2021_SSP Faculty Projects

Row 9

Research Group	Embree
Project Title	**What's the dirt on ASC? Baseline geo-biochemical findings.**
Research Question, Hypothesis, or Conjecture	After characterizing geological, historical, structural, chemical, and biological baseline information about ASC soil samples, how much carbon can we estimate is currently sequestered within the ASC footprint? How does that estimate compare with a native grassland referent? What is the potential for carbon capture with improvement of soil health?
Project Description	This 8-week project is a pilot study for a larger, longer-term project. In coordination with the Office of Sustainability, I am developing a Sustainable Agriculture Research & Education (SARE) Program proposal for a 2-year project aligned to ASC's goals of achieving carbon neutrality by 2037, and engaging and educating the campus community on sustainability best practices. The larger project will take a systems approach to analyzing ASC's ecosystem inputs, outputs, and cycles through biological, economic, social, political, and geochemical systems, focusing on carbon and nutrient cycling. We will examine waste diversion as a starting point for creating more regenerative loops in our local foodshed and watershed. Goals of the long-term project will be to 1) improve sustainability at ASC and at local organic farms by finding complementary inputs and outputs of "waste" for regenerative agriculture, and 2) improve food equity within our local (Dekalb County area) foodshed by connecting our ecosystems, and 3) reduce the destructive impact of storm water runoff by improving soil health and water retention capacity. We will begin the larger project with this 8-week summer pilot study to investigate and characterize ASC soil health using validated measures, including soil organic carbon, cation exchange capacity, and water infiltration rate. Objectives for the pilot project will include describing geological, historical, structural, chemical, and biological profiles of soil. Baseline indices of soil health on campus will allow estimation of amount of carbon currently sequestered within the ASC footprint. These indices will also allow an estimated calculation of the carbon-sequestering potential within our footprint, which can inform our decision-making about strategies to reach our carbon neutrality goal on time. While the pilot study will use a number of field and lab tests that might be used in labs adapted for courses in biology, chemistry, ecology, and environmental sciences, this research project will differ substantially from traditional coursework. We are pursuing real-world questions about Agnes Scott's soil carbon bank and about its potential to sequester more carbon; we are pursuing real-world questions about how ASC can improve its soil function, thereby improving its watershed function and our urban microclimate. As in all authentic research, the answers are currently unknown. We will ground our work (unavoidable pun in this line of research) in the current theoretical and empirical literature on regenerative soil health, and we will use quantitative, analytic methods from multiple disciplines to evaluate our questions. Baseline results are simply the quantitative answers to specific questions about soil structure, texture, biology, chemistry, and function. The more valuable,

	intellectual component of the work will be to examine our findings within a systems view that takes into account Agnes Scott's role as a civic leader, with the ability to effect real change in our biological, economic, political, and social systems. We aim to synthesize our findings to begin to answer the larger question of how Agnes Scott can create specific, tangible, attainable changes to improve our climate resilience.
Introductory References	1) For a fun overview, watch the documentary "Kiss the Ground" on Netflix or with library access. 2) Leake, J. R., Renforth, P., Edmondson, J., Manning, D. A. C., & Gaston, K. J. (2011). Designing a carbon capture function into urban soils. Urban Design & Planning: Proceedings of the Institution of Civil Engineers, 164(2), 121. (3) Sustainable Agriculture Research & Education (Program), National Institute of Food and Agriculture (U.S.), & Drinkwater, L. E. (2016). Systems research for agriculture: innovative solutions to complex challenges / by Laurie E. Drinkwater ; with Diana Friedman and Louise Buck. iv. – preface & ch. 1.
Project Timeline (weekly), during June 1 - July 31	Week 1: receive assignments, block schedules, make appts, literature review; define Q Week 2: lit review, extra Q lit search, first soil tests (structure, texture, pH), summarize results Week 3: lit review (every week), soil test validation, 2nd soil tests (water infiltration, etc), results Week 4: soil tests (chemistry) & summary, create tables, draft figures, continue review Week 5: soil tests (biology) & summary, improve tables & figures; continue review Week 6: draft lightning talks & video poster; peer feedback; review & editing Week 7: practice lightning talks & edit; edit video poster & video documentary Week 8: deliver lightning talks; demo video poster; receive feedback & plan refinements
Expected Learning Outcomes	1. seek & leverage librarian guidance for focused literature search strategies 2. collaborate to build and effectively use a zotero research library 3. summarize research objectives and literature & experimental findings in tables. 4. Create and license an original scientific figure describing research process & methods. 5. Craft, edit, and deliver lightning talks designed for different audiences. 6. Effectively use NRCS, SHI, and other digital resources to extract targeted info for integration into project. 7. Conduct soil tests according to validated protocols. 8. Record precise and accurate data. 9. Describe historical, geological, structural, chemical, and biological characteristics of soil samples. 10. Evaluate results of soil tests in context of literature & make recommendations to improve soil health or to refine research protocols.
Research Team & Environment	The team will be Dr. Embree and 1-2 undergraduate students. There are no grad students or postdocs in the team, but we will reach out to various other research and regenerative agriculture groups in the local area (Emory, Rodale Institute, local farmers) to look for collaborators going forward. Dr. Embree seeks students whose instrinsic interests & goals match the topic in some way, who can follow through on plans with self-initiative, and who want to get the absolute most out of a research opportunity.
Project Duration	8 weeks
Project Dates	June 1 - July 31
Institutional Approvals	NA

Required Trainings_each student	none required
# of full-time student positions requested (1-3)	Two students requested
Minimum Requirements (for research novices)	BIO 110 OR ESS 101; doesn't mind getting dirty/muddy!
Requirements for Advanced students	none
Recommended Preparation (but not required)	Think about questions of your own that might connect to the study.