Terrestrial Ecosystem Sciences program

Introducing FRED: A growing Fine-Root Ecology Database

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Variation and tradeoffs within and among plant traits are increasingly being harnessed by empiricists and modelers to predict ecosystem processes in response to current and future environmental conditions. While fine roots play an important role in ecosystem processes, most fine-root traits are extremely underrepresented in global trait databases. The lack of available and centralized data has hindered efforts to analyze fine-root trait variation at a global scale, and limited meaningful linkages among above- and belowground traits. Together, these limitations have contributed to the coarse representation of fine-root processes and associated parameters in terrestrial biosphere models. To address the need for a centralized fine-root trait database, we are compiling the Fine-Root Ecology Database (FRED) from published literature and datasets as well as unpublished sources; data collection is ongoing and will continue for the foreseeable future. To date, FRED contains ~39,000 species-specific trait observations from 936 species, and ~15,000 trait observations collected from mixed plant communities. In total, these observations encompass approximately 170 root traits. The observations housed in FRED are from ecosystems spanning the globe, but the data compiled thus far highlight in stark relief the *observations that are missing*. This is particularly striking for polar and boreal regions underlain by permafrost or characterized by organic soils, as well as tropical regions. In order to fill gaps in our global understanding and modeling of root traits and processes, we are focusing our belowground efforts in the SPRUCE (http://mnspruce.ornl.gov/) and NGEE Arctic (http://ngee-arctic.ornl.gov/) projects on quantifying the morphology, phenology, and depth distribution of fine roots, and linking these traits with ecosystem processes and environmental gradients.

FRED will be available to the broader community of modelers, root and rhizosphere ecologists, and applied ecological communities with unrestricted access through a website hosted by ORNL (roots.ornl.gov); we are targeting a release date of late 2016. We recognize that a considerable number of discrete trait datasets still reside with individual researchers, and we are actively encouraging the broader scientific community to contribute published past and future datasets to FRED. The website will serve as a location for the broader community to contact us and provide input or additional sources of data, and will also be used for communication and updates.

FRED is both global and growing, but more work is needed to improve our understanding of fine-root traits and their contribution to ecosystem processes, now and in the future.