Project Name: Urban Food Forests for Healthy Soils
Ref#: C148
Contact: Joy Winbourne, Assistant Professor

Progress on deliverables and objectives.

We have made several significant advancements towards our goals and objectives that we outline below:

- We have established the proposed food forest at UML in the summer of 2024 and continue to monitor micro-meteorological conditions, biogeochemical cycles, and anthropogenic resource contributions to maintain sites (irrigation, mowing, etc) at both the food forest site and nearby lawn. Figure 1 shows images of each field site from this August and Fall, illustrating how we have completed our first set of plantings at the food forest site and installed several benches and a shed with attached greenhouse suitable for propagating seedlings/saplings for future planting efforts (all with in-kind contributions). We have completed the installation of the meditation labyrinth with proposed funds as planned.

Figure 1. Pictures showing the completion of the food forest site and instrumentation of both the food forest site and nearby reference lawn.

- We are continuing to monitor micro-meteorological and soil conditions using HOBO sensors (in-kind contributions) that were installed in April 2024. These sensors continuous monitoring of soil moisture, soil temperature, solar radiation inputs, air temperature and air humidity. We have also continued to make measurements of greenhouse gas fluxes with undergraduate assistant supported by the grant. Figure 2 shows preliminary data from this August on carbon dioxide fluxes from soils (or soil respiration) – the primary pathway by which carbon leaves an ecosystem. We installed three pairs of soil respiration collars to monitor respiration at the food forest and additional three lawn sites across UML south campus, as well as areas with more traditional landscape mulching around open ground trees. Among traditional landscape areas we are finding rates of soil respiration consistent with those observed in the literature (for which we are only aware of one other study in Boston, MA) with elevated rates of soil respiration in areas with mulch. Perhaps unsurprisingly we found very high rates of soil respiration in our raised beds (comprised of loam and mulch). We are currently investigating why this might be the case, both by conducting more in-depth QC/QA analysis on raw datasets and determining potential physical drivers such as irrigation (with continuous soil moisture sensors) and nutrient availability.
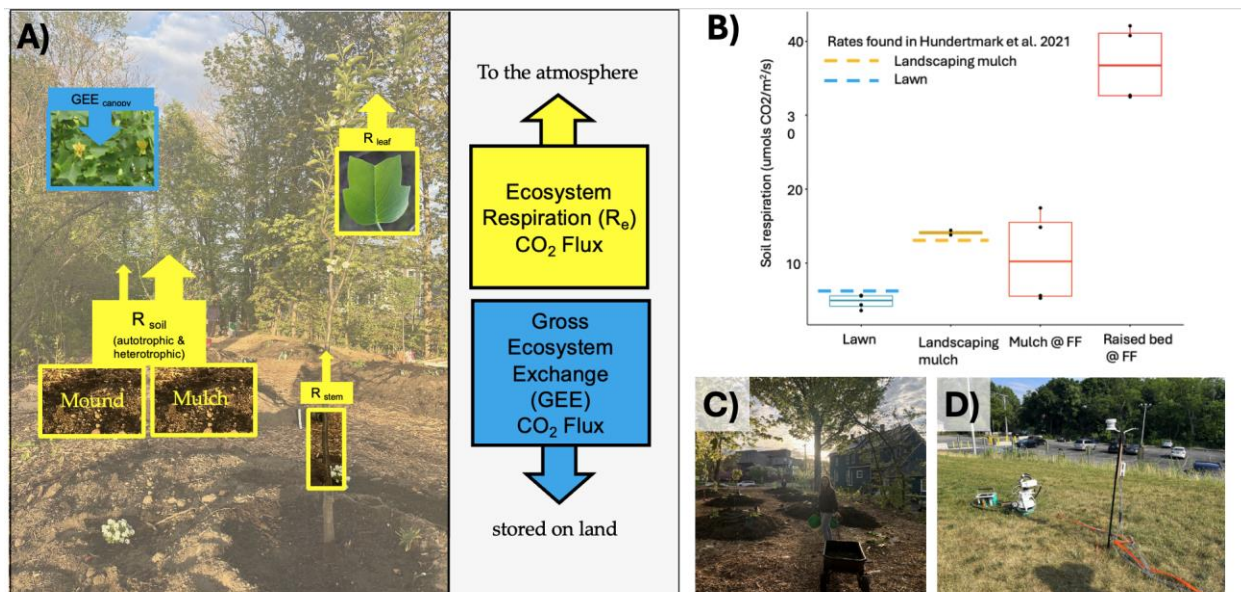
Figure 2. A) Figure demonstrating the measurements being made to conduct site level carbon budget; **B)** Preliminary data on soil respiration rates among areas within the food forest (red), nearby lawns (blue), and classic landscape mulch (yellow). Dashed lines show rates found in similar landscape types by study conducted in Boston, MA by Hundertmark et al. 2021. **C)** Picture showing food forest; **D)** Picture of lawn site with instrumentation for measuring fluxes.

- We have conducted an end of the growing season soil sampling effort at proposed site and archived soil and mulch samples in a minus 80 degree Celsius freezer for future analyzes. Samples are currently being processed for quantification of soil organic matter and nutrient pools.
- The graduate student Alana Smith will be leading the efforts on developing the life cycle assessment framework for the food forest ecosystem services with her advisor Dr. Burek. This work is part of her dissertation research. She has successfully defended her dissertation proposal which included her approach for generating the life cycle assessment framework. She is currently working on addressing feedback raised by her committee members.

Any delays or changes to the overall implementation schedule?
There was an initial delay for project start date (August 1 instead of June 1), however, with our in-kind contributions we were able to get everything we proposed started in beginning of growing season.

Financial or budget update can include funds spent so far, amount invoiced for, amount reimbursed and any matching funds that have been utilized.
We are working now on invoicing for expenses. Expenses that will be invoiced in end November include funding for graduate student Alana Smith and undergraduate research assistant, installation of the meditation labyrinth, and supplies for quantification of soil nutrient pools.

How are you doing on outreach?
We are being to organize spring workshops we have proposed to conduct. We have connected with new group, regenerative roots association in Nashua, NH, to locally

source plants for spring planting. Alana Smith and Joy Winbourne gave a talk at Hampshire College on preliminary findings and visited the Hampshire College food forest. We have launched a website hosted by the UML RIST institute and an email for directing questions regarding the project (food_forest@uml.edu). Additionally funds have been donated to generate a sign for the site which we hope will also help generate continue to engage the community with the site. In June 2024 Dr. Winbourne organize the first Lowell food forest tour with members from the City of Lowell, Audubon Society, Mill City Grows, Lowell Parks and Conservation Trust, University of New Hampshire, and Boston Food Forest Coalition. This included tours of the UML food forest and Pawtucket Farm (site of a future food forest). Several classes at UML have had field trips at the UML food forest site including Dr. Winboure's Soil Science course where they conducted soil tests. Dr. Jessica Wilson's (adjunct professor at UML and City of Lowell urban planner) brought her course in urban planning for environmental justice for site visit. Dr. Hamilton's Ecology field course for a second year in a row made estimates of biodiversity at the site.