SON Number: RCSON-13-02 **October 27, 2011**

Strategic Environmental Research and Development Program (SERDP)

FY 2013 STATEMENT OF NEED

Resource Conservation and Climate Change (RC) Program Area

IMPROVED UNDERSTANDING OF SOIL ECOLOGY TO MEET DEPARTMENT OF DEFENSE NATURAL RESOURCE MANAGEMENT CHALLENGES

1. Objective of Proposed Work

The objective of this Statement of Need (SON) is to improve our fundamental and applied understanding of the abiotic, biotic, and functional aspects of the soil ecosystems associated with terrestrial ecosystems of concern to Department of Defense (DoD) natural resource managers in the lower continental United States and Alaska. Research proposals are sought that improve our understanding of soil ecology in relation to its role in (1) mediating native species versus non-native invasive species (NIS) interactions and (2) facilitating the recovery of degraded ecosystems.

Research needs include but are not limited to improvements in our understanding of the following to address either or both of the research objectives identified above:

1. Abiotic, biotic (i.e., soil biota), and functional aspects of soils associated with the study ecosystem. Of particular interest is an understanding of the functional diversity of the soil biota and the role of key taxa in maintaining desired functional attributes.
2. Processes by which desired soil properties and associated biotic communities are degraded by human activities and mechanisms to restore such properties and communities. Of interest is the role that restored soil communities may play in facilitating recovery of degraded terrestrial ecosystems.
3. Role of ecological processes, including disturbance, in determining the functional attributes of soil communities.
4. Role of soil in carbon and nitrogen cycling and how such cycles may be adversely impacted by regional (e.g., nitrogen deposition) and global change (e.g., climate change and climate variability) stressors. Of particular interest are changes in soil biotic communities that may act as a priori indicators of potential regime shifts in soil ecosystems.
5. Role of soil in mediating interactions between native species and NIS. Of interest is whether management of soil abiotic and biotic attributes can be used as an NIS control strategy.
6. Innovative approaches to the study of soil ecology and their implications for management that are cost-efficient and transferable across different soil ecosystems.

Proposals submitted in response to this SON may address one or more of the research needs listed above. Proposals should clearly articulate how proposed fundamental and applied research leads to an improved understanding of soil ecology in relation to its role in (1) mediating native

species versus non-native invasive species (NIS) interactions and (2) facilitating the recovery of degraded ecosystems. Proposals submitted in response to this SON may address one or more ecosystem. Overlying surface features, such as biotic crusts, are considered part of the soil ecosystem for purposes of this SON; however, proposals associated with permafrost will not be considered under this SON.

2. Expected Benefits of Proposed Work

The desired outcome is knowledge that improves our understanding of: (1) the abiotic, biotic, and functional aspects of the soil ecosystems associated with terrestrial ecosystems of management concern to DoD natural resource managers, (2) how aspects of soil ecology can be managed to mediate native species versus NIS interactions, and (3) how aspects of soil ecology can be managed to facilitate the recovery of degraded ecosystems.

3. Background

Soil ecology is the study of the interactions among soil organisms and also the interactions between these biotic elements and the abiotic aspects of the soil environment. Of particular relevance is how the ecology of soil relates to the: (1) cycling of nutrients, carbon, and water; (2) formation and stabilization of soil structure, chemical makeup, and functional attributes; (3) biodiversity of soil and how it shifts under different environmental conditions; and (4) how all of the preceding relate to environmental challenges mediated by soil today and under future global change.

Of interest to DoD natural resource managers is how to use an understanding of soil ecology to assist in addressing their particular management challenges. This is in keeping with a holistic, ecosystem-based approach to management that recognizes it is insufficient to be concerned only with the condition of the above-ground vegetation and that in most cases above- and below-ground ecosystem conditions are inextricably linked. Moreover, much of the land currently used by DoD for training and testing had prior land uses that resulted in legacy impacts to the local soils, especially if these lands had been in prior agricultural production. Current and past military uses differ in intensity, frequency, and spatial extent with respect to the effects on soil ecology and cause new and ongoing impacts. A significant portion of lands used for training and testing occur in areas where biotic crusts play a primary role in soil ecology and yet these crusts have been heavily impacted by past and current land uses.

Soil degradation can lead to both military readiness and stewardship impacts. Soil condition affects trafficability, dust generation, and erosion and surface water runoff potentials. Poor soil condition may affect the health of above ground vegetation, alter biogeochemical cycles, and decrease overall ecosystem resilience to other environmental stressors. Disturbed soils may facilitate the establishment of ruderal species, many of which could be NIS, and could complicate attempts to recover degraded terrestrial ecosystems. As carbon sequestration and storage become important considerations, the role of soil in carbon cycling requires improved understanding.

Effects on soils are not just a result of local phenomena. Altered nitrogen deposition patterns arising from human sources and activities, as well as the artificially added amounts of biologically available nitrogen in the environment attributable to humans, have altered nitrogen

cycles at regional scales. Climate change will alter soil temperature and moisture conditions at global scales. These phenomena will have to be considered, in addition to the stressors of local origin, for their impacts on: (1) soil ecology, including potential compositional shifts in soil biota; (2) rates and nature of chemical reactions, and how these affect soil attributes; and (3) the strategies available to managers for addressing these challenges.

4. Cost and Duration of Proposed Work

The cost and time to meet the requirements of this SON are at the discretion of the proposer. Two options are available:

Standard Proposals: These proposals describe a complete research effort. The proposer should incorporate the appropriate time, schedule, and cost requirements to accomplish the scope of work proposed. SERDP projects normally run from two to five years in length and vary considerably in cost consistent with the scope of the effort. It is expected that most proposals will fall into this category.

Limited Scope Proposals: Proposers with innovative approaches to the SON that entail high technical risk or have minimal supporting data may submit a Limited Scope Proposal for funding up to $150,000 and approximately one year in duration. Such proposals may be eligible for follow-on funding if they result in a successful initial project. The objective of these proposals should be to acquire the data necessary to demonstrate proof-of-concept or reduction of risk that will lead to development of a future Standard Proposal. Proposers should submit Limited Scope Proposals in accordance with the SERDP Core Solicitation instructions and deadlines.

5. Point of Contact

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For Core proposal submission due dates, instructions, and additional solicitation information, visit the SERDP web site at www.serdp-estcp.org/Funding-Opportunities/SERDP-Solicitations.