**Target Audience**

Target audiences included leaders in climate, natural resource, and agroecosystem fields, farmers, K-12 teachers, and the general public.

**Project Summary, Goals and Objectives**

The goal of our project is to provide stakeholders--organic dairy farmers and organic dairy industry--with science-based information and decision support systems on grazing practices that maximize soil carbon (C) sequestration and minimize soil greenhouse gas (GHG) losses, particularly during the transitional period from conventional to intensively managed, organic systems.  We will accomplish our goal through a combination of 1) measurements of soil organic carbon (SOC) stabilization and GHG emissions at three organic dairy farms located throughout the Northeast; 2) modeling that simulates soil C storage and GHG losses in intensively grazed pastures; 3) refinement of the Northeast Dairy Emissions Estimator (NDEE) to reflect soil C and GHG dynamics with intensive grazing; and 4) dissemination of our research products, both through direct extension and via eOrganic and the USDA Northeast Climate Hub.  We define our measurements and modeling as research, our dissemination of research products as extension, and our work refining and training stakeholders to use the NDEE as the integration across our efforts.  Our specific objectives include:

1. Quantifying SOC stocks with MIG at three organic dairy farms throughout the Northeast at different stages of transition to intensive, organic pasture management;

2. Investigating drivers of soil carbon stabilization with grazing, i.e., biomass production and allocation, N inputs, soil organic matter decomposition, bulk density, and time;

3. Measuring soil N2O emissions in grazed and ungrazed pastures and comparing them, in net global warming potential (GWP) equivalents, to changes in SOC stocks;

4. Developing a grazing-specific version of the biogeochemical model Manure-DeNitrifcation-DeComposition (DNDC) using data collected in objectives 1, 2, and 3;

5. Refining the NDEE using the updated Manure-DNDC model generated in objective 4;

6. Hosting workshops at regional gatherings that train stakeholders to use the refined NDEE developed in objective 5 to understand how they might build soil C stocks and minimizes soil greenhouse gas losses;

7. Developing webinars on the NDEE, writing extension bulletins on soil C and GHG losses with pasture management, publishing research papers describing our results, and broadly disseminating these products through eOrganic and the USDA Northeast Climate Hub; and

8. Using feedback from producers, industry, and other stakeholders to define future research questions.

**What was accomplished under these goals?**

During the first year of the project, we primarily focused on Objectives 1 through 3 in accordance with our proposed timeline. To meet Objective 1, we conducted a spatially intensive soil sampling effort at all of our study sites and are currently in the process of analyzing soil samples for total SOC stocks as well as physiochemical fractions to determine mechanisms of C stabilization (Objective 2). We also conducted a spatially and temporally intensive measurement campaign of greenhouse gas emissions at our study sites (Objective 3), which span a range of management, edaphic, and climatic conditions. In preparation of addressing Objective 4, we have begun compiling management data required for modeling and have also developed modeling architecture for simultaneously running different versions of the DNDC model as well as other biogeochemical models such as DayCent. Regarding Objective 7, we have disseminated initial project findings and described overall project goals in both formal and informal venues involving a variety of stakeholders.

**What opportunities for training and professional development has the project provided?**

In Y1, the primary avenue for training and professional development was an informal discussion we held at the UNH Organic Dairy Research Farm with a group of high school Earth science teachers describing the project and discussing ways in which teachers can use project goals and activities as context for developing novel and hands-on Earth science curricula in their classrooms.

**How have the results been disseminated to communities of interest?**

In addition to the training and professional development activities outlined above, we have disseminated results to communities of interest through both formal and informal activities, reaching a broad array of stakeholders. These include:

A research demonstration at one of our study sites, Wolfe's Neck Farm, for NRCS soil conservationists, directors of the USDA Northeast Climate Hub, American Farmland Trust, and farm staff showing our soil and trace gas monitoring protocols and brainstorming synergies between our research and 1) baseline soil sample collection for the National Soil Health Assessment effort of which Wolfe's Neck is a member; 2) a USDA Climate Hub virtual farm tour featuring our ongoing research and education initiatives; and 3) open source platforms for collecting and disseminating our agroecological data and management information for decision support.

A pasture walk sponsored by NOFA Vermont and Organic Valley at another farm within our study, Franklin Farm, that featured informal discussions of pasture improvement, herd health, and agroecosystem management for building soil organic matter while reducing greenhouse gas emissions.

A formal presentation plus informal discussion at the Harvard Forest Grazing and Conservation seminar describing project goals and objectives to a group of regional dairy farmers, land trust representatives, farm advocacy groups, and scientists.

Participation in a short film for international distribution as part of the by the G8 Global Open Data for Agriculture and Nutrition (GODAN) initiative.  Our role in the film was to show how our ongoing measurements of soil biogeochemical processes and real-time monitoring of soil microclimate can contribute to an emerging movement among citizens, farmers, and scientists to promote sustainable agriculture through open source and transparent data collection, modeling, and decision support tools.

**What do you plan to do during the next reporting period to accomplish the goals?**

During the second year of the project, we will conduct an additional year of soil greenhouse gas emissions measurements and will complete physiochemical analysis of soil samples. We will also begin development of a grazing specific version of Manure-DNDC (Objective 4) and use model results to begin refining the NDEE (Objective 5). We will continue to engage stakeholders in a variety of informal and formal settings (Objective 6), and will also increase our visibility to the broader public through the eOrganic and the USDA Climate Hub (Objective 7). Already we are collaborating with eOrganic to build a project website and coordinating with the Climate Hub to be featured in their virtual farm tour of Wolfe’s Neck Farm. We will also prepare publications for both extension and peer-reviewed journals.