the budget period. We had small amounts left in our travel and direct cost categories, but the majority was underspent in personnel; particularly undergraduate research expenditures. While not all budgeted hours were used this category, most of the dashboard/decision support was completed within the project period.

Plans for Expenditure:
It is our understanding that the surplus is not permitted to be spent outside of the project period.