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GRL-FLUXNET: A Network of Integrated Flux Measurement Systems in the Southern Great Plains

Grazinglands Research Laboratory, El Reno, Oklahoma May 2017

Rationale: Accurate estimation of carbon and nutrient dynamics and evapotranspiration (ET) across space (point, plot, and landscape) over time is vital to quantify carbon, nutrient, and water balances. Eddy covariance (EC) technique is recognized as the standard method to measure exchange of energy, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and ET between terrestrial ecosystems and the atmosphere at landscape levels. Such data on major agroecosystems is essential to develop, test, and improve crop and hydrologic models, satellite-based production efficiency, and ET models from local to global scales. In addition, this will lead to better understanding of the potential of agroecosystems to mitigate rising atmospheric CO_2 and other greenhouse gases and their effects on climate change. Microbes play a key role in carbon and nitrogen cycles in agroecosystems. To understand how climate change and/or management alternatives could affect the ecosystem services, we also have to understand how soil microbes respond to the environmental variations. However, availability of such a comprehensive dataset for major agroecosystems in the U.S. Southern Great Plains is limited.

Objective: Monitor and develop a comprehensive database consisting of surface energy, water, carbon, nutrient budgets, and soil biology of a diverse range of terrestrial ecosystems in the U.S. Southern Great Plains to support ARS Grand Challenge Research Goals on soil and water quality, sustainable crop production, and mitigation of GHG emissions.

What we are doing: The GRL-FLUXNET is a network of integrated flux measurement stations coupled with static chambers for measuring GHG emissions established in 2016 to develop a comprehensive database for development, evaluation, and enhancement of various environmental and ecological models. This network is located within the 3,000 ha USDA-ARS Grazinglands Research Laboratory (GRL) in El Reno, Oklahoma. It is currently consists of 14 eddy covariance systems to measure exchanges of CO_2, H_2O, CH_4, and energy fluxes between the atmosphere and a diverse range of terrestrial ecosystems including native and introduced tallgrass prairie pastures, burned and unburned prairie pastures, alfalfa, and grazed/non-grazed winter wheat, canola, and other forage crops under till and no-till practices. Data on biometerological variables (LAI, % cover, canopy height, and biomass), soil chemistry (total soil C and N, extractable soil C, NO_3, NH_4, and basic organic acids) and soil microbial community are being collected periodically at the study sites. In addition, measurements of surface reflectance (400-2400 nm range), surface temperature, net radiation, photosynthetically active radiation, and soil heat fluxes are being made. Chamber-based measurements of three major greenhouse gases (CO_2, CH_4, and N_2O) and soil heterotrophic respiration are being carried at all sites. Efforts are also being made to acquire very high resolution hyperspectral and thermal images of the integrated flux measurement sites.

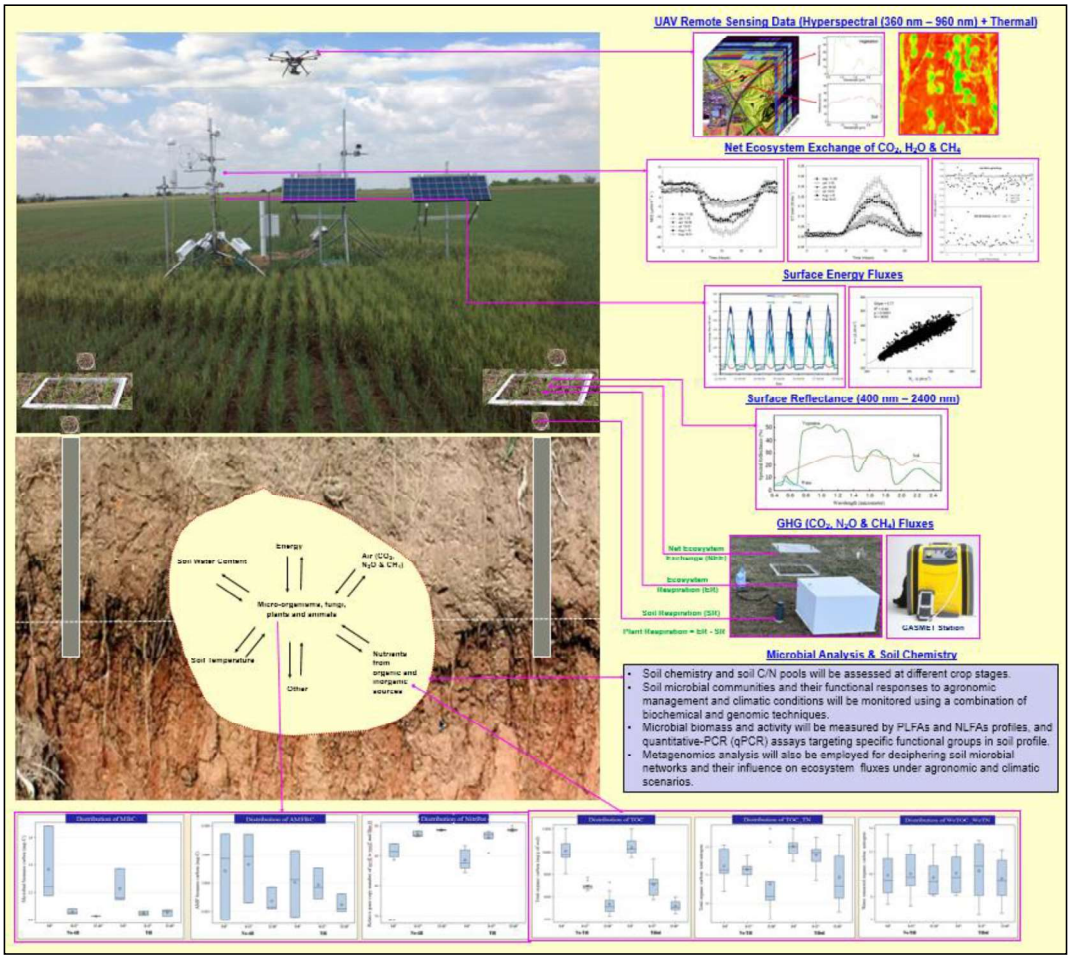

Fig. 1. An integrated flux measurement system.

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