

RESEARCH PLAN

The Strategic Environmental Research and Development Program (SERDP) and the Environmental Security Technology Certification Program (ESTCP) Resource Conservation and Resiliency (RCR) Program Area Research Plan

2021–2025

FEBRUARY 2021

SERDP & ESTCP

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RESEARCH PLAN

Research Plan 2021–2025

TABLE OF CONTENTS

	Page
1.0 MISSION	1
2.0 OBJECTIVES	1
3.0 RESEARCH THRUST AREA: INSTALLATION INFRASTRUCTURE FOR MILITARY OPERATIONS	2
4.0 RESEARCH THRUST AREA: MILITARY LAND CONDITIONS ON READINESS, HEALTH, AND SAFETY	5
5.0 RESEARCH THRUST AREA: READINESS-ECOSYSTEM NEXUS	7
6.0 CONCLUSION	9
APPENDIX A: DOD-RELEVANT RESOURCE CONSERVATION ENVIRONMENTAL REGULATION AND POLICY	A-1

LIST OF FIGURES

	Page
Figure 1. The portfolio encompasses two focus areas: (1) coastal flooding and storm damage and (2) extreme and changing weather. Likely research focus areas into 2025 are suggested.....	4
Figure 2. The portfolio encompasses three focus areas: (1) erosion and water quality, (2) dust generation and impacts, and (3) wildfires and prescribed burns. Wildfire and proscribed burn research efforts will be the principle focus of the portfolio into 2025.....	6
Figure 3. Timeline of readiness-ecosystem nexus—informally the “Threatened and Endangered Species plus Invasive Species (TES+I)” portfolio—research activities since 2009 and though the period of interest for this report, 2021–2025.	8

LIST OF TABLES

	Page
Table 1. Relationship between Strategic Goals and Mission Needs.....	9

ACRONYMS AND ABBREVIATIONS

CAA	Clean Air Act
CWA	Clean Water Act
DCAT	DoD Climate Assessment Tool
DoD	U.S. Department of Defense
DoDD	Department of Defense Directive
DRSL	DoD Regional Sea Level
eDNA	environmental DNA
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESOH	Environment, Safety, and Occupational Health
ESTCP	Environmental Security Technology Certification Program
MMPA	Marine Mammal Protection Act
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
RCR	Resource Conservation and Resiliency
SERDP	Strategic Environmental Research and Development Program
TC	Technical Committee
TMDL	Total Maximum Daily Load

1.0 MISSION

The mission of the Resource Conservation and Resiliency (RCR) program area is to develop and transition knowledge, tools, and technology to enhance the U.S. Department of Defense's (DoD's) mission effectiveness through improved understanding and management of DoD's natural and built infrastructure.

As stated in a recent Defense Environmental Programs Annual Report to Congress:

... The Office of the Secretary of Defense oversees the Military Departments' and Defense-wide environmental technology programs and manages the Strategic Environmental Research and Development Program (SERDP) and the Environmental Security Technology Certification Program (ESTCP). **The mission of the environmental technology programs is to address high-priority environmental challenges.** The DoD Components' environmental technology investments focus on unique Military Service requirements and complement other Defense-wide investments. SERDP, ESTCP, and the DoD Components work together to coordinate and leverage these investments.¹...

To restate, SERDP and ESTCP seek to address the DoD's environmental and facility energy challenges through advances in science, engineering, and technology. SERDP funds research and development (R&D) projects that address DoD's environmental requirements and ESTCP invests in technology demonstrations to test and accelerate the transition of new environmental and facility energy technologies.

The RCR program area within SERDP and ESTCP seeks to ensure military installations have the tools required today and, in the future, to meet their mission needs as efficiently and effectively as possible. The purpose of each specific RCR program area focus is to mature research that assists the DoD in meeting its policy objectives. These policy objectives include DoD Directive (DoDD) 3200.15 *Sustaining Access to the Live Training and Test Domain* to preserve, enhance, and sustain military readiness; DoDD 4715.1E *Environment, Safety, and Occupational Health (ESOH)*; and DoDD 4715.21 *Climate Change Adaptation and Resilience*, Change 1 Effective August 31, 2018. (For additional information, see Appendix A: DoD-Relevant Resource Conservation Environmental Regulation and Policy).

2.0 OBJECTIVES

To accomplish its mission, the RCR program area advances toward research and technology transitions that meet the following objectives:

- Maintain near and long-term training and test capacity,
- Minimize and prevent restrictions to training and testing—today and in the future—that arise from environmental regulations,

¹ Defense Environmental Program Annual Report to Congress for Fiscal Year 2019 (April 2020),

- Manage the natural assets and mitigate the natural conditions that can impact installation infrastructure, and
- Ensure safe, efficient, and healthy conditions on the installation.

The “research thrust” is used to pursue the above-listed research and technology transfer objectives. A research thrust is a focused concentration of research activity and resources brought to bear on a problem to allow for progress to be made in a technical area. In identifying research thrust areas, the RCR program area manager and the supporting RCR Technical Committee (TC) consider whether the thrust pursues the above objectives and whether the thrust is likely to result in progress of high value (with value measured by increased operational capability), economic efficiency, or supports environmental defense objectives set forth by the Secretary of Defense.

The TC also provides the link between the program and the functional analysis performed by the Services as their needs evolve with regard to changes in doctrine, organization, training, material, training, personnel, facilities, and policies—changes that may result in a research need. The RCR program area manager also coordinates across the federal environmental research community to determine whether others are funding similar research or have needs that correspond with DoD needs that might result in concurrent or mutually beneficial research activities. The RCR program area manager does this in an effort to avoid duplication, leverage other research activities, and confirm that there is a sufficiently unique military-environmental link to warrant SERDP or ESTCP consideration of the research thrust. Using this process, the following three RCR research thrusts are currently being pursued and investments are being made to develop the knowledge, tools, and technology to improve their management:

1. Installation infrastructure for military operations;
2. Military land conditions on readiness, health, and safety; and
3. Readiness-ecosystem nexus.

The RCR TC plays a key role in thrust area development. To develop the program portfolio, the program manager relies on the technical skills offered by the participating Services and Agencies to assist in the technical aspects of program development, project monitoring, and technology transfer. Selected by the Services and Agencies represented on the SERDP Council, the TC brings an understanding of the needs of their organizations and knowledge of related research efforts to the table. Their knowledge helps the program avoid duplication of effort and promotes joint and cooperative funding of projects. In addition to portfolio development, the TC also assists in reviewing technical proposals, conducting technical reviews of the ongoing projects, and facilitating technology transfer according to the needs of users in the field.

3.0 RESEARCH THRUST AREA: INSTALLATION INFRASTRUCTURE FOR MILITARY OPERATIONS

“The DoD must be able to adapt current and future operations to address the impacts of climate change in order to maintain an effective and efficient U.S. military.”² These impacts can directly impact the availability of the buildings on an installation or range as well as power, transportation,

² DoD Directive 4715.21, Climate Change Adaptation and Resilience, Change 1 Effective, August 31, 2018.

and communication networks. In addition to the impact to operations, these conditions can threaten the health and safety of personnel stationed at an installation.

The RCR program area research investments in installation infrastructure resilience and adaptation research is more than a decade old and has already made a huge, positive impact. This research thrust area established the Coastal Assessment Regional Scenario Working Group (CARSWG) that published the Regional Sea Level Scenarios for Coastal Risk Management report and developed an accompanying web-based DoD Regional Sea Level (DRSL) database. This working group was reenergized as (CARSWG2) in 2019.

The DRSL database is unprecedented in the scientific and defense community due to its authoritative individual evaluation of DoD sites worldwide. The DoD recently incorporated use of the database into the DoD Unified Facilities Criteria for use in all future coastal military installation engineering and planning. In addition, and as part of an ongoing improvement process, the RCR program recently released a publicly available version of the DRSL database.³ Public access to the database allows for the integration of future sea level change information by contracted third parties such as engineering firms in their efforts to provide installation and facilities planning and design services for DoD coastal locations. Use of DRSL information is now incorporated into DoD's installation master planning criteria and civil engineering design criteria for coastal locations. In short, all coastal military installations now use the database to identify coastal vulnerabilities to flooding, storm damage, and sea level rise. The RCR program is tasked with continuing to improve the database as a tool for DoD planning.

The installation infrastructure resiliency research thrust area research focus is currently centered on coastal flooding and storm damage and the development of technologies that allow for resilience in the face of extreme weather and changing climate. With regard to research efforts surrounding improved resilience in the face of extreme weather and changing climate, research is also on-going to improve the capability of DoD installation planners and managers identify the impacts of extreme and changing weather on installation infrastructure, ranges resiliency, and requirements of providing a trained and ready force. This research will ultimately provide the DoD with technologies that allow for adaptation to changing conditions and improvement of infrastructure and range resiliency.

Threats from long-term changes in weather and ocean conditions as well as more acute conditions, such as extreme weather events, can directly impact the availability of the installation to train and deploy the force. In addition to ranges, power, transportation, and communication networks can all be impacted, the health and safety of personnel stationed at an installation threatened, and strategic deterrence negatively impacted. The military installation infrastructure research portfolio is described in Figure 1. The portfolio possesses two focus areas: (1) coastal flooding and storm damage and (2) extreme and changing weather. The figure provides a timeline of past research activities within the portfolio and the likely focus of the portfolio for 2021–2025.

³ <https://drsl.serdp-estcp.org/>.

Military Infrastructure Resiliency

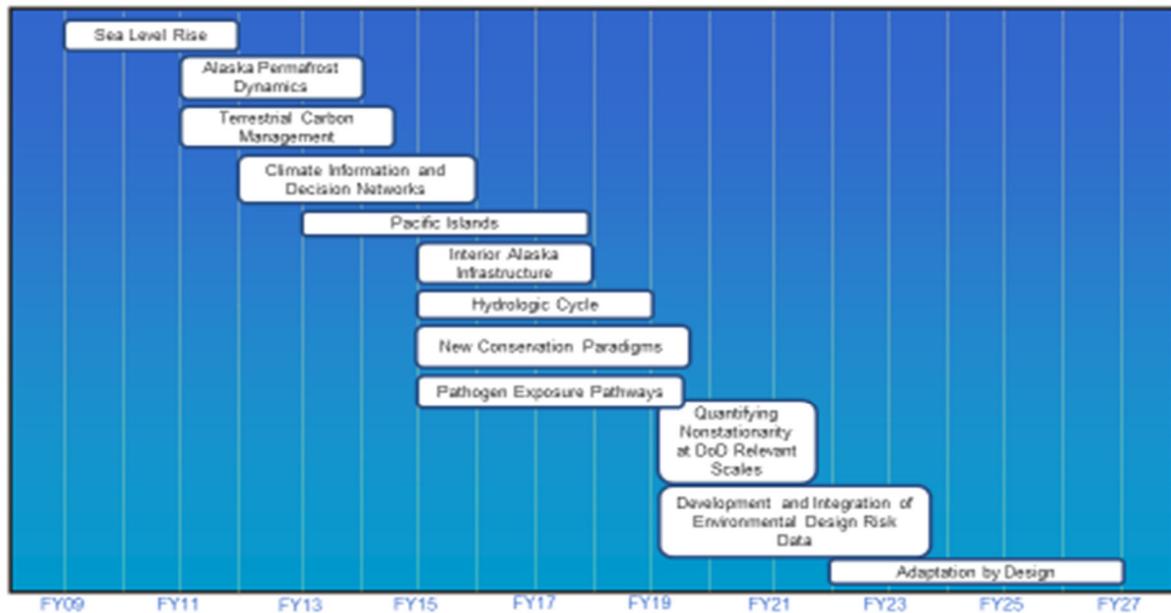


Figure 1. The portfolio encompasses two focus areas: (1) coastal flooding and storm damage and (2) extreme and changing weather. Likely research focus areas into 2025 are suggested.

In terms of coastal flooding and storm damage research, the DoD has 1,774 military sites worldwide that are vulnerable to coastal flooding. The changing climate has led to a broad increase in sea level worldwide with incidents of coastal flooding becoming more frequent at many of these facilities. Given that a modest change in coastal water levels can combine with a change in storm intensity or duration, DoD research in this area focuses on improved capabilities to assess and predict the vulnerability of installation and natural infrastructure to coastal flooding and storm damage, the ability to analyze and predict mission impacts of coastal flooding and storm damage, and the technological development of cost-effective adaptation approaches to support installation operations in the face of coastal flooding and storm damage.

Regarding research focused on extreme and changing weather, SERDP and ESTCP do not generally fund atmospheric modeling efforts. The DoD is a user of long-term climate science information and the Military Services—principally the Navy and Air Force—have weather assets and research activities that are mission funded. Nonetheless, weather events impact training and testing in important ways. For example, extreme heat limits training days, reduces lift capacity of aircraft, and can cause health concerns. Extreme precipitation impacts many activities on an installation, and extended droughts can limit an installation’s capacity. As extreme events become more frequent and weather patterns shift, the built and natural infrastructure will respond. SERDP and ESTCP research seeks to improve risk management tools and assessments of available tools

that may identify the likelihood and severity of impacts from extreme and changing weather and climate to installation infrastructure.

Research and engineering projects are underway that focus on the DoD mission's need for reliable, functioning, existing infrastructure and technology in the face of climate-related impacts; new and improved technologies; and benefits to be accrued from assessments of statistical and dynamic climate change prediction models as well as the continued development of climate resiliency metrics. No broad program or testbed exists specifically to evaluate the effect of climate change on natural and physical infrastructure and technologies' ability to perform their designed or natural function. The maturation of a focused, sufficiently resourced effort reflects a potential opportunity for 2021–2025. This task reflects the DoD policy to support the Assistant Secretary of Defense for Sustainment who is responsible for improving the reliable functioning of existing infrastructure and technology in the face of climate-related impacts.

4.0 RESEARCH THRUST AREA: MILITARY LAND CONDITIONS ON READINESS, HEALTH, AND SAFETY

The military land conditions research area focuses on maintaining the condition of DoD lands regarding their use for maintaining military readiness as well as safeguarding the health and safety of the force. DoD's ranges are among its most valuable assets since ranges ensure readiness by providing the dedicated range complexes essential to train soldiers, sailors, marines, and airmen in realistic conditions. Live-fire training, maneuver exercises, and myriad other training activities provide hands-on experience critical to supporting national security objectives and to ensuring a high state of military readiness.

Topics of research interest within the military land conditions thrust area include erosion and water quality, dust generation, and wildfires and prescribed burns. Regarding erosion and water quality, DoD policy and federal and state water quality regulations require the DoD to protect the water quality in and around ranges. With regard to dust generation, military training and testing and range operations have the potential to generate considerable dust emissions by vehicle-induced mechanical disturbance and by wind erosion of surface materials, particularly in areas where operations regularly disturb the ground surface. These dust emissions are important issues, especially in areas that do not meet National Ambient Air Quality Standards (NAAQS) or where the requirements of the Regional Haze Rule apply to visibility degradation. With regard to wildfires and prescribed burns, training and live-fire activities are fundamental to trained and ready forces but they initiate fires that hold the potential to—and have in the past—negatively impacted personnel, infrastructure on military installations, and surrounding communities—impacts for which the military is often held liable.

The military land conditions readiness thrust area focuses on research that improves the DoD natural resource. Range managers need the ability to deploy DoD fire management tools for DoD land management, make risk-based tradeoffs for frequency and conditions for prescribed burns, manage landscapes to decrease risks from wildfires, and predict emissions and smoke dispersion patterns resulting from wild and prescribed fires. These research activities advance science and technology to meet these end states for ranges and forests on military installations across the United States. Ultimately, these research investments improve mission-critical infrastructure and avoid degradation of operations, avoid restrictions or loss of test and training lands due to

regulations and/or degraded conditions, and improve the health and safety for base personnel and surrounding communities.

The military land conditions readiness portfolio, also informally known as the “Military Lands” research portfolio, is shown in Figure 2. The portfolio possesses three focus areas: (1) erosion and water quality, (2) dust generation and impacts, and (3) wildfires and prescribed burns. The figure also provides a timeline of past research activities within the Military Lands research portfolio and the likely focus of the portfolio for 2021–2025.

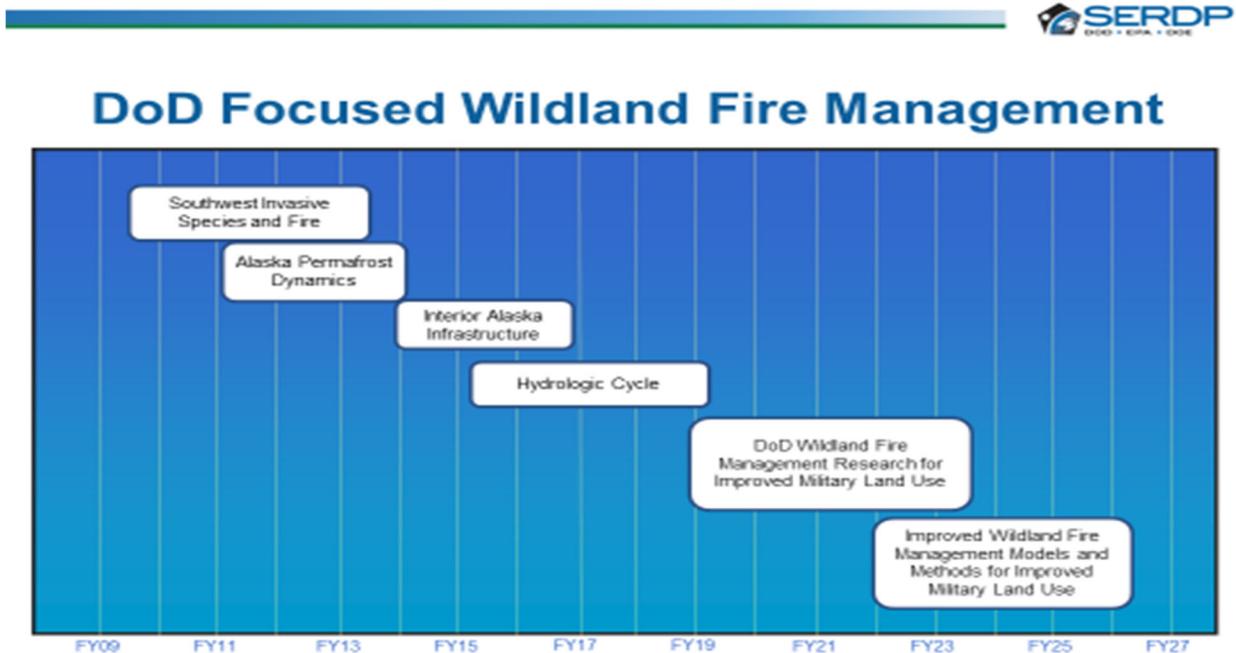


Figure 2. The portfolio encompasses three focus areas: (1) erosion and water quality, (2) dust generation and impacts, and (3) wildfires and prescribed burns. Wildfire and proscribed burn research efforts will be the principle focus of the portfolio into 2025.

With regard to erosion and water quality, DoD land ranges must be able to sustain their conditions even though they are used for training with tactical vehicles, including tanks and other heavy tracked vehicles that can, through overuse, degrade the terrain and quality and realism of training. In addition, DoD policy and federal and state water quality regulations require DoD to protect the water quality in and around ranges. A traditional land management approach based on the general management of public lands such as public forest is insufficient to the level of impact resulting from military training on DoD lands. The DoD does not have the luxury of not training on its land for years to allow for recovery, as training lands are needed to meet readiness and force requirements. Every day, DoD land managers attempt to balance the need for training today with requirement to support the future force with lands that will provide training lands in realistic conditions. As a result, the erosion and water quality research focuses on developing capabilities that allow DoD natural resource managers to better predict the impact of training operations on water quality and land conditions and deploy effective prevention and mitigation approaches that

allow for optimal training time on ranges while protecting water quality and sustaining the landscape.

As previously noted, military training and test ranges have the potential to generate considerable dust emissions by vehicle-induced mechanical disturbance and by wind erosion of surface materials, especially in areas where operations regularly disturb the ground surface. These fugitive dust emissions are not trivial. Fine particle dust emissions generated by military training activities potentially impact air quality, thus impairing the full use of military installations, especially where installations are located in NAAQS nonattainment areas or where the requirements of the Regional Haze Rule regarding visibility degradation applies. DoD managers face critical decisions to balance the ability to continue training and testing while meeting community needs and air quality compliance. Finally, increased development pressure surrounding many DoD installations only increases the need for research and technological development to provide DoD natural resource and range managers the ability to predict fugitive dust emissions for DoD activities on ranges, measure fugitive dust emissions at DoD installations by deploying monitoring methods with regulatory acceptance and implement dust control technologies to ensure dust does not restrict training ranges.

Currently, wildfire and proscribed burn research efforts are the principle focus of the military land conditions readiness portfolio. Training activities, especially live-fire training, are prone to initiating fire on the landscape. These fires are a risk to personnel and infrastructure on military installations and can be the source of liability and complaints from surrounding landholders and communities. In response to these risks, prescribed burning on military lands is a common natural resource management practice. The DoD uses prescribed burning to maintain and restore native ecological systems, including listed species, that are dependent on fire as an ecological process. The DoD is one of the largest landholders in the United States in areas where fire is a key component of training and a healthy ecosystem. Moreover, the DoD is more likely than other landholders, such as the National Park Service, to have adjoining population centers, both on-base personnel and families as well as the commercial/residential populations adjacent to the training lands receiving pyrotechnics and munitions. As a result, SERDP and ESTCP research focuses efforts to improve DoD fire management tools, make risk-based tradeoffs for frequency and conditions for prescribed burns, manage landscapes to decrease risks from wildfires, and predict emissions and smoke dispersion patterns resulting from wild and prescribed fires.

5.0 RESEARCH THRUST AREA: READINESS-ECOSYSTEM NEXUS

The readiness-ecosystem nexus focus area, informally called the “Threatened and Endangered Species plus Invasive Species (TES+I)” research thrust, is defined by those research elements relevant to ecosystems on military installations. These elements include impacts on species and ecosystems from training and testing activities. The flora and fauna found on DoD ranges can directly impact the availability and conditions of military ranges. These issues, if not properly addressed, can significantly impact military readiness by reducing the availability of training land and restricting training and testing conditions, thus limiting effectiveness. Areas of interest within the readiness-ecosystem nexus thrust area includes research into threatened, endangered, and at-risk species. This research focus is important since many DoD landscapes are unique and are increasingly rare habitats within the United States. Technology development focused on the control of invasive species is a second important focus within the readiness-ecosystem nexus.

Invasive species pose not only a challenge to DoD’s stewardship responsibilities, but also pose a threat to the mission from directly threatening equipment and personnel and to strategic mobility by significantly increasing the logistics friction—the time and effort required to move personnel and material around the globe in a manner that supports mission goals. The portfolio research activities are shown in Figure 3. The portfolio has been active since 2009. As shown in Figure 3, for 2021–2025 the portfolio will focus on TES+I research, improvement of environmental DNA (eDNA) as a future management tool, natural capital investments, and beginning in 2021 investigations into preferred system states.

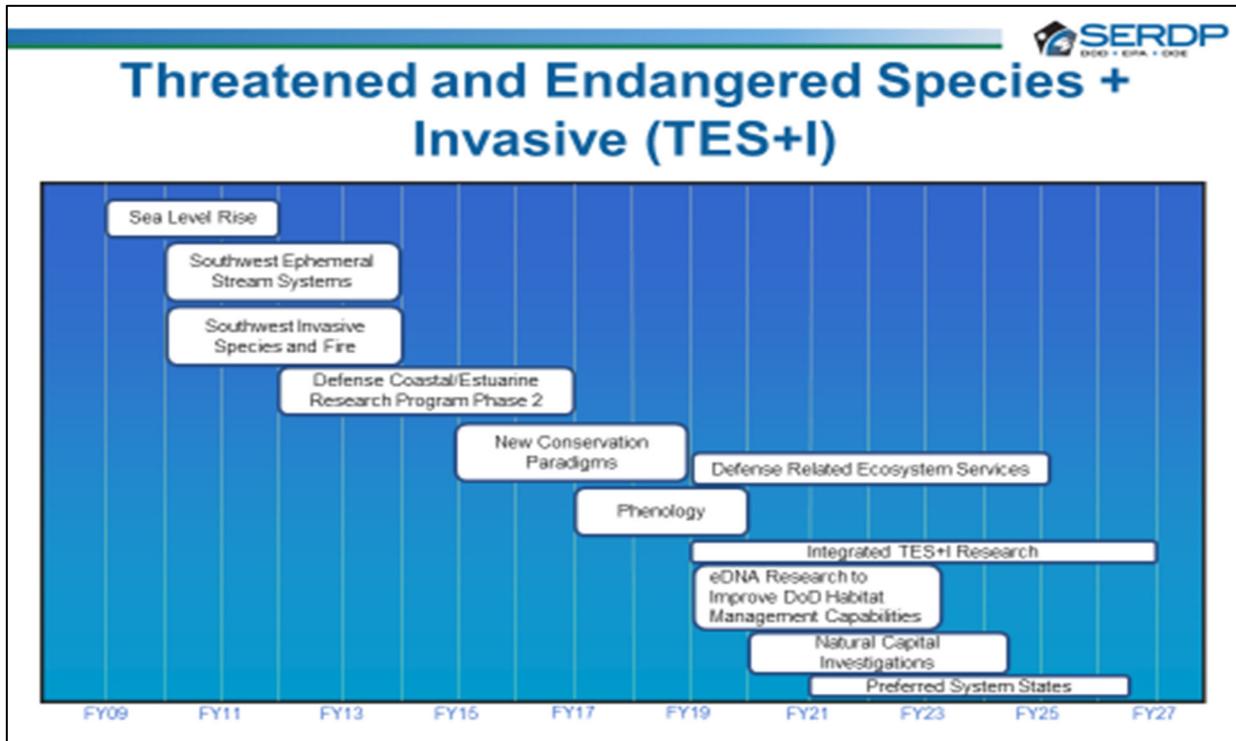


Figure 3. Timeline of readiness-ecosystem nexus—informally the “Threatened and Endangered Species plus Invasive Species (TES+I)” portfolio—research activities since 2009 and though the period of interest for this report, 2021–2025.

The current and future program focus areas—the meaning of Integrated TES+I Research, Defense Related Ecosystem Services, eDNA Research to Improve DoD Habitat Management Capabilities, Natural Capital Investigations, and Preferred System States—are clearly described within the SERDP Statements of Need and ESTCP Calls for Proposal when written.

Integrated TES+I Research—relevant research now and in the future—will seek to advance scientific understanding of threatened, endangered, and at-risk species and populations in response to exposure from multiple stressors. Cumulative risk from exposure to multiple stressors cannot currently be predicted with existing scientific theory and data for individuals or their populations.

In the same manner, the eDNA focus area supports the maturation of eDNA with the anticipation that it will be a key technology for future use in the conservation efforts of terrestrial, aquatic, and marine ecosystems. Research objectives include the development of methods to determine the temporal and spatial distribution of eDNA in habitats of relevance on DoD lands as related to:

temporal and spatial biodiversity of ecosystems generally and the distribution of at-risk or specific threatened and endangered species; the advance of the science and the body of knowledge necessary to provide improved confidence in species presence and absence determinations and eDNA measurements; and the expansion of the science and the body of knowledge necessary to provide increasingly precise links between eDNA concentration and species abundance. While it is anticipated that the maturation of this key technology will continue, it is unclear whether maturation will be sufficient to warrant an ESTCP (6.4 demonstration and validation funding) effort by the end of this plan’s period, 2025.

The natural capital investigations focus area will likely continue through the period. The objective of this focus area is to analyze the relationship of natural capital and ecosystem services delivered through the management of DoD test and training lands and the associated benefits that accrue to the DoD, the broader ecosystem, and society at large. Specifically, research seeks to define appropriate boundaries and scale to support the analysis, functional definition of services provided, and delineation of the biological, physical, and chemical services provided to include natural and nature-based features that provide benefit. Ultimately, the goal is to examine and develop models that incorporate economic concepts, which may improve decision-making to balance training requirements, land stewardship, costs, legal drivers, and coordination beyond installation boundaries, even in cases where the benefits cannot be monetized. Given the challenges that DoD-relevant ecosystems face, this line of research is likely to remain relevant and perhaps will expand through the period.

For the preferred system states focus area, research will build on earlier efforts that improved fundamental and applied understanding of how the phenology of specific plant and animal species on DoD installations are responding to abiotic features of the environment and how these responses may change under climate change conditions, how the changes in phenology impacts key interactions involving species of management concern, and the combined effects that influence conservation and management challenges associated with affected species of concern. Given the dynamic environmental changes being observed at DoD installations, the question that this research focus area will seek to address is what ecosystem character will DoD management need to pursue once conservation goals—goals based on the historical ecosystem—are no longer viable due to climatic shifts.

6.0 CONCLUSION

Three research and technology thrust areas—installation infrastructure for military operations; military land conditions on readiness, health, and safety; and readiness-ecosystem nexus—and their portfolios comprise the focus of the RCR program area through 2025. Table 1 illustrates the relationships between the three thrust areas and the four RCR program area goals.

Table 1. Relationship between Strategic Goals and Mission Needs

RCR Program Area Goals	RCR Research Thrust Area		
	Installation Infrastructure	Military Lands	Readiness-Ecosystem
I. Maintain near and long-term training and test capacity		◆	◆

RCR Program Area Goals	RCR Research Thrust Area		
	Installation Infrastructure	Military Lands	Readiness-Ecosystem
II. Minimize and prevent restrictions to training and testing—today and in the future—that arise from environmental regulations		◆	◆
III. Manage the natural assets and mitigate the natural conditions that can impact installation infrastructure	◆	◆	
IV. Ensure safe and healthy conditions on the installation	◆	◆	

Given that SERDP research may encompass basic research (6.1), applied research (6.2), and advanced technology development (6.3), the SERDP research portfolios in each thrust area:

- pursue greater knowledge or understanding of fundamental aspects of phenomena and/or observable facts without specific applications,
- seek to gain the knowledge or understanding necessary to determine a recognized and specific need may be met, or
- may include all efforts that have moved into the development and integration of hardware for field experiments and tests.

Furthermore, when ESTCP (6.4) is considered, demonstration and validation projects also fall within the purview of the science and technology thrust areas and may include efforts to evaluate integrated technologies in as realistic an operating environment as possible to assess the performance or cost reduction of potential advanced technology. As a result, program goals and overall RCR mission are pursued using a full suite of research, development, demonstration, and evaluation efforts—efforts which, in the case of SERDP, are science driven and needs informed, and in the case of ESTCP, are needs driven and science informed.

APPENDIX A: DOD-RELEVANT RESOURCE CONSERVATION ENVIRONMENTAL REGULATION AND POLICY

Environmental Regulations

The DoD must comply with federal and state environmental laws and regulations. These laws and regulations constrain and direct DoD activities at installations within the United States. Major federal environmental laws that are relevant to topics addressed by the RCR program area are briefly described below. This list is not exhaustive but focuses on those laws that can have the largest impact on DoD training and testing operations and missions.

Endangered Species Act (ESA):⁴ ESA is designed to protect critically-imperiled species from extinction. The law protects plants and animals that are listed by the federal government as “endangered” or “threatened” and is enforced by the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Services (NMFS). A species or subspecies is endangered if it is “in danger of extinction throughout all or a significant portion of its range.” A threatened species is one that is likely to become endangered within the foreseeable future. DoD must fully comply with ESA for species on its installations.

Clean Water Act (CWA):⁵ The CWA is the primary federal law governing water pollution. The law’s objective is to restore and maintain the chemical, physical, and biological integrity of the nation’s waters by preventing point and nonpoint pollution sources and maintaining the integrity of wetlands. DoD’s impact on the land can lead to impacts on neighboring water bodies and is subject to CWA rules. In particular, CWA Section 303(d): Impaired Waters and Total Maximum Daily Loads (TMDLs) authorizes the U.S. Environmental Protection Agency (EPA) to assist states, territories, and authorized tribes in listing impaired waters and developing TMDLs for these waterbodies. Many DoD installations are impacted by these rules.

Clean Air Act (CAA):⁶ Under the CAA, NAAQS are required for harmful pollutants, and the generation of particulate matter and hazardous air pollutants including byproducts of fires. Section 169A of the CAA further sets “as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility.” The 1990 CAA amendment established the Regional Haze Program that covers all 50 states.

Marine Mammal Protection Act (MMPA):⁷ The MMPA prohibits, with certain exceptions, the “take” of marine mammals in U.S. waters and by the United States on the high seas. All marine mammals are protected under the MMPA. A “take” is defined as “to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.” Harassment is defined as “any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.”

⁴ Endangered Species Act, Pub. L. No. 93-205 (1973, December 28).

⁵ Federal Water Pollution Control Act, also known as the Clean Water Act, Pub. L. No. 92-500 (1972, October 18).

⁶ Clean Air Act, Pub. L. No. 88-206 (1963, December 17).

⁷ Marine Mammal Protection Act, Pub. L.No. 92-522 (1972, October 21).

Sikes Act:⁸ The Sikes Act recognizes the importance and value of military lands to natural resources. It seeks to ensure that these ecosystems are protected and enhanced while allowing the military lands to continue to meet the needs of military operations. The Sikes Act requires military installations to provide for the conservation and rehabilitation of natural resources on DoD lands and to prepare and implement an Integrated Natural Resources Management Plan (INRMP) for each military installation with significant natural resources.

National Environmental Policy Act (NEPA):⁹ DoD is required to comply with NEPA and consider the environmental impacts of its actions. NEPA has two primary aims—to require federal agencies to consider the environmental effects of their actions before proceeding with them, and to involve the public in the decision-making process. To ensure that environmental impacts are integrated into that process, federal agencies must prepare an Environmental Impact Statement for actions “significantly” affecting the quality of the human environment. NEPA covers a broad set of environmental issues including all-natural resource impacts and specifically calls out invasive species issues.

Military Installation Resilience

Military installation resilience is newly codified in section 101(e)(8) of title 10, United States Code:

“The term “military installation resilience” means the capability of a military installation to avoid, prepare for, minimize the effect of, adapt to, and recover from extreme weather events, or from anticipated or unanticipated changes in environmental conditions, that do, or have the potential to, adversely affect the military installation or essential transportation, logistical, or other necessary resources outside of the military installation that are necessary in order to maintain, improve, or rapidly reestablish installation mission assurance and mission-essential functions.”¹⁰

DoD Policy

DoD policy serves as the foundation for the RCR program area mission. DoDD 3200.15 *Sustaining Access to the Live Training and Test Domain*,¹¹ DoDD 4715.1E *Environment, Safety, and Occupational Health (ESOH)*,¹² and DoDD 4715.21 *Climate Change Adaptation and Resilience*, Change 1 Effective August 31, 2018¹³ are key relevant policy documents.

Live training is essential to maintaining the readiness of military forces and testing of weapons is essential in the development of future capabilities. It is DoD’s policy (DoDD 3200.15) to:

⁸ Sikes Act, Title 16 U.S.C. 670, as amended by Pub. L. No. 113-291 (2014, December 19).

⁹ National Environmental Policy Act, Pub. L. No. 91-190 (1970, January 1).

¹⁰ <https://uscode.house.gov/view.xhtml?req=military+installation+resilience&f=treesort&fq=true&num=1&hl=true&edition=prelim&granuleId=USC-prelim-title10-section101>.

¹¹ <https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodd/320015p.pdf?ver=2020-07-02-144702-607>.

¹² <https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodd/47151Ep.PDF?ver=2019-12-30-141505-590>.

¹³ <https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodd/471521p.pdf>.

- “Preserve and sustain access and operational use of the live training and test domain needed to support current and future requirements through...management that incorporates sound environmental principles and range sustainment considerations.”
- “Sustain the resiliency and capacity of areas used for training and test through...management that balances usage and level of maintenance to support realistic training and testing.”

A healthy and safe environment on military installations is both necessary for the defense mission and mandated by laws and regulations such as the CWA, the CAA, the Sikes Act, the MMPA, the ESA, NEPA, and others. It is DoD’s policy (DoDD 4715.1E) to:

- “manage... installation assets to sustain the DoD national defense mission.”
- “manage the ESOH risks that [DoD] activities generate.”
- “prevent pollution, prevent illness and injury, ensure cost-effective compliance, and maximize the existing resource capability.”
- “protect the public from risk of death, injury, illness, or property damage because of DoD activities.”

Given that “DoD must be able to adapt current and future operations to address the impacts of climate change in order to maintain an effective and efficient U.S. military” (DoDD 4715.21), the RCR program area within SERDP supports DoD climate change adaptation and resilience research, development, testing, and evaluation programs in coordination with the Under Secretary of Defense for Research and Engineering (USD(R&E)) and, through the RCR TC, collaborates with the Military Departments and other federal agencies on climate change-related research and its applications to produce actionable science.

DoD Actions

A significant challenge to installation resilience is the uncertainty of long-term future environmental conditions. In response to this, SERDP and ESTCP developed long-range projections of sea level change at DoD’s coastal locations for various climate change scenarios within the DRSL database. This data was recently incorporated into DoD’s installation master planning standards and civil engineering design standards for coastal locations. Recently, DoD launched the Climate Assessment Tool (DCAT), which incorporates the DRSL database as well as information from other authoritative data sources to provide vetted and authoritative projected (future) climate data for 157 DoD installations via a web-enabled dashboard. DCAT enables Military Departments and their installation personnel to deliver consistent exposure assessments and identify regions or installations for additional climate-related studies.

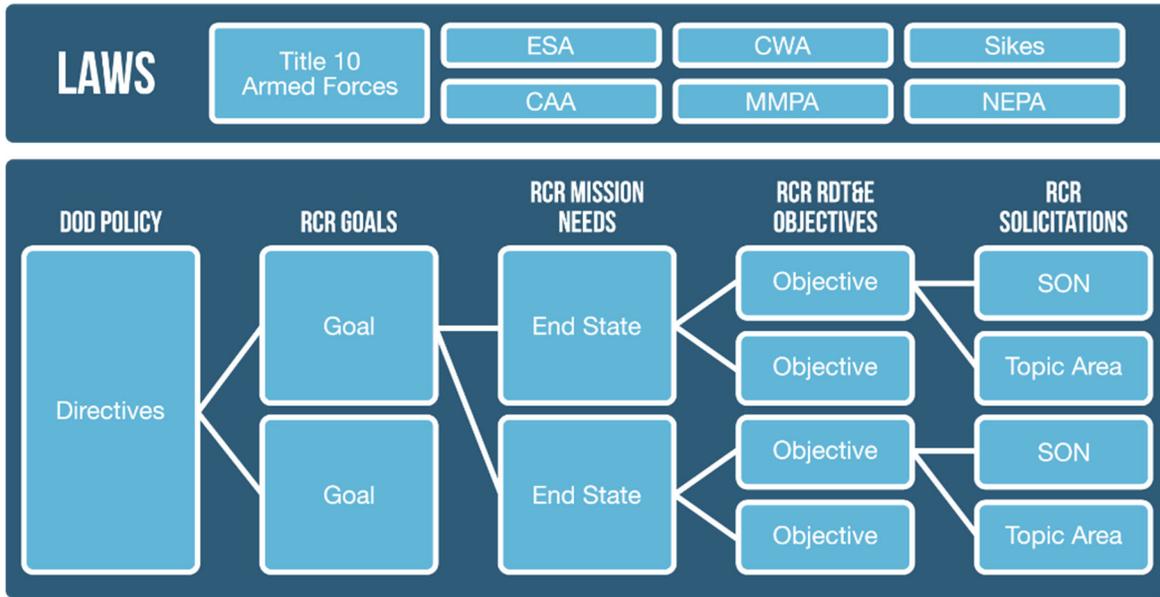


Figure A-1. All RCR program area projects link to DoD-relevant regulation and policy