Department of Defense Climate Adaptation Plan

2024–2027

PLEASE CITE THIS DOCUMENT AS:

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FOREWORD

Climate change fundamentally alters the conditions that shape military operations at home and around the world. At the same time, climate change is reshaping our strategic interests. As changes in the physical environment create the opportunity for well-prepared forces to secure a competitive advantage, deter aggression, and protect the United States and its interests, the Department of Defense (DOD) must both understand and adapt to the ways in which extreme weather and climate change affect our readiness and capabilities.

Over the past decade alone, extreme weather has significantly disrupted military readiness and driven tens of billions of dollars in damage and recovery costs across DOD. These extreme weather events, typical of those fueled by climate change, also impact training, testing, equipment availability, and infrastructure and thus compromise DOD's ability to execute its mission. As emphasized in the National Defense Strategy, accounting for climate change effects in strategic readiness planning and decision-making processes remains essential to secure our nation's defense.

In the face of domestic and overseas challenges, the Department must modernize and adapt the Joint Force in ways that enhance the mission and sustain readiness. The Department continues to respond to climate change in two ways: adaptation to enhance resilience and mitigation to reduce greenhouse gas emissions.

This includes increasing platform efficiencies and accelerating innovations to reduce logistics burdens in contested environments, hardening critical infrastructure against the impacts of extreme weather and climate change, and improving agility and flexibility of supply chains against shocks and disruptions. In addition, DOD must adapt the built and natural infrastructure on our installations to ensure their continued readiness to serve as the platforms from which DOD trains, organizes, equips, cares for, and sustains forces and their families.

Climate adaptation also supports the Department's commitment to ensuring resilient and healthy defense communities. Supporting our Service members requires that we implement effective resilience measures to reduce the effects of extreme weather and climate change, environmental hazards, and other risks that can disrupt our installations and surrounding communities.

This update to our DOD Climate Adaptation Plan provides a roadmap for the period 2024 through 2027 and builds on our 2021 Climate Adaptation Plan and previous Progress Reports. This plan further underscores our commitment to ensure that DOD can operate under changing climate conditions, preserving operational capability and enhancing the natural and man-made systems essential to the Department's success.

To train, fight, and win in an increasingly complex threat environment, we must consider the effects of extreme weather and climate change at every level of the enterprise.

Lloyd J. Austin III
Secretary of Defense

DEPARTMENT OF DEFENSE CLIMATE ADAPTATION END STATE:

Ensure the Department of Defense can operate under changing climate conditions, preserving operational capability and enhancing the natural and man-made systems essential to the Department's success.

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Figure 1. Adaptation, resilience, and mitigation summary.

Adaptation: Adjustment in natural or human systems in anticipation of or response to a changing environment in a way that effectively uses beneficial opportunities or reduces negative efforts.

Resilience: The ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions.

— *Department of Defense Directive 4715.21, Climate Change Adaptation and Resilience*

Mitigation: Measures to reduce the amount and speed of future climate change by reducing emissions of heat-trapping gases or removing carbon dioxide from the atmosphere.

— *Fifth National Climate Assessment*

2024-2027 CLIMATE ADAPTATION PLAN EXECUTIVE SUMMARY

Climate change continues to increase the demand and scope for military operations at home and around the world. The Department of Defense's (DOD) missions and operations are adversely impacted by climate change through amplifying operational demands on the force, degrading installations, infrastructure, and systems, and increasing health risks to Service members.

The DOD has been forced to absorb billions of dollars in recovery costs from extreme weather events typical of those fueled by climate change. This includes $3 billion to rebuild Camp Lejeune, North Carolina, after Hurricane Florence in 2018; $3.7 billion to rebuild Tyndall Air Force Base, Florida, after Hurricane Michael in 2018; $1 billion to rebuild Offutt Air Force Base, Nebraska, after historic floods in 2019; and more than $3.5 billion to support recovery efforts for military installations in Guam following Typhoon Mawar in 2023. Most recently, estimates show that an extreme precipitation event at the U.S. Military Academy, West Point, New York, in July 2023 caused more than $200 million in damages to military training infrastructure.

Climate adaptation efforts must align with and support the Department's warfighting requirements. Reducing climate risks and bolstering installation resilience is critical to prevent disruptions to DOD's operational plans, enable rapid recovery from extreme weather and climate impacts, and maintain mission readiness. The DOD is invested in increasing its resilience and improving combat capability, all while reducing the Department's own contributions to climate change. Efforts include reducing energy demand, substituting clean energy and materials, and leveraging rapid advancements in clean energy markets and technologies. Preparedness and adaptation require the incorporation of climate considerations into strategic, operational, and tactical decision-making. To be effective globally, these efforts need to be done in collaboration with allies and partners.

The National Defense Strategy (NDS) emphasizes the Department's strategic commitment to incorporating climate risk assessments into planning and decision-making processes. The 2022 NDS details the Department's path forward to secure our nation's defense. Among other actions, the NDS calls for the DOD to make supporting systems more resilient and agile to address multiple threats ranging from competitors to the effects of climate change. The NDS also calls for the DOD to build resilience in the face of destabilizing and potentially catastrophic transboundary challenges such as climate change and pandemics. The NDS recognizes that climate change, as well as other threats, increases demands on the resources of the DOD, federal civil authorities, and the public and private sectors. The NDS notes that by "joining with allies and partners in efforts to enhance resilience to climate change, we will both strengthen defense relationships and reduce the need for force to respond to instability and humanitarian emergencies." Furthermore, the NDS reiterates the DOD's commitment to account for climate change impacts in strategic readiness planning and threat assessments, including accounting for climate extremes in training and equipping the force.

The DOD Climate Adaptation Plan (CAP) for 2024–2027 continues to rely on the 2021 climate adaptation strategic framework (Figure 2) with five major lines of effort (LOEs) and four enablers designed to support and integrate the LOEs. The examples provided throughout this document represent just a few activities from a larger compilation of climate resilience efforts across the Department.

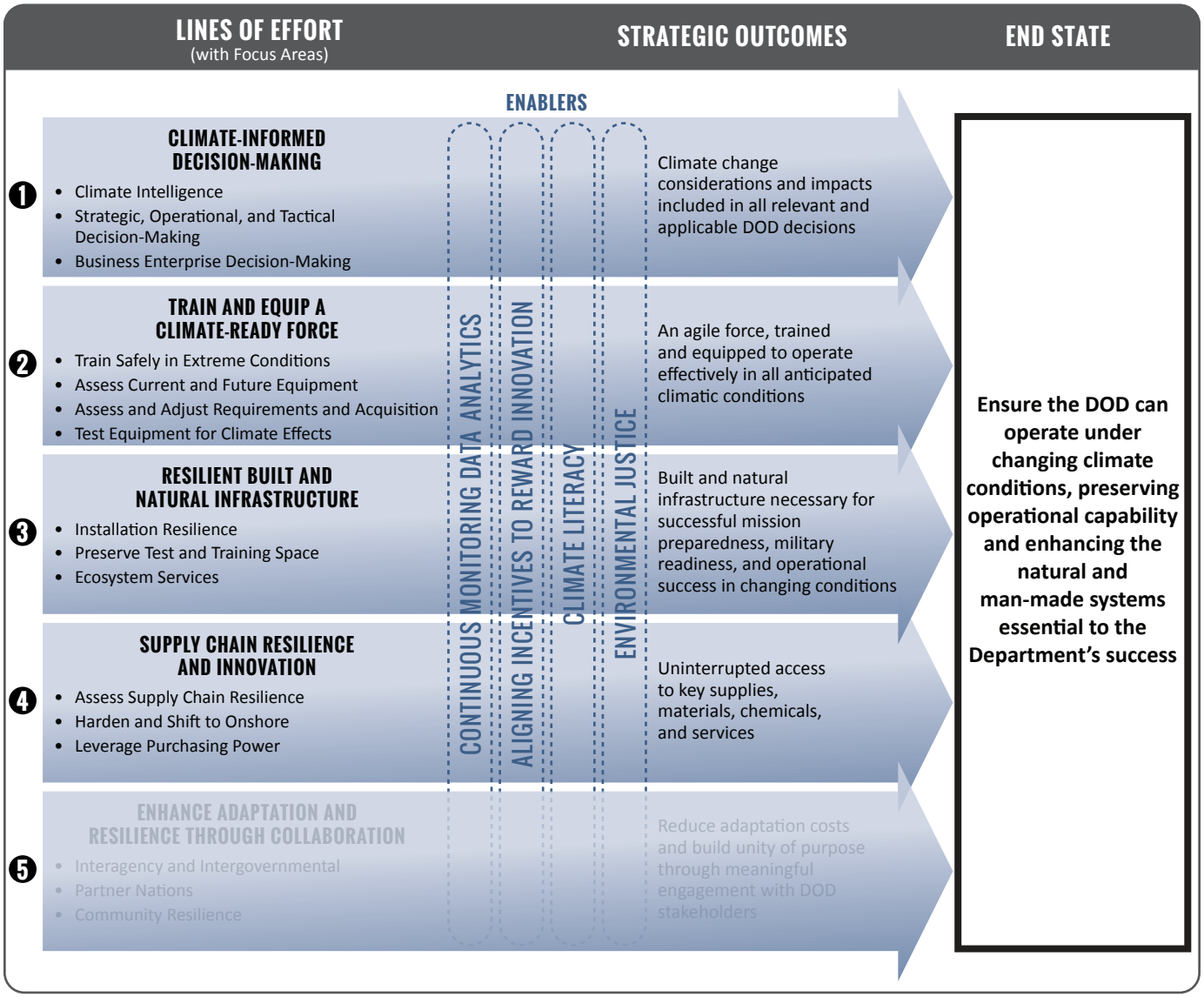

Figure 2. DOD Climate Adaptation Strategy Framework for Current and Future Force Decisions, from 2021 CAP.

Table 1. DOD Profile.

AGENCY PROFILE	
Agency Mission	The DOD provides the military forces needed to deter war and ensure our nations' security. –- *Department of Defense Strategic Management Plan (SMP) Fiscal Years 2022-2026*
Agency Bureaus in the Climate Adaptation Plan	The Office of the Secretary of Defense (OSD), the Military Departments (Army, Navy, Air Force), the Office of the Chairman of the Joint Chiefs of Staff and the Joint Staff, the Combatant Commands, the Defense Agencies, the DOD Field Activities, and all other organizational entities within the DOD (referred to collectively in this issuance as the "DOD Components")
Agency Climate Adaptation Official	Dr. Kate White, Climate Change Program Director, Office of the Deputy Assistant Secretary of Defense for Energy Resilience and Optimization
Agency Risk Officer	N/A. Risk Management occurs through the Department and Components.
Point of Public Contact for Environmental Justice	*Executive Order (EO) 14096* requires agencies and departments to designate a Chief Environmental Justice Officer. The DOD is in the process of designating a Chief Environmental Justice Officer.

Table 1. DOD Profile (continued).

AGENCY PROFILE	
Owned Buildings[1]	157,129 buildings (1,638,862,108 square feet)
Leased Buildings[1]	3,574 buildings (27,578,130 square feet of rentable space)
Employees[2]	1,895,647 civilian and military employees 1,058,884 contractor support
Federal Lands and Waters (Acres)[1]	8,276,467 acres owned (number of acres owned by the federal government) 24,619,495 acres total (number of total acres at the site; includes government-owned land, public land, public land withdrawn for military use, licensed and permitted land and acreage of foreign land used by DOD)
Budget	$776.6B enacted in Fiscal Year (FY) (Public Law [P.L.]. 117-81) $851.8B enacted in FY 2023 (P.L. 117-263) $842.0B requested in FY 2024 (P.L. 118-31) $849.8B FY 2025 President's Budget (PB)
Key Areas and Programs Where Climate Adaptation Efforts Occur	DOD policy states that all operations, planning activities, business processes, and resource allocation decisions shall include climate change considerations through the five LOEs and enablers.

1 The BSR represents a snapshot of the DOD real property inventory as of 30 September 2022 in line with *DOD Instruction 4165.14: Real Property Inventory and Forecasting* which supports the requirements of 10 USC 2721.
2 2022 data for contractor support from FY 2022 Inventory of Contractors for Services reported to Congress per 10 USC 4505(c). The data represents all full time equivalents working as primes or subcontractors on DOD contracts.

LINE OF EFFORT 1:
CLIMATE-INFORMED DECISION-MAKING

Meeting National Defense requirements is our highest priority. This CAP informs these requirements by having the DOD consider the effects of climate change in all relevant plans, processes, and decisions in accordance with the Chairman's Risk Terminology identified in Chairman of the Joint Chiefs of Staff Manual 3105.01 and Joint Publication 5.0.

More than 30 individuals participated in a Climate Change Wargame co-hosted by the Center for Excellence in Disaster Management and Humanitarian Assistance and the Office of the Under Secretary of Defense for Policy Arctic and Global Resilience team. The wargame, "Ho'okele Mua" or "Navigating the Future", was designed by The Center for Naval Analyses to address various scenarios in which the U.S. Indo-Pacific Command can best prepare for strategic and operational climate change impacts in the region.

Climate considerations are becoming an integral element of DOD's enterprise-wide resource allocation and operational decision-making processes. DOD climate assessments are based on the best available, validated, and actionable climate science that informs the most likely climate change outcomes. To account for the rapid rate of climate change, climate data sources are continuously monitored and updated while considering operational impacts. **All other actions in this plan are dependent on the successful outcomes of this Line of Effort**.

The Department's existing guidance for adaptation and resilience dates to the release of the DOD's *2014 Climate Change Adaptation Roadmap* and the 2016 policy, *DOD Directive (DODD) 4715.21: Climate Change Adaptation and Resilience*. The DOD's climate resilience guidance and policy also addresses energy and water resilience, both of which can be adversely impacted by extreme weather and climate change. The Department issued the following policies related to adaptation and resilience: *DODD 4180.01, DOD Energy Policy*, and *DOD Instruction (DODI) 4170.11, Installation Energy Management*.

RELEVANT EXECUTIVE ORDERS

Several EOs relate to climate risk reduction, including:
EO 14008, Tackling the Climate Crisis at Home and Abroad;
EO 14017, Executive Order on America's Supply Chains;
EO 14030, Climate-Related Financial Risk;
EO 14057, Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability;
EO 14072, Strengthening the Nation's Forests, Communities, and Local Economies;
EO 14082, Implementation of the Energy and Infrastructure Provisions of the Inflation Reduction Act of 2022; and
EO 14096, Revitalizing Our Nation's Commitment to Environmental Justice for All.

Successful implementation of LOE 1 will be demonstrated when climate change and associated impacts are considered in all relevant and applicable decisions. These decisions range from historical lessons learned to current and future operations, exercise and contingency planning, and budgeting and strategy development. Relevant and applicable decisions also include longer-term weapon system and infrastructure planning decades into the future. To maximize the utility of climate-informed decisions, the Department must know what information to use at the right timescale and where to find that information. Figure 3 shows examples of how the Department is accounting for climate considerations across the continuum. For more information, see Appendix 2.

The Department has developed several tools and resources to incorporate climate projections into its climate risk assessments to address statutory and Office of Management and Budget (OMB) requirements. These tools use the best available and actionable climate information.

The primary tool is the DOD Climate Assessment Tool (DCAT), which meets the requirements of Section 326 of the National Defense Authorization Act (NDAA) of FY 2020. DCAT also complies with *OMB Circular A-11* and its components, including the *Capital Programming Guide* and *Appendix 13,* for use in assessing climate considerations and risks. DCAT supports climate-informed decision-making to increase resilience against climate hazards while preserving operational capability and enhancing the natural and man-made systems essential to the Department's success.

In FY 2023, the DOD produced stand-alone versions of DCAT to support Partner Nation (PN) use of climate information in long-term planning and international decision-making. The PN Climate Assessment Tools (CATs) use globally available data and authoritative information on historical extreme weather conditions and projected climate information to identify PN exposure to climate hazards over time. Using the PN CAT as part of a comprehensive analysis will help international decision-makers determine where best to apply resources to improve climate adaptation and resilience.

CLIMATE-INFORMED DECISION SUPPORT

In January 2024, DOD entered into a formal agreement with the Federal Emergency Management Agency (FEMA) to co-fund and co-develop probabilistic coastal flood hazards inundation mapping for the U.S. territories of Guam and Commonwealth of the Northern Mariana Islands for present and future conditions including multiple sea level rise scenarios. Flood mapping products will be incorporated into the DOD Regional Sea Level (DRSL) database and DCAT. In early 2024, DOD also developed a climate dashboard for Guam to inform and facilitate ongoing recovery and reconstruction efforts and other strategic initiatives. DOD continues to enhance, develop, and socialize actionable tools for climate-informed planning and decision-making across the Department.

The DRSL database provides projected sea level rise data for DOD coastal and tidally influenced military sites worldwide. DRSL is informed by an interagency Coastal Assessment Regional Scenario Working Group that includes subject matter experts from the DOD, the U.S. Army Corps of Engineers, the National Oceanic and Atmospheric Administration (NOAA), the National Aeronautics and Space Administration (NASA), the Environmental Protection Agency (EPA), U.S. Geological Survey (USGS), and others.

DOD Components also issue specific climate-related policies and memoranda. Military Departments use the following resources to identify relevant hazards, and plan and implement resilience measures for extreme weather and climate change: *Army Climate Resilience Handbook*; *the Naval Facilities Engineering Systems Command (NAVFAC) Installation Adaptation and Resilience Climate Change Planning Handbook*; *the Air Force Civil Engineer Severe Weather/Climate Hazard Screening and Risk Assessment Playbook*; and applicable Unified Facilities Criteria (UFC); and DOD Instructions, Directives, Manuals, and memoranda.

"The Department will include the security implications of climate change in all our risk analyses, strategy development, and planning. These are essential steps to defend the nation under all conditions."
— Lloyd J. Austin III, Secretary of Defense

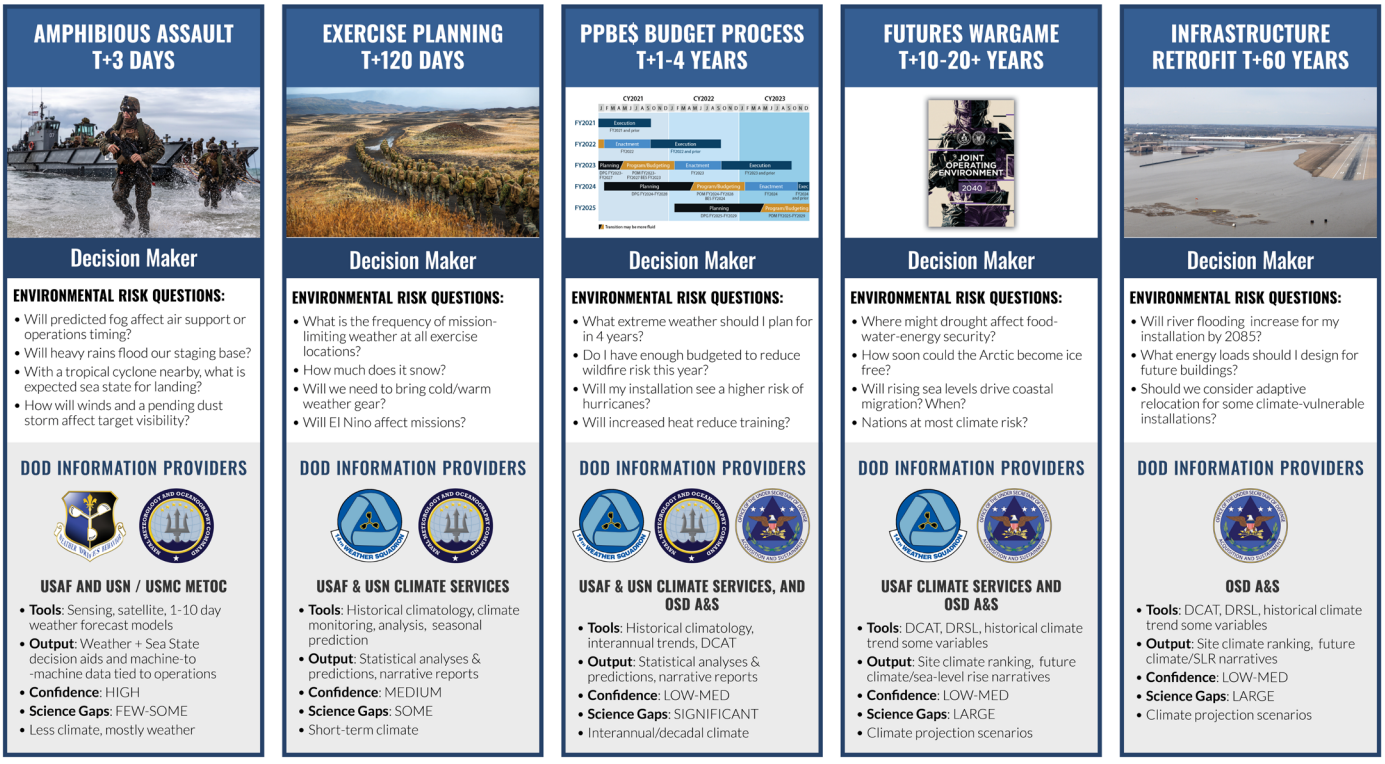

Figure 3. Example DOD decisions and considerations across the Weather to Climate Continuum. OSD, Department of the Navy (DON), and Department of the Air Force Meteorological and Oceanographic communities and where their decision-space lies are represented by the appropriate office symbol.

INSTALLATION CLIMATE RESILIENCE PLAN:

The FY 2020 and FY 2022 National Defense Authorization Acts, and later 10 U.S. Code (USC) 2864, directed the DOD to develop a "military installation resilience component" within Installation Master Plans for major military installations. UFC 2-100-01, Installation Master Planning, labeled this component the Installation Climate Resilience Plan (ICRP). An ICRP assesses current and future hazards and risks to installation resilience and contains eight sections including assets and infrastructure at risk, lessons learned, ongoing and planned risk mitigation projects, and agreements and efforts with local communities.

INCORPORATING CLIMATE RISK ASSESSMENT INTO BUDGET PLANNING

The financial consequences of failing to adapt to climate change compound over time and are measured in terms of lost military capability, weakened alliances, weakened international stature, degraded infrastructure, and missed opportunities for technical innovation and economic growth. Since the release of the *DOD 2014 Climate Change Adaptation Roadmap*, Department policy has been updated to require all operations, planning activities, business processes, and resource allocation decisions to consider climate change.

CLIMATE RISK: AIR FORCE

Documents from the DOD and the Department of the Air Force (DAF), as well as guidance from UFC 2-100-01, *Installation Master Planning*, mandate that DAF installation professionals include severe weather and climate risk in Installation Development Plans (IDPs) and facility projects. The *Severe Weather/Climate Hazard Screening and Risk Assessment Playbook (Playbook)* provides a consistent and systematic framework to screen and assess severe weather and climate hazards, while addressing associated current and future risks at DAF installations. Planners leverage the Playbook to develop and inform ICRPs (See ICRP callout box above).

CLIMATE RISK: ARMY

The Army piloted ICRPs in 2022 and 2023 at seven installations. The ICRPs help installations ensure they meet critical missions under current and future weather conditions. DCAT, the National Climate Assessment, and NOAA supplied the authoritative climate data used in the ICRPs' risk projections.

The DOD commits to considering climate change as an integral element of enterprise-wide resource allocation and operational decision-making processes. The Department works with other federal agencies, interagency working groups (IWGs), international working groups, academics, non-governmental organizations (NGOs), and the private sector to continuously monitor and update climate data and information sources to account for accelerating and varying rates of climate change and its impacts across the globe.

The DOD incorporated climate risk into budget planning, in accordance with *EO 14030, Climate-Related Financial Risk*, as reflected in the $3.1 billion subset of the FY 2023 budget request in the FY 2023 report *Meeting the Climate Challenge*. Further investments described in the FY 2024 report *Enhancing Climate Capability – Mitigating Climate Risk* ensure the Department can meet all mission requirements and maintain the ability to operate in all conditions. Since 2022, the DOD has reported climate-related risk in the Department's *Agency Financial Report*. DOD will assess any new Congressional climate resilience funding from 2024 through 2027.

INCORPORATING CLIMATE RISK

Strategic objectives and performance goals in the Department's SMP for FY 2022-2026 articulate the Secretary of Defense's strategic management priorities and reflect the DOD's long-term goals and DOD Components' priorities, which align with the NDS. For example, the SMP's Strategic Priority 3: *Strengthen Resilience and Adaptability of our Defense Ecosystem* identifies climate, energy, and environmental challenges as a strategic objective. Strategic Objective 3.3: *Enhance the DOD's Ability to Combat 21st Century Climate, Energy, and Environmental Challenges* can also be found in the following: Agency Priority Goals (APG) (*Reduce Climate Impacts to DOD Installations*); Secretary of Defense Priority *Defend the Nation* (*Tackle the Climate Crisis*); and the Office of the Undersecretary of Defense (OUSD) for Acquisition and Sustainment's (A&S) Big Plays (*Climate Change*). By including climate in high-level goals and priorities, the DOD better integrates climate risk assessments into planning and decision-making processes.

INCORPORATING CLIMATE RISK INTO POLICY AND PROGRAMS

The Department is taking bold steps to accelerate integrated installation resilience to meet current and future all-hazards challenges through policy and programs. These efforts align policy and guidance with strategic objectives and mission requirements so our military can continue to deter aggression and defend the Nation under all conditions. The DOD APG to "Improve Resilience of DOD Installations" has a metric to measure progress on incorporating climate risk into policies and technical guidance. APGs highlight priority policy and management areas to achieve near-term performance advancement through focused senior leadership attention.

The Department reviewed statutory requirements and EOs to identify the issuances, technical guidance, and UFCs that need updates to properly guide climate-informed decision-making, planning and implementation, investment prioritization, and business processes. This review enables DOD to establish a more comprehensive approach to all-hazards planning that will integrate climate, energy, and water resilience into planning and implementation together with a climate resilience strategy that encompasses climate adaptation, mitigation, and sustainable operations.

DOD POLICY, TECHNICAL GUIDANCE, AND UPDATES WILL ADDRESS THE FOLLOWING STATUTORY REQUIREMENTS RELATED TO CLIMATE, WATER, AND ENERGY RESILIENCE:

10 USC 101, Definitions

10 USC 2285, Department of Defense Climate Resilience Infrastructure Initiative

10 USC 2691, Restoration of land used by permit or damaged by mishap; reimbursement of State costs of fighting wildland fires

10 USC 2694, Conservation and cultural activities

10 USC 2802, Military construction projects

10 USC 2815, Military installation resilience projects

10 USC 2816, Consideration of energy security and energy resilience in life-cycle costs for military construction

10 USC 2864, Master plans for major military installations

10 USC 2866, Water conservation at military installations

10 USC 2911, Energy policy of the Department of Defense

10 USC 2915, Facilities: Use of renewable forms of energy and energy efficient products

10 USC 2919, Department of Defense participation in programs for management of energy demand or reduction of energy use during peak periods

10 USC 2920, Energy resilience and energy security measures on military installations

10 USC 2925, Annual Department of Defense Energy Management Report

POLICY, PLANS, AND STRATEGY UPDATES

CLIMATE ADAPTATION AND RESILIENCE

Army: The Army updated Installation Energy and Water Plans (IEWPs) to consider climate risk and the results of DCAT. The IEWPs use risk assessment to inform planning and investment for increased installation energy and water resilience. As part of Army's Military Installation Resilience Planning, the Army conducts policy and implementation review of IEWPs, ICRPs, Mission Assurance Assessments, Integrated Natural Resources Management Plans (INRMPs), and the Army Real Property Master Plans to identify opportunities to consider acute and long-term climate hazards in risk assessments and align planning requirements.

Navy: Navy has issued annual policy on master planning prioritization that states the importance of climate resilience planning and provides a rubric to help regions plan for subsequent updates. Navy Master Planning is primarily done by in-house workforce, and the Navy shore enterprise has held multiple training sessions annually to ensure installation personnel understand the new UFC requirement and how to use the Navy's *Installation Adaptation and Resilience Climate Change Planning Handbook*.

As part of its efforts to integrate climate change considerations into master planning, Navy issued a standard operating procedure titled "Resilience Component to the Master Plan" on August 23, 2022, which defines the minimum requirements of an ICRP. In addition to completing an ICRP at Naval Base San Diego, DON is actively performing ICRPs at Joint Base Pearl Harbor-Hickam, Naval Air Station (NAS) Joint Reserve Base (JRB) New Orleans, NAS Whiting Field, Commander Fleet Activities Yokosuka, Naval Base Guam, Naval Support Activity (NSA) Marine Corps Base (MCB) Camp Blaz, NSA Hampton Roads, NSA Bethesda, Naval Submarine Base Kings Bay, NAS JRB Fort Worth, NSA Jacksonville, Naval Station Mayport, and Naval Base Coronado.

Marine Corps Installations Command is preparing a worksheet for installations with climate and resilience goals and targets to ensure they are built into the Installation Master Plans. Using the existing conditions analysis, the installations and planning teams will develop new actionable and measurable climate and resilience projects for the master plans.

Air Force: The DAF is actively incorporating risk assessments into several procedures and plans. Climate and severe weather hazards and controls are incorporated into its Mission Sustainment Risk Report (MSRR) database and reporting framework, to consider holistic current and future risk for DAF locations and missions. Additionally, climate assessment information is incorporated into its INRMPs and Integrated Cultural Resources Management Plans (ICRMPs), to include climate projections for 2030 and 2050, potential effects on natural infrastructure, and management strategies to build climate resilience.

ENVIRONMENTAL JUSTICE

DOD released the *Equity Action Plan 2023 Update* which outlines the Department's equity advances, including Environmental Justice actions, such as integrating environmental justice tools into DOD's own planning tools for decision-making, where appropriate. The 2023 Update also highlights DOD's Environmental Justice Scorecard, which assesses DOD's progress in delivering environmental and health benefits to underserved communities.

DOD is also a member of the White House Environmental Justice Interagency Council (IAC). The Department is reviewing the recommendations that were provided to the IAC in the *White House Environmental Justice Advisory Council Recommendations: Climate Planning, Preparedness, Response, Recovery and Impacts Workgroup* report, and is taking steps to address them, as appropriate and as permitted by law.

ENVIRONMENTAL JUSTICE (CONTINUED)

Defense Logistics Agency (DLA): The DLA incorporated Environmental Justice considerations into the *FY 2022 DLA Zero Emission Vehicle (ZEV) Strategic Plan*.

The Environmental Justice Screening and Mapping Tool (EJSCREEN) Tool was used for a 1-mile diameter surrounding each host site, factoring socioeconomic indicators as well as environmental indictors, with special attention paid to the particulate matter 2.5 and ozone pollution indicators. This resulted in prioritizing early rollout of ZEVs to DLA Defense Supply Center Columbus (Ohio) to advance Environmental Justice by reducing Scope 1 emissions from fleet vehicles. Resilient defense communities require implementation of both adaptation and mitigation efforts.

TRIBAL NATIONS

Under DODI 4710.02, *DOD Interactions With Federally Recognized Tribes*, and DODI 4710.03, *Consultation With Native Hawaiian Organizations*, military installations are required to engage in regular, meaningful, and robust consultation with federally recognized tribes and Native Hawaiian Organizations (NHO) affiliated with installation-managed lands on proposed projects or ongoing mission-focused activities which may affect the Tribe's or NHO's lands, rights, or resources. Installations routinely consult and coordinate with Tribes and NHOs on cultural and natural resources management plans, projects proposed to address emerging climate-related threats to mission-critical activities and facilities, and threats to Tribal or NHO resources on installation-managed lands. These examples of consultation also highlight where DOD installations are requesting opportunities to collaborate with Tribes and NHOs to determine how their indigenous knowledge may help inform solutions to climate-related challenges.

Navy: The DON has hired its first Director of Tribal and Indigenous Affairs to build the DON's Tribal and Indigenous Program. DON has also established Tribal Liaison positions in Navy Region Northwest and at NAS Fallon, as well as a Native Hawaiian Coordinator in Hawai'i. DON understands that the needs of Tribal Nations and ensuring mission readiness should not be exclusive and that environmental stewardship is an asset to advancing the mission.

In FY 2023, the Navy, in direct partnership with Skagit River System Cooperative, a natural resource consortium of the Sauk-Suiattle Indian Tribe and the Swinomish Indian Tribal Community, awarded a project to assess and plan the restoration of 5,000 linear feet of coastal stream that drain into a large, previously restored pocket estuary at Crescent Harbor Lagoon on Tribal conservation lands near Naval Air Station Whidbey Island. The stream provides valuable non-natal rearing habitat for juvenile Chinook salmon.

In May 2023, Marine Corps Base Hawai'i (MCBH) signed a memorandum of understanding (MOU) with a consortium of NHOs from Windward O'ahu. The MOU reflects the MCBH's commitment to work with community representatives to develop ways to assist in active management of both cultural and natural resources in MCBH's Nu'upia Fishponds.

CO-BENEFITS OF ADAPTATION

Army: The Army released the *Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in Army National Environmental Policy Act Reviews* memorandum in June 2023. This policy highlights certain communities for Environmental Justice concerns, including communities that are underserved, racial and ethnic minorities, those with low socioeconomic status, Tribal nations, and indigenous communities, that are especially vulnerable to climate-related effects. This ensures that Army greenhouse gas-related actions, both the proposed action and any mitigation measures, are consistent with applicable laws and policies of state, local, and tribal governments, and that National Environmental Policy Act (NEPA) analyses comport with referenced standards.

CO-BENEFITS OF ADAPTATION (CONTINUED)

Navy: The DON has released five Chief Sustainability Officer serial memos to establish additional policy and guidance regarding the implementation of sustainability goals. The Office of the Assistant Secretary of the Navy for Energy, Installations, and Environment issued a policy memorandum in September 2023 providing direction to DON components on investments in resilience planning, implementation of nature-based solutions (NBS) and nature-based carbon sequestration, and incorporating water resilience and mitigation recommendations into the Installation Energy Program Summaries and Installation Energy Security Plans.

WILDFIRE NATIONAL STANDARDS

In December 2022, the DOD became a primary member of the National Wildfire Coordinating Group (NWCG). The NWCG develops national standards for federal and interagency wildland fire operations. DOD's membership in the NWCG provides access to the standards development process and enables autonomy in personnel training and credentialling. The DOD is integrating NWCG standards for training and qualifications across the Department to properly train the workforce to respond to wildfires and to manage ecosystems with prescribed fires. DOD's membership builds on previous efforts such as the Joint Army/Air Force Wildland Fire Training Academy. Since 2015, this academy provides DOD wildland fire personnel access to NWCG training courses and interagency instructors. NWCG personnel qualification standards contribute to effective management of its fire dependent ecosystems and supporting the mission through safe, effective, and risk-based wildfire response.

LINE OF EFFORT 2:
TRAIN AND EQUIP A CLIMATE-READY FORCE

The 2021 CAP stated that the DOD, to successfully accomplish their mission, must prepare combat forces to operate under the most extreme and adverse weather and terrain conditions. Climate change complexities require the Department to anticipate, train, and equip the force to account for emerging environmental conditions that differ from the range of environments known today. This effort considers both the compounding effects of climate hazards as well as the effects' interactions with other disruptions (e.g., pandemic).

The evolving operational environment and the need to operate in new and more extreme environments may require changes to where and how U.S. forces train for future conflict. Additionally, the Department must account for the new operational environment when developing new capabilities. Lastly, the Department must consider environmental factors in acquisition and sustainment planning (e.g., installation energy resilience both on- and off-base, within and outside the U.S.).

A C-130J Hercules assigned to the 146th Airlift Wing based at Channel Islands Air National Guard Base in Port Hueneme, Calif., which is carrying the Modular Airborne Fire Fighting System, drops fire retardant onto a ridge line above Santa Barbara, Calif., on Dec. 13, 2017, as part of the effort to contain the Thomas wildfire.

The DOD continues to incorporate climate considerations into wargames, tabletop exercises (TTXs), and studies to gain insight into how climate change could impact the Department's ability to achieve its mission and to identify changes to deliberate plans, global defense posture, or operational capabilities. The Climate Wargaming Sub-Working Group, led by the Joint Staff, advocates for the inclusion of appropriate climate change data into operationally focused wargames, TTXs, and studies to generate actionable outcomes that inform future planning or capability development. The sub-working group identifies and supports analytical partnerships to understand the impacts of climate change and potential adaptation and mitigation measures for the Joint Force. The work of the sub-working group informs day-to-day operations, potential contingencies, and future warfighting environments which impact the DOD's readiness and investment strategies.

In the past year, six combatant commands actively pursued climate-informed TTXs or studies addressing a range of strategic and operational subjects including defense posture and basing, regional security, and ally and partner engagement. For 2024, the Department allocated $3 million from the Wargame Incentive Fund for additional wargames, TTXs, and studies that address challenges identified in the NDS through a climate security lens.

OPERATIONAL ENERGY CAPABILITY IMPROVEMENT FUND/OPERATIONAL ENERGY PROTOTYPING FUND

Operational Energy Innovation: The Department leverages the Operational Energy Capability Improvement Fund (OECIF) to advance technology development and the Operational Energy Prototyping Fund (OEPF) to validate more mature technologies and accelerate their transition to the warfighter. Operational Energy-Innovation investments drive operational energy capability improvements required for advanced warfighting capabilities. A further benefit of these advancements are positive climate impacts through demand reduction, increased efficiencies, and clean energy technologies that reduce climate adaptation needs. OECIF and OEPF are investing to develop new technologies and practices in four main thrust areas:

- **Contested Logistics and Battlespace Awareness** focuses technology investments across strategic, operational, and tactical environments. These environments are characterized by competition for access to resources, services, and capabilities, as well as adversarial actions. Operational Energy technology improvements better the acts of planning, executing, and enabling the movement, fires, and support of military forces by bringing energy awareness—coupled with climate considerations—into the DOD's platform and weapon system missions and command and control architectures.

OPERATIONAL ENERGY CAPABILITY IMPROVEMENT FUND/OPERATIONAL ENERGY PROTOTYPING FUND (CONTINUED)

- **Operational Energy Resilience** is a critical enabler for mission assurance, operational flexibility, and freedom of maneuver. Technical innovation areas include climate-informed energy diversification, standardization, interoperability, and energy components advancing next-generation warfighting capabilities.
- **Operational Energy Demand Reduction** drives innovations reducing operational energy requirements, increases efficiencies across all domains, especially aviation and space, and reduces risks by providing next-generation power and clean energy delivery options for military effectiveness in contested and denied environments.
- **Nuclear Power** encompasses DOD innovations enabling nuclear power supply and electrification for the battlespace. Technology advancement investment areas include nuclear fuel fabrication processes, energy conversion methods, novel power generation, and energy storage technologies.

Sea level rise, increased temperatures, and other hazards identified in the *Department of Defense Climate Risk Analysis* will affect the military operating environment. Training on the projected conditions can reduce operational risks. The DOD also conducted a climate change and training assessment that considered the potential consequences of climate change for military training for the near-term (2030) and mid-term (2050). The assessment developed a methodology that uses the best available data and, as a case study, focused on the western Pacific's First Island Chain and a unit with mission responsibilities in that area. A follow-on study is underway for the Arctic region to validate the DOD's methodology and to provide a case study for selected units with mission responsibilities in the High North. Results of the DOD's military training climate assessments will inform future policy and program decisions.

In 2022, OUSD Personnel and Readiness (P&R) sponsored a study on *Understanding Climate Vulnerability of U.S. Joint Force Readiness* conducted by the research organization RAND. The study developed and populated a framework for analyzing pathways through which climate change presents risk to military readiness. The study also collected opportunities for the framework to inform readiness decision-making and future descriptive and predictive analytic models. The resulting framework helped the DOD to understand the impact of climate hazards on unit readiness.

In 2023, OUSD (P&R) leveraged RAND's previous work and sponsored an additional Climate Impacts Study to apply the developed climate readiness framework to accomplish the following:

- Identify requirements for metrics, data, and quantitative assessments for evaluating the risk to training readiness from climate change;
- Identify existing or potentially promising data sources and analytic capabilities to support such risk evaluation; and
- Build analytic capabilities to quantify the extent to which climate change may reduce flexibility in terms of available training time and quality.

The desired end-state is to incorporate this framework into the Readiness Decision Impact Model (RDIM) used to enhance senior leader decision-making processes. This study is expected to conclude with the release of a final report and model documentation in November 2024.

EMERGENCY MANAGEMENT PROGRAMS

DOD installations use an all-hazards threat assessment framework across the planning, response, recovery, and risk reduction phases of their emergency management programs and capabilities, including those provided by Fire and Emergency Services personnel and equipment. Fully staffing these all-hazards management programs with appropriately resourced, credentialed personnel positions the DOD to better plan for, respond to, and recover from incidents efficiently and effectively. Personnel must also be appropriately informed of climate's influence on natural hazards. Emergency management programs serve on the front lines when incidents occur. These programs improve installations' resilience with appropriate resourcing and training.

LINE OF EFFORT 3:
RESILIENT BUILT AND NATURAL INSTALLATION INFRASTRUCTURE

Built and natural infrastructure serve as the platforms from which the DOD executes its mission, sustains forces, maintains mission readiness and resilience, and also cares for its people. DOD released the *Resilient and Healthy Defense Communities (RHDC) Strategy* in February 2024, which will guide the Department's actions in the coming years to improve the built and natural environment on defense installations. These installations are built and natural spaces where our people live, work, train, raise their children, and spend time with their families. The RHDC will guide the Department's actions to achieve healthy, safe, functional, and resilient spaces that enhance the quality of life and readiness of our Service members, families, and civilian workforce. This includes integrating climate risk assessments and natural infrastructure resilience strategies into design and construction processes.

Navy Seabees deployed with Naval Mobile Construction Battalion (NMCB) 5 place concrete for the seawall project on board White Beach Naval Facility. NMCB-5 is deployed across the Indo-Pacific region conducting high-quality construction to support U.S. and partner nations to strengthen partnerships, deter aggression, and enable expeditionary logistics and naval power projection.

The Department's 2021 CAP identified three implementation activities to achieve resilient built and natural installation infrastructure: installation resilience; testing and training space preservation; and ecosystem services.

The DOD promotes resilient built and natural infrastructure through comprehensive installation assessments (e.g., installation energy, water, and climate plans), INRMPs, and the Master Planning Process. Expanded programs and partnerships, such as the Readiness and Environmental Protection Integration (REPI) Program, the Office of Local Defense Community Cooperation (OLDCC), and the Sentinel Landscapes Partnership, enhance natural infrastructure mission capabilities. The DOD is currently updating program policies to further support built and natural infrastructure by including climate, NEPA, natural and cultural resources, range planning, and real estate considerations. The DOD encourages Nature-Based Solutions (NBS), where appropriate, by supporting built and natural infrastructure in its policies.

The Department is working to better understand how DOD's existing building criteria can be optimized to deliver healthy, functional, and reliable spaces that reduce risks to people and alleviate the demands placed on critical supply chains, which strengthens both mission resilience and readiness. Through engagements with building code experts across federal agencies and within industry, the Department will compare existing DOD building criteria against industry-leading standards and best practices and seek to prioritize revisions that will increase the performance of existing and new infrastructure, enhance mission resilience, reduce operational and embodied carbon, enhance efficiency, and improve quality of life. DOD building criteria experts will have final determination on the adoption of recommendations provided to the government.

The DOD must be able to defend the nation operating from and within any environment. The DOD selects locations for installations and supporting real property assets and infrastructure based on a range of factors including operational military effectiveness, the environment, risks, and Congressional appropriations. Using long-term climate planning tools such as DCAT, the Department can now also identify locations, facilities, and infrastructure most exposed to climate hazards (Watch the DCAT video on climate.mil). Decision-makers use models and datasets to reliably capture whether and how the major climate drivers are likely to change and how potential changes impact performance or vulnerability of project military missions, operations, personnel, infrastructure, and systems.

A critical part of wildland fire management, and climate resilience, is pre-planning. Wildland Fire Managers at DOD installations apply wildfire risk assessments informed by hazard assessment tools, such as DCAT, and those available through interagency partners within the U.S. Department of Agriculture (USDA) and the Department of the Interior (DOI). These wildfire hazard and risk assessments inform the need for wildfire planning, risk reduction, response, and recovery activities within Integrated Wildland Fire Management Plans (IWFMPs) at the installation level to ensure appropriate preparation and resourcing near-and long-term wildfire resilience. IWFMPs also document how proactive fire use, including prescribed burns, will be used on military installation landscapes to sustain and enhance ecosystem function and biodiversity, another key to climate resilience.

Investment programs that support the architectural, non-structural, and engineering modification of installations bolster installation resilience, improve adaptive capacity, and improve long-term performance and reliability in a changing climate. Climate exposure information from DCAT provides context for applications to the Energy Resilience and Conservation Investment Program (ERCIP) to enhance energy and water infrastructure and resilience while accounting for changing climate and avoiding exposure (e.g., wildfire, flood inundation). The DOD Legacy Program included an FY 2023 NBS Program to assist installations in identifying structural and non-structural NBS to reduce the impacts of extreme weather and climate change. Likewise, the REPI Program funds off-base NBS, through its REPI Installation Resilience Projects, to reduce the effects of extreme weather and climate change on DOD testing and training lands, infrastructure, and community facilities that safeguard military missions. The OLDCC awards installation resilience grants across the country to address resilience and encroachment risks and impacts and assists installations with optimizing their missions.

NATURE-BASED SOLUTIONS

Army: The Army's NBS reduce wildfire and flooding risks, stabilize permafrost, and improve at-risk species habitat at installations ranging from the Kwajalein Atoll to Puerto Rico and Alaska, as well as at sites across the continental U.S. Many of these projects also provide direct resilience benefits to the surrounding communities. Throughout the process, the Army's approach to NBS leveraged partner agency and organizations' expertise to identify priority issues and apply proven approaches. The Kentucky Army National Guard's Wendell H. Ford Regional training center, for example, is restoring nearly five miles of the Cypress Creek corridor and floodplains to a more stable and natural condition. Project plans such as installing native seeds, trees, shrubs, and live stakes, and reshaping existing channels, will improve water flow during flooding events. The training center is also used by personnel from other DOD and federal agencies. Providing sustainable training land is imperative to the center's mission.

Navy: Navy and Marine Corps installations and training ranges throughout the west face climate change-induced impacts like drought, wildfires, dust, and extreme flooding events that threaten infrastructure, water supplies, and assets critical to readiness. The Navy and Marine Corps, as stewards to more than 2 million acres of arid and semi-arid ecosystems, are identifying high-impact opportunities to implement NBS and sustainable land management practices that build resilience at the scale of the challenge. The Department of Navy was designated the lead service for the Strategic Environmental Research Program (SERDP) and the Environmental Security Technology Certification Program's (ESTCP) Southwest National Innovation Landscape Network which aims to accelerate the development of climate adaptation practices that positively impact groundwater recharge, fire risk reduction, dust mitigation, and provide other resilience benefits.

Air Force: Tyndall Air Force Base has several NBS pilot projects, including a living shoreline, oyster reefs, and saltwater marsh enhancement to reduce erosion and mitigate wave energy, and coastal dune restoration using sand accretion processes. MacDill Air Force Base created oyster reefs off the coastline to counteract rapid erosion near the vulnerable West Indian manatee critical habitat and several important Native American burial sites. The oyster reefs also help safeguard the nearby commercial shipping lane. The NBS projects depend upon a range of stakeholders from within the DOD, local, state and federal agencies, conservation organizations, and academia.

ADVANCING THE AMERICA THE BEAUTIFUL INITIATIVE

Table 2. America the Beautiful Initiative.

AMERICA THE BEAUTIFUL	
ACTION	**ADVANCING THE NATIONAL CONSERVATION GOAL TO INCREASE CLIMATE ADAPTATION AND RESILIENCE**
In 2024, the DOD REPI Program will dedicate $5 million (subject to the availability of funds) to projects funded through the National Fish and Wildlife Foundation's (NFWF) America the Beautiful Challenge (ATBC). Through the ATBC, the DOD, the USDA, and the DOI fund conservation and restoration projects to invest in watershed restoration, climate resilience, equitable access, workforce development, and other efforts consistent with the ATBC initiative.	*Since 2022, the DOD REPI Program dedicated nearly $7 million to the ATBC to support nine projects across sentinel landscapes that contain areas of strategic importance for the DOD, the USDA, and the DOI. These projects are increasing climate resilience and supporting national conservation goals by preserving critical habitats for endangered species, implementing NBS to respond to changing climactic conditions, and establishing new local partnerships to help streamline landscape-scale efforts. For example, in 2023, the Avon Park Air Force Range Sentinel Landscape in Florida received $1.4 million in DOD REPI funding to recruit private landowners to develop individualized climate-smart management plans for future land protection efforts and quantify the economic and environmental impacts of those land management practices. This project will provide technical and financial assistance to landowners across 40,000 acres to help maintain the viability of working rangelands, reestablish native species, and create invasive species control measures.* *Highlights are provided below; additional details are found in the Department's FY 2021–2023 ATBC annual reports.*

Conservation efforts can facilitate improved climate resilience in the form of risk reduction to flooding, wildfires, and urban heat. In FY 2024–2027, the DOD will continue to support the ATBC key tenets of supporting Tribally led conservation and restoration priorities, expanding collaborative conservation of fish and wildlife habitats and corridors, and incentivizing and rewarding the voluntary conservation efforts of fishers, ranchers, farmers, and forest owners through the Native American Lands and Environmental Mitigation Program (NALEMP), the Recovery and Sustainment Partnership (RASP), and the Sentinel Landscapes Partnership. Each of these programs will continue to build on DOD's FY 2021–2023 accomplishments and support priorities and initiatives that DOD stated in its Conservation Action Plan and reported on through its FY 2021–2023 ATBC annual reports.

To support Tribally led conservation and restoration priorities for ATBC, the DOD, through the NALEMP, will continue to develop Cooperative Agreements (CAs) that support Tribal priorities for addressing environmental impacts to their lands from past military activities with maximum Tribal participation through government-to-government consultation. DOD NALEMP cleanup actions will continue to support Tribal conservation and restoration priorities; expand collaborative conservation of fish and wildlife habitats; increase access to safe areas for traditional cultural and subsistence practices; develop economic and outdoor recreation opportunities; and create jobs by investing in the capacity of Tribal community members to manage and support NALEMP projects.

In FY 2022, under NALEMP, the DOD entered into two-year CAs with 13 Federally Recognized Tribes (10 in Alaska and 3 in New Mexico) and appropriated $20 million to the program–the most ever awarded–to address environmental impacts on Tribal lands from past DOD activities. In FY 2023, the DOD executed 14 CAs with Federally Recognized Tribes (9 in Alaska and 5 in the lower 48). The total CA funding for FY 2023 was $15.5 million.

The DOD also contributes funding to ATBC projects through REPI. The REPI Program protects military missions by helping promote compatible land uses near installations, address endangered species restrictions that inhibit military activities, and enhance military installation resilience to climate change. REPI projects align with the core focal areas for the ATBC by protecting open, natural landscapes outside DOD installations and ranges and improving installation resilience to climate change.

For FY 2024–2027, the DOD, with its partners, through the Sentinel Landscapes Federal Coordinating Committee will explore designating additional Sentinel Landscapes. The Sentinel Landscapes Partnership is a coalition of federal agencies, state and local governments, and NGOs that work with willing landowners and land managers to advance sustainable land use practices around military installations and ranges. Founded in 2013 by the USDA, DOD, and DOI, the Sentinel Landscapes Partnership's mission is to strengthen military readiness, conserve natural resources, bolster agricultural and forestry economies, increase public access to outdoor recreation, and enhance resilience to climate change.

As of January 2024, there are 13 designated sentinel landscapes. The Sentinel Landscapes Partnership designates new landscapes through a biennial designation cycle. The next of which is scheduled to run from 2025–2026.

ARMY:

The Army preserved 6,672 acres of the Franklin Mountains Range by Fort Bliss, Texas. The Army used the area for testing and training from 1926 to 1966. President Biden designated the protected area the Castner Range National Monument on March 21, 2023. The Castner Range National Monument connects open spaces and will eventually offer outdoor opportunities to the city of more than 800,000 people, many with limited access to natural and cultural landscapes. Castner Range National Monument will help to mediate some impacts of climate change by keeping the land open for long-term water recharge and maintaining a cooler urban setting through landscape conservation.

DOD LEGACY PROGRAM:

The Office of the Deputy Assistant Secretary of Defense for Environmental Management and Restoration's Legacy Resource Management Program, in support of NBS Projects, provided funding to the Defense Supply Center Columbus (Ohio) to address installation stormwater runoff by adapting dry detention ponds to create constructed wetlands. This project is expected to improve stormwater runoff quality and alleviate current and future flooding and stream bank erosion problems. As a result, the installation will reduce the rising costs to maintain and repair damaged infrastructure from more frequent and extreme weather events caused by climate change. The new wetlands, and the native plants and trees incorporated into the design, will provide habitat for pollinators and migratory birds identified by the U.S. Fish and Wildlife Service (USFWS) as species of concern, threatened, or endangered and that may be further impacted by climate change.

DOD REPI PROGRAM: SOUTHEASTERN SENTINEL LANDSCAPES

(Georgia, Northwest Florida, Avon Park Air Force Range, South Carolina Lowcountry, and Eastern North Carolina)

To protect the fire-dependent longleaf pine forests from future degradation, this 2023 NFWF America the Beautiful Challenge project received over $800,000 in REPI Program funding and $1.7 million from DOI to execute prescribed burns on more than 42,000 acres. The project activities also include several measures to protect threatened species across the four states, such as planting more than 300 acres of trees and restoring 100 acres of wetlands. This project supports the goals of all five sentinel landscapes by retaining working forestry lands, increasing the resilience and sustainability of natural systems, and improving habitat for endangered species outside installations and ranges.

DOD REPI PROGRAM: CAMP BULLIS SENTINEL LANDSCAPES

Joint Base San Antonio (JBSA) relies on two aquifers, the Edwards and Trinity Aquifers, for their primary source of water. However, there is limited data on the water levels in the Edwards and Trinity Aquifers, which limits JBSA's understanding of how to effectively protect this critical resource. To fill the data gap, his 2023 NFWF America the Beautiful Challenge project received over $700,000 in REPI Program funding to create a new web mapping application for the Camp Bullis Sentinel Landscape that combines the following into a single application: groundwater data, climate data, mission training data from JBSA, ecological data for the Air Force Civil Engineering System, and wildfire risk data. The project will also conduct water level surveys to understand the groundwater flow paths within the aquifers and water levels during peak demand in the summer.

LINE OF EFFORT 4:
SUPPLY CHAIN RESILIENCE AND INNOVATION

CLIMATE-SMART SUPPLY CHAINS AND PROCUREMENT

A climate resilient supply chain ensures that DOD suppliers and industries can effectively manufacture and deliver critical material and other supplies to the warfighter despite disruptions from the effects of a changing climate and extreme weather events. This is especially true when these supply chains are across dispersed and austere locations with limited infrastructure and little ability to respond quickly to shocks. To improve supply chain resilience, the DOD must become more agile and flexible in responding to changing conditions through actions such as improving the efficient delivery and use of energy to reduce demand and the supporting logistics requirements. Achieving this requires the DOD acquisition system to consider Operational Energy Key Performance Parameters (per 10 USC 2911) and the Operational Energy Strategy in the development of all its weapons platforms. The optimization of logistical support and delivery requirements and capabilities can make our forward supply lines less vulnerable to the effects of climate change and our adversaries.

Resilient and innovative operations and supply chain management continue to be a primary focus for the DOD under CAP LOE 4. Globally-connected and transborder stressors such as the COVID-19 pandemic, the Russian Federation's invasion of Ukraine, and increased efforts to obtain secure access to critical minerals have resulted in an increased strain on available resources. As the Fifth National Climate Assessment (NCA5) notes, international stressors, combined with extreme weather and climate-induced shocks, can affect the supply chains and the Defense Industrial Base (DIB). One notable example involved a period of extreme drought in Taiwan in 2020–2021 that resulted in the island's worst water shortage in half a century and increased strain on semiconductor production, a highly water-intensive industry.

To better prepare for supply chain shocks, the Department, as required by *EO 14017: America's Supply Chains*, released a strategic report in 2022 to address supply chain vulnerabilities in the DIB. The report, *Securing Defense-Critical Supply Chains*, articulates the Department's plans to ensure supply chain security vital to national security. The focus areas in the report include kinetic capabilities, energy storage and batteries, castings and forgings, microelectronics, and strategic and critical materials. The report lays the foundation for the Department's inaugural *National Defense Industrial Strategy* (NDIS) released in 2024.

Director of Technology and Partnerships for the Marine Corps Installation Next Program observes solar panels at Marine Corps Air Station Miramar on July 15, 2020.

DLA:

The DLA uses a Supply Chain Risk Management approach to illuminate risk across the various supply chains. The approach enables the DLA to prioritize efforts and resources to reduce impact. Then, the DLA reviews and updates policies accordingly to align with DOD resilience policies, goals, and initiatives. The DLA continues to update its design directive to include updated energy codes, OSD electrification memorandum, and the Federal Building Performance Standards. The DLA is currently updating DLA Instruction 4170.11: Energy and Water Resource Management to capture the resilience practices and goals of DODI 4170.11: Installation Energy Management and the OUSD for A&S Memorandum: Metrics and Standards for Energy Resilience. This update will stress the importance of seeking project funding through methods such as Energy Savings Performance Contracts, Utility Energy Service Contracts, ERCIP, and Power Purchase Agreements.

Regardless of the type of supply chain shock, the Department intends to use a flexible framework of actions to achieve resilient supply chains, as found in Section 2.1 of the NDIS. These actions will:

- Incentivize industry to improve resilience by investing in extra capacity;
- Manage inventory and stockpile planning to decrease near-term risk;
- Continue and expand support for domestic production;
- Diversify supplier base and invest in new production methods;
- Leverage data analytics to improve sub-tier visibility to identify and minimize strategic supply chain risks and to manage disruptions proactively;
- Engage allies and partners to expand global defense production and increase supply chain resilience;
- Improve the Foreign Military Sales process; and
- Enhance industrial cybersecurity.

The *Securing Defense-Critical Supply Chains* and *NDIS* reports are DOD's first strategies to ensure supply chain security, including from the effects of climate change. DOD has begun to identify priorities and establish goals based on these assessments. All of DLA's Supply Centers have been added to DCAT and climate exposure assessments have been completed. DOD will continue to identify priorities and develop strategies to improve adaptive capacity, as climate hazard risk assessments to critical supplies and services are refined and expanded. The upcoming transition of DCAT to a global gridded framework will allow for additional climate exposure assessments across the Department's supply chains.

In addition, the Department will continue to innovate and consider logistic support of supply chains (e.g., fuel and power requirements) in austere locations that are more vulnerable to climate-related effects. Programs such as the OECIF and the OEPF improve the energy efficiency of combat operations and platforms while envisioning climate informed ways for deploying new technologies that improve lethality and reduce logistics risk in contested environments. Throughout, these programs leverage innovations to build operational advantages. These are not only essential steps for the climate of the world that we share, but also strategic moves to defend our country and strengthen our military. To remain agile and flexible in responding to changing conditions, the Department will continue to take actions and advance policies that make use of advanced technologies to lower our energy demand, reduce logistics requirements, and optimize water and energy usage for both operational and installation energy needs.

ENERGY RESILIENCE AND INNOVATION

Navy: Marine Corps Logistics Base (MCLB) Albany possesses load-shedding and peak shaving capabilities, along with the ability for the installation to island itself as a result of its advanced microgrid controls. Through its extensive investments in heating, ventilation, and conditioning upgrades, in addition to the usage of a biomass steam turbine and landfill gas generators interconnected with Georgia Power, MCLB Albany has been able to not only supply most of their energy needs but also export energy back to the grid.

Air Force: The DAF is ruggedizing installations against the spectrum of natural and man-made threats with integrated solutions critical to ensuring that we can project power and compete in an era of Great Power Competition. The DAF is piloting DOD's first nuclear micro-reactor at Eielson Air Force Base, a pathfinder pilot to develop, certify, and operate a new technology with potential to improve DOD and commercial energy resilience. Additionally, they are developing 10 projects worth $520 million to establish microgrids and improve resilience of base electrical systems for ERCIP funding, as well as executing Defense Innovation Unit prototypes at Mountain Home and Joint Base San Antonio to assess if cutting-edge geothermal technologies can develop a utility-scale, on-site facility to provide energy and improve resilience.

The DAF also continues to improve the energy efficiency of its legacy aircraft to increase combat capability while pushing for revolutionary aircraft designs like the Blended Wing Body aircraft demonstrator that will change the future of aviation.

LINE OF EFFORT 5:
ENHANCE ADAPTATION AND RESILIENCE THROUGH COLLABORATION

Effective and efficient climate adaptation over the range of DOD missions, operations, and infrastructure requires leveraging all relevant information, methods, technologies, and approaches. The Department builds unity of effort and mission across DOD Components, commands, services, and theaters to exploit lessons learned and economies of scale. Close cooperation with all who have a stake in our national security (other federal agencies, Congress, private industry, academia, NGOs, the American people, and allies), as well as other nations, will help secure our common interests and promote our shared values.

Interagency and academic partnerships through the competitively funded SERDP, ESTCP, OECIF and OEPF are critical to develop and test new technologies that ensure the DOD can operate under changing climate conditions, preserve operational capability, and enhance the natural and man-made systems essential to the Department's success.

The Navy's only forward-deployed aircraft carrier, USS RONALD REAGAN (CVN 76), steams in formation with ships from Carrier Strike Group Five (CSG 5) and the Republic of Korea Navy during Exercise Invincible Spirit.

SERDP/ESTCP

SERDP and ESTCP provide science-based tools that enable installations to plan for, respond to, and rapidly recover from extreme weather events. Several funded projects led to the development and refinement of two key climate adaptation tools, DCAT and the DRSL database, that installations are now required to use for planning. SERDP and ESTCP recently launched the National Innovation Landscape Network with the USGS and other partner research and land management agencies to accelerate the development and adoption of technologies that protect DOD test and training lands. The network, comprised of three regional landscapes in Alaska, the Eastern U.S., and the Southwestern U.S., addresses rapid ecological changes impacting military operations.

OUSD Policy directs, controls, and administers the Defense Operational Resilience International Cooperation (DORIC) pilot program. DORIC supports engagement with the national security forces of partner countries on defense-related environmental and operational energy issues in support of the theater campaign plans of the Geographic Combatant Commands. DORIC also supports DOD regional centers and the Center for Excellence in Disaster Management and Humanitarian Assistance to increase understanding of climate impacts on international DOD partnerships, including how they pertain to ongoing operations, missions, and activities. Notably, DORIC is the only security cooperation authority explicitly addressing climate resilience considerations.

DOD hosted the inaugural International Climate and Energy Security Forum (ICESF) to bring together close defense allies to discuss shared national security concerns related to climate change and energy security. The ICESF built relationships in this emerging space and identified actions that Defense Ministries can take to address these challenges from a security perspective. The ICESF also provided an important opportunity to exchange views and deepen understanding on respective strategies and national priorities, wargaming analyses, security cooperation related to climate resilience, and energy technology innovation.

DOD climate adaptation is intrinsically interconnected with the decisions made by neighboring communities. Military installations coordinate and cooperate with nearby communities for commodities and infrastructure, such as access roads and telecommunications. The DOD strengthens partnerships and increases adaptation and resilience capabilities and capacity through the OLDCC and the REPI Program.

INTERAGENCY WILDLAND FIRE EFFORTS

DOD participates in numerous IWGs at the Department level, including the Wildfire Resilience IWG, the Wildland Fire Leadership Council, the NWCG, National Prescribed Fire Training Center, and collaborates with each of the National Cohesive Wildland Fire Management Strategy regional committees. At the installation level, DOD wildland fire managers collaborate with partners across federal, state, tribal, and local agencies and organizations to ensure optimal preparedness for and interoperability during wildland fire events.

CLIMATE INFORMED FUNDING TO EXTERNAL PARTIES

OLDCC furthers the priorities of the NDS by supporting the readiness and resilience of military installations and defense communities.

OLDCC's Installation Resilience Program provides states and communities the opportunity to partner with their local installations to identify man-made or natural threats across the community that are likely to impair the continued operational utility of local military installations. Once threats are identified, the partners collaborate to plan and carry out responses, including the enhancement of both man-made and natural infrastructure as well as assessment of community assets, such as housing, education, and healthcare.

In FY 2023, OLDCC enabled 17 locally-led TTXs. A TTX can facilitate a threat-based scenario to "dry run" planned emergency response to disasters and catastrophic events. The goal is to validate that response actions on- and off-installation are executed effectively and to identify gaps in critical infrastructure. Once an installation-community team assesses the ability of military mission and public infrastructure owners to continue their missions in the face of attack or disaster, they can collectively identify opportunities for future projects to preserve and enhance mission resilience and assurance.

OLDCC's Defense Community Infrastructure Program (DCIP) addresses deficiencies in community infrastructure that support a military installation through construction projects to enhance military value, cadet training at covered educational institutions, installation resilience, and family quality of life. 10 U.S. Code 2391(d) authorizes the Secretary of Defense, through DCIP, to make grants, conclude cooperative agreements, and supplement funds available under other federal programs in support of the program. Proposals evaluated under the installation resilience category are assessed for their evidence to enhance military installation resilience as defined under this authority.

On behalf of the Department, OLDCC also carries out an invitation-based Public Schools on Military Installations Program. For a Priority List of schools approved by the Deputy Secretary of Defense, the program allocates funding to local education agencies to develop proposals to address the condition and capacity issues that underly a specific school's ranking in the Priority List. In response to *EO 14057*, the program also encourages local education agencies to design net-zero projects that can both significantly offset their energy use and be resilient to the region's natural threats.

The REPI Program preserves military missions by promoting compatible land uses near DOD installations, addressing endangered species restrictions that inhibit military activities, and enhancing military installation resilience to climate change. By collaborating with NGOs and state and local governments on climate change projects, the REPI Program can accelerate project outcomes to defend national security while supporting sustainable land management practices. The Military Services and their dedicated partners can receive REPI Program funding for climate resilience projects through multiple opportunities including, but not limited to, the following: annual REPI proposals, REPI Challenge, the NFWF's National Coastal Resilience Fund, the NFWF's ATBC, and the DOI's Readiness and Recreation Initiative.

In 2023, the Sentinel Landscapes Partnership designated three new sentinel landscapes: the Lowcountry Sentinel Landscape in South Carolina; the Potomac Sentinel Landscape in Virginia; and the Tidewater Sentinel Landscapes also in Virginia. The South Carolina Lowcountry Sentinel Landscape supports immense biodiversity, encompassing more than 2.2 million acres of longleaf pine forest, ranchlands, salt marsh, forested wetlands, and unbroken wildlife corridors.

The two Virginia Sentinel Landscapes make up more than 2.9 million acres of land and water in Virginia's "Golden Crescent," an area of high military concentration, agricultural lands, and complex marsh and riverine systems that connect to the Chesapeake Bay.

DUGWAY PROVIDING GROUND – PUBLIC SCHOOLS ON MILITARY INSTALLATIONS

OLDCC assistance rebuilt the Dugway High School to correct capacity and facility deficiencies. The project uses a renewable energy geothermal ground source heat pump system to heat and cool the new school. This system reduces life-cycle costs and carbon emissions, building resilience through both adaptation and mitigation measures.

PORT OF SAN DIEGO – INSTALLATION RESILIENCE

This project enables the San Diego Unified Port District to collaborate with Naval Base Coronado, Naval Base Point Loma, and Naval Base San Diego to identify site-specific opportunities for sustainable restoration, enhancement, or retrofitting of existing shorelines throughout San Diego Bay to improve the installations' resilience. The project will result in a proactive, digital planning tool that will identify shoreline vulnerabilities and provide alternative site-specific, resilient solutions. The project will enable stakeholders to improve strategic collaboration and partnerships to pursue funding opportunities for the design, construction, and implementation of shoreline projects throughout San Diego Bay.

PORT OF ALASKA STORMWATER SYSTEM RECONSTRUCTION PROJECT – DEFENSE COMMUNITY INFRASTRUCTURE PROGRAM

This project enables the Port of Alaska to replace aged stormwater management infrastructure, alleviating flooding and soil erosion issues that impact mission readiness and execution both on Joint Base Elmendorf-Richardson and at the Port of Alaska, a strategic commercial port used extensively by the installation.

MAUNAWILI FOREST – RESTRICTIVE USE EASEMENT

On O'ahu, the U.S. Forest Service (USFS), the State of Hawai'i, and the Trust for Public Land worked in partnership with the REPI Program to bring together more than $32 million to purchase a restrictive use easement of 1,084 acres in the Maunawili Forest. This easement ensures compatible land uses that will not impact operations and flyover access at the adjacent Marine Corps Base Hawai'i training areas while supporting critical waterways, cultural and historic sites, and fertile agricultural lands.

PACIFIC MISSILE RANGE FACILITY BARKING SANDS – RESTORATION AND CONSERVATION

On the island of Kaua'i, Pacific Missile Range Facility Barking Sands received more than $5.1 million in REPI funding to reduce upland flood potential, soil erosion, and wildfire potential while restoring habitat for endangered seabirds. Restoration and conservation of native forests will increase water supply for the long-term benefit of the military mission at Pacific Missile Range Facility Barking Sands.

ADDRESSING CLIMATE HAZARD IMPACTS AND EXPOSURES

DOD used DCAT to conduct a high-level screening of climate hazard exposure for federal facilities and personnel. In addition to this high-level screening, DOD used Climate Mapping for Resilience and Adaptation (CMRA) data to assess exposure of DOD personnel to sea level rise, the FEMA National Flood Hazard Layer (NFHL) to assess exposure of DOD personnel to riverine flooding, and the USFS Wildfire Risk to Communities data to assess potential exposure of buildings and personnel to wildfire.

DOD assessed the exposure of its buildings; employees; and lands, waters, and cultural and natural resources to five climate hazards: extreme heat, extreme precipitation, sea level rise, flooding, and wildfire risk.

Table 3. Climate data used in agency risk assessment.

HAZARD	DESCRIPTION	SCENARIO	GEOGRAPHIC COVERAGE
Extreme Heat	For this hazard, the DCAT indicator for High Heat Days was used. High Heat Days is the average number of days in which temperatures exceed the 99th percentile temperature in the historic baseline period. On average in the historic baseline period, only three days per year exceed the 99th percentile temperature value. For CONUS locations, the data source is 32 Coupled Model Intercomparison Project Phase 5 (CMIP5) General Circulation Models (GCMs) model runs downscaled using the LOcalized Constructed Analogs (LOCA) method for daily temperature data. For Alaska and Hawai'i, the data source is 25 CMIP5 GCMs downscaled via the Bias Correction and Spatial Disaggregation (BCSD) method for daily temperature data. For overseas locations, the data source is 21 CMIP5 GCMs downscaled via the BCSD method for daily temperature data.	Representative Concentration Pathway (RCP) 4.5 RCP 8.5	Global
Extreme Precipitation	For this hazard, the DCAT indicator for Extreme Precipitation Days was used. Extreme Precipitation Days is the average annual number of days that precipitation in a future epoch scenario is greater than what would have been considered an extreme precipitation day historically (a 1% annual chance precipitation event). For CONUS locations, the data source is 32 CMIP5 GCM model runs downscaled using the LOCA method for daily precipitation data. For Alaska and Hawai'i, the data source is 25 CMIP5 GCMs downscaled via the BCSD method for daily precipitation data. For overseas locations, the data source is 21 CMIP5 GCMs downscaled via the BCSD method for daily precipitation data.	RCP 4.5 RCP 8.5	Global
Coastal Flooding	The DRSL database containing the 1% annual exceedance probability (AEP) coastal water levels for lowest and highest sea level scenarios drove a Geographic Information System bathtub model to translate these elevations into areas of inundation based on a digital elevation model (DEM) topographic map. This data was crosswalked with building data from the Real Property Asset Database and Defense Installation Spatial Data Infrastructure geospatial platform to identify buildings potentially impacted by this hazard.	RCP 4.5 RCP 8.5	Global
Sea Level Rise	To assess this hazard as it pertains to DOD personnel at the county level, CMRA data was used. The CMRA sea level rise coastal inundation layers were created using existing federal products: the NOAA Coastal DEMs and 2022 Interagency Sea Level Rise Technical Report Data Files.	Intermediate 2050, Intermediate-High 2050, Intermediate 2090, Intermediate-High 2090	CONUS Only

Table 3. Climate data used in agency risk assessment (continued).

HAZARD	DESCRIPTION	SCENARIO	GEOGRAPHIC COVERAGE
Wildfire Risk	This risk measures whether an asset is in a location rated as having direct, indirect, or no exposure to wildfire based on the USFS Wildfire Risk to Potential Structures (a data product of Wildfire Risk to Communities). This product estimates the likelihood of structures being lost to wildfire based on the probability of a fire occurring in a location and likely fire intensity. Data reflects wildfires and other major disturbances as of 2014.	Historical	CONUS/AK/HI
Riverine Flooding	DCAT displays Riverine Flooding exposure for a 1% AEP event. Future extents are based the Federal Flood Risk Management Standards (FFRMS) freeboard approach of adding 2 feet (low) and 3 feet (high) to the flood elevations and estimating the resulting extent of flooding. Where available, historical inundation areas are based on the FEMA NFHL 1% AEP inundation maps. Where not available, a two-dimensional Hydrologic Engineering Center River Analysis Tool (HEC-RAS) model was developed based on 10-meter DEM data and the 1% precipitation depths from the NOAA Atlas 14 and Atlas 2 precipitation datasets to delineate historical floodplains. For overseas locations, the European Centre for Medium-Range Weather Forecasts Parametrized eXtreme Rain-2 (PXR-2) dataset was used.	Historical; + 2 feet, + 3 feet FFRMS freeboard approach	Global

Exposure to extreme heat, extreme precipitation, and sea level rise were evaluated at mid- (2050) and late-century (2080) under two emissions scenarios, RCP 4.5 and RCP 8.5. Exposure to wildfire was only evaluated for the present day due to data constraints.

Table 4. Climate scenarios considered in agency risk assessment.

SCENARIO DESCRIPTOR		SUMMARY DESCRIPTION FROM NCA5
RCP 8.5	Very High Scenario	Among the scenarios described in NCA5, RCP 8.5 reflects the highest range of carbon dioxide (CO_2) emissions and no mitigation. Total annual global CO_2 emissions in 2100 are four times the emissions in 2000. Population growth in 2100 doubles from 2000. This scenario includes continued fossil fuel development.
RCP 4.5	Intermediate Scenario	This scenario reflects reductions in CO_2 emissions from current levels. Total annual CO_2 emissions in 2100 are 46 percent less than in 2000. Mitigation efforts include expanded renewable energy compared to 2000.

Additional details about the data used in this assessment are provided in Appendix 1.

ADDRESSING CLIMATE HAZARD EXPOSURES AND IMPACTS AFFECTING FEDERAL CIVILIAN EMPLOYEES AND BUILDINGS

DOD civilian employees (DOD civilians) play an important role in supporting the U.S. Armed Forces. More than 750,000 DOD civilians work in more than 650 occupations in the U.S. and around the globe, in nearly every industry and work setting. DOD analyzed climate hazard exposure for approximately 649,000 DOD civilians[3] in the continental U.S., Alaska, and Hawai'i (CONUS/AK/HI) to provide the estimates in the tables below. Tables 5 and 6 show that in the coming decades, DOD civilians will be exposed to multiple climate hazards and may experience serious climate impacts, such as heat-, water-, and food-related illnesses or injuries. Climate exposure and related impacts vary by location as well as time (mid-century, late-century) and greenhouse gas emission scenarios.

3 Due to data limitations, this analysis did not include DOD civilians for whom full location data was not available (86,000 or 11% of all DOD civilians), nor those stationed outside of the U.S. (35,000 or 4%).

The DOD has an expansive global footprint, with buildings both leased and owned serving many purposes and located in a wide variety of landscapes. Table 5 documents the results of an analysis using the most current geospatial data representing DOD buildings in DCAT. Table 6 documents an analysis of climate hazard exposure conducted for 407,351 DOD buildings globally,[4] representing more than 90 percent of buildings in the DOD portfolio.

As stated in the RHDC, DOD will integrate climate risk assessments and natural infrastructure resilience strategies, such as NBS, into design and construction processes, understanding that proactive management of our infrastructure to adapt to or mitigate against evolving risks will have significant impacts on our people and buildings. This will better equip our installation managers to plan for an uncertain future. It will also inform installation master plans that drive design, construction, and maintenance decisions, including which materials to use and where to locate new infrastructure. These scenarios and impacts shall inform installation INRMPs to develop actions to reduce environmental risks, improve environmental quality, and promote resilience.

Table 5. DOD civilian exposure to climate hazards.

INDICATORS OF EXPOSURE OF FEDERAL EMPLOYEES TO CLIMATE HAZARDS	RCP 4.5 2050 (MID-CENTURY)	RCP 4.5 2080 (LATE-CENTURY)	RCP 8.5 2050 (MID-CENTURY)	RCP 8.5 2080 (LATE-CENTURY)
Extreme Heat. *% of employees duty-stationed in counties projected to be exposed to an increase in the annual number of days with the maximum temperature greater than the 99th percentile*	100%	100%	100%	100%
Extreme Precipitation. *% of employees duty-stationed in counties projected to be exposed to an increase in the annual number of days with precipitation exceeding the 99th percentile*	95.0%	91.7%	95.1%	96.0%
Sea Level Rise. *% of employees duty-stationed in counties projected to be inundated by sea level rise*	45.0%	45.0%	45.0%	45.0%
Wildfire. *% of employees duty-stationed in counties at highest risk to wildfire*	Not exposed: 3.7%	Indirectly exposed: 3.3%	Directly exposed: 92.8%	

Table 6. DOD buildings exposure to climate hazards.

INDICATORS OF EXPOSURE OF BUILDINGS TO CLIMATE HAZARD	RCP4.5 2050 (MID-CENTURY)	RCP4.5 2080 (LATE-CENTURY)	RCP8.5 2050 (MID-CENTURY)	RCP8.5 2080 (LATE-CENTURY)
Extreme Heat. *% of agency federal buildings globally in areas projected to be exposed to an increase in the annual number of days with the maximum temperature greater than the 99th percentile*	100%	100%	100%	100%
Extreme Precipitation. *% of agency federal buildings globally in areas projected to be exposed to an increase in the annual number of days with precipitation exceeding the 99th percentile*	93.0%	93.5%	93.3%	96.8%
Sea Level Rise. *% of agency federal buildings globally projected to be inundated by sea level rise*	3.6%	3.9%	5.0%	7.7%
Wildfire. *% of buildings at highest risk to wildfire*	Not exposed: 15.6%	Indirectly exposed: 59.9%	Directly exposed: 24.4%	
Flooding. *% of buildings located within floodplains*	Within 100-year riverine floodplain: 20.7%	Within 100-year riverine floodplain + 2 feet:[5] 45.2%	Within 100-year riverine floodplain + 3 feet:[4] 50.0%	

4 Based on a dataset comprised of FY 2022 building feature locations provided by the Defense Installations Spatial Data Infrastructure Program that was cross-referenced with Real Property Sites in DCAT.

5 Per the freeboard option of the FFRMS.

EXTREME HEAT EXPOSURE

Employees. DOD personnel will experience large increases in the number of days of extreme heat. Hot days will become more common by mid-century. The average DOD Service member and civilian could experience four to eight times as many high heat days and three times the number of days more than 95°F as compared to the current climate. Extreme heat impacts may be particularly noticeable in the Midwest, Northeast, Northern Great Plains, Northwest, and Alaska Regions, where DOD personnel currently experience fewer days with temperatures more than 95°F. Increased temperatures will increase employees' risk for heat-related issues including heat stroke and exhaustion. DOD's Defense Health Agency tracks heat-related morbidity and mortality across the Department.

Buildings. DOD buildings are in areas that will be exposed to large increases in the number of days of extreme heat. Hot days will become more common. In the RCP 4.5 (2050 epoch scenario), the average site with a DOD building will experience more than seven times as many high heat days. In the RCP 8.5 (2050 epoch scenario), these locations will experience more than 10 times as many high heat days on average compared to the base climate. Internationally, under both high and low RCP (both mid- and late-century epochs), heat impacts may be especially larger at sites in the Small Islands Region, as well as sites in Central and South America, though all regions globally and domestically will experience an increase in high heat days. In the U.S., although all regions may experience an increase in high heat days, the greatest heat impacts may be at sites in Hawai'i, the Southeast, the Southern Great Plains, and the Midwest. With severe heat, facility HVAC systems may be overused or inadequate. High heat days in the Arctic can lead to permafrost thaw, impairing the structural integrity of infrastructure and facilities.

EXTREME PRECIPITATION EXPOSURE

Employees. DOD personnel will experience increasing precipitation hazards that lead to riverine and surface water flooding. Flooding may disrupt employee access to and from installations and result in the loss of transportation facilities and means. During extreme events, it can also result loss of life. DOD personnel in the Northwest and Alaska Regions will experience the largest percent increases in rainfall amounts. By mid-century, the average DOD Service member or civilian in the Northwest Region will experience heavier total precipitation and about two additional extreme precipitation days each year. DOD personnel in the Southwest, Southern Great Plains, and Northern Great Plains will experience the smallest increases in extreme rainfall. The Department is analyzing how extreme precipitation can result in stormwater flood events that expose installation residents and employees to pollutants.

Buildings. Most DOD buildings are in areas that will experience increasing precipitation hazards that lead to riverine and surface water flooding. Flooding may disrupt employee access to and from installations as well as loss of facilities, roads, and other infrastructure. However, the following regions may experience a slight decrease in the number of days per year with extreme precipitation events: Small Islands Region under RCP 4.5 (2050 epoch scenario) and the Hawai'i Region under RCP 4.5 (2050 epoch scenario), RCP 4.5 (2085 epoch scenario), and RCP 8.5 (2050 epoch scenario). DOD buildings in the Polar, Alaska, and Central and South America Regions will be exposed to the largest percent increases in the average number of days per year with extreme precipitation. In the RCP 8.5 (2050 epoch scenario), an average DOD building in the Polar and Alaska Regions will experience four additional days of extreme precipitation each year. DOD buildings in the Southwest, Southern Great Plains, and Northern Great Plains will experience the smallest increases in extreme rainfall, with average indicator values increasing by 20 percent or less in three of four epoch scenarios.

SEA LEVEL RISE AND RIVERINE FLOODING EXPOSURE

Employees. At the county-level resolution, approximately 45 percent of DOD civilians are stationed in a county exposed to sea level rise, while nearly all DOD civilians live in a county with a 100-year or 500-year floodplain. At the requested resolution, the exposure does not change noticeably between epoch scenarios. At a higher resolution, the exposure across epoch scenarios will change. Flooding may disrupt employee access to and from installations and result in the loss of transportation facilities and means. During extreme events, it can also result loss of life. Rising sea level also increases saline intrusion, with potential to adversely impact underground utilities and drinking water sources. Sea level rise can cause tidal inundation events that expose installation residents and staff to waterborne pollutants.

Buildings. More than 7 percent of DOD buildings are in an area exposed to sea level rise under the RCP 8.5 (2085 epoch scenario), while approximately 50 percent of DOD buildings are found within a 500-year floodplain. Of the buildings exposed to coastal flooding under RCP 8.5 2085, the majority are in the Southeast Region. Flooding may disrupt employee access to and from installations as well as loss of facilities, roads, and other infrastructure. Rising sea level also increases saline intrusion, with potential to adversely impact underground utilities and drinking water sources.

WILDFIRE EXPOSURE

Employees. Currently, approximately 93 percent of DOD civilians work in a zip code with direct exposure to wildfire hazards. DOD personnel will be more likely to experience wildfire impacts in the future. In the Midwest, Northeast, Northern Great Plains, and Northwest Regions, zip codes wherein DOD personnel reside that have historically experienced less than a day of fire season length[6] conditions will see multiple days of fire season length conditions on average in the future. Specific zip codes in the Southwest and Southern Great Plains where DOD personnel live will experience at least 20 more days of fire season conditions through the end of the century. Health impacts of wildfire include air quality hazards resulting from particulates.

Buildings. Wildfires can cause extensive and severe damage to buildings and property, causing long-term disruption to operations. Currently, approximately 84 percent of DOD buildings are on an installation directly exposed to wildfire hazards. DOD buildings are more likely to be impacted by wildfire in the future. At DOD installations in the Midwest, Northeast, Northern Great Plains, Northwest, Southeast, and Southwest Regions, DOD buildings at sites that have historically experienced less than a day of fire season length conditions will see multiple days of fire season length conditions on average in the future. At DOD installations in the Midwest, Northeast, Southeast, Southern Great Plains, and Southwest, DOD buildings will be exposed, on average, to at least 20 more days of fire season length conditions in all epoch scenarios.

6 Fire Season Length is the average annual number of days in which the Keetch-Byram Drought Index (KBDI) is > 600, indicating long-term arid conditions and dry coarse fuels.

ADDRESSING CLIMATE HAZARD EXPOSURES AND IMPACTS AFFECTING MISSION, OPERATIONS, AND SERVICES

The DOD is committed to the health, safety, and wellbeing of its workforce and surrounding communities. Per DODI 6055.17, *DOD Emergency Management Program*, installations address potential hazards in a comprehensive, all-hazards Emergency Management Plan coordinated with federal, state, regional, and local government and emergency response entities. These plans align with the five mission areas of prevention, protection, mitigation, response, and recovery, and must be flexible enough for use in all emergencies, including unforeseen events, but detailed enough to provide an initial course of action for installation commanders to proceed with pre-planned responses to potential unexpected events. Installation Emergency Managers conduct all-hazards threat assessments to consider the impact of any natural or human-caused hazard on the installation, its people, infrastructure, and mission. These plans include a risk communication plan, evacuation plans, and an outreach component to make Service members and DOD civilians aware of the hazards and risk reduction strategies. In addition to the Installation Emergency Management Plans, Services and individual installations engage in their own efforts to increase hazard awareness among the workforce and implement safety measures in the event of climate exposure.

Measures to help prepare Service members, DOD civilians, on-site contractors, installations, and surrounding communities absorb, recover from, and adapt to weather and climate exposure include the following:

- Improve education around heat-related morbidity and mortality including recognizing conditions under which outdoor activity should be reduced; identifying signs and symptoms of heat-related illness; and communicating methods of treatment in the field.
- Increase acclimatization times for newly arrived personnel on installations during the warmer months and adjust the schedule of outdoor activities to coincide with cooler portions of the day.
- Designate locations to function as cooling centers during heat waves, as necessary, particularly in locations where air conditioning is not a common facility feature.
- Engage in pre-disaster evacuation planning that accounts for social vulnerability and other demographic factors.
- Improve Joint Force knowledge of personnel safety in extreme conditions.
- Reduce the likelihood of brownouts and blackouts during heat waves by requiring improvements to the energy efficiency of buildings and infrastructure to reduce energy demand. These improvements could include passive heating and cooling, passive solar design, use of solar canopies over adjacent parking areas, and integration of buildings with microgrids, battery storage, and installation-wide controls systems.
- For installations where drought is a concern, provide the necessary drought education to comply with water use restrictions. Such education addresses water use issues but also drought-related issues such as water quality, wildfire, and heat stress. These installations should also have a water conservation plan with long-term goals for water supply management. The plan should also identify water supply thresholds below which increasingly stringent water restrictions would come into effect.
- For installations where wildfire exposure is a concern, employ wildfire resilience strategies including fire-resistant landscaping, defensible spacing, and structure hardening. Non-structural strategies may include prescribed fires, which enhance ecosystems, build wildfire resilience, and provide realistic, resilient, training environments for the mission.

ADAPTATION — RELOCATION:

An example where the DOD relocated functions to a lower risk property is in Guam where the NAVFAC Marianas partnered with the Guam Power Authority in 2010 to move power generation from shore side to higher inland areas due to risks associated with tsunamis, storm surge, and rising sea levels.

Actions to address climate sensitive buildings at risk from flooding due to riverine and coastal inundation include:

- **Adaptation** measures such as the elevation of buildings, roads, and utilities; dry and wet floodproofing; floodable development; floatable development; and ring walls and levees;
- **Relocation** or removal measures that consist of moving facilities and buildings from impacted or exposed areas out of reach of floodwaters;
- **Mission changing measures** that align mission criticality and operations accordingly with asset vulnerabilities; and
- **Repurposing** measures that designate buildings and facilities to house activities with lower mission criticality; repurposing can provide the additional benefit of use of the evacuated area, building, or facility.

FLOOD HAZARD EDUCATION:

Fort Cavazos is the Army's premier installation to train and deploy heavy forces. Fort Cavazos, with 214,968 acres, is the only post in the U.S. capable of stationing and training two armored divisions. The rolling, semi-arid terrain is ideal for multifaceted training and testing of military units and troops. In response to changing flash flood risks associated with higher rainfall and increased rainfall intensities, Fort Cavazos improved active communication of flood hazards. Namely, Fort Cavazos asks its personnel to maintain heightened awareness at low water crossings, even those that have not flooded in the past. In collaboration with the USGS, Fort Cavazos raised flood hazard awareness and established and supported the operation and maintenance of stream gauges for several low water crossings. The installation introduced several safety measures to reduce the risk of flash floods, including new bridges over low-water crossings, water gauges to measure the current amount of water in a certain area, and closed roadways when there is an immediate risk of flash flooding.

CLIMATE HAZARD EXPOSURES AND IMPACTS AFFECTING FEDERAL LANDS, WATERS, AND ASSOCIATED CULTURAL RESOURCES

With its large global footprint, the DOD assessed projected climate exposures to federal lands and waters in a regional, screening-level assessment using DCAT (Figure 4). DCAT currently includes regional summaries from the Fourth National Climate Assessment (NCA4), produced by the U.S. Global Change Research Program, and from the Fifth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC), which provide overviews of climate change causes and effects. Information from the recently released NCA5 and Sixth Assessment Report of the IPCC will update these regional summary assessments in FY 2024.

The Department uses more than 27 million acres of land including government-owned land, public land, public land withdrawn for military use, licensed and permitted land, and foreign land used by the DOD. To successfully manage federal lands, waters, and cultural resources, the DOD must understand climate threats to the species and habitats on the lands. There are more than 550 threatened and endangered species on DOD installations and ranges. Of those more than 550 species, 54 listed species, and 74 at-risk species exist only on DOD lands. The DOD has long understood that conserving military lands protects the species and their habitats.

To advance understanding of climate risks to military lands, DCAT identifies the potential Threatened, Endangered, and At-Risk Species (TER-S) that are known or predicted to be on installations. For each potential TER-S, the DOD assessed the vulnerability of the species to each climate-related hazard based on a combination of known threats to the species, the particular habitats the species is associated with, their known susceptibility to climate-related hazards, and ecological characteristics of the species and their implied effect on vulnerability to climate-related hazards. Summary installation climate exposure reports within DCAT include projected vulnerabilities of TER-S to climate-related hazards using the NatureServe Network Program.

The DOD also manages several types of cultural resources, including historic buildings and structures, archeological resources and sites, objects, historic districts and landscapes, ethnographic resources, sacred sites, and burial sites. Climate hazards have overlapping or similar impacts on cultural resources. For example, sea level rise is causing erosion on coastal sites and cemeteries. Melting ice and permafrost is also causing coastal erosion, as well as allowing millennia-old organic remains that had been preserved in ice to become exposed and rot. Increased rainfall, river flow, and downcutting is eroding mud-brick ruins and buried archaeological sites. Drought and rising temperatures will pose threats to wooden buildings as termites and other pests are able to survive at higher latitudes and altitudes. Desert sands are damaging traces of ancient civilizations, and increased lightning strikes and fires are destroying historic buildings and archaeological sites, as well as facilitating the erosion of buried archaeological sites.

NAVY:

Western Landscapes Resilience Initiative*: Across the DON's western installations and ranges, extreme temperatures, drought, wildfire, dust, and flooding events threaten built and natural training assets. In April 2023, the DON established the requirement for Navy and Marine Corps to collectively identify 500 thousand acres on or around arid and semi-arid installations in the Western U.S. to take actions that positively impact groundwater recharge, stormwater retention, and sustainable land management. Installations identified parcels where NBS could be implemented to enhance mission resilience (e.g., range access roads washing out; training interruptions; water security) as well as natural resources management (e.g., habitat enhancement; water sources for listed species; biodiversity; carbon sequestration). The DON is investing in several FY 2024 projects as demonstrations that can be leveraged by other installations and scaled up to inform future implementation.*

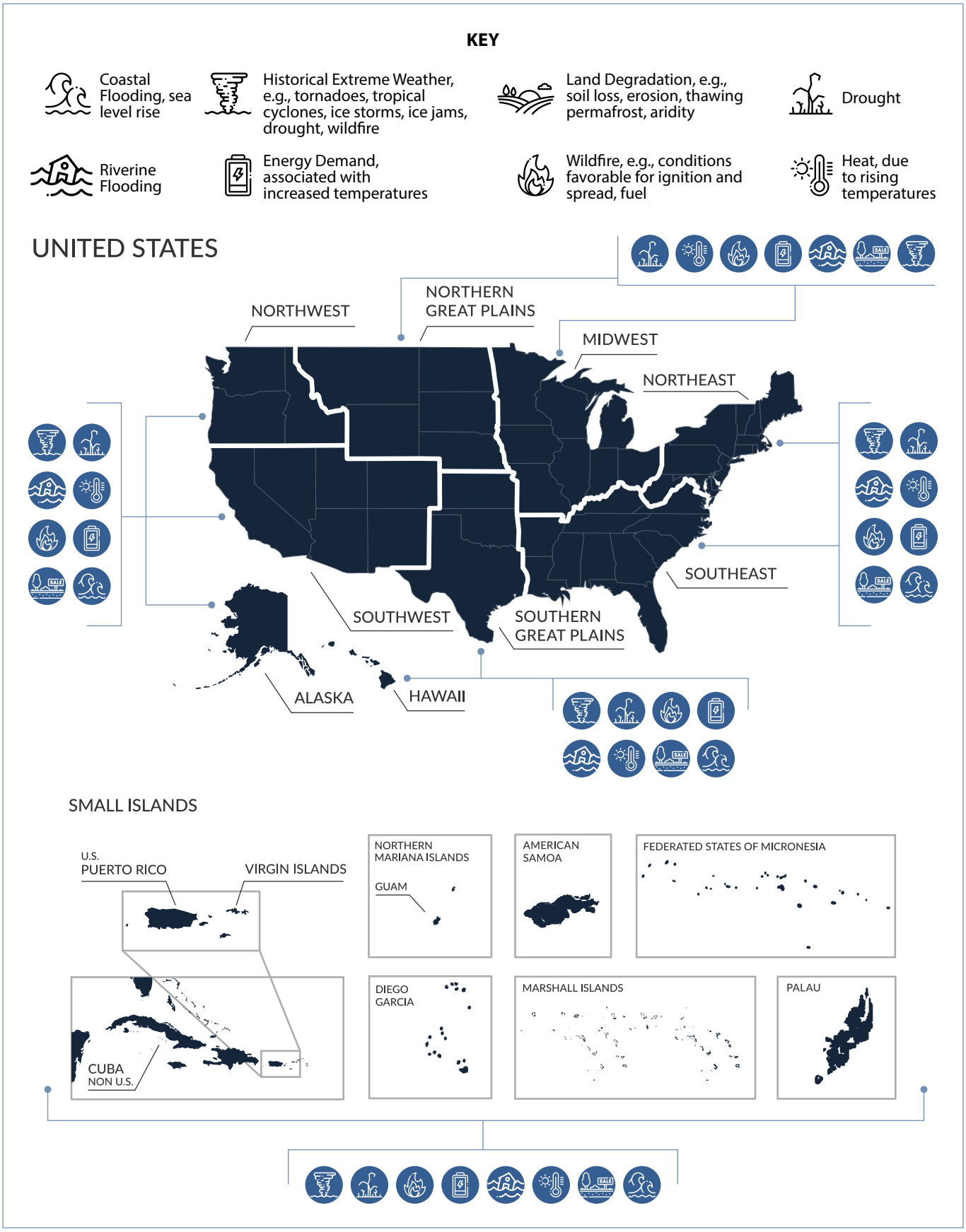

Figure 4. Projected regional climate hazard exposures to DOD installations, lands, and waters using DCAT identified climate hazards and regional summaries.

ADDRESSING CLIMATE HAZARD EXPOSURES AND IMPACTS AFFECTING FEDERAL LANDS, WATERS, AND ASSOCIATED CULTURAL RESOURCES

DOD's natural infrastructure is critical to military combat readiness through its ability to provide realistic operational testing and combat environments and conditions. Climate-informed natural resource plans focus on protecting and enhancing testing and training. Natural resource managers work with surrounding communities to protect land near installations and proactively engage with the private sector to address impacts of off-base development. They also work to enhance the management of DOD natural assets to preserve or expand ecosystem services, building resilience at the regional level. Examples and highlights are provided below.

Prescribed fire, the planned use of wildland fire to restore and maintain ecosystems and to reduce wildfire severity, is a critical tool used by DOD wildland fire managers. On average, the Department uses prescribed fires on a higher ratio of its managed lands than any other federal agency, and in many cases, the use of prescribed fire has helped the recovery of many threatened and endangered species. Prescribed fires are conducted to reduce fuel loading on installation training and testing ranges, increase accessibility to training lands, reduce hazards near facilities, maintain diverse and resilient ecosystems, and train wildfire response personnel. These factors make prescribed fires an effective tool for ensuring resilient natural infrastructure on DOD lands.

In June 2023, DOD published the *Climate Adaptation Guide for Cultural Resources*. This guidance document presents methodology for considering and integrating climate change risks into cultural resources management and potential ways to improve resilience for cultural resources. This guide also presents ways to integrate these climate adaptation strategies into Integrated Cultural Resources Management Plans.

Changing climate conditions may lead to declines in species, making them eligible for legal protection under the Endangered Species Act (ESA) and more difficult for installations to manage. The RASP initiative builds on years of collaboration and innovation under the ESA between DOD and DOI. The partnership was established in 2018 to develop and promote species conservation while promoting increased flexibility for mission activities. Since its inception and through conservation efforts, the RASP has positively impacted the status of 11 species listed under the ESA that are found on DOD lands and waters. The RASP also aims to recognize and respond to the current and projected impacts of climate change on ecosystems and watersheds, and on the species within those ecosystems and watersheds.

In 2023, RASP focused on improving the conservation status of more than 55 species, and celebrated numerous successes. In 2023, six species, all endemic to DOD lands, were declared recovered and removed from the ESA. This extraordinary accomplishment showcases DOD's continued commitment to species protection while enhancing the military mission. The DOD and the USFWS are working together on Species Action Plans (SAPs) that benefit 25 priority species, achieve conservation outcomes, and improve DOD mission flexibility at more than 150 installations and ranges. These SAPs identify priority actions, milestones, and desired outcomes between the two agencies that support the species conservation and recovery while minimizing constraints to military readiness. Additionally, DOD and USFWS will continue to collaborate through partnerships to improve the conservation status and military mission impacts of more than 30 more species.

The DOD will continue to support efforts regarding interagency coordination and collaboration for the protection of Tribal treaty and reserved rights, including increasing the incorporation of the use of Indigenous knowledge and applying the White House Memorandum on Uniform Standards for Tribal Consultation. The DOD makes good faith efforts to build effective relationships with Federally Recognized Tribes and to meet its responsibilities to meaningfully consult with these Tribes on proposed military training and construction actions, plans, and ongoing activities that may have the potential to significantly affect protected Tribal lands, cultural properties, or Tribal treaty rights.

CONSERVATION PROGRESS:

Thanks to conservation efforts, the USFWS downlisted or delisted 11 species found on DOD lands. The Hawaiian goose (Nēnē), American burying beetle, and Stephens' kangaroo rat have been downlisted. The Lesser long-nosed bat, black-capped vireo, five San Clemente Island species (Bell's sparrow, paintbrush, lotus, larkspur, and bush mallow), and Okaloosa darter have been delisted.

CLIMATE LITERACY EFFORTS

The 2021 CAP stated that prepared combat forces capable of operating under the most extreme and adverse weather and terrain conditions are necessary to carry out our mission. Climate change complexities require the Department to anticipate, train, and equip the force to account for emerging environmental conditions different from the range of environments existing in the past. This includes compounding effects of climate hazards together or with other disruptions (e.g., pandemic).

DOD personnel experience the impacts of a changing climate every day. These effects complicate already complex operations and exacerbate risks to Joint Force readiness, lethality, and mission execution. In the 2021 CAP, the DOD identified climate literacy as a key enabler integral to the success of all DOD climate adaptation efforts. Since then, the Department made climate literacy a priority in its overall resilience work.

Public Health Activity Fort Lewis participates in high altitude canine insertion and recovery rotary wing training across the Alaska Mountain Range with the 354th Security Forces and 549th Military Working Dog Detachment on Fort Wainwright on March 17, 2023.

The Department's almost 3 million-member workforce of active-duty, civilian, National Guard and Reserve personnel, and support contractors underpin DOD's ability to address the risks associated with a changing global climate. The knowledge, skills, and capabilities required to address the impacts of a changing climate depend on the unique mission, function, and role of each member of this workforce. Therefore, the climate literacy effort is developing appropriate and tailored information allowing the workforce to understand when, why, and how to apply climate considerations. Innovative solutions from a climate-informed DOD workforce can optimize operational planning and enable effective energy use to reduce future climate risks.

Figure 5. DOD's approach to building and supporting a climate-literate workforce has three pillars: education, training, and engagement.

In 2022 and 2023, the Department issued a voluntary Climate Literacy Pulse Check to assess workforce climate knowledge, use, and requirements for climate information. In both years, this Pulse Check reached a broad cross section of military and civilian personnel across the OSD, the Services, Joint Staff, and Defense Agencies. The Department also conducted a series of Climate Literacy Focus Groups with personnel in career fields closest to the climate challenge, and issued data calls to military education institutions regarding climate-relevant curricula. Cumulatively, these efforts provided important indicators of climate education, training, and resources needed across DOD Components, career fields, and professional rank and grades. DOD senior leadership used the findings from these efforts to develop data-informed recommendations for DOD-wide initiatives to strengthen military and operational resilience to climate change. The Department intends to replicate these efforts annually, or as needed, to measure progress and assess change from the 2022 baseline.

Integrating climate literacy into all education and training remains a cornerstone of DOD's climate literacy efforts, particularly for professional military education (PME) programs. PME programs are essential in the development of future military leaders prepared to navigate the challenges of future operating environments. The DOD identified climate literacy learning outcomes for intermediate- and senior-level PME programs and the DOD supports faculty members to implement these outcomes at the war colleges, command and staff colleges, and Service academies. Standardizing climate literacy learning outcomes across institutions help future PME graduates understand climate risks to military operations. The effort also equips PME graduates with the information, tools, and resources for operational resilience in an evolving climate and security environment.

The Department's Climate Working Group and Sub-Working Groups, Climate Wargaming, Climate Literacy, and Strategic Integration, continue to coordinate responses and track implementation of climate and energy-related directives, actions, and progress. The DOD will continue efforts to integrate climate resilience into curricula, wargames, and TTXs for Military Service members. The Department will also support ally and partner climate military education initiatives, where possible.

The Department launched the Climate Resilience Portal in 2023 to help optimize climate-informed decision-making across its workforce. The Department continues to build additional capabilities into the Portal including general informational materials, tailored education (e.g., senior leader training), and training resources. DOD practitioners use the Portal to guide climate-informed decisions as appropriate to their mission, function, and role.

Table 7. Pulse Check findings.

EDUCATION, TRAINING, ENGAGEMENT, AND CAPACITY BUILDING	
Agency Climate Education, Training, and Engagement Efforts	More than a quarter of pulse check respondents in 2022 and 2023 reported receiving "some" or "extensive" climate education, training, or information related to their job while employed at the Department.
	Respondents at the senior level (i.e., General/Flag Officer, Senior Executive Service) reported receiving slightly more climate education and training than the broader workforce—coming in at around 40 percent.
	Approximately 27 percent of respondents identifying with the financial management and administration career field in 2023 have received climate education, training, or information while at DOD—up from 20 percent in 2022.
	Of the respondents to the 2023 pulse check identifying with career fields in acquisition, operations, supply, logistics, and transportation, roughly 30 percent reported receiving "some" or "extensive" climate education, training, or information—up from a quarter the year prior.
Agency Capacity	Of the more than 12,000 annual responses DOD received to its pulse check in 2022 and 2023, 40 percent thought climate change would affect their work or mission in the near term, and more than 50 percent in the far term.

WILDLAND FIRE TRAINING:

The Army, in conjunction with the Air Force, established a Wildland Fire Academy. The focus of the academy is to provide training on wildland fire management. Army covers 80 percent of the costs for students to attend the training.

The Basilone Complex Fire burned more than 22,000 acres in grass and brush causing evacuations of installation personnel and risk to installation property, facilities, and infrastructure. Camp Pendleton's successful fuel management significantly contributed to halting the Basilone Complex Fire before it could reach installation facilities and other protected resources. Through systematic vegetation clearance in a mechanical fuel treatment zone around the cantonment area and strategic fuel break location, the base established a reliable defensible space against the wildfire's progression. Routine maintenance of firebreaks and proactive application of prescribed fires played a key role in reducing fuel loads, thus reducing the risk of intense fires. The collaborative efforts between Camp Pendleton's firefighting teams and local agencies demonstrated a practical and effective approach to preventing the spread of wildfires, ensuring the safety of the base and its surrounding areas. This proactive approach showcases the military's commitment to wildfire prevention and ensured the protection of both military readiness and the surrounding environment.

The DAF manages more than 9.8 million acres of land across 96 installations that require INRMPs. A significant portion of this land, especially in the southeast, west, and Alaska, is comprised of areas where wildland vegetation and fuels pose a hazard to infrastructure and land uses. In FY 2020, the Air Force Wildland Fire Branch taught 57 courses to 796 students for the Air Force and partner organizations. The Air Force also partners with the Army Wildland Fire Program to deliver 12 additional higher-level wildland fire training courses to develop a 5-year annual average of 40 Air Force natural resources, fire, and emergency services personnel. Training and qualifications follow national standards in wildland fire management set by the National Wildfire Coordinating Group (which is also used by the U.S. Forest Service, DOI, and National Association of State Foresters).

TIMELINE SUMMARY OF MAJOR MILESTONES

SEE THE 2021 CAP FOR ALL PREVIOUS CLIMATE-RELATED ACTIVITIES.

2021

- Secretary of Defense signs the *Department of Defense Climate Adaptation Plan* in September
- Secretary of Defense signs the *Department of Defense Climate Risk Analysis* in October

2022

STRATEGIES AND PLANS:

- DOD releases *Securing Defense-Critical Supply Chains*, an action plan developed in response to President Biden's *EO 14017*, in February
- Department of the Army publishes *United States Army Climate Strategy* in February
- DOD releases the *Department of Defense Equity Action Plan* in April
- DON releases *Climate Action 2030* in May
- DAF releases the *Department of the Air Force Climate Action Plan* in October
- Department of the Army releases the *Army Climate Strategy Implementation Plan Fiscal Years 2023–2027* in October
- Secretary of Defense signs the *Climate Adaptation Plan 2022 Progress Report* in October
- DOD includes climate in the *2022 National Defense Strategy* released in October
- DOD releases the *2022 Department of Defense Sustainability Plan* in November

BUDGET:

- DOD OUSD (Comptroller) includes *Meeting the Climate Challenge* in the FY 2023 budget materials in April
- DOD includes climate-related risk in the Other Information section of the *United States Department of Defense Agency Financial Report for Fiscal Year 2023* in September
- DOD releases the *DOD Strategic Management Plan for Fiscal Years 2022–2026* in October

SELECT REPORTS TO CONGRESS:

- DOD submits the *Department of Defense 2021 Climate Change Adaptation Roadmap* in February
- DOD submits *Improving Water Management and Security on Military Installation*s in April
- DOD submits *Report on Effects of Extreme Weather on the Department of Defense* in April
- DOD submits *Strategic and Operational Impacts of Extreme Weather on the Department of Defense* in May

TOOLS AND CAPABILITIES:

- DOD makes climate exposure assessments available for all major U.S. installations using DCAT in April
- DOD adds flooding and permafrost data crosswalk with DOD buildings to DCAT in May
- DOD added environmental justice layers from the Climate and Economic Justice Screening Tool (CEJST) and EPA's EJScreen Tool to the Defense Installations Spatial Data Infrastructure Program in September
- DOD conducts a Department-wide Climate Literacy Pulse Check questionnaire in November
- DOD conducts first Department-wide Climate Literacy Focus Groups in December

POLICY:

- The Office of the Assistant Secretary of the Army for Installations, Energy, and Environment (ASA (IE&E)) releases the *Installation Climate Resilience Plan (ICRP) of the Installation Master Plan* memorandum in February
- DOD releases *Directive-type Memorandum (DTM) 22-003, "Flood Hazard Area Management for DOD Installations"* in June
- Department of the Army releases *Guidance for Installation Energy and Water Plans (IEWPs)* in May
- DOD releases the memorandum *Climate Parameters for Wargames* in November
- ASA (IE&E) releases the memorandum *Guidance for Installation Climate Resilience Plans (ICRPs*) in November
- The Office of the Assistant Secretary of the Air Force for Energy, Installations, and Environment and the Office of the Deputy Chief of Staff for Logistics, Engineering and Force Protection, Headquarters U.S. Air Force, releases memorandum *Climate Resilience Considerations in Installation Master Planning* in December

2023

STRATEGIES AND PLANS:

- The United States Space Force releases the *Mission Sustainment Strategy* in March
- DOD releases the *Department of Defense Plan to Reduce Greenhouse Gas Emissions* in April
- DOD releases the *Operational Energy Strategy* in May
- DOD releases the *Climate Adaptation Guide for Cultural Resources* in June
- DOD verbally updated the CEQ on progress on the CAP in July
- DAF releases the *Climate Campaign Plan* in July

BUDGET:

- DOD releases the FY 2024 report on *Enhancing Climate Capability – Mitigating Climate Risk* in March
- DOD includes climate-related risk in the Other Information section of the *DOD Agency Financial Report* in August

TOOLS AND CAPABILITIES:

- DOD adds CEQ's CEJST environmental justice data crosswalk with DOD buildings to DCAT in March
- DOD completes climate exposure assessments on all major overseas installations using DCAT in April
- DOD makes DCAT Analog Tool available to six partner nations in April
- DOD adds climate vulnerability of potential TER-S to DCAT in May
- DOD updates climate exposure data in DCAT Overseas in June
- The Office of the Assistant Secretary of Defense for Energy, Installations, and Environment holds the 2023 DOD Climate Resilience Workshop in July
- DOD releases the beta version of the Water Resilience Dashboard in July
- DOD adds a facility crosswalk with climate hazard exposure layers to the Defense Installations Spatial Data Infrastructure Program in August
- The Office of the Assistant Secretary of Defense for Readiness and National Defense University co-host the first DOD faculty workshop on Military Resilience in an Evolving Climate and Security Environment in September
- DOD supports climate literacy by releasing the public version of DOD Climate Resilience Portal (Climate.mil) in October
- DOD conducts a second Department-wide Climate Literacy Pulse Check questionnaire in October

POLICY:

- Dr. William A. LaPlante, Under Secretary of Defense for Acquisition and Sustainment (USD(A&S)) signs the *Electrification of Standard Building Operations* memorandum in March
- Department of the Army releases the Army Electrification Guidance for Military Construction Projects in May
- DOD reissues DTM 22-003: *Flood Hazard Area Management for DOD Installations* in July
- Assistant Secretary of Defense for Readiness signs memorandum on *Integrating Climate Security Learning Outcomes in Professional Military Education* in August
- Department of the Navy issues the *Department of the Navy Building Electrification Implementation Policy* in November

2024 - 2027

STRATEGIES AND PLANS:

- DOD releases the first *National Defense Industrial Strategy*, signed by Deputy Secretary of Defense in January 2024
- DOD releases the *Resilient and Healthy Defense Communities*, signed by Deputy Secretary of Defense in February 2024

BUDGET:

- DOD assesses any new Congressional climate resilience funding

TOOLS AND CAPABILITIES:

- DOD implements the following DCAT enhancements:
  - Climate dashboard for Guam as a pilot for gridded DCAT
  - Continued work on adding sensitivity and adaptive capacity to DCAT to compute vulnerability
  - Updates to DCAT climate data and information
  - Adding any additional major installations per FY Base Structure Reports plus Service-requested sites
  - Transition to global gridded framework
  - Additional Partner Nation CATs for allies and partners
- DOD develops coastal hazard flood maps for Guam and Commonwealth of the Northern Mariana Islands
- DOD incorporates extreme weather and event damages into existing reporting databases
- DOD continues DOD-wide climate literacy pulse checks and onboarding materials
- DOD builds out the DOD Climate Resilience Portal to secure, CAC-enabled version and tailored mission-essential content
- The Office of the Assistant Secretary of Defense for Energy, Installations, and Environment continues DOD Climate Resilience Workshop

POLICY:

- The Office of the Deputy Assistant Secretary of the Air Force for Environment, Safety, and Infrastructure releases policy memorandum *Electrification of Installations, Standard Building Operations, Flightlines, and Non-Tactical Vehicles (NTV)* in February
- DOD releases *Integrated Installation Resilience Planning DOD Instruction*
- DOD releases *Water Resilience Policy Memorandum*
- DOD releases *Water Resilience Policy DOD Instruction*
- DOD releases *Climate Adaptation Policy Memorandum*
- DOD releases UFC updates, including 2-100-01: *Master Planning and 3-201-01 Civil Engineering*

MEASURING PROGRESS

To advance the Department's warfighting efforts, DOD uses several methods to track strategic objectives, performance goals, and priority metrics. The DOD SMP's Strategic Management Framework outlines strategic priorities and objectives which describe how the DOD will achieve its goals and priorities. In addition to the SMP, each year the Department communicates its commitment to strategic planning and performance management by publishing an Annual Performance Plan (APP) and Annual Performance Report (APR). The APR defines specific performance goals and measures for every fiscal year along with targets for successful implementation of the SMP. APGs within the SMP and the APP also highlight near-term priority policy and management areas.

Table 8. Climate adaptation process metrics.

KEY PERFORMANCE INDICATOR: Climate adaptation and resilience objectives and performance measures are incorporated in agency program planning and budgeting by 2027.	
PROCESS METRIC (PM)	**AGENCY RESPONSE**
PM 1. Agency has an implementation plan for 2024 that connects climate hazard impacts and exposures to discrete actions that must be taken. (Y/N/Partially)	Yes. The Department's 2021 CAP identifies five LOEs, each discussing discrete actions with focus areas and end states. The DOD's 2024-2027 CAP Implementation Plan will continue to identify and measure discrete actions. The NDS emphasizes the Department's strategic commitment to incorporate climate risk assessments into planning and decision-making processes and lays the path forward to identify discrete actions which must be taken.
PM 2. Agency has a list of discrete actions that will be taken through 2027 as part of their implementation plan. (Y/N/Partially)	Yes. Building upon the 2021 CAP and five LOEs, the DOD developed a list of discrete actions which will be taken through 2027 as part of the Department's implementation plan. For example, UFC 2-100-01: *Installation Master Planning* includes master planning processes and products, including energy and climate resilience requirements.
PM 3. Agency has an established method of including results of climate hazard risk exposure assessments into planning and decision-making processes. (Y/N/Partially)	Yes. DOD has an established method for including climate hazard risk exposure assessment results into all relevant plans, processes, and decisions using such tools as DCAT and DRSL in compliance with *OMB Circular A-11*. See Appendix 3 for how the Department is accounting for climate considerations across the continuum. Guidance from UFC 2-100-01, *Installation Master Planning*, and DOD and Military Department documents mandate that installation professionals include severe weather and climate risk in IDPs and facility projects. Each Military Department has a severe weather and/or climate change playbook or handbook which provides a clear methodology and framework for installation planners.
PM 4. Agency has an agency-wide process and/or tools that incorporate climate risk into planning and budget decisions. (Y/N/Partially)	Yes. Department policy has been updated to require all operations, planning activities, business processes, and resource allocation decisions to consider climate change. Coordination is done across the Planning, Programming, Budgeting, and Execution process. Since 2022, the DOD has reported climate-related risk in the Department's Agency Financial Report.

Table 8. Climate adaptation process metrics (continued).

KEY PERFORMANCE INDICATOR: Climate adaptation and resilience objectives and performance measures are incorporated in agency program planning and budgeting by 2027.	
PROCESS METRIC (PM)	**AGENCY RESPONSE**
PM 5. By July 2025, agency will identify grants that can include consideration and/or evaluation of climate risk. (Y/N/Partially)	Yes. Processes for including climate considerations within the DOD's budgetary documents, including grants, are reflected in a $3.1 billion subset of the FY 2023 budget request and are set forth in the FY 2023 *Meeting the Climate Challenge* report (released in April 2022). The *FY 2024 Enhancing Capability – Mitigating Climate Risk Report* identifies the investments needed for the Department to meet all mission requirements and maintain the ability to operate in all conditions in a $5.1 billion subset of the FY 2024 Budget request. Programs with grants which include climate considerations include but are not limited to: • REPI Program (REPI proposals, REPI Challenge, the NFWF's National Coastal Resilience Fund, the NFWF's ATBC, and the DOI's Readiness and Recreation Initiative); • OLDCC's DCIP, Installation Resilience (IR), PSMI; • SERDP and the ESTCP; • DORIC.
PM 6. Agency modernizes all applicable funding announcements/ grants to include a requirement for the grantee to consider climate hazard exposures. (Y/N/Partially)	Partial. Several programs within the Department, including REPI, have included requirements for grantees to consider climate hazard exposure. The Department will continue to identify funding opportunities where requirements may be made.
KEY PERFORMANCE INDICATOR: Data management systems and analytical tools are updated to incorporate relevant climate change information by 2027.	
PROCESS METRIC	**AGENCY RESPONSE**
PM 1. Agency has identified the information systems that need to incorporate climate change data and information, and will incorporate climate change information into those systems by 2027. (Y/N/Partially)	Yes. The Department is incorporating relevant climate change data into data management systems and analytical tools. The Department uses DCAT and the DRSL Database for screening-level assessments of climate change exposure to identify if and where further, more detailed, studies might be required, depending on the decision and its consequences . Future updates to DCAT include a gridded coverage, secure version that includes vulnerability by adding metrics for climate sensitivity and adaptive capacity and a global, watershed-based approach of climate data to more fully incorporate climate information beyond installations (e.g., supply chain planning, contingency basing, and defense communities).

Table 8. Climate adaptation process metrics (continued).

KEY PERFORMANCE INDICATOR: Agency CAPs address multiple climate hazard impacts and other stressors, and demonstrate nature-based solutions, equitable approaches, and mitigation co-benefits to adaptation and resilience objectives.	
PROCESS METRIC (PM)	**AGENCY RESPONSE**
PM 1. By July 2025, 100 percent of climate adaptation and resilience policies have been reviewed and revised to (as relevant) incorporate nature-based solutions, mitigation co-benefits, and equity principles. (Y/N/Partially)	Partially. The Department has a Performance Measure and Agency Priority Goal under the *DOD SMP FY 2022-2026* to report on the number of policy and technical guidance updates submitted for publishing to the Washington Headquarters Service (WHS). The DOD has reviewed statutory requirements and EOs for updates. The DOD plans to revise the issuances, technical guidance, and UFCs on an ongoing basis. Updates must go through formal coordination and WHS processes. The below target policy updates will cover integrated installation resilience, water resilience, federal flood risk management standards, installation energy resilience, ERCIP, and various UFCs, including master planning and civil engineering. **FY 2024 Target:** Update 12 policies and 4 technical guidance documents. **FY 2025 Target:** Update six policies and four technical guidance documents.
KEY PERFORMANCE INDICATOR: Federal assets and supply chains are evaluated for risk to climate hazards and other stressors through existing protocols and/or the development of new protocols; response protocols for extreme events are updated by 2027.	
PROCESS METRIC	**AGENCY RESPONSE**
PM 1. Agency has assessed climate exposure to its top five most mission-critical supply chains. (Y/N/Partially)	Partial. Through the *Securing Defense-Critical Supply Chains* report, the Department identified four focus areas in which critical vulnerabilities pose the most pressing threat to national security: kinetic capabilities, energy storage and batteries, castings and forgings, microelectronics, and strategic and critical materials.
PM 2. By July 2026, agency has assessed services and established a plan for addressing/overcoming disruption from climate hazards. (Y/N/Partially)	Yes. Updating DCAT to gridded coverage will enable DOD to evaluate climate exposure and risk to supply chains and existing protocols by 2026.
PM 3. Agency has identified priorities, developed strategies, and established goals based on the assessment of climate hazard risks to critical supplies and services. (Y/N/Partially)	Partially. The *Securing Defense-Critical Supply Chains* and *NDIS* reports are DOD's first strategies to ensure supply chain security, including from the effects of climate change. DOD has begun to identify priorities and establish goals based on these assessments and DCAT's evaluation of Defense Supply Centers. DOD will continue to identify priorities and develop strategies as climate hazard risk assessments to critical supplies and services are refined and expanded, e.g., transition of DCAT to a global gridded framework.

Table 8. Climate adaptation process metrics (continued).

KEY PERFORMANCE INDICATOR: By 2027, agency staff are trained in climate adaptation and resilience and related agency protocols and procedures.	
PROCESS METRIC (PM)	**AGENCY RESPONSE**
PM 1. By December 2024, 100% of agency leadership have been briefed on current agency climate adaptation efforts and actions outlined in their 2024 CAP. (Y/N/Partially)	Yes. Agency leadership will be briefed on the current climate adaptation efforts and actions outlined in the 2024–2027 CAP through the DOD Climate Working Group, a senior-level group that coordinates responses and tracks implementation of climate and energy-related directives, actions, and progress.
PM 2. Does the agency have a Climate 101 training for your workforce? (Y/N/Partially) If yes, what percent of staff have completed the training?	Partially. DOD is integrating climate into the education and training its workforce already receives. In addition, introductory climate materials are being offered to all members of the workforce via the DOD Climate Resilience Portal. These include onboarding materials and climate resources tailored to DOD functional areas to help build enduring advantages for our military.
PM 3. By July 2025, 100 % employees have completed climate 101 trainings. (Y/N/Partially)	Partially. DOD will continue to integrate climate into education and training across the human capital life-cycle to meet the workforce where they are and give them the information they need, when they need it, at the right stage of their career. DOD is not pursuing additional, mandatory Climate 101 training for its workforce.

ADAPTATION IN ACTION

The Department took significant steps to address climate-related threats since the publication of the 2021 CAP and the 2022 Progress Report. The DOD invested in increasing its resilience and improving combat capability, all while reducing the Department's contributions to climate change. The 2021 CAP's strategic framework outlined five LOEs to enable the DOD to operate under changing climate conditions, preserve operational capability, and enhance the natural and man-made systems essential to the Department's success.

The DOD continues to review and update performance metrics to reflect the evolving understanding of observed and foreseeable climate impacts to each of the five LOEs. The DOD integrated climate metrics into the Department's strategic objectives and performance goals. The climate metrics remain a senior leader priority. The DOD continues to integrate adaptation resource considerations and cost management (including life-cycle costs) into plans, business processes, material management, acquisition strategies, and associated investment and risk management processes. This work requires analyzing the costs associated with climate impacts to all five LOEs and how to reduce the costs through effective climate change adaptation.

LOE 1: CLIMATE-INFORMED DECISION-MAKING

With senior leader support, the DOD uses climate-informed decision-making. See LOE 1 for a few highlighted activities from a larger compilation of climate resilience efforts across the Department.

LOE 2: TRAIN AND EQUIP A CLIMATE-READY FORCE

The DOD continues to prepare a climate-ready force through appropriate training and equipment. The DOD is preparing combat forces capable of operating under the most extreme and adverse weather and terrain conditions. See LOE 2 for a few highlighted activities from a larger compilation of climate resilience efforts across the Department.

LOE 3: RESILIENT BUILT AND NATURAL INSTALLATION INFRASTRUCTURE

The DOD continues to improve the resilience of built and natural installation infrastructure. See LOE 3 for a few highlighted activities from a larger compilation of climate resilience efforts across the Department.

LOE 4: SUPPLY CHAIN RESILIENCE AND INNOVATION

The DOD continues to innovate and improve the resilience of the supply chain. The DOD is continuing to assess its supply chain resilience and how it can leverage purchasing power to spur innovation and deployment of climate adaptation and mitigation technologies. See LOE 4 above for a few highlighted activities from a larger compilation of climate resilience efforts across the Department.

LOE 5: ENHANCE ADAPTATION AND RESILIENCE THROUGH COLLABORATION

The DOD continues to collaborate to enhance adaptation and resilience. The DOD strengthened existing partnerships, formed new partnerships, and increased the capabilities and capacity of adaptation and resilience programs. See LOE 5 above for a few highlighted activities from a larger compilation of climate resilience efforts across the Department.

APPENDIX 1. RISK ASSESSMENT DATA

The Department of Defense's (DOD's) risk assessment uses the following data:

Buildings. The geospatial data delineating Fiscal Year (FY) 2022 DOD building footprints comes from the Defense Installations Spatial Data Infrastructure database. Climate hazard information sourced from the DOD Climate Assessment Tool (DCAT) at the Real Property Site level was joined to the DOD building dataset via a Real Property Site Unique Identifier.

Personnel. Personnel data comes from the Defense Manpower Data Center combined with climate exposure information from DCAT and the Climate Mapping for Resilience and Adaptation (CMRA) tool. An analysis of climate hazard exposure was conducted for approximately 634,000 DOD Civilians in the Continental U.S. and Alaska. This analysis did not include DOD Civilians for whom full location data was not available, nor those stationed in Hawai'i or outside of the U.S.

Climate Hazards. DOD used climate hazard information within DCAT to analyze climate exposure to extreme precipitation days, high heat days, coastal flood extent, and riverine flood extent.

In addition to this high-level screening, DOD used CMRA data to assess sea level rise exposure to DOD personnel, the Federal Emergency Management Agency (FEMA) National Flood Hazard Layer (NFHL) to assess riverine flood exposure to DOD personnel, and the U.S. Forest Service Wildfire Risk to Communities data to assess potential wildfire exposure of buildings and personnel.

APPENDIX 2. RISK ASSESSMENT MAPS

TEMPERATURE AND PRECIPITATION EXPOSURE TO DOD BUILDINGS

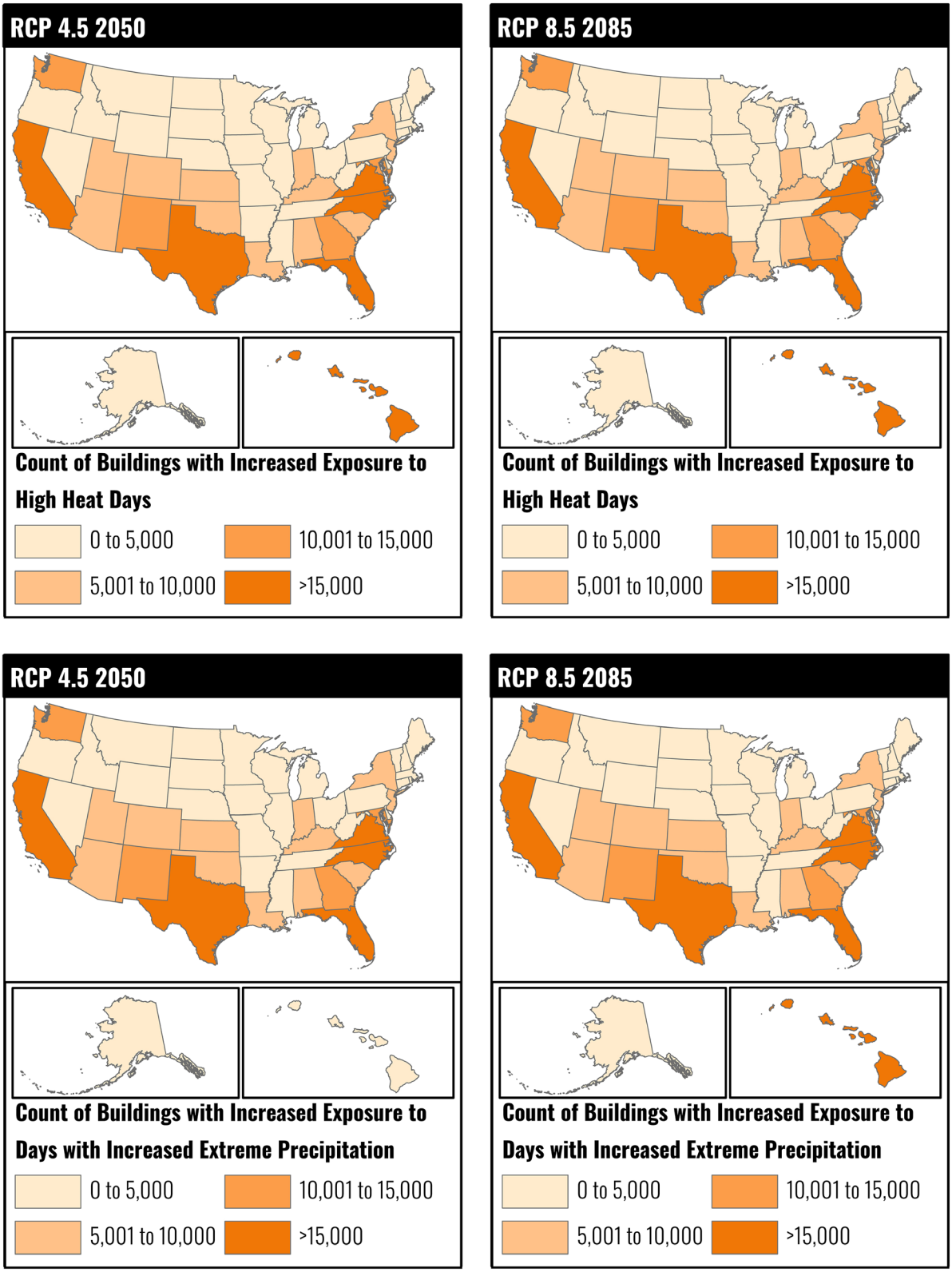

Figure A1. This map series represents the count of DOD buildings in each state that are exposed to either extreme temperature or extreme precipitation under different epoch scenarios, based on geospatial data delineating FY 2022 building footprints, and analysis from DCAT for DOD Real Property Sites. The top row of maps in the series represent the count of buildings in each state that are located at DOD Real Property Sites for which DCAT CONUS/AK/HI indicates potential increased exposure to high heat days under two different epoch scenarios: RCP 4.5 2050 (top left) and RCP 8.5 2085 (top right). The bottom row in the series represent the count of buildings in each state at DOD Real Property Sites for which DCAT CONUS/AK/HI indicates potential increased exposure to extreme precipitation under two different epoch scenarios: RCP 4.5 2050 (bottom left) and RCP 8.5 2085 (bottom right).

COASTAL AND RIVERINE INUNDATION EXPOSURE TO DOD BUILDINGS

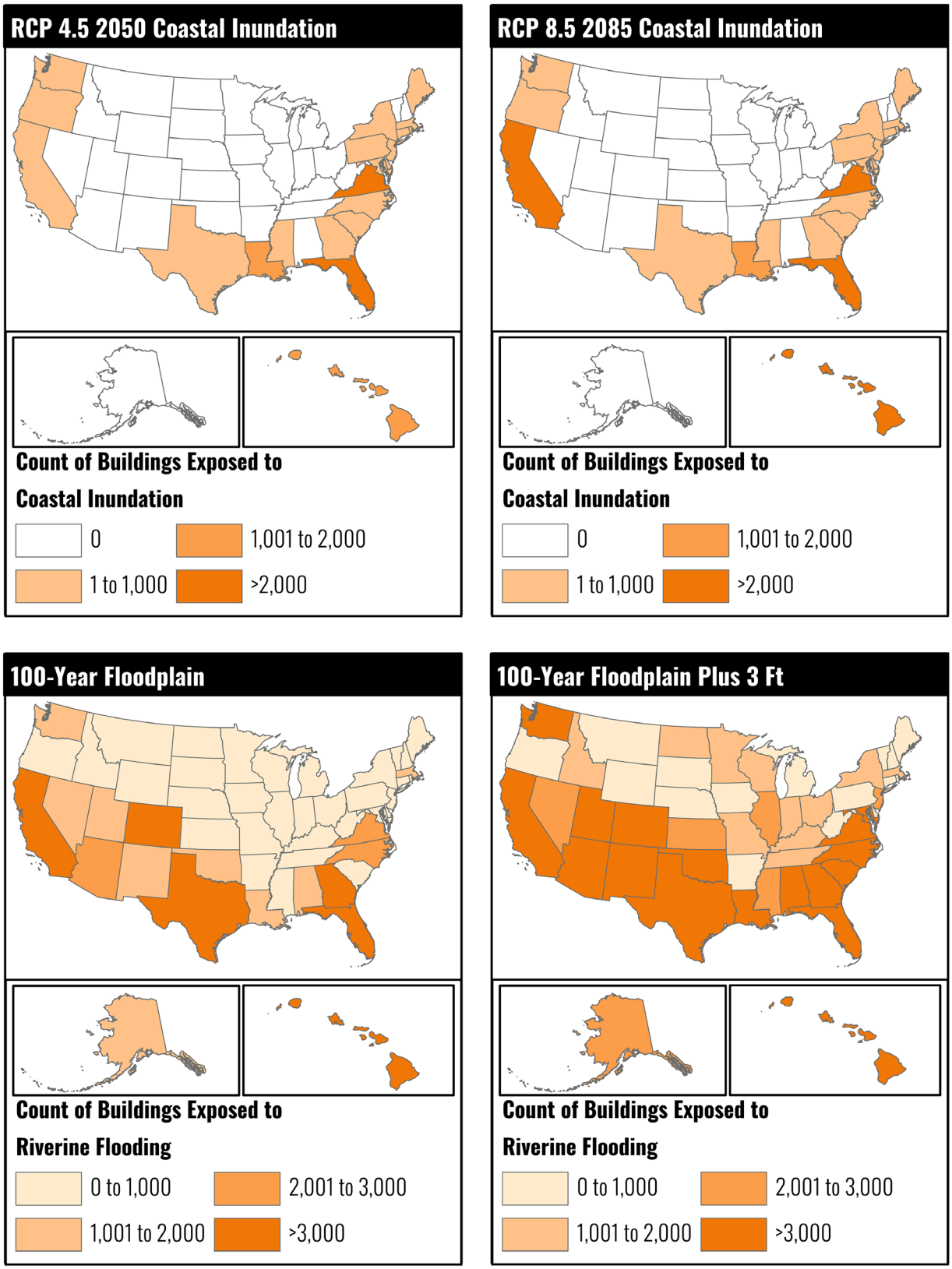

Figure A2. This map series represents the count of DOD buildings in each state that are exposed to coastal or riverine inundation under different scenarios, based on geospatial data delineating FY 2022 building footprints, and the geographic extent of potential coastal and riverine flooding used in DCAT for CONUS/AK/HI. The top row of maps in the series represent the count of buildings in each state that are located within the extent of coastal flood exposure under two different epoch scenarios: RCP 4.5 2050 (top left) and RCP 8.5 2085 (top right). The bottom row in the series represent the count of buildings in each state that are located within the extent of the 100-year floodplain for riverine systems (bottom left) and the 100-year floodplain plus 3 feet (bottom right).

WILDFIRE EXPOSURE TO DOD BUILDINGS

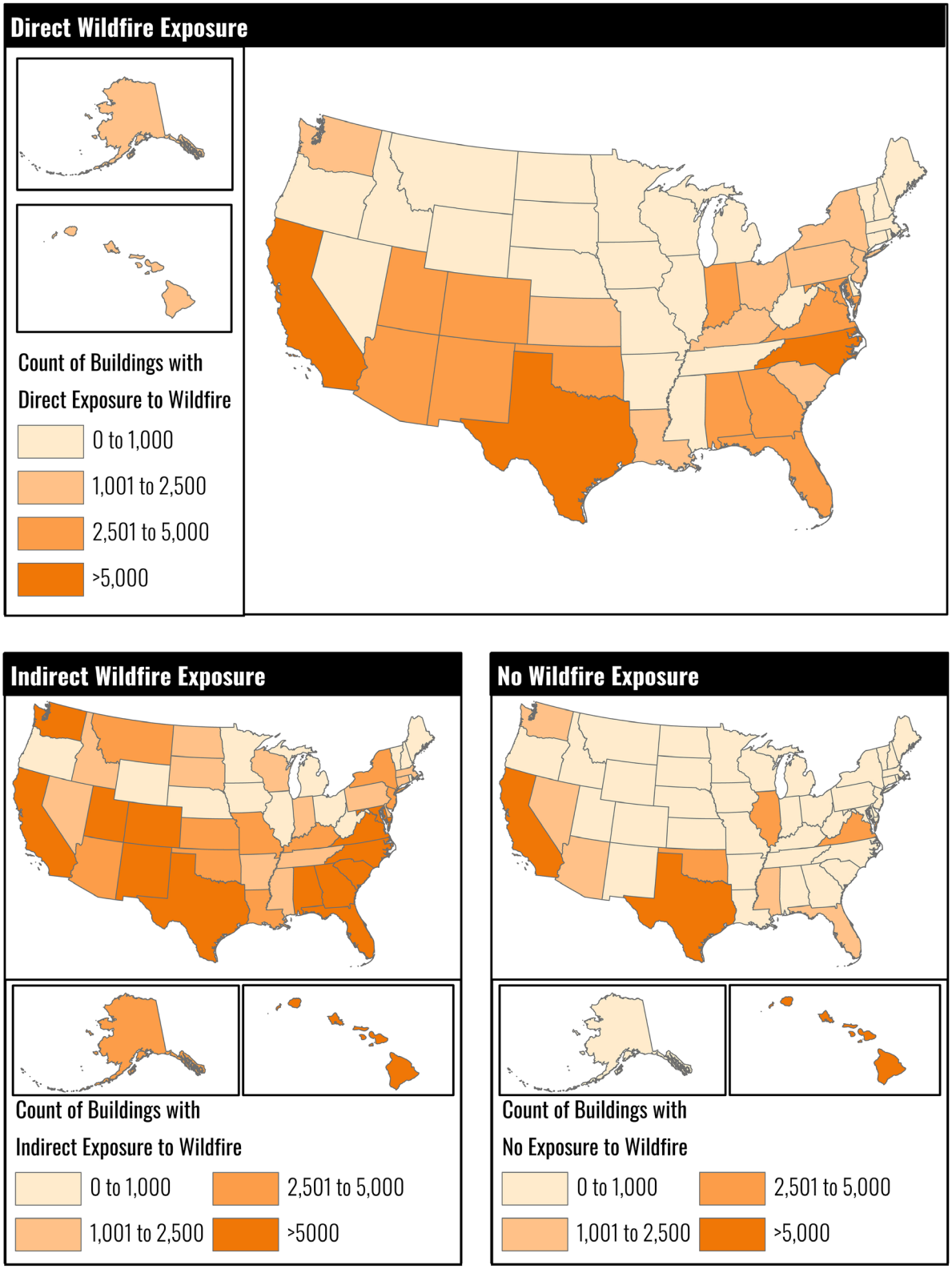

Figure A3. This map series represents the count of DOD buildings in each state that are either directly exposed (top), indirectly exposed (bottom left), or not exposed (bottom right) to wildfire risk as a function of their location, based on geospatial data delineating FY 2022 building footprints and wildfire exposure data made available from the U.S. Forest Service Research Data Archive (citation below).

Citation: Scott, Joe H.; Gilbertson-Day, Julie W.; Moran, Christopher; Dillon, Gregory K.; Short, Karen C.; Vogler, Kevin C. (2020). Wildfire Risk to Communities: Spatial datasets of landscape-wide wildfire risk components for the United States. Fort Collins, CO: Forest Service Research Data Archive. Updated 25 November 2020. https://doi.org/10.2737/RDS-2020-0016

APPENDIX 3. DOD WEATHER TO CLIMATE CONTINUUM

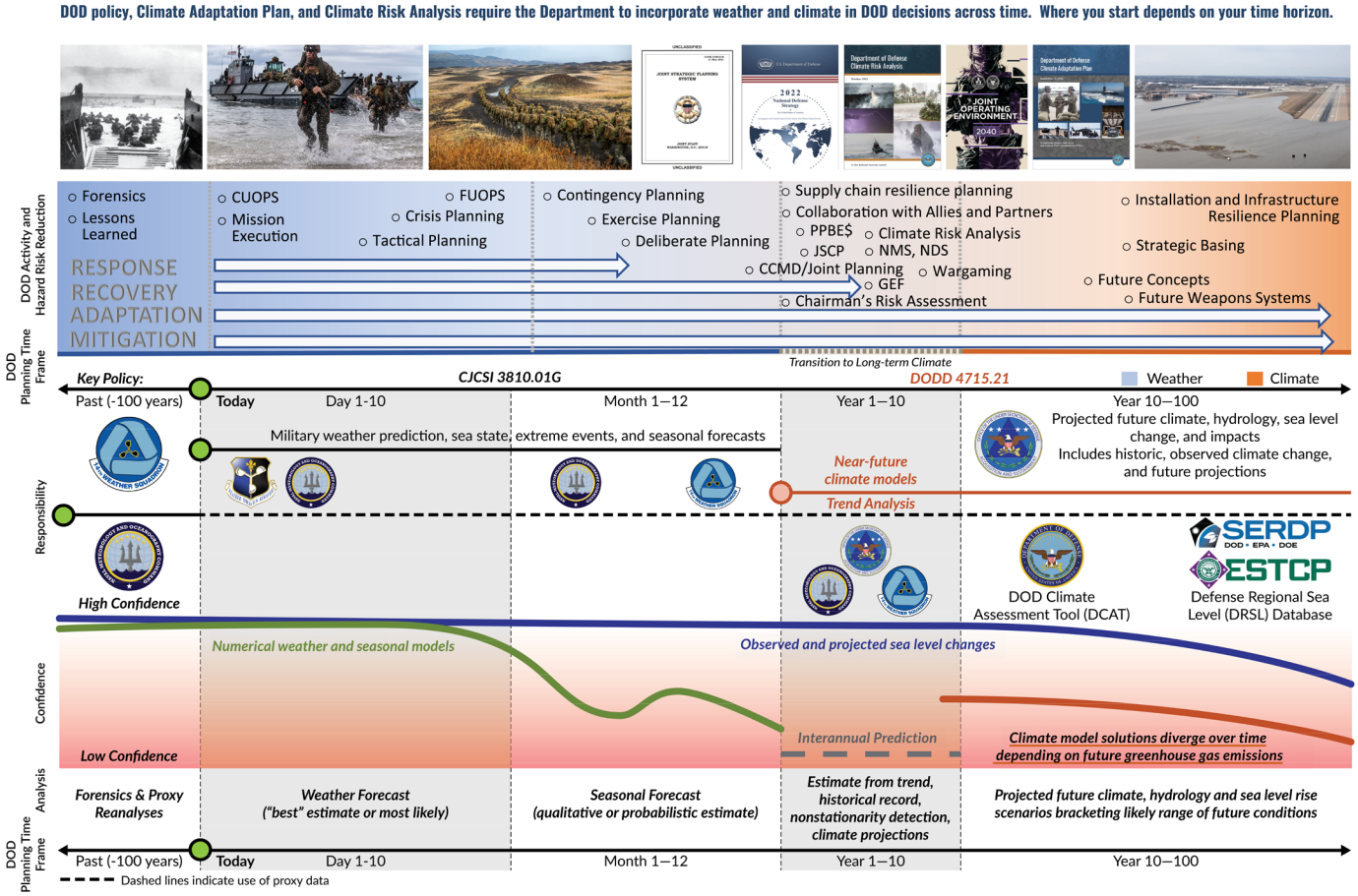

Figure A4. The weather-to-climate continuum is a graphical representation of DOD activities, planning timeframes (from historical to the end of the century), key policies, authoritative climate information sources, relative confidence levels in the weather and climate information, and typical analyses across time. The Office of the Secretary of Defense, Department of the Navy (DON), and Department of the Air Force (DAF) Meteorological and Oceanographic communities and where their decision-space lies are represented by the appropriate office symbol. As noted in the 2022 Climate Adaptation Plan Progress Report, the infographic is the collaborative result of senior Department subject matter experts to identify the proper points of entry for DOD user questions along the continuum of weather to climate change. As shown, the DON and DAF already have several existing weather and past climatology tools and decision aids. These allow decision-makers to understand climate trends to date to set a context for how future projected climate conditions vary from this observed baseline. Data and information from these tools and systems will be integrated with climate projection information as appropriate for strategic, operational, and tactical decisions. Climate information gaps and uncertainty at various points in the continuum point to important research needs. The 1- to 10-year look-ahead period is the most uncertain time horizon, with critical DOD activities such as the National Defense Strategy and budget planning, in that timeframe, requiring both weather and climate expertise to shape and inform those activities. This gap area is currently being addressed through further consideration of four proposals received under the supplemental statement of need Strategy, Framework, and Datasets to Bridge the Weather-to-Climate Continuum Gap in DOD Weather and Climate Change Exposure Assessment, Adaptation, and Resilience, in August 2023.