

**Strategic Environmental Research and Development Program  
(SERDP)**

**FY 2016 STATEMENT OF NEED**

**Resource Conservation and Climate Change (RC) Program Area**

**CHANGES IN PATHOGEN EXPOSURE PATHWAYS UNDER NON-  
STATIONARY CONDITIONS AND THEIR IMPLICATIONS FOR  
WILDLIFE AND HUMAN EXPOSURE ON DEPARTMENT OF DEFENSE  
LANDS**

**1. Objective of Proposed Work**

The objective of this Statement of Need (SON) is to improve our fundamental and applied understanding of how non-stationary conditions of land cover, land use, management practices, climate change, and vector population dynamics may affect pathogen<sup>1</sup> exposure pathways and ultimately impact wildlife and military personnel in training environments on Department of Defense (DoD) installations in the United States (U.S.) and its territories.

Research needs include developing or improving our understanding of each of the following:

1. Ecology of potential pathogens and, as applicable, their vectors of concern on DoD lands as this relates to wildlife and human exposure.
2. Plausible scenarios of future change that may impact exposure pathways for wildlife or humans and disease severity.
3. Modeling frameworks based on the preceding that also consider current or emerging theory on species niche changes under non-stationary conditions. Models are needed that can project within testable and adaptable frameworks how exposure pathways and disease severity may change in the future and their implications for wildlife management and human exposure.

Outcomes of proposed research should inform future pathogen control strategies. It is expected that additional work beyond this SON will be required to develop these control strategies; however, proposed work should be structured so that appropriate data are gathered to facilitate developing strategies in the future. Such future strategies are anticipated to be integrated, pathogen and vector control methods that are based on: (1) an understanding of ecological mechanisms underlying the spread of pathogens of concern and their vectors, as applicable, (2) current or emerging theory related to characterizing how the spatial and temporal distributions of pathogens and their vectors will change under non-stationary conditions, and (3) management of the vector's habitat from a system-level perspective versus relying solely on direct intervention strategies.

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<sup>1</sup>Pathogen herein refers to anything that can produce disease. Typically the term is used to mean an infectious agent (colloquially known as a germ)—a microorganism. Pathogen for the purpose of this SON includes any virus, bacterium, prion, fungus, or protozoan that causes disease in its host.

All proposals must address the SON objective and all three research needs. ***Proposals must be explicit with respect to how they address the objective and research needs.*** The pathogens and their associated vectors chosen for study must be relevant to one or more DoD installations in the U.S. or its territories and make a clear link to a DoD management responsibility associated with potentially affected wildlife species of concern. Wildlife of concern include not only listed species but also at-risk species and those species that otherwise may receive management attention on an installation (e.g., game species).

## **2. Expected Benefits of Proposed Work**

The desired outcome is knowledge that improves our understanding, in the context of a non-stationary world, of plausible futures and how they may be applied to provide the context for the future management of pathogens and their associated vectors and can lead to development of practical methodologies resulting in significant reductions in disease incidence to humans and wildlife species of concern on DoD lands.

## **3. Background**

The DoD manages a broad range of ecosystems covering millions of acres on installations across the U.S. and its territories. Effective and sustainable management practices that lower the incidence of human and/or wildlife exposure to pathogens and that result in a better understanding of the ecological factors affecting their spread and disease severity are urgently required. Research conducted under this SON is intended to yield an improved understanding of those climatic, land-cover, land-use, and ecological factors in a non-stationary world (in which the past is not necessarily a guide for the future) that could cause changes in the populations and distribution of important pathogens and their vectors, as applicable, as well as those integrated control and land management practices that enable environmental or wildlife health specialists to significantly reduce the incidence of human and/or wildlife exposure to pathogens on DoD lands. For example, prescribed burning in the Southeast and deer management may contribute to the control of vector populations and become more important in the future.

Species have evolved in the presence of pathogens and their diseases; however, introductions of new pathogens and their vectors, as well as changes in land cover, land use, and climate, have and will continue to create novel conditions in terms of exposure sources, exposure pathways for wildlife and humans alike, and severity of impacts. Although the causes of and interactions with other factors are not entirely understood, amphibian exposure to the chytrid fungus (*Batrachochytrium dendrobatidis*) and bat exposure to the fungus causing white nose syndrome (*Pseudogymnoascus destructans*) are examples of the changing dynamics between pathogens and wildlife populations and may involve not only vectors but host-to-host transmission as well. Besides introductions of novel pathogens, climate change itself may facilitate opportunities for changes in the distribution patterns of extant pathogens and their vectors and land-cover and land-use changes may otherwise alter exposure pathways by creating favorable environmental conditions that may not have previously existed.

In regards to human exposure, Lyme disease, which is transmitted by ticks, is now the most important arthropod-borne disease in the U.S. The factors responsible for this increase are numerous but may include habitat fragmentation, a subsequent reduction in biodiversity, exploding deer populations, and other as yet poorly evaluated environmental parameters, such as climate change. As a consequence, Lyme and other diseases transmitted by ticks represent a growing

occupational health risk, adversely impacting military readiness and the health of military dependents and surrounding communities. Confirmed cases of Lyme disease in the U.S. population now number 20,000 to 30,000 per year and are likely closer to 300,000 because of underreporting and misdiagnosis. In the military, nearly 7,000 cases of confirmed Lyme disease have been reported among Active Duty and Guard/Reserve members and dependents over the last 10 years with the number of unreported cases considered to be much higher as well.

Ongoing and future non-stationary changes and their implications for wildlife and/or human exposure to pathogens present significant management challenges. Direct (from human exposure) and indirect (from exposure of wildlife species of concern) impacts to military readiness are possible and may exacerbate over time. Novel and innovative management solutions that take a system-level perspective are needed. Such solutions must be grounded in an understanding of the ecology of potential pathogens and their vectors, native or introduced, in terms of how distribution, severity, and exposure pathways will change under future non-stationary conditions caused by climate change, as well as land-cover and land-use change.

#### **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 of up to \$150,000 over approximately one year. 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 website at [www.serdp-estcp.org/Funding-Opportunities/SERDP-Solicitations](http://www.serdp-estcp.org/Funding-Opportunities/SERDP-Solicitations).