IGEM Grant Report *send to HERC@edu.idaho.gov*

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

IGEM Grant #: 25-004 **Principal Investigator:** Kathleen Lohse

Name/Full Title: Demonstration of Soil Thickness and Carbon (STC) Method
Submission Date: July 15, 2026 **Primary Institution:** Idaho State University

Section 1: Project and its goals - We took a proof of concept of a model predicting soil thickness and carbon stocks to demonstrate its utility across diverse terrains for commercial marketing. Our goals were as follows: 1) Conduct elevation terrain analysis to identify field areas across the contiguous United States, 2) Evaluate predicted soil thickness and carbon based on STC method to observed values, 3) Develop a demonstration model exhibiting use of method across diverse terrain and also identify limitations, and 4) Simultaneously conduct market research and develop a business plan.

Section 2: Summary of accomplishments and future plans - We completed 13 field areas across a wide climatic and lithologic gradient to test and validate our method (**Figure 1**). A full-time research specialist processed and analyzed 1161 samples from 144 profiles in the lab, because Co-PI Patton accepted a Visiting Assistant Professor position at ISU during the academic year (Fall 2025-Spring 2026). We registered all samples to the SESAR database (*Link*). We determined soil thickness for every profile and analyzed samples for carbon and nitrogen, with over 90% of the soil samples completed; the remaining are in a queue to be completed by August, 2026. A subset of samples was run for radiocarbon and optically stimulated luminescence (OSL). Patton produced technical product reports and published these as DOI's. Patton honed the workflow and developed a demonstration visualization model as a Google Earth layer/flight path (**Figure 2**).

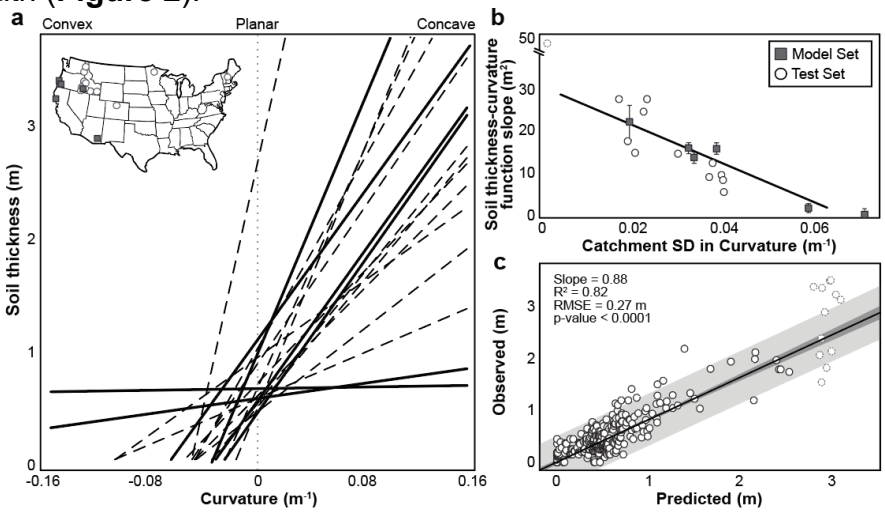

Figure 1: a) *Soil thickness-curvature trends for the six and thirteen model (dashed lines) and validation sites (solid line), respectively. In general, soils are thinnest on convex hillslopes positions and thicken with increasing concavity.* ***b)*** *The slope of this function is dependent on the catchment-wide standard deviation (SD) of curvature with smoother topography (lower values) depicting steeper slopes whereas rougher topography (higher values) having shallow slopes.* ***c)*** *Validation of method at the twelve sites from 156 soil pits. Note, largest variations from best-fit line are correlated to loess deposition.*

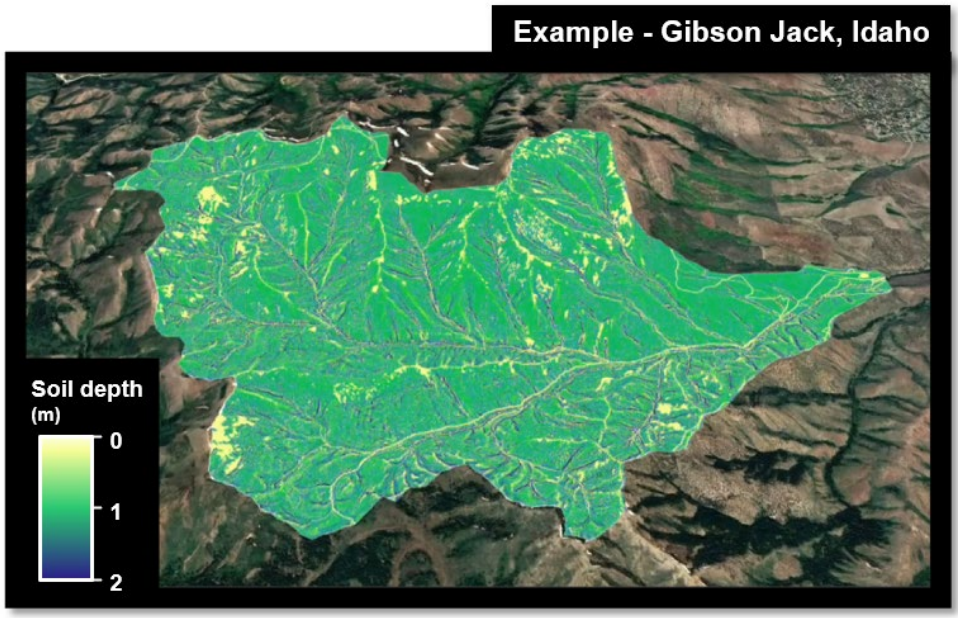

Figure 2:) *Soil thickness map product produced as a* GoogleEarth layer/flight path *for Gibson Jack watershed, Idaho.*

Section 3: Summary of budget expenditures - We have spent $**147,831.63 out of the $149,193.26,** leaving **1,361.37 or 0.9%**. In February 2026, we rebudgeted because we needed additional salary to support Patton in the summer to complete reporting products. We ended up underspending salary by $8k because in May, our research specialist resigned and left us with approximately 2 months of salary. We ended up overspending in services/M&S because in addition to soil analyses, our water system, which was critical for soil textural analyzes, had a catastrophic leak and needed repair to complete analyses. Finally, we also serviced our discrete analyzer that was being used for soil nutrient analyses. We underspent in travel. The original budget was more comparable to our spending.

Section 4: Economic development/impact - We have continued to engage with private sector and are working toward an industry partner. We attended a geophysics conference to interacted with 5 potential industry partners). We received continuation of our patent, U.S. Patent No. 12,405,261, in August. We registered our domain name as *Grounded Technologies*, and plan to create a legal business in in November 2026. We created two and half full time and two temporary positions.

Section 5: Participants - Two faculty (Lohse, Patton), 1.5 research specialists, and 2-4 students participated. Students and staff were involved in field collections, processing samples, and analyzing them for soil carbon and other properties.

Section 6: Updated details and/or progress on the long-term sustainability plan for the project and description of future plans for project continuation or expansion. We plan to submit a National Science Foundation Translation to Practice (NSF TTP) Type T grant in the fall (due Nov 2026).

Section 7: Expenditure Report –

Expenditures					
Operating	**Original budget**	**Modified Budget**	**Actual Expenses**	**Budget Available**	**Budget % difference**
Salaries	$49,516	$58,991	$50,767	$8,224	-13.94%
Irregular Help	$22,080	$29,311	$31,906	($2,595)	8.85%
Fringe Benefits	$17,459	$21,343	$19,754	$1,589	-7.45%
Subtotal	$89,055	$109,645	$102,427	$7,218	-6.58%
Travel	$24,000	$17,410	$14,238	$3,172	-18.22%
Services	$25,138	$17,138	$25,686	($8,548)	49.88%
Supplies	$11,000	$5,000	$5,481	($481)	9.62%
Subtotal	$60,138	$39,548	$45,405	($5,857)	14.81%
Total All Expenses	**149,193.26**	**149,193.26**	**147,831.63**	**1,361.37**	**0.9%**