Overview

Identified by security experts as a “threat multiplier” and a “threat without threateners,” climate change crosses all physical and political borders. It is inherently complex, highly uncertain, and global in scope, posing a unique challenge to infrastructure, communities, and security in the United States and throughout the world. Moreover, scientific consensus indicates that climate change and its effects on humans and the environment will worsen by 2040 and beyond. To prepare for and build resilience to climate change—including more-frequent and more-intense extreme weather events, rising sea levels, increasing temperatures, and changing precipitation patterns—governmental, military, and private entities will need to adapt to these effects.

Such climate adaptation starts with planning. Climate adaptation plans anticipate climate changes; direct financial, human, and natural resources; and strengthen infrastructure systems. Climate adaptation plans are often conceptualized, written, and implemented by individual governmental, military, and private entities. However, siloed planning can lead to inadequate investment or ineffective policies when neighbors plan for different futures or follow different planning paths but experience the same climate hazards.

Climate adaptation planning can, instead, be fortified through collaboration and coordination between neighboring entities—governmental, military, and private—that share infrastructure systems, personnel, and natural resources. Research is increasingly focused on the beneficial role that collaborative processes can play in improving climate resilience and bolstering the efficacy of adaptation strategies. A growing number of collaborative climate planning efforts, largely among U.S. cities, counties, and local and state agencies, further demonstrates that regional entities realize they must work together to adapt effectively to climate change.

The U.S. military can also benefit from engaging in these types of collaboratives. As of 2017, the U.S. Department of Defense (DoD) managed 4,793 military installations in the United States and around the world. This geographic reach makes it likely that DoD will experience a wide range of global climate change effects, at home and abroad, that may challenge its military readiness, stretch its resources, distract from its missions, or affect its ability to respond to multiple, simultaneous crises that may also arise from climate-related conflict. U.S. military installations are often co-located in or near civilian facilities and share infrastructure, personnel, and resources, including water and power, with these local governments. These installations are thus highly dependent on the resilience and viability of infrastructure and services provided by their surrounding communities. As a consequence, the readiness of installations can be degraded by the effects of climate change off-base—including road closures, power loss, property damage, and health effects—that affect the mobility and availability of staff and contractors, support services, and logistics.

To assess how collaboration might build community and U.S. military resilience to climate change and to support communities and installations considering whether to pursue long-term, regional resilience, this research aims to answer the following two questions: What role can collaboration play in military and local government climate resilience planning, and what organizational attributes would enable local governments and military services to collaborate more effectively on such climate planning efforts?

In this pilot study, we answer these questions by examining the case of the Hampton Roads region of Virginia, a coastal region that is home to one of the largest concentrations of military facilities and personnel in the United States. Hampton Roads recently hosted a collaborative sea-level rise planning pilot project that included representatives from local governments and the military. Hampton Roads thus serves as an illustrative case for the broader problem of how critical local and U.S. military infrastructure within the United States and around the world can adapt and become more resilient to climate change’s effects.

Through our research, we found that collaboration, generally, is beneficial to improving regional capacity to deal with climate change and provides the flexibility needed to address complex challenges amid multiple participants. We also uncovered common themes contributing to the success of climate resilience collaboration among regional stakeholders.
that are generalizable and applicable to other areas, especially those with a significant military presence. From these findings, we provide insights that can help foster the conditions and mechanisms for successful collaboration:

1. Implement a regional, intergovernmental collaborative approach to climate change planning
2. Establish concrete common goals in the initial phases of collaborative arrangements
3. Secure strong commitments from leaders and stakeholders to the collaborative’s success, goals, and implementing measures
4. Create durable lines of communication and information-sharing among collaborators and with the public
5. Identify and secure funding streams and establish financial management processes.

In the next section, we discuss recent congressional and DoD examination of climate change’s effects on military installations. Following, we provide a definition of collaboration and an example of successful government-military coordination on environmental planning and management. We then present our case study of collaborative climate planning in the Hampton Roads region and include an analysis of expert opinion solicited from climate change practitioners in the region. Finally, we conclude with thoughts on the role of collaborative climate planning between local government and military entities.

Climate Change: A Threat to Military Installations

The national security effects of climate change can be organized into three broad categories: geostrategic, regional, and military operations and readiness. While all three are critical to national security, we chose to focus on the last category to add to the congressional and military inquiries on the role of climate change in military readiness and operations pursued over the past few years. In the 2018 National Defense Authorization Act (NDAA), Congress reaffirmed that climate change is a “direct threat to the national security of the United States.” The law recognized multiple instances of climate-induced effects upon U.S. military installations, ranging from the potential for the Air Force’s Marshall Islands radar installation to be underwater within two decades to the fact that “a three-foot rise in sea levels will threaten the operations of more than 128 United States military sites, and it is possible that many of these at-risk bases could be submerged in the coming years.” The act called for the Secretary of Defense to produce a report within a year of the law’s passage on the vulnerabilities of military installations to climate change over the next 20 years and mitigation needed to ensure installation and mission readiness.

In response to this requirement, DoD released a report in January 2019 that outlined climate-related events that have affected selected installations and estimated the projected incidence of these types of events 20 years into the future. Limited in detail, the report described the results of a survey that asked 79 mission assurance priority installations to report and project five types of climate-related events: recurrent flooding, drought, desertification, wildfires, and thawing permafrost. The report stated that recurrent
flooding, drought, and wildfires are the most significant current and potential future climate events for the 79 installations. The 79 installations included many from the Hampton Roads region, including Joint Base Langley-Eustis, Naval Station Norfolk, Naval Air Station Oceana, Naval Support Activity Hampton Roads, and Naval Support Activity Hampton Roads–Northwest. The report highlighted that the greater Hampton Roads region is “one of the most vulnerable to flooding military operational installation areas in the United States.” It included brief anecdotes of individual site experiences and short discussions of how a changing climate harms operations and mission execution, for example, recurrent flooding affecting submarine squadrons and telecommunications at Naval Base Guam. The report also briefly covered different DoD methods for building resiliency on installations both already in place and planned for the future, including implementing installation master planning, design, and construction standards and conducting research to enhance resilience. For instance, DoD’s Strategic Environmental Research and Development Program (SERDP) began a project to “detect and assess drought response of sensitive riparian forests to drought stress” to better understand the potential impact of drought upon installations in desert conditions.

DoD also issued a report in January 2018 on the results of a 2015 survey of more than 3,500 U.S. military installations about their concerns regarding climate change and installation readiness. About half of the installations reported they had already experienced climate change–related effects, including drought, wind, extreme temperature, non–storm surge flooding, flooding attributable to storm surge, or wildfire. Airfields, transportation infrastructure, energy infrastructure, training and range facilities, and water and wastewater systems were reported as most affected.

Of particular interest to our research, the survey asked targeted questions regarding the effects of specific types of climate-related events, including coastal flooding. A number of installations identified coastal flooding from storm surge and non–storm surge as a concern. In the Navy, 45 percent of 292 sites within two kilometers of the coastline experienced effects from storm surge and non–storm surge flooding. Approximately 33 percent of the 78 Air Force sites within two kilometers of the coastline also experienced effects from flooding, including six major installations and multiple critical communications and radar sites. For example, the rock seawall protecting Alaska’s Cape Lisburne Long Range Radar Station’s northwest coastline deteriorated over the past decade due to tidal and storm-driven wave action. The gravel airstrip protected by the seawall became unusable, forcing the Air Force to spend $46.8 million to replace the 5,450-foot wall.

Collaborative Planning for Climate Change

Collaboration Defined

Over the past few decades, governments at all levels have been turning to collaboration with other stakeholders to address the inherently complex and long-term challenge of a changing climate. For this study, we reviewed a selection of the scholarship on collaboration to define the broad term within the context of climate change and identify approaches that appear best suited to the challenge. Richard Margerum, an expert in environmental management and planning, provided the definition we believe addresses the type of collaboration needed for climate change planning: “Collaboration is an approach to solving complex problems in which a diverse group of autonomous stakeholders deliberates to build consensus and develop networks for translating consensus into results.” Margerum states that when addressing complex planning questions, a long-term, ongoing relationship between entities is implied. With multifaceted planning efforts, such as climate change planning, Margerum contends that stakeholders “face complex problems with unclear data, changing conditions, and unclear intervention strategies. This often means there is a need for ongoing arrangements during implementation to respond to new information, make adjustments, and manage adaptively.”
Choosing to Collaborate: Costs and Benefits

Choices about whether or when to collaborate are shaped by the complexity and understanding of the problem, the number of stakeholders, the persistence of the problem, the costs and benefits of the proposed collaboration, and the demands of decisionmakers for solutions. As their understanding of a problem increases, decisionmakers must weigh whether collaboration will improve problem solving or increase transaction costs and interfere with decisionmaking and implementation. Many of the sources we reviewed conclude that collaboration is most useful in managing complex problems that cross organizational boundaries and affect a greater number of individuals, groups, and organizations.30 Collaboration becomes a critical means of creating opportunities for stakeholder involvement. Including multiple representatives from different groups and organizations and ensuring adequate representation across affected groups helps to ameliorate contention that arises when only one group or a few specific groups are represented.31

Complex problems tend to persist over long periods of time and across jurisdictional boundaries. Collaboration becomes a structured means of planning for adaptive actions to be taken over time, providing a channel through which stakeholders and government representatives can continue to interact and respond to problems as they arise and shift. However, collaboration brings trade-offs in the form of both costs and benefits that should be considered by potential participants before forming a collaborative. This is especially true because not all collaboratives are successful. The costs of collaborations include time, money, and staff. Enough people need to be willing to participate in the collaborative, and the participating organizations may require them to work additional hours and on a voluntary basis. The benefits of collaboration include the opportunity to share and optimize limited financial resources, the ability to benefit from the knowledge and expertise of fellow participants from different organizations, and the hope of better outcomes than each individual organization could achieve alone.32

Federal Support for Environmental and Climate Planning Collaboration

Collaborative and beneficial arrangements between different levels of government, especially within the environmental realm, already exist in many places.33 One relevant example is the six-decade-long cooperation between military installations, the U.S. Fish and Wildlife Service (USFWS), state natural resource agencies, citizens, and environmental groups to maintain natural resources on military bases, as mandated by the 1960 Sikes Act.34

The success of the collaborations resulting from the Sikes Act can be seen in the Integrated Natural Resource Management Plans (INRMPs) implemented across the country. Since the passage of the Sikes Act, more than 340 military installations have collaborated with federal, state, and local agencies to develop INRMPs and conduct projects that include natural resource assessments, species and habitat monitoring, forestry and rangeland management, adaptive management, and native habitat restoration. For instance, on Marine Corps Base Camp LeJeune in North Carolina, Sikes Act projects “restored longleaf pine habitat on 521 acres, and enhanced endangered red-cockaded woodpecker habitat on 2,170 acres of upland pine. This decreased military training restrictions and simultaneously restored the dwindling red-cockaded woodpecker population.”35 In another example, projects increased the population of three endangered or threatened species on Naval Base Coronado near San Diego, California.36 During congressional testimony in 2013 for the reauthorization of the Sikes Act, then–Acting Assistant Deputy Under Secretary of Defense for Installations and Environment John Conger captured the overall success of the collaborations when he stated,

For more than 50 years, the Act has proven instrumental in helping our installations coordinate with the U.S. Fish and Wildlife Service (USFWS) and State fish and game agencies to develop many cooperative plans and projects . . . to successfully manage our Nation’s natural resources for both military mission and long-term stewardship objectives.37

This example shows how collaboration is helping to address the complex issue of long-term
stewardship of public lands. Our research shows that climate change also appears to fit the type of problem that most benefits from collaboration. Key military reports on the subject also support collaboration in this realm. For instance, the 2016 DoD Strategic Sustainability Performance Plan, in part geared toward updating guidance on regional climate change planning efforts, stated how the department intended to work with others to address climate change. The department also touted the steps it had already taken to better coordinate with other governmental entities, showing that it considers collaboration to be an important part of successfully addressing climate change.

Of specific significance for our research, the CNA Military Advisory Board’s most recent report on climate change and national security cited the Hampton Roads region as an example of how collaboration will be necessary for climate change planning moving forward:

DoD realizes that the sea level rise will impact not only the Hampton Roads installation, but also the surrounding community. Put simply, DoD may modify roads and bridges, seawalls, piers, runways, and other mission-critical infrastructure on its installations, but the roads and bridges off base that are used by military commuters will also need to be evaluated for potential sea-level-rise impacts and modified as needed. The same holds true for water systems, local airports, local schools attended by military dependents, and other state and local infrastructure. As a result, mitigation solutions cannot be developed and implemented by DoD alone. DoD will need to work with the Commonwealth of Virginia and the Hampton Roads–area local governments to develop a comprehensive strategy.

Thus, not only does climate change exhibit the characteristics of a problem that lends itself to collaboration, but military leadership also recognizes the applicability and importance of collaboration to planning for climate change. To understand how such collaboration might work in a practical setting, we chose to examine the case of Hampton Roads, which recently conducted an Intergovernmental Pilot Project (IPP) between local governments and federal agencies, including the military services, on preparing for anticipated sea-level rise. Our intent in using this case study is to understand the process that the entities went through to collaborate, the successes and challenges they encountered, and lessons learned that might inform similar future efforts in collaborative climate change planning.

Case Study: Hampton Roads, Virginia

The following sections explain why we chose the Hampton Roads region as our case study due to its relevance for both climate change and national security, describe the background on and lessons learned from the IPP, and provide overall insights and considerations from our research.
Hampton Roads Military Installations

The southeastern corner of the Commonwealth of Virginia is collectively known as the Hampton Roads region. The region includes the cities of Chesapeake, Hampton, Newport News, Norfolk, Portsmouth, Suffolk, and Virginia Beach and is pictured below in Figure 1.

The region’s military installations (including Joint Base Langley-Eustis [Air Force and Army]; Joint Expeditionary Base Little Creek–Fort Story [Army and Navy]; Fifth Coast Guard District; U.S. Marine Corps Forces Command; Naval Station Oceana; Naval Medical Center Portsmouth; and Naval Station Norfolk) participate in a wide variety of mission sets that directly connect to operations around the world. According to a military expert panel report from 2018, the commands within the Hampton Roads region affect “U.S. strategic objectives in the Pacific, the Middle East and North Africa, and Europe.”

The same report states that “if significant portions of the Hampton Roads infrastructure, including Naval Station Norfolk, were regularly inundated, as is projected under a number of scenarios for the years 2035 to 2100, the impediment to force deployments for critical Atlantic, Mediterranean and Pacific war-fighting and humanitarian operations—many of which are tied to core strategic goals of the United States—would be significant.”

* Center for Climate and Security, 2018, p. 43.
† Center for Climate and Security, 2018, p. 23.
Relevance of the Region to Climate and National Security Concerns

Hampton Roads is a coastal region of Virginia with more than 1.7 million people and critical commercial, industrial, and military facilities, including the largest naval base in the world and a major port. The region has the largest concentration of military facilities and personnel in the United States. According to a military expert panel report, the military presence in Hampton Roads is “essential for overall military readiness and a range of critical operations.”

Naval Station Norfolk supports the entire U.S. Atlantic fleet. It berths 64 ships and 36 aircraft squadrons and is one of DoD’s key supply centers. Joint Base Langley-Eustis contains most of the F-22 force, and its Distributed Common Ground Station sustains worldwide operations with intelligence, surveillance, and reconnaissance planning. More than 100,000 military and 40,000 civilian personnel serve at commands that represent all branches of the military and their facilities, including the North Atlantic Treaty Organization’s (NATO’s) Allied Command Transformation, U.S. Joint Forces Command, U.S. Fleet Forces Command, the U.S. Air Force’s Air Combat Command, U.S. Marine Corps Forces Command, and the U.S. Army Training and Doctrine Command. Former Secretary of Defense Leon Panetta, speaking of the Hampton Roads region, said, “simply put, this region houses perhaps the greatest concentration of military might in the world.”

Hampton Roads’ economy and security are tied closely to its coastline, which is already experiencing the daily effects of climate change, including sunny day flooding from sea-level rise and increases in extreme precipitation events. The effects of climate change reach military installations in two principal ways: (1) when critical assets and operations within a base are flooded or otherwise disrupted, and (2) when access to bases is impeded by weather events, and service members who live in neighboring cities or towns, or necessary supplies and equipment, cannot reach installations. The combination of the proximity of critical infrastructure assets to the coastline, the nation’s highest rates of sea-level rise, and the size of the region’s population has led Hampton Roads to be cited as the second largest population center in the United States at risk from sea-level rise.

In the region, recent planning documents reflect the scientific consensus that sea levels will continue to rise by between 0.49 meters (1.61 feet) and 2.3 meters (7.55 feet) by 2100. Sea-level rise can lead to coastal erosion and coastal tidal flooding, permanent inundation of coastal lands and communities, and seawater intrusion of groundwater and surface water. Trends of increasing precipitation intensity and volume are likely to continue, which will exacerbate coastal and urban flooding. Together, increases in the magnitude and frequency of precipitation events and heightened sea-level rise will likely lead to more frequent flooding of roadways, disrupted traffic, limited mobility, loss of coastal land area, declining property values, and property damage to homes and businesses. Military installations could experience increases in operations and maintenance expenditures; damage to critical base infrastructure, such as runways or docks; and loss of personnel readiness.

Furthermore, the region could experience increases in the frequency of tropical and extratropical storms, as well as increased wind speeds and rainfall rates associated with these storms. Some studies project a 33-percent increase in the number of snowstorms for the Hampton Roads region. Extreme heat events could increase, with the number of days above 95°F increasing and average water temperatures rising 2°C to 6°C. While storms could lead to widespread damage and disruption, temperature changes could lead directly or indirectly to human health problems, higher energy consumption, disrupted coastal ecosystems, and algal blooms.

Communities across the region are grappling with how to adapt to existing changes and lessen the impacts of future climate change. The majority of efforts have been unique to a single entity, and, in some cases, within those entities, hazard mitigation planning has been done in isolation from other relevant departments or partners. For example, the City of Norfolk developed a Norfolk Resilience Strategy and Norfolk Vision 100 independent of other jurisdictions in the region.

Collaborative efforts to address climate-related issues have occurred through the Hampton Roads Hazard Mitigation Plan and the Hampton Roads Sea Level Rise Preparedness and Resilience IPP. Yet, for the region, the challenge of agreeing on the magnitude
of climate impacts, prioritizing investments, and communicating across entities has hindered cooperation.

In our exploration of whether and how collaborative efforts between military and civilian entities have or could overcome such challenges, the Hampton Roads Sea Level Rise Preparedness and Resilience IPP is the subject of this case study for a number of reasons. First, the IPP included local, federal, civilian, and military agencies, and thus provided insight into a multilevel intergovernmental process. Second, the IPP completed its official work in 2016, allowing us time to interview participants while the experience was still fresh in their minds. Third, two of the experts interviewed had participated in other intergovernmental efforts on related environmental topics. Thus, the IPP allowed us to examine an area directly affected by climate change today and in the future, with a significant military presence, and with a recent experience in collaboration that could provide insight for similar efforts.

Collaboration in Hampton Roads: Sea Level Rise Preparedness and Resilience Intergovernmental Pilot Project

Background

The Hampton Roads Sea Level Rise Preparedness and Resilience IPP began in 2014. It was selected by the White House and DoD as one of six regional pilot projects proposed under President Barack Obama's executive order entitled “Preparing the United States for the Impacts of Climate Change.” The region featured a wide variety of entities extending beyond local governments and was the only pilot project of the six proposed to have a community convener external to the direct participants, Old Dominion University (ODU). The project sought “to create a framework or template for regional intergovernmental strategic planning that could be used outside of the region, and to implement that integrated strategy in Hampton Roads, VA creating an effective and efficient method for planning holistically for sea-level rise and flooding.” Encompassing the goals delineated for the White House and DoD pilots, the participants implemented a “whole of government” approach, which broadened to a “whole of community” approach, with representation from DoD, federal agencies, the White House, the Commonwealth of Virginia, multiple regional localities, and other local stakeholders. The steering committee convened representatives from the Air Force, Navy, Coast Guard, Virginia Department of Transportation, City of Norfolk, City of Portsmouth, ODU, and many others.

The IPP relied primarily on time and resources volunteered by participating organizations. Participants attended meetings and produced work on their own time due to a lack of official funding. As the designated convener, ODU supplied staff, communications, and event management support. The project did not receive independent funding during its first phase, while grants from private foundations provided a small amount of funding for working groups to complete their research during the second phase. The IPP’s final report noted the difficulties presented by this lack of funding and recommended that future efforts ensure a dedicated source of monetary support.

The IPP’s organizational structure consisted of a steering committee, supporting working groups, and advisory committees. The steering committee supplied strategic direction from members representing local, state, and federal governments, as well as private entities. The steering committee signed a charter in October 2014, creating the majority of working groups and advisory committees. The IPP comprised the following working groups and advisory committees:

- Working groups
  - Legal
  - Infrastructure
  - Land use planning (dissolved in December 2015)
  - Citizen engagement
  - Public health
- Advisory committees
  - Economic impacts
  - Private infrastructure
  - Municipal planning
  - Senior leadership
  - Science

The working groups formed after the passage of the charter, nominating chairs or cochairs to serve as
leaders and representatives for the individual groups during cross-group meetings. Nearly all of the working group and committee chairs still active at the end of the IPP held positions at one of three local educational institutions: ODU, William & Mary, and the Virginia Institute of Marine Science. Each working group formed action plans and determined scopes for its work, meeting to discuss topics and conduct necessary research. The IPP final report noted that participation in and frequency of meetings for working groups varied throughout the effort and largely depended upon the availability and level of engagement of participants.

Halfway through the project, the steering committee, federal liaisons, working group and advisory committee chairs, and key stakeholders took part in a full-day strategic planning session. The session provided the opportunity to assess the progress made during the first year and establish a plan forward for the second year. After this assessment, the steering committee began meeting on a monthly basis and established a formal timeline for achieving the goals of the project by the end of the second year.

Each of the working groups presented an individual set of recommendations based upon their collective knowledge, research, and work conducted during the IPP. Consequently, the committees’ and working groups’ recommendations focus upon the specific topic and efforts of each group, and how these could continue within the region after the conclusion of the IPP. Working group and committee recommendations ranged from sharing data through a common database between localities, by the Economic Impacts Advisory Committee, to the development of specific planning standards, from the Private Infrastructure Committee. Additionally, all of the working groups and committees endorsed the idea of continuing the collaborative by inviting all members of the IPP to be involved in ongoing activities and the establishment of a follow-on entity that would formalize the relationships created during the IPP. Our research here essentially aims to expand upon this overall recommendation to understand how Hampton Roads and other regions can work together in a collaborative setting on climate change issues.

The final IPP recommendation was that a current regional entity, the Hampton Roads Planning District Commission (HRPDC), continue the collaborative work established by the IPP with a permanent staff and source of revenue. The resolution charged the HRPDC with determining whether an independent authority or further joint agreement would be necessary to implement plans developed by the collaborative. However, after review and consideration of the resolution, the HRPDC decided it could not sign the resolution, as its members believed actual implementation of planned actions should remain with local jurisdictions and not a new regional entity. Therefore, the overall recommendations made by the resolution were not formally endorsed at the close of the IPP.

IPP Lessons Learned
To identify lessons learned from the IPP in terms of collaborative planning efforts, we interviewed nine participants who represented the different constituencies present within the project: military/federal, local, and regional. The following sections cover the lessons we gleaned from these interviews, based upon what worked well during the effort and what challenges and barriers the participants faced. The final section provides overall insights and considerations derived from our research.

What Worked Best
We asked the interviewees what they thought worked best during the IPP and what they would recommend for future collaborations. Their responses included agreement over the importance of the problem at
By having a wide variety of participants, the IPP benefited from the knowledge and skill sets of individuals who might not otherwise have been brought together to address the problem.

hand, the diversity of stakeholders involved, the backing of political leaders, the participation of an impartial convener, and opportunities for regular interaction between collaborative participants.

Collective Recognition of the Problem’s Significance
Building a collaborative around an acknowledged, critical problem encourages the active and sustained participation of relevant stakeholders. According to our interviews on the IPP, officials reported that most people in the Hampton Roads region recognized the need for action on sea-level rise and climate change due to their location and significant military presence. Interviewees noted that it was surprisingly easy to get individuals to participate in the project. They affirmed that getting “people to come to the table” was not difficult. Despite a lack of funding, interviewees stated they were able to find relevant, educated experts and officials willing to commit time to the effort. Officials also observed how impressive it was for organizations and individuals to remain involved in the pilot project for so long. One interviewee noted that since sea-level rise affects the military, and the military provides such a strong base for the local economy, supporting the effort simply made sense.77

Diversity of Stakeholders
Including a diverse set of stakeholders in a collaborative ensures that different perspectives will be brought to the problem at hand. Our interviews highlighted the fact that the IPP included a broad and diverse range of stakeholders, which was not necessarily true of similar efforts in other locations. As one interviewee stated, “for the diversity of stakeholders, the IPP was incredibly successful. Other intergovernmental pilot projects involved one base and one city. This one did more than that.”78 By having a wide variety of participants, the IPP benefited from the knowledge and skill sets of individuals who might not otherwise have been brought together to address the problem.

Support of Political Leadership
Political leadership and buy-in can help ensure the success of a collaborative. During the IPP, the support and endorsement of local political leaders proved critical for the continuation of the pilot over its two-year span. Broader political leadership support, especially from state and federal leaders, helped to spur the effort at the outset of the IPP. As noted above, the IPP clearly had support from the contemporaneous administration, serving as one of the six pilot projects initiated by President Obama’s 2014 executive order. Additionally, Senator Tim Kaine held a bipartisan event on the significance of climate change to the region during the first month of the IPP. Actions and events by such leaders showed committed and potential participants the political importance of the pilot.79

An Impartial Convener
The IPP featured an impartial convener, ODU, which played host to the pilot throughout the two years. This unique aspect of the collaborative proved critical to the IPP’s functioning, serving as one of the best features of the IPP, and thus our interviewees stressed the benefits of including such an actor in future collaborative efforts. The officials we spoke with highlighted that ODU provided a central hub for sharing and prioritization of information that otherwise might have proven difficult.80 Not only does having an impartial convener prevent any one participant from seemingly having more power than the others,
but such a convener can also supply a neutral location at which participants can meet. The mere presence of a neutral location during the IPP put contributing officials at ease and allowed them to build a stronger sense of collegiality.81

Regular Interaction
Collaborations often bring together individuals who do not know one another or have never worked together in the past. Consequently, collaborative organizers should ensure opportunities for continued interaction between participants. Our interviewees emphasized that regular meetings held during the IPP were important for bringing participants together on a consistent basis.82

Challenges to Collaboration
Through the course of our interviews, we identified seven types of challenges or barriers to collaboration:83 stakeholder engagement, leadership, governance, funding, communication and information-sharing, political and cultural differences, and goal-setting.

Stakeholder Engagement
A key component of climate planning collaboratives is the continued engagement of stakeholders throughout the duration of the effort. IPP participants reported four challenges with stakeholder engagement.

First, interviewees asserted the importance of recognizing what is needed to get participants to the table and to keep them involved. This was of special significance for the IPP, since it required voluntary participation. Knowing when, how, and under what circumstances participants would meet helps to produce continuity, builds the relationships necessary to keep them coming to meetings, and ensures progress.84 However, this was not always straightforward. Interviewees cited challenges to stakeholder engagement in the IPP from determining whom to work with in the military and ensuring a continued commitment from the military establishment, due to changes in personnel as military members rotated through their assignments.85

Second, interviewees also noted the importance of interpersonal relationships and of one-on-one connections for the success of collaboration. Since many organizations and persons may be involved in the effort, these basic relations drive the overall cooperative.86 This, however, was cited by interviewees as an obstacle because a significant amount of time was needed to build these relationships. In addition, the level of engagement varied among participants, depending upon their perceived benefit of taking part in the effort. This made equal participation across the working groups, committees, and project quite difficult.87

Third, interviewees noted the importance of including individuals with the power and authority to take action. When stakeholders lacked the ability to make changes and decisions within and for their own entities, participation and interest waned.88

Fourth, bringing in nongovernmental organizations, such as representatives from the private sector, helps projects move beyond basic collaborations to those that include the whole of the community. However, only select state and private sector representatives participated in the IPP, despite the pilot’s desire for a whole-of-community approach. An interviewee noted with regret that more businesses and state entities did not participate in the pilot and believed more involvement from these types of organizations would improve future collaborative efforts.89

Leadership
Strong leadership is crucial for the success of any collaboration.90 Since collaborative efforts require the interaction of so many different parties, effective leaders need to be continually engaged to ensure the consistent input of diffuse participants. Interviewees noted that top leaders had limited time for the project and changed jobs or roles during the two-year pilot. Since leadership often determined the level and duration of commitment by an organization, the rotation of individual leaders greatly affected the institutional knowledge and level of commitment provided by that organization. Additionally, progress made under one leader would often require starting anew with his or her replacement.91
Governance

Collaborative efforts require entities not only to work together but also to work within the governance structures of their respective institutions. Prior to the IPP, Hampton Roads, like many regional authorities and governments, often addressed problems in a siloed manner with each organization or jurisdiction acting on its own. Different agencies worked on their individual plans and implemented solutions independently, and there was no governance structure for collaboration. The IPP and other similar efforts thus needed to build these channels from scratch. One other specific governance barrier occurred due to the inclusion of federal participants in the IPP. Federal representatives could not vote on local decisions and could only participate in discussions and provide vocal input or support. Thus, future collaboratives can benefit from developing organizational structures and recognizing any limitations on participation due to local, state, or federal regulations.\(^9\)

Funding

Having a dedicated funding source can provide logistical and administrative support, enable a stronger commitment from participants and leaders, and support longer-term efforts through dedicated facilities and staff to host and organize the collaborative’s meetings and activities. However, funding proved to be a challenge for the IPP, as it was never independently sponsored outside of the administrative support provided by ODU.\(^9\) In addition, the size and relative economies of the cities posed some challenges, as discussions over power and funding inevitably circled around which city had enough financial strength to fund mutually beneficial projects and programs.\(^9\)

Political and Cultural Differences

Agreement on the goals, metrics, and implementation of collaborative efforts requires working through a variety of perspectives. Political and economic differences among cities participating in the IPP caused difficulties between participants seeking to come to agreement on such topics as the anticipated range of sea-level rise.\(^9\) Some entities proved hesitant to acknowledge the importance of climate-related issues, particularly due to a desire not to overstate the problem and overly concern constituencies. This limited the action that the participants agreed upon as they struggled to find a common base from which to work in these instances.\(^9\) One interviewee noted that there were some expected cultural differences between the main types of organizations involved. For example, some cities elected to plan for rates of sea-level rise at the low end of scientific projections, rather than at the middle or upper ranges, often due to political and cultural views on climate change.\(^9\)

Communication and Information Sharing

Collaborative climate planning efforts often require the sharing of data, information, and models. In the IPP, multiple interviewees stated that such sharing proved difficult at times. Military installations were unable to disclose some information, such as specific usage of critical access roads, because of national security concerns or restrictions, while private industry participants needed to protect proprietary interests.\(^9\) One interviewee expressed frustration that lack of information—for example, on how flooding affects military installations on a daily basis and the number of personnel affected by sea-level rise—impeded understanding of the magnitude of the problems being faced by the region.\(^9\)

External communication beyond direct stakeholders and to the public helps to further ensure the duration and impact of a collaborative effort.

Some cities elected to plan for rates of sea-level rise at the low end of scientific projections, rather than at the middle or upper ranges, often due to political and cultural views on climate change.
Interviewees highlighted the need for outreach meetings to discuss progress and gain input. One official noted that “steadfast engagement and a communication plan to the public [are] critical.”

Early Goal-Setting

Stakeholders in collaborative efforts should identify and share clear, measurable, and common goals. Interviewees stressed the importance of determining such goals, ideally from the outset of the effort. Getting buy-in from all parties provides a basis from which the collaboration can form and ensures that everyone is on the same page from the beginning. Failure to do so early on delayed action during the IPP, and interviewees believed successfully establishing goals could have improved the pilot’s overall outcomes.

Insights and Considerations

We derived the following insights from both our case study covered in this section and our broader research for other officials and organizations seeking to use collaboration to enhance their climate change planning efforts:

1. Climate change planning can be centralized under, and be the sole priority of, one organization, rather than one of many initiatives within multiple agencies.

   Establishing concrete common goals is essential in the earliest phases of collaboration. For collaboration to work, everyone must agree on the tangible problem, or set of problems, being addressed and the desired outcomes. Knowing the problems and goals to be addressed by the effort not only establishes common ground but also aids in forming relationships and a common language on the topic, especially between civilian and military entities. Concrete goal-setting can also provide participants with the evidence they need to encourage their organizations’ continued participation, which may prove especially useful during transitions in leadership.

   Collaboratives should secure funding and establish financial management processes.

   Administration and participation can suffer without front-end and continuing funds for necessary staff, facilities, and materials. Dedicated funding encourages stakeholder participation and allows for longer-term collaboration. Participants may consider cost sharing based upon size and economic capability and seek external sources of funding from state, federal, and nongovernmental sources. Collaboratives should also designate a specific manager for the funds, whether that be one of the participating members, a third party, or a newly established organization. Once the collaborative has secured funding for itself and has produced goals and plans, additional financial support may be needed to enact its initiatives. This type of funding will likely come directly from participating organizations or state and federal funds.

   Leaders and stakeholders need to commit to the collaborative’s planning process and goals.

   Leaders and stakeholders must be willing and able to attend regular meetings, conduct necessary research and related tasks, and provide the administrative and funding support that will enable success in the planning process and follow-through to implementation. This includes ensuring continuity of support through transitions in personnel and leadership, especially within the military. Members of leadership
committees and working groups must have the authority to vote on initiatives, represent their organizations in decisionmaking processes, and take action on decisions that address the collaborative’s goals. If voting or representation is limited, as in the case of military and federal participation in local governance, priority should be placed on including these representatives and their input in every other possible forum.

**A sustained and inclusive communication strategy is vital to building trust-based relationships essential for successful collaboration.** Our research highlighted three aspects of communication critical to collaboration:

1. Creating formal, established channels of communication among all types and levels of stakeholders allows for the kind of consistent interaction required to build relationships.
2. Collaborative efforts should provide mechanisms for sharing data and information, either through a central clearinghouse or through standardized channels. While sharing of certain data may be difficult due to national security concerns, priority should still be placed upon sharing information that does not pose a security threat.
3. Communication with external entities and the general public facilitates critical input and buy-in from the community. This is especially important for climate change planning efforts, which require the approval of local constituencies.

**Concluding Thoughts**

A changing climate presents near- and longer-term challenges to communities in the United States and throughout the world. What was an abstract concern as recently as a decade ago has now become a reality—and one that will worsen over time. Many U.S. cities and local governments are now engaged in an unprecedented reappraisal of the resilience of their critical infrastructure in the face of long-term changes to their region’s climate, including more-frequent or more-intense extreme climatic events. Many vital U.S. military installations are located in or around these communities. The installations depend on a wide array of professional and technical labor and services as well as the critical infrastructure—such as roads, electric power, and water—that their local governmental entities provide to support operations and readiness.

Facing these circumstances, local government and military authorities no longer have the luxury of ignoring the threats to their mutual viability or following their own independent paths. At the same time, while collaborative planning is unobjectionable to promote, it is surprisingly difficult to do and even more difficult to do well. It requires a large number of disparate organizations—military and civilian, public and private, local and regional—to come together over the course of months and even years, converge on a set of common goals, secure funding, develop a mutually agreeable plan, and then establish and empower multiple organizations to act in concert.

When entering into these collaborative regional planning processes, local government and military entities may have different motivations, but they are bound together by their mutual interest in maintaining sustainable and resilient communities. U.S. military services are focused on national security and ensuring their readiness to respond as security challenges arise. Cities and localities strive to promote economic growth and safeguard the well-being of their citizens. Still, they share responsibility in planning jointly to mitigate the highly uncertain, complex, and pervasive challenges that a changing climate already poses now, and which will only be magnified by 2040 and beyond.
Appendix A: Climate Planning Collaborations in the United States

Through our research and interviews with participants in the Hampton Roads IPP, we identified other collaborative efforts actively working to address environmental challenges within the United States. The existence of such efforts shows how communities have realized that they must work together if they hope to tackle complex climate planning topics. The relatively small number of current climate collaboratives also highlights the fact that these arrangements are still fairly novel compared with other environmental management collaborations. The initiatives we identified include:

- Bay Area Regional Collaborative (California)
- BayCAN (California)
- Capital Region Climate Readiness Collaborative (California)
- Central Coast Climate Collaborative (California)
- Charleston Resilience Network (South Carolina)
- Eastern Shore of Virginia Climate Adaptation Working Group (Virginia)
- King County-Cities Climate Collaboration (Washington)
- LARC: Los Angeles Regional Collaborative for Climate Action and Sustainability (California)
- North Coast Resource Partnership (California)
- Puget Sound Climate Preparedness Collaborative (Washington)
- San Diego Regional Climate Collaborative (California)
- Sierra CAMP (California)
- Southeast Florida Regional Climate Change Compact
- Western Adaptation Alliance (Nevada, Utah, Colorado, Arizona, New Mexico, Texas)

To provide a sense of the extent of existing climate collaborative efforts, we highlight two of these initiatives: the Southeast Florida Regional Climate Change Compact and the Charleston Resilience Network. Scholarship on collaboration stresses the variety of methods and channels available for organizations to coordinate among themselves, depending on the goals and objectives of particular efforts. These examples help to highlight the different types of collaboration that occur, from the formal, voluntary intergovernmental agreement of the Southeast Florida Regional Climate Change Compact to the looser, voluntary participation of organizations within the Charleston Resilience Network.

Southeast Florida Regional Climate Change Compact

The Southeast Florida Regional Climate Change Compact began in 2010 among Broward, Miami-Dade, Monroe, and Palm Beach counties for the purpose of arriving at a common set of sea-level rise scenarios and coordinating climate change adaptation and mitigation activities. The compact, adopted in 2009 and 2010 by each of the participating counties, requires each county to work in close collaboration to develop joint legislative policy statements on proposed climate and energy policies, and a regional climate action plan. The counties each promised to commit the needed staff and resources to the effort to ensure that the compact continued and was implemented effectively. The effort has since expanded beyond the four counties to include other stakeholders, such as local municipalities, the South Florida Regional Planning Council, South Florida Water Management District, and the Florida chapter of the Nature Conservancy, to name a few. Since its inception, the compact has issued two regional climate change plans. The first Regional Climate Action Plan (RCAP), published in 2012 with a five-year planning horizon, provided recommendations, implementation guidelines, and best practices for climate change adaptation and mitigation. The compact issued the second RCAP in 2017, recapping the actions taken since the first climate plan and lessons learned from the first plan’s implementation.

Charleston Resilience Network

In contrast to the Southeast Florida Regional Climate Change Compact and the IPP, the Charleston Resilience Network is a completely voluntary network of private and public sector organizations in the
The network’s mission is to “foster a unified regional strategy and provide a forum to share science-based information, educate stakeholders, and enhance long-term planning decisions that result in resilience.” The network consists of an organizing committee, advising members, partnering organizations, and participating organizations, allowing different levels of participation and commitment from entities. The network holds a number of events throughout the year seeking to build opportunities for coordination efforts toward resilience to climate change. The network also brings together member and participating organizations to apply for funding for climate- and resilience-related projects. The network, represented by the South Carolina Sea Grant Consortium, received grants from the National Oceanic and Atmospheric Administration and the Department of Homeland Security’s National Infrastructure Protection Plan Security and Resilience Challenge for coastal infrastructure projects.

Appendix B: Methodology

Literature Review

We performed searches using Google and Defense Technical Information Center search engines, as well as DoD, U.S. Air Force, U.S. Navy, U.S. Army, SERDP, and Norfolk, Newport News, and Hampton city websites. Our initial searches focused on region-specific research, plans, and planning frameworks related to climate adaptation, sea-level rise, and hazard mitigation. We then expanded the search to higher-level state and federal government documents, as well as integrated frameworks with broader application to intergovernmental planning and defense land use planning. We created an annotated bibliography referencing key points from each document, the goals of the study or plan, the outcomes, and data relevant to this study. Literature was categorized according to the following types: academic literature; government reports and defense materials; resilience, adaptation, and hazard mitigation plans and planning frameworks; and public tools and data.

Interviews

In conducting interviews with Hampton Roads officials, we first identified categories of individuals we wished to speak with and then derived our list from the list provided within the IPP’s final report. To acquire perspectives from a wide variety of participants, we included representatives from the following categories in our proposed interviewee list: military (Navy), city government, regional organizations, and academia. We then selected individuals from the IPP to contact based on their background and on input from our RAND Corporation advisors. We initially contacted approximately 15 representatives and received ten responses to those inquiries. Of those ten responses, we conducted eight interviews with nine individuals (one interview included two participants) during a four-week period in fall 2018.

The scope of our interviews was limited due to time and resource constraints, but we managed to include at least one representative from each of our four categories. We conducted the interviews using a semistructured interview format, to enable us to make some comparisons across the interviews but also build in some flexibility to follow the direction of the discussion. Our interview protocol included questions on the interviewees’ backgrounds and expertise; their experiences as participants in their respective collaboratives, including questions on their motivation for joining the collaborative, the successes and challenges of the collaborative, and the lessons they learned and recommendations they would make to others; and short follow-up questions on any additional insights they could share based on any other participation in intergovernmental collaboration, as relevant. We additionally employed follow-up questions based on the information shared by each individual interviewee, as needed. The interviews were conducted by phone; two individuals from the research team always participated, with one leading and the other taking notes. The interviews each lasted an hour on average. The interview notes formed the basis of our discussion within the report on the Hampton Roads case study (in addition to our extensive literature review) and were coded by topic, including benefits to collaboration, challenges to collaboration, lessons learned, and recommendations.
Appendix C: Climate Change as a National Security Threat and Its Implications for Military Installations

Government and Expert Recognition of Climate Change as a National Security Threat

Climate change began to be widely recognized as a national security threat in official circles early in the 21st century. In 2007, the CNA Military Advisory Board, consisting of 11 retired generals, admirals, and commanders, issued a report entitled *National Security and the Threat of Climate Change*. The report was the first to characterize climate change as a “threat multiplier,” describing climate change as a legitimate and serious threat and imploring the national security community to consider its potential impact on security broadly moving into the future. It marked “the first time that such an elite body of military leaders expressed their concern over the security implications of climate change.” Aimed primarily at both a broad national audience and at DoD and military leadership within the services, its recommendations included integrating climate change into national security strategies and assessing the effects of climate change on military installations over the next 30 to 40 years.

That same year, Congress adopted the CNA Advisory Board’s first recommendation. In the 2008 NDAA, passed in 2007, Congress required that climate change assessment be included in the next National Security Strategy and National Defense Strategy. In these key documents, Congress directed DoD to “(1) . . . assess the risks of projected climate change to current and future missions of the armed forces; (2) update defense plans based on these assessments, including working with allies and partners to incorporate climate mitigation strategies, capacity building, and relevant research development; and (3) develop the capabilities needed to reduce future impacts.” Congress also required the next Quadrennial Defense Review (QDR) to consider the “capabilities of the armed forces to respond to climate change.”

The 2010 QDR responded to the requirement included in the 2008 NDAA by examining climate change impacts on national security from two perspectives: first, how a changing climate would affect the operating environment, roles, and missions for the military; and second, the possible effects of climate change on facilities and military capabilities. The report envisioned geopolitical impacts of climate change, noting that climate-induced natural disasters and other events could lead to additional conflict and the need for more humanitarian assistance, potentially straining other mission-critical assignments. The report recognized the vulnerabilities of installations and critical infrastructure, especially those located along U.S. coastlines, and called for efforts to adapt to and mitigate the effects of climate change. It also recommended a more comprehensive assessment of U.S. military installations’ vulnerabilities.

Building on these reports and laws, DoD released its *Climate Change Adaptation Roadmap* in 2014. The Roadmap addressed the potential impacts of climate change on DoD and national security. The Roadmap stated that DoD would be “integrating climate change considerations into our plans, operations, and training across the Department so we can manage associated risks.” It set three main goals: “(1) identify and assess the effects of climate change upon the department, (2) integrate climate change considerations across the department and manage associated risks, and (3) collaborate with internal and external stakeholders on climate change challenges.” To provide concrete guidance and policy on the incorporation of climate change into DoD’s business and planning, the department issued DoD Directive 4715.21, Climate Change Adaptation and Resilience, in January 2016. The directive designated responsibilities among department and service heads to carry out the three goals identified within the Climate Change Adaptation Roadmap to build resilience across the department. In September 2016, DoD released its *Strategic Sustainability Performance Plan*, which stated the department’s commitment to reducing its impact on the environment. The report recognized climate change as posing multiple challenges to national security and called for improving installation resiliency.
and efficiency as a critical component of continued sustainability.\textsuperscript{123}

Climate Change Implications for Military Installations

Climate change implications for national security can be organized into three main categories: geostrategic, regional, and military operations and readiness.\textsuperscript{124} Geostrategic implications represent the ways in which climate change acts as a threat multiplier by increasing tensions that already exist, such as increased instability in regions with constrained access to water resources that is anticipated to become worse due to climate change. Climate change can also serve as a catalyst for new challenges that did not exist before. The second category focuses on how climate change affects regions differently, thereby creating unique challenges that must be addressed to meet each of those specific needs. The third category relates to the ways in which climate change affects the operations and capabilities of the U.S. military. Climate change presents multiple types of challenges to military operations and capabilities, making it more difficult to carry out and meet the missions of the armed services. Climate change directly influences the military’s readiness, infrastructure, personnel, and logistics in a variety of ways. Table C.1 provides examples of the ways in which climate change may challenge military operations and capabilities.

\textbf{TABLE C.1}

Potential Climate Impacts on Military Operations and Capabilities

<table>
<thead>
<tr>
<th>Operations and Capabilities</th>
<th>Personnel and Training</th>
<th>Infrastructure</th>
<th>Logistics and Supply</th>
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</thead>
<tbody>
<tr>
<td>Mission fulfillment: Altered ability to successfully carry out missions due to increased occurrence of extreme weather</td>
<td>Training areas: Change in access to training areas/ranges; increased damage and consequent repair to training lands and areas</td>
<td>Infrastructure: On military installations and within surrounding communities may be impacted by changing weather patterns and events, including:</td>
<td>Logistics: Impact of transportation and distribution of goods and material; altered availability of natural resources such as water</td>
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<tr>
<td>Military readiness: Capacity to be prepared to meet assigned missions</td>
<td>Training opportunities: Reduced number of days available for training due to various weather conditions: extreme heat/cold, dry/drought conditions leading to wildfires and inability to train with explosives, extreme storms and heavy rain, increased flooding due to elevated sea levels and precipitation</td>
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<td>• Transportation facilities</td>
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<td>• Water/wastewater systems</td>
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<td>• Headquarters buildings</td>
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<td>• Information systems</td>
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<td>• Energy structures</td>
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<td>• Fueling infrastructure</td>
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<td>• Heating, ventilation, and air conditioning systems</td>
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<td>• Parking</td>
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<td>• Sewage systems</td>
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<td></td>
<td></td>
<td>• Training/testing lands</td>
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<td></td>
<td>• Command, control, communication, computers, intelligence, surveillance, and reconnaissance (radars, towers, etc.)</td>
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<td>• Environmental restoration sites</td>
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<td>• Historical/cultural resources</td>
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<td>• Rail lines</td>
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<td>• Cooling/heating costs</td>
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<td></td>
<td><strong>Supply:</strong> Impacts upon space for—and storage, inspection, and maintenance of—goods and material</td>
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<tr>
<td>Operations and Capabilities</td>
<td>Personnel and Training</td>
<td>Infrastructure</td>
<td>Logistics and Supply</td>
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<tr>
<td>Force deployments: Capabilities for operations overseas may be affected by increased extreme weather patterns and events due to strategic capabilities of bases, especially those in coastal areas</td>
<td>Personnel access: Ability to get to base from surrounding communities</td>
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<td>External partners and suppliers: Effects of weather on private suppliers to military installations, both in production and distribution</td>
</tr>
<tr>
<td>Dispersed forces: Capability to meet national security missions as forces address more frequent natural disasters/emergencies; account for otherwise occupied forces in total force structure</td>
<td>Personnel support: Ability of civilian and military employees to provide support functions on daily basis</td>
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<td>Natural resources: Lands and resources relied upon by installations impacted by extreme weather</td>
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<td>Emergency services: Ability to protect life through the maintenance and support of hospital, clinic, and emergency operations centers</td>
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<td>Airfield operations: Ability to sustain landing and takeoff of aircraft</td>
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<td>Water services: Ability to provide port and pier services for water-based vehicles</td>
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Notes


4 Adaptation measures seek to enhance the long-term resilience of human systems and make them less vulnerable to climate change. According to the IPCC, climate change adaptation is focused on the consequences rather than the causes of climate change; “adaptation is defined as adjustments in human and natural systems, in response to actual or expected climate stimuli or their effects, that moderate harm or exploit beneficial opportunities.” National Oceanic and Atmospheric Administration, “Climate Change Impacts,” webpage, 2018; IPCC, 2014.

5 Climate adaptation plans can either be stand-alone documents or integrated into other critical planning processes, such as land use plans or hazard mitigation plans.

6 IPCC, 2014.

7 The Rockefeller Foundation’s 100 Resilient Cities project defines urban resilience, for example, as “the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience” (100 Resilient Cities, “What is Urban Resilience?” webpage, undated). In a broader regional context, resilience can be generalized to mean “the ability of a social, ecological, or socio-ecological system and its components to anticipate, reduce, accommodate, or recover from the effects of a hazardous event or trend in a timely and efficient manner,” as defined by the IPCC, 2014.


9 See Appendix A for examples of existing collaborative climate planning entities.


11 The Congressional Research Service identified two principal meanings of the term military readiness, one broad and the other narrow. We apply the broad meaning of military readiness they identified, which states that readiness describes “whether military forces are able to do what the nations asks of them.” For more on defining military readiness, see Russe Rumbaugh, Defining Readiness: Background and Issues for Congress, Washington, D.C.: Congressional Research Service, June 14, 2017.


13 Typically, about 70 percent of an installation’s working population will live off-base, making access to the base critical for its day-to-day functioning.

14 In developing these recommendations, we acknowledge that localities and the military may have different perspectives on long-term climate change planning based on their respective constituencies and missions. Military services, in some cases, may shift their missions and capabilities based upon the need to adapt to changing strategic requirements, climate change or other environmental conditions, or other causes. Local governments do not have the option to relocate, except in the direst of circumstances. Consequently, perspectives and levels of interest in collaboration will likely differ. However, for the purpose of this research, we assume that installations in the case study will maintain their missions and capabilities in the region. While some missions could be shifted elsewhere, we also assume that Hampton Roads installations will remain in place and could be granted new missions and capabilities in the future.

15 These three categories were derived from those presented within CNA Military Advisory Board, 2007.

16 Since the beginning of the 21st century, several reports issued by the federal government and national security experts and practitioners have identified climate change as a threat to national security. For a review of those reports, see Appendix C.

17 The pending bill for the Fiscal Year 2020 National Defense Authorization Act (NDAA) includes a section that directs military installations to address installation resilience within their master plans. This includes assessing multiple factors, ranging from risks and threats of “extreme weather events, mean sea level fluctuation, wildfires, flooding and other environmental conditions” to vulnerabilities in assets and infrastructure, to agreements with external entities for maintaining or enhancing base resilience. See U.S. House of Representatives, National Defense Authorization Act for Fiscal Year 2020, H.R. 2500, July 12, 2019.

18 Public Law 115-91, National Defense Authorization Act for Fiscal Year 2018, December 12, 2017. Congress affirmed statements made in previous laws and governmental reports; see Appendix C for a discussion of these laws and reports.


These climate impacts are those considered in Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, 2018. Non-storm surge flooding is defined in the report to include flooding of facilities and assets due to rain, snow, sleet, ice, and river overflow. Storm surge flooding is conceptualized as coastal flooding due to the rise in water from a storm event. The impacts of sea-level rise on coastal DoD infrastructure were included in the study’s survey, but the results of this portion of the survey are not included in the report.


There are multiple definitions and considerations of the term collaboration that inform and support the definition we selected. Much of the literature on collaboration refers to a 1998 definition provided by public management scholar Eugene Bardach that collaboration is “any joint activity by two or more organizations intended to increase public value while working together rather than separately.” Russell Linden describes collaboration as when “people from different organizations (or units within one organization) produce something together through joint effort, resources, and decision making, and share ownership of the final product or service.” (Eugene Bardach, Getting Agencies to Work Together: The Practice and Theory of Managerial Craftsmanship, Washington, D.C.: Brookings Institution Press, 1998, p. 8; Russell M. Linden, Working Across Boundaries: Making Collaboration Work in Government and Nonprofit Organizations, San Francisco, Calif.: Jossey-Bass, 2002, p. 7)

Definitions of collaboration tend to be rather broad, and understandably so, as collaboration encompasses a wide variety of potential actions between a wide variety of potential actors. Collaboration can vary from informal interaction between members of different agencies to formal agreements between entire organizations. Robert Agranoff, a scholar of intergovernmental relations and management, provides a useful framework to show four possible levels of collaboration: “minimal engagement, intermittent interaction; minimal engagement, regular interaction; maximum engagement, intermittent action; and maximum engagement, regular interaction” (Robert Agranoff, Collaborating to Manage: A Primer for the Public Sector, Washington, D.C.: Georgetown University Press, 2012, p. 14).

Resource Management Plans (INRMPs) in coordination with the other agencies. This cooperation often includes local entities, ranging from interested citizens to related environmental groups like the Nature Conservancy. The plans must be kept up to date, with agencies required to reconfirm their commitment to the plans every five years with a formal review. The fact that the Sikes Act requires collaboration contributed to the collaborative’s continued success and implementation. Without a legal requirement and continued oversight by congressional committees, this collaborative effort might have faced similar challenges to other, more voluntary endeavors, such as the Intergovernmental Pilot Project (IPP) presented in this research. See Teresa K. Hollingsworth, “The Sikes Improvement Act of 1997: Examining the Changes for the Department of Defense,” Air Force Law Review, Vol. 46, 1991, pp. 112–113 and 118–119; and U.S. Fish and Wildlife Service, “Legislative History of the Sikes Act,” webpage, October 2015.


39 “DoD also made major strides in developing processes to address climate effects on a regional basis, collaborating with surrounding communities and local and state governments to identify ways to leverage one another’s capabilities and become more resilient together. As the effects of a changing climate continue to affect today’s perception of normal and the ability to carry out the DoD mission, it is critical that the Department have in place appropriate planning processes” (DoD, 2016, p. 32).


44 Emily Steinhilber, John Whitelaw, and Carol Considine, Hampton Roads Sea Level Rise Preparedness and Resiliency Intergovernmental Pilot Project Phase 1 Report: Accomplishments and Lessons Learned, Norfolk, Va.: Old Dominion University, 2015.

45 Relative sea-level rise is defined as the combined effects of land subsidence from groundwater pumping and post-glacial sinking in the earth’s crust, flat topography, and sea-level rise.


48 Najjar et al., 2010.


50 Madsen and Wilcox, 2012.

51 Najjar et al., 2010.


54 Najjar et al., 2010.


56 City of Norfolk, Norfolk Resilient Strategy, Norfolk, Va., October 2015.

57 City of Norfolk, Norfolk Vision 2100, Norfolk, Va., November 22, 2016.

58 HRPDC, 2017.

59 Additional collaborative planning in the region includes the American Flood Coalition, which includes stakeholders from Virginia, Florida, and South Carolina (American Flood Coalition, “About Us,” webpage, undated), and the Hampton Roads Military and Federal Facilities Alliance, which does not focus solely on climate resilience planning (Hampton Roads Military and Federal Facilities Alliance, “About Us,” webpage, undated). Emily Steinhilber, Maura Boswell, Carol Considine, and Larry Mast, Hampton Roads Sea Level Rise Preparedness and Resiliency Intergovernmental Pilot Project Phase 2 Report: Recommendations, Accomplishments, and Lessons Learned, Norfolk, Va.: Old Dominion University, 2016, p. 10.

60 The research for this project began in 2017.

61 Steinhilber et al., 2016, p. 10.
While our research here focuses on the collaborative process that unfolded during the IPP, more information on the topics and issues covered by each of the working groups can be found in the IPP’s reports. See Steinhilber et al., 2016, and Steinhilber, Whitelaw, and Considine, 2015.

We conducted eight interviews with nine individuals, where one interview included two participants. For more information, refer to Appendix B.

Regional representatives included those from the Hampton Roads Region Planning District and ODU as the project’s official convener.

The IPP’s Phase 2 report notes that some participating organizations tasked individuals from their organizations with participation in the project. See Steinhilber et al., 2016, p. 16.

We asked Hampton Roads officials about challenges they faced in collaborating with other entities. While the final report on the IPP provides some discussion of barriers within each of the working groups, lessons learned often revolved around the specific topic area (economic, infrastructure, etc.), rather than broader considerations of collaboration. We add to conclusions already described in the IPP’s reports by primarily focusing on participants’ experiences with collaboration. Our goal in our discussions with IPP participants was to broaden their experiences to be applicable beyond the Hampton Roads region to other cases and regions interested in pursuing collaborative efforts.

For a full list of the recommendations from each of the working groups and committees, see Steinhilber et al., 2016, pp. 62–71.

For a full list of the recommendations from each of the working groups and committees, see Steinhilber et al., 2016, pp. 16–17.

The IPP’s Phase 2 report notes that some participating organizations tasked individuals from their organizations with participation in the project. See Steinhilber et al., 2016, p. 16.

Regional representatives included those from the Hampton Roads Region Planning District and ODU as the project’s official convener.

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We conducted eight interviews with nine individuals, where one interview included two participants. For more information, refer to Appendix B.

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The IPP’s Phase 2 report notes that some participating organizations tasked individuals from their organizations with participation in the project. See Steinhilber et al., 2016, p. 16.
While our interviewees emphasized these types of challenges that arose between the cities involved in the collaborative, additional RAND research highlights some of the challenges that have occurred between civilian and military entities involved in partnerships. See Lachman, Resetar, and Camm, 2016.

Interview S3, university official familiar with climate change planning, August 8, 2018; Interview S7, city official familiar with local government–military collaboration, August 27, 2018; Interview S8, retired Navy official familiar with the IPP, August 30, 2018.

Interview S4, retired Navy official familiar with the IPP, August 13, 2018.

Interview S1, university official familiar with climate change planning, August 6, 2018; Interview S3, university official familiar with climate change planning, August 8, 2018; Interview S5, city official familiar with local government–military collaboration, August 14, 2018.

Interview S2, city official familiar with land use planning, August 7, 2019.

Interview S4, retired Navy official familiar with the IPP, August 13, 2018; Interview S7, city official familiar with local government–military collaboration, August 27, 2018.

Interview S7, city official familiar with local government–military collaboration, August 27, 2018.

Interview S1, university official familiar with climate change planning, August 6, 2018; Interview S2, city official familiar with land use planning, August 7, 2018; Interview S7, city official familiar with local government–military collaboration, August 27, 2018.

Due to the multitude of complex issues facing governments and stakeholders, several of these recommendations may also be applicable to other transboundary problems.

Collaborations are built upon relationships between individuals and entities that take time to mature and develop. Some regions may have rich, existing collaborations or regional collaboratives that could be leveraged for regional climate resilience planning efforts. Some examples include Joint Land Use Studies, Sentinel Landscapes, and the REPI Program.

Support for such agreements from the federal government, especially through statutory requirements to collaborate, could further ensure the continued engagement of all stakeholders.

Such centralization of planning and decisionmaking could be of particular benefit in states and localities in which existing governance structures may impede the type of multijurisdictional collaboration needed for climate adaptation and planning.

As of July 2019, one such funding option is DoD’s Office of Economic Adjustment federal funding opportunity for collaborative installation and civilian coordination and planning (“Department of Defense, Office of the Secretary: Announcement of Federal Funding Opportunity,” Federal Register, Vol. 84, No. 150, July 30, 2019).


Charleston Resilience Network, “Who We Are,” webpage, undated-d.


CNA Military Advisory Board, 2014, p. i.


DoD Directive 4715.21, 2016, p. 3.


These three categories were derived from the organization of CNA Military Advisory Board, 2007.


HRPDC—See Hampton Roads Planning District Commission.


IPCC—See Intergovernmental Panel on Climate Change.


Southeast Florida Regional Climate Change Compact, "What Is the Compact?" webpage, undated-a. As of December 18, 2018: http://www.southeastfloridaclimatet(compact.org/about-us/what-is-the-compact/


Security 2040

This report is part of a RAND initiative to envision critical security challenges in the world of 2040, considering the effects of political, technological, social, and demographic trends that will shape those security challenges in the coming decades. The research was conducted within the RAND Center for Global Risk and Security.

The RAND Center for Global Risk and Security

The Center for Global Risk and Security works across the RAND Corporation to develop multidisciplinary research and policy analysis dealing with systemic risks to global security. The center draws on RAND’s expertise to complement and expand RAND research in many fields, including security, economics, health, and technology. A board of distinguished business leaders, philanthropists, and former policymakers advises and supports the center’s activities, which are increasingly focused on global security trends and the impact of disruptive technologies on risk and security. For more information about the RAND Center for Global Risk and Security, visit www.rand.org/international/cgrs.

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About This Report

As part of the RAND Corporation’s Security 2040 Initiative, this research report describes a critical global challenge that will shape the security landscape over the next 20 years: contending with and preparing for the effects of climate change. Due to the magnitude and complexity of the effects of climate change on communities and regions, as well as on the populations and activities among and within them, governments at all levels will need to be involved. Within the United States, many governmental entities, from cities to counties to military services, have already begun to prepare for and directly address climate change’s impacts. The U.S. Department of Defense and its military services have also begun to incorporate climate-related considerations within their strategic documents and for their extensive network of installations across the country.

The resilience of these communities and installations does not lie neatly within designated jurisdictional borders. Communities are dependent upon how their neighbors, which include local military installations, also choose to adapt to climate change. Likewise, military installations require the communities on which they depend for transportation, resources, and personnel to equally contend with and plan for climate change. Military installations and communities are coexisting and codependent entities, relying on mutual infrastructure and resources to support their respective functions. Yet, due to the federal structure of the U.S. government, governmental entities often focus on building climate resilience only within their own jurisdictional boundaries, where they logically and legally have the authority to act. To more fully and effectively bolster their resilience to climate change, local governments and military entities will need to shift their current separate climate planning approaches by beginning to collaborate and work together.

This research is intended to support local government and military officials who may be considering reaching across their jurisdictional borders to more comprehensively plan for climate change within their regions. This could include city managers, urban planners, stormwater practitioners, base commanders, and military civil engineers. We aimed to provide supporting evidence for such individuals, who already understand the cross-boundary nature of climate change and who seek both justifications and methods for working with regional partners to build resilience. We use the case of the Hampton Roads Sea Level Rise Preparedness and Resilience Intergovernmental Pilot Project, initiated in 2014, to lend insight into how these collaborations could be structured to ensure that local government and military interests are reconciled and addressed.

As part of RAND’s Security 2040 Initiative, this research is meant to inspire and spur future in-depth research on collaborative climate change planning. Due to the nature of these exploratory projects, our scope is limited by design. While we were able to capture only a relatively small number of interviews and focus primarily on only one case study, the findings of this work can still prove useful for those considering implementing collaborative efforts. In particular, we conclude that collaboration can help co-located entities better plan for climate change; yet, the lack of widespread collaboration on climate change planning shows that challenges continue to impede its effective implementation. Thus, by looking at a past effort through targeted interviews, we sought to more clearly identify the barriers faced, as well as which of the stakeholders’ efforts worked best, to better inform and prepare collaborators in the future.
As part of the RAND Corporation’s Security 2040 Initiative, the authors of this report explored a critical global challenge that will shape the security landscape over the next 20 years: contending with and preparing for the effects of climate change. Within the United States, many governmental entities, from cities to counties to military services, have already begun to prepare for and directly address climate change's impacts. The resilience of these communities and installations does not lie neatly within designated jurisdictional borders. Communities are dependent on how their neighbors, which include local military installations, choose to adapt to climate change. Likewise, military installations require the communities on which they depend for transportation, resources, and personnel to contend with and plan for climate change. Military installations and communities are coexisting and codependent entities, relying on mutual infrastructure and resources to support their respective functions.

To explore this challenge, the authors reviewed and analyzed relevant literature, assessed other instances of intergovernmental collaboration, and applied the case of the Hampton Roads Sea Level Rise Preparedness and Resilience Intergovernmental Pilot Project to examine the role of collaboration in military and local government climate resilience planning. They found that collaboration between military services and local governments improves collective capacity to address climate change, and they provide insight into the attributes of effective joint planning. While limited in scope by design, the findings of this work are useful for those considering collaborative planning efforts and are intended to inspire future in-depth research on collaborative climate resilience planning.