Climate Change and the Joint Force: An Assessment

A Monograph

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The US military has been in persistent conflict fighting the Global War on Terrorism since 2001. It has closed with and fought the enemy in the most remote areas of the world. The US military is able to execute these operations because it has functioning bases in which to project power. The ability to possess stable power projection platforms is slowly turning into an assumption due to the threat climate change poses. Climate change volatility is slowly creating new security threats that will affect the military's ability to continue its mission to defend the United States. The Arctic Region is becoming more navigable and will require the US Navy to adapt its sea and air capabilities for arctic operations. Rising sea levels will impact the United States' coastal military facilities and surrounding support communities, causing extensive damage and degradation to mission. Climate change is also causing more frequent and intense extreme weather events that can destabilize fragile governments. This monograph conducts a DOTMLPF analysis to determine the military's ability to confront climate change's new security threats.

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Abstract

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The US military has been in persistent conflict fighting the Global War on Terrorism since 2001. It has closed with and fought the enemy in the most remote areas of the world. The US military is able to execute these operations because it has functioning bases in which to project power. The ability to possess stable power projection platforms is slowly turning into an assumption due to the threat climate change poses. Climate change volatility is slowly creating new security threats that will affect the military's ability to continue its mission to defend the United States. The Arctic Region is becoming more navigable and will require the US Navy to adapt its sea and air capabilities for arctic operations. Rising sea levels will impact the United States' coastal military facilities and surrounding support communities, causing extensive damage and degradation to mission. Climate change is also causing more frequent and intense extreme weather events that can destabilize fragile governments. This monograph conducts a DOTMLPF analysis to determine the military's ability to confront climate change's new security threats.

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Acronyms

ADRP	Army Doctrine Reference Publication
AMSP	Advanced Military Studies Program
ASLSP	Advanced Strategic Leadership Studies Program
AR	Assessment Report
AOC	Army Operating Concept
AOR	Area of Responsibility
CCAR	Climate Change Adaptation Roadmap
COEDMHA	Center for Excellence in Disaster Management and Humanitarian Assistance
DHS	Department of Homeland Security
DoD	Department of Defense
DOTMLPF	Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities
DSCA	Defense Support of Civilian Authorities
ESF	Emergency Support Function
GCC	Geographic Combatant Command
HADR	Humanitarian Assistance/Disaster Relief
IPCC	Intergovernmental Panel on Climate Change
JCIDS	Joint Capabilities Integration and Development System
JP	Joint Publication
NIC	National Intelligence Council
NORTHCOM	Northern Command
NMS	National Military Strategy
NSS	National Security Strategy
PACOM	Pacific Command
PME	Professional Military Education
QDR	Quadrennial Defense Review

SECDEF	Secretary of Defense
SERDP	Strategic Environmental Research and Development Program
US	United States
USCG	United States Coast Guard
WG	Working Group

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Introduction

Climate change is a global issue and the United States and its military will play a leading role in responding and adapting to climate change and its associated extreme weather outcomes. Climate change is occurring on the planet. This phenomenon is likely to produce more frequent extreme weather patterns that undermine social and geopolitical stability. Fragile states are prone to political and social instability, which climate change may exacerbate. Climate change does not have political boundaries and impacts not only fragile nations but entire continents. Global climate change may trigger cross border mass migrations of people, natural resource scarcity, water shortages, and military conflict. Climate change has the potential to influence the national interests of the United States, and the United States (US) Government must prepare and adapt its policies to protect its interests. These effects are likely to pose significant national security challenges over the next two decades, though models forecast the most dramatic effects further into the future. While specific extreme weather events remain difficult to attribute entirely to climate change, unusual patterns of extreme and record-breaking weather events are likely to become more common, according to the Intergovernmental Panel on Climate Change (IPCC).[1]

The IPCC is an all-volunteer scientific organization of thousands of scientists from around the globe, created by the United Nations to amass, review, and analyze the most recent scientific data regarding the environmental impacts of climate change. The IPCC's principal function is to provide rigorous and balanced information for policymakers about the global impact of climate change.[2] The IPCC was established by the UN Environment Programme and

[1] National Intelligence Council (NIC), *Implications for US National Security of Anticipated Climate Change* (Washington DC: Office of the Director of National Intelligence, 2016), 5, accessed January 17, 2017, https://www.dni.gov/files/documents/Newsroom/Reports%20and%20Pubs/Implications_for_US_National_Security_of_Anticipated_Climate_Change.pdf.

[2] "*Organization*," IPCC – Intergovernmental Panel on Climate Change, no date, accessed April 1, 2017, https://www.ipcc.ch/organization/organization.shtml.

the World Meteorological Organization in 1988 to provide the world with a clear scientific view on the current state of knowledge regarding climate change and its potential environmental and socio-economic impacts.[3] The IPCC has three working groups (WG)s that analyze and articulate scientific data in assessment reports, which are published worldwide. Each WG's assessment report is an exhaustive, thousand page plus report articulating the findings of their particular field of study. These WGs consist of thousands of volunteer scientists and experts, which assist in editing and peer reviewing the reports to ensure the information is accurate, error free, and comprehensive.[4] The IPCC has stated that the "warming of the climate system is unequivocal, and since the 1950's many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished and sea level has risen."[5] In this context, the climate change phenomena will change every aspect in which the military operates.

Global warming overall and rising sea levels in particular will affect how the military deploys and trains in the future. The *2010 Joint Operating Environment* states that the Arctic region and global rising sea levels pose new security threats for the future operations of the military.[6] The precise environmental future the military will operate in is uncertain. Policymakers and commanders assess risks based on the best information available at the time. There is ample evidence to suggest that climate change poses significant risks to the United States' national security interests. Environmental stability of a region is no longer a valid planning assumption.

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[3] "*Organization,*" IPCC – Intergovernmental Panel on Climate Change.

[4] "*Structure,*" IPCC – Intergovernmental Panel on Climate Change, no date, accessed April 1, 2017, https://www.ipcc.ch/organization/organization_structure.shtml.

[5] Rejandra K. Pachauri, et al., *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Geneva, Switzerland: IPCC, 2014), 40, accessed January 17, 2017, http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf.

[6] US Joint Forces Command, *The Joint Operating Environment 2010* (Washington DC: Government Printing Office, 2010), 32-33, accessed April 1, 2017, https://fas.org/man/eprint/joe2010.pdf.

The decision not to act and adapt to climate change impacts could be dire. In addition, military facilities are threatened by drought, flooding, storm surge, and rising sea levels. Furthermore, the ability of the military to deter the nation's enemies and defend its national interests "at a time and place of our choosing" may no longer be our choice in the future. This monograph will investigate the military's ability to respond and adapt in a rapidly changing climate environment.

There are five sections in this monograph. The first section provides an introduction. The next section frames the current and future operational environment and describes potential geopolitical disputes that could lead to conflict and/or regional militarization. The third section evaluates the evolution of US national strategy and policy regarding climate change in order to assess the US military's ability to meet national strategic objectives. The fourth section highlights the current capabilities across the US Joint Force and presents considerations based on existing Department of Defense (DoD) equipment, infrastructure, and policies. The fourth section specifically addresses the US military's operational capabilities and gaps utilizing the analytical framework of Doctrine, Organization, Training, Materiel, Leadership, Personnel, Facilities (DOTMLPF) analysis. The last section concludes with a summary of capability gaps and potential solutions to mitigate operational risks for the US military.

Current and Future Operating Environment

The world is a complex system of systems that humans have created in order to survive. Energy systems, water systems, food systems, political systems, and economic systems are just a few of the systems that underpin human life. These systems all interact with each other, creating a delicate balance of functionality. Furthermore, the earth has multiple ecosystems, dependent on climatic conditions. Climate change affects every other system on earth and causes those systems to adapt or to be removed from the system. Global climate change may create security issues for the United States and indeed for the entire world. The US military must understand the current

operating environment and the changes that are occurring, as well as preparing for the anticipated future-operating environment based on scientific modeling. Climate change, coupled with shifting population demographics, rising sea levels, extreme weather events, and increased access to the Arctic region due to ice melting, pose security threats to the United States.

"Climate change" and "global warming" are phrases used interchangeably to describe the same phenomenon. However, there is a distinction. Global warming is a result of climate change. It is the most influential emergent property of climate change and affects all other aspects of the climate system. The IPCC states that the mean global temperature has increased significantly. The IPCC data, collected from multiple independently produced and peer reviewed datasets, shows that the earth has warmed .85^{o} Celsius from 1880-2012 and that the period from 1983-2012 was the warmest 30 year period in the last 1400 years.[7] In the United States, during the same time period, the average surface temperature rose between 1.3 – 1.9 ^{o} Fahrenheit.[8] The following figure illustrates the independently produced datasets confirming a rise in global temperature.

[7] Thomas F. Stocker et al, C*limate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge: Cambridge University Press, Intergovernmental Panel on Climate Change, 2013), 187, accessed January 17, 2017, http://www.climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf.

[8] Jerry M. Melillo, Terese (T.C.) Richmond, and Gary W. Yohe, *Climate Change Impacts in the United States: The Third National Climate Assessment* (Washington, DC: US Global Change Research Program, 2014), 28, accessed January 17, 2017, http://s3.amazonaws.com/nca2014/low/NCA3_Climate_Change_Impacts_in_the_United%20States_LowRes.pdf?download=1.

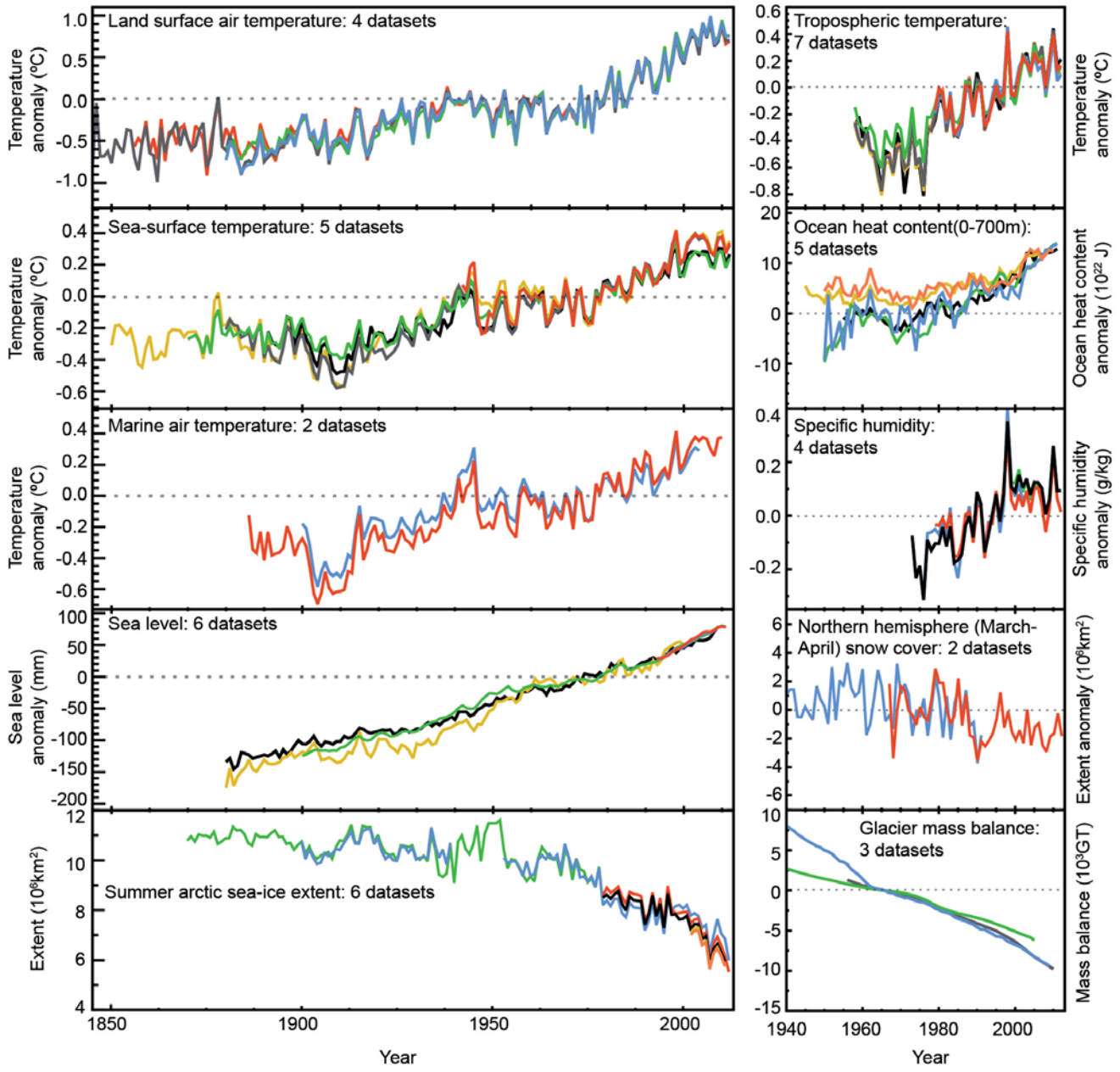

Figure 1. Multiple complementary indicators of a changing global climate. Each line represents an independently derived estimate of change in the climate element. UN Intergovernmental Panel on Climate Change, C*limate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, United Kingdom: Cambridge University Press, 2013), 38, accessed January 17, 2017, http://www.climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf.

A rising global temperature is an irrefutable scientific fact. Furthermore, climate scientists project that it will continue to increase in the United States and around the world.[9] The warmer global atmospheric temperatures also influence ocean temperature levels.

The ocean temperature is also increasing. The increase stems from the greenhouse effect causing energy that is trapped in the earth's atmosphere from the sun's radiation to reflect back to the earth, which is stored in the earth's oceans.[10] As a result, the ocean temperature has warmed .09 - .13 ° Celsius from 1971 to 2010. This temperature increase occurred at depths of 0 to 75 meters, and ocean waters continue to warm at deeper and deeper depths.[11] Unable to escape the earth's atmosphere, greenhouse gases drive this increase in temperature. With the warming of the oceans, the ocean water also expands and takes up more surface area in a process known as "thermal expansion."[12] This has many ramifications for the US military both at home and abroad, which will be discussed in depth later in this monograph.

Global sea levels have risen eight inches since modern recording of this data started in 1880 and with expectations to rise one to four feet by 2100.[13] The degree to which rising sea levels will occur depends on the location on the earth and the amount of greenhouse gases that will be released into the atmosphere. The DoD maintains 1,774 military sites along 95,471 miles of coastlines across the world, all of which are vulnerable to rising sea levels.[14] In 2011, the National Academy of Sciences published a report stating that "128 DoD installations that could

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[9] Melillo, Richmond, and Yohe, 25, 29; Stocker et al., 1054, 1078.

[10] Stocker et al., 260.

[11] Ibid.

[12] Ibid., 1151.

[13] Melillo, Richmond, and Yohe, 44.

[14] John A. Hall et al., *Regional Sea Level Scenarios for Coastal Risk Management: Managing the Uncertainty of Future Sea Level Change and Extreme Water Levels for Department of Defense Coastal Sites Worldwide* (Alexandria, VA: US Department of Defense (DoD), Strategic Environmental Research and Development Program, 2016), 2-2, accessed January 17, 2017, https://www.serdp-estcp.org/content/download/38961/375873/version/4/file/CARSWG+SLR+April+2016.pdf.

be affected by a sea-level rise of equal to or greater than 1 meter. Fifty-six of these installations (or 43 percent of the total) were Navy installations. This number represents more than 50 percent of the 103 Navy installations that reported. Roughly $100 billion is the estimated dollar value of U.S. Navy installations that are at risk due to this one facet of climate change."[15] In 2016, The Union of Concerned Scientists published a study of extensive research on 18 military installations along the East and Gulf coasts in the United States. Figure 2 on the next page shows the installations chosen for analysis. These strategically important installations are at risk for more frequent and extensive tidal flooding, land loss due to permanent inundation, daily high tide flooding, and deeper and more extensive flooding due to storm surges. They also found that many sites could flood 100 times per year at even the most modest rise in sea level.[16] The report further argues that by 2050, most of the 18 installations analyzed will experience more than ten times the amount of flooding than they do today. By 2070, half of the installations could experience more than one flooding event daily. By 2100, eight bases are at risk of losing 25 to 50 percent or more of their land. Finally, and perhaps most critical, Naval Air Station Key West, Joint Base Langley-Eustis, Dam Neck Annex, and Parris Island are at risk of losing between 75 and 95 percent of their land by the end of this century.[17]

[15] National Academy of Sciences NAS. *National Security Implications of Climate Change for US Naval Forces* (Washington, DC: The National Academies Press, 2011), 74, accessed January 17, 2017, https://www.nap.edu/read/12914/chapter/5?term=128#74

[16] Erika Spanger-Siegfried et al., *The US Military on the Front Lines of Rising Seas* (Cambridge, MA: Union of Concerned Scientists, 2016), 2, accessed January 17, 2017, http://www.ucsusa.org/sites/default/files/attach/2016/07/front-lines-of-rising-seas-key-executive-summary.pdf.

[17] Ibid.

Figure 2. Map of vulnerable bases along Easter and Gulf Seaboards. Source: Erika Spanger-Siegfried, Kristina Dahl, Astrid Caldas, and Shana Udvardy, *The US Military on the Front Lines of Rising Seas* (Cambridge, MA: Union of Concerned Scientists, 2016), 2, accessed January 17, 2017, http://www.ucsusa.org/sites/default/files/attach/2016/07/front-lines-of-rising-seas-key-executive-summary.pdf.

Again, under even the most modest rise in sea level, multiple military installations will be jeopardized in the coming century. These potential flooding events are not confined only to military installations, but will affect the surrounding communities that support the bases and perhaps render them unable to perform their military functions.

In addition to rising sea levels, the warming global temperature has caused significant melting of the polar ice caps, creating new challenges in the Arctic. The Arctic region has previously been recognized as a northern boundary that separates the United States from other countries that border the region. The Arctic sea ice was dense and broad enough that assuming risk in the Arctic was acceptable. The area was not navigable, making any resources in the region cost prohibitive to obtain. This is no longer the current state of the Arctic region. Arctic sea ice is receding at an unprecedented rate, declining 3.5% – 4.1% per decade since 1979.[18] The Arctic sea ice is no longer maintaining its thickness and expanse and is gradually decreasing with the most drastic decreases occurring within the last decade.[19] The Arctic is also warming faster than any other place on the globe. The average temperature in the Arctic has increased by 2^{o} Celsius, a significant increase exceeding many predictions.[20] The Arctic region continues to become more navigable for longer periods of time throughout the year. Due to global climate change, year round navigation of the arctic may become possible. As shipping lanes increase in the Arctic, there will be a reduction in the travel time of commerce around the globe. There is already a tenfold increase in commercial vessels traversing the Arctic with 71 cargo ships fully navigating the region, including vessels from China and Korea that do not share an arctic boundary.[21] The

[18] Stocker et al., 330.

[19] Ibid., 324.

[20] Stocker et al., 1092; Melillo, Richmond, and Yohe, 46.

[21] CNA Military Advisory Board, *National Security and the Accelerating Risks of Climate Change*. (Alexandria, VA: CNA Corporation, 2014), 19, accessed January 17, 2017, https://www.cna.org/CNA_files/pdf/MAB_5-8-14.pdf.

following graphs shows that temporal access to arctic sea lanes is growing, making the arctic a new frontier to defend.

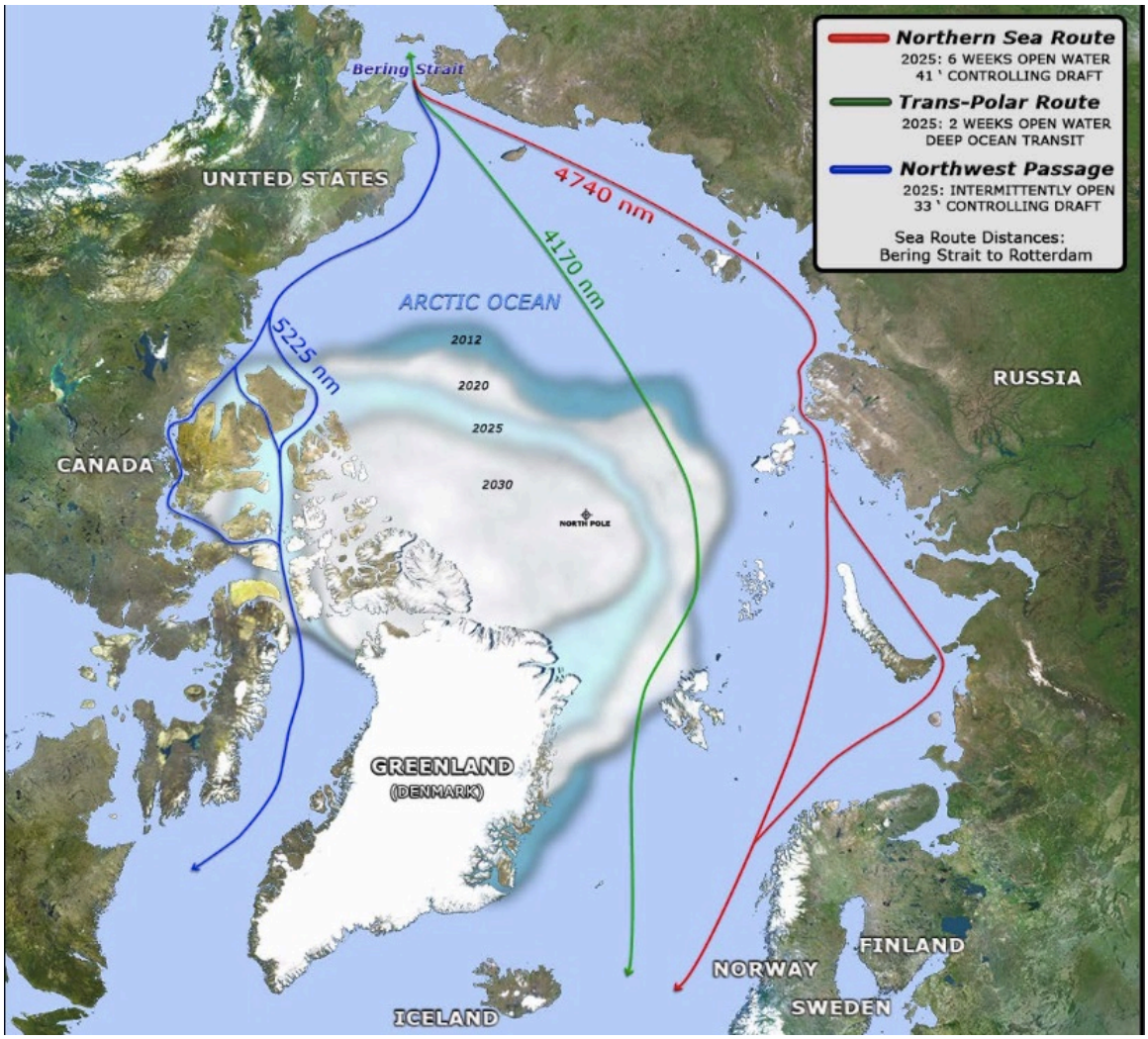

Figure 3. Arctic Seasonal Sea Lanes. *Source:* Chief of Naval Operations, *The United States Navy Arctic Roadmap for 2014 to 2030* (Washington, DC: US Department of the Navy, 2014),14, accessed January 17, 2017, http://www.navy.mil/docs/USN_arctic_roadmap.pdf

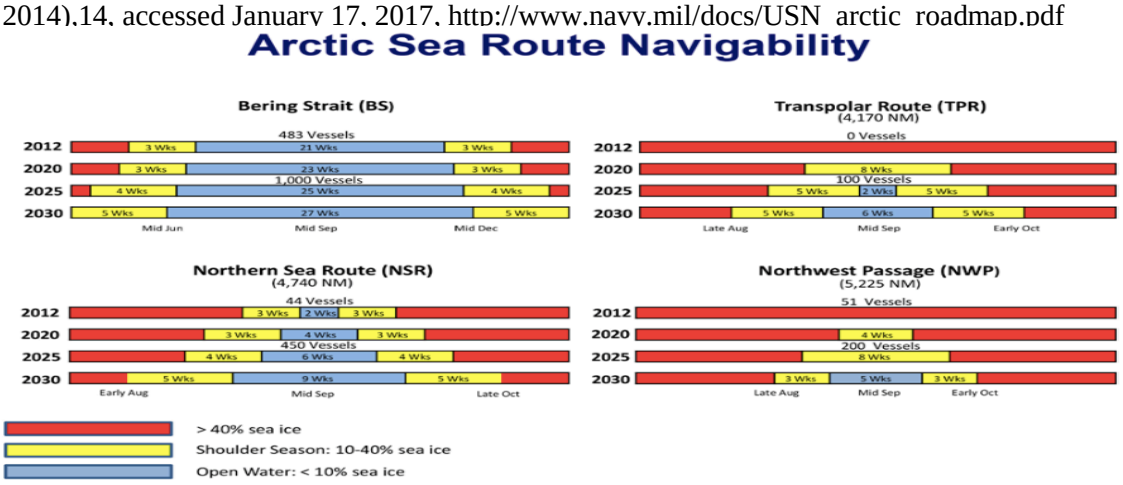

Figure 4. Arctic Sea Route Navigability Timetables. *Source:* Chief of Naval Operations, *The United States Navy Arctic Roadmap for 2014 to 2030* (Washington, DC: US Department of the Navy, 2014),11, accessed January 17, 2017, http://www.navy.mil/docs/USN_arctic_roadmap.pdf

Global warming has created conditions where extreme weather events likely will occur with more frequency and more devastating impacts, causing the United States to invest large amounts of resources in materials, equipment, and manpower. In the United States, records are being broken in almost every weather event category. This demonstrates how volatile the climate system is. According to scientists, there have been changes in many types of extreme weather events over the last several decades. Heat waves have become more frequent and intense, especially in the West. All over the United States, the average number of days above 95° F has increased 44% or sixteen days. The most significant increases have occurred in the Northeast and Northwest where days above 95° F have increased by ten and five days respectively.[22] On the inverse, the amount of fewer extreme cold days is decreasing an average of 17% or seven days per winter season.[23] In short, the summers in the United States are getting hotter and longer, while the winters are becoming more mild and shorter. There have also been regional trends in floods and droughts. River floods are increasing in the Northeast and Midwest, due to more extreme storm systems that carry more precipitation causing flash flooding.[24] In the drought prone areas of the Southwest and Northwest, prolonged droughts followed by an extreme storm system also create flash flooding scenarios.[25] Projections suggest increased drought conditions in the Southwest and heat waves everywhere, with cold waves becoming less intense everywhere.[26] Coastal flooding due to storm surge and rising sea levels will also increase in the United States, affecting the 5 million people that live within four feet of a high tide level, which is the most vulnerable area for storm surges and rising sea levels.[27] As these events become more frequent

[22] Melillo, Richmond, and Yohe, 117.

[23] Ibid.

[24] Ibid., 36, 75.

[25] Ibid.

[26] Ibid., 38.

[27] Ibid., 45.

and intense, the likelihood of military units responding in some capacity is likely to increase. These events will also have an impact on training and unit effectiveness. This will be discussed in further detail later in the monograph.

The convergence of the above events will likely impact food and water security, basic necessities of life which may trigger military or political conflicts. [28] In addition, the combination of climate change and meteoric global population growth may create local or regional natural and/or water resource scarcity conditions or famines. The UN Department of Economic and Social Affairs anticipates that the global population will climb to 8.5 billion by 2030, 9.7 billion by 2050, and 11.2 billion by 2100.[29] Additionally, by 2030, there may be a growing global middle class, increasing demands for food by 35%, energy by 50%, and water consumption by 40% above sustainable water withdrawal supplies.[30] These events, coupled with a shifting population demographic from rural areas towards coastal cities, will place more people in harm's way and make them vulnerable to extreme climatic events associated with global climate change. Although climate change is not the sole driver of instability, it is an increasing factor. One regional drought or flood has the potential to disrupt supply and demand chains, destabilizing communities and their governments. Vulnerable societies are those that are unable to respond to basic human needs of its citizens, creating conditions rife for opportunistic terrorist or insurgent organizations to control a population.[31] Events in Northern Africa during the Arab Spring, the

[28] NIC, *Global Trends: Paradox of Progress*, 170.

[29] "World Population Expected to Reach 9.7 billion by 2050," United Nations Department of Economic and Social Affairs, July, 29, 2015, accessed April 11, 2017, http://www.un.org/en/development/desa/news/population/2015-report.html.

[30] NIC, *Global Trends 2030: Alternative Worlds*, 30.

[31] Christopher B. Field et al., *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change* (Cambridge: Cambridge University Press, UN Intergovernmental Panel on Climate Change, 2012), 247, accessed April 1, 2017, http://www.ipcc.ch/pdf/special-reports/srex/SREX_Full_Report.pdf.

famine and drought in Somalia in 2011-2013, and the ongoing Syrian Civil War were all influenced by factors related to global climate change.[32]

Climate change has the potential to influence the national security interests of the United States and the DoD needs to prepare and adapt its policies to protect its interests. These extreme weather systems impact a large part of the earth's population. The United States is not immune to these factors, but it must become resilient against these factors and respond as required. However, climate change can stress the United States' ability to respond and potentially compromise the safety and security of the nation and military forces. Acknowledgement of the risks and proactive planning can mitigate these security risks.

Evolution of US policy regarding Climate Change

The significance of climate change within national military strategy and planning increased with the 2008 election of President Barack Obama. Under his administration, the United States participated in many international conversations about climate change and global security. From 30 November -12 December 2015, a watershed conference occurred in Paris, France, called the UN Climate Conference (COP 21). At the conference, the United States signed an agreement, along with 136 other nations, to implement nationally-determined policies to maintain global temperature increases under two degrees Celsius.[33]

President Obama's administration led a foreign and domestic policy shift regarding climate change. Published in May 2010, the administration's first National Security Strategy (NSS) directly addressed climate change.[34] The NSS address climate change as part of the

[32] NIC, *Implications for US National Security of Anticipated Climate Change,* 9; CNA Military Advisory Board, 13.

[33] "The Paris Agreement," United Nations Framework Convention on Climate Change, no date, accessed March 24, 2017, http://unfccc.int/paris_agreement/items/9485.php.

[34] Barack H. Obama, *National Security Strategy* (Washington, DC: The White House, 2010), 29, accessed February, 27 2017, http://nssarchive.us/NSSR/2010.pdf.

strategic environment, which affects US interests. The NSS emphasized the need to engage global partners as a means to protect the United States' interests abroad.[35] It noted that the "danger from climate change is real, urgent, and severe" and that global warming would trigger natural disasters, land degradation, and refugee crisis.[36] The administration outlined domestic and foreign policy goals aimed at reinvigorating the nuclear industry, increasing renewable energy, investing in clean energy technology, and lowering emissions by 80 percent by 2050. The 2010 NSS also led to the incorporation of climate change in the 2010 *Quadrennial Defense Review* (QDR).

The 2010 QDR identified climate change as a major driver of social and political instability and included a section titled "Crafting a Strategic Approach to Climate and Energy."[37] It argued that climate change shaped the operating environment and affected the roles and missions of the US military. It continued, "climate change could have significant geopolitical impacts around the world, contributing to poverty, environmental degradation, and the further weakening of fragile governments. Climate change will not only contribute to food and water scarcity and increase the spread of disease, but may spur or exacerbate mass migration," accelerants of instability and conflict.[38] At this time, the DoD developed effective assessment tools and promoted environmental security cooperation as a way forward. The QDR also recognized that coastal military installations were especially vulnerable to rising sea levels and encouraged measures to be implemented to ensure their climate resilience. This report focused more on mitigation measures rather than adaptation measures. The language of the 2010 QDR towards climate change carried over to the 2011 *National Military Strategy* (NMS) as well. The 2011 NMS acknowledged the 2010 QDR climate change mitigation measures and expanded the

[35] Obama, *National Security Strategy,* 2010, 8, 11.

[36] Ibid., 47.

[37] Robert M. Gates, *Quadrennial Defense Review Report* (Washington, DC: DoD, 2010), 84, accessed March 27, 2017, https://www.defense.gov/Portals/1/features/defenseReviews/QDR/QDR_as_of_29JAN10_1600.pdf.

[38] Ibid., 84-88.

effects of climate change to demographic pressures as well. The document stated that "The uncertain impact of global climate change combined with increased population centers in or near coastal environments may challenge the ability of weak or developing states to respond to natural disasters."[39] The 2011 NMS thus tied climate change to vulnerable populations around the world, primarily coastlines and coastal megacities.[40]

With the reelection of President Obama in 2012, climate change remained embedded in political and military discourse. The administration also published an assortment of Executive Orders to review existing policies, directives, and guidance regarding climate change across all government programs. The President's 2013 *Climate Action Plan* and the ensuring Executive Order 13653, *Preparing the United States for the Impacts of Climate Change*, established a federal policy framework for addressing climate change and required agencies to submit their climate change adaptation plans within 120 days. Three concepts within the President's Climate Action Plan guided the climate adaptation plan: 1) Cut carbon pollution in America, 2) Prepare the United States for the impacts of climate change, 3) Lead international efforts to address global climate change.[41] The Executive Order also established an interagency Council on Climate Preparedness and Resilience.[42] President Obama established this council as a White House Task Force consisting of 25 intergovernmental agencies to assist in achieving the goals outlined in the above Executive Order.[43] These documents required all agencies, including the DoD, to develop

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[39] Michael G. Mullen, *The National Military Strategy of the United States of America 2011: Redefining America's Military Leadership* (Washington, DC: US Joint Chiefs of Staff, 2011), 2, accessed February 27, 2017, https://www.army.mil/e2/rv5_downloads/info/references/NMS_Feb2011.pdf.

[40] Ibid.

[41] Executive Office of the President, *The President's Climate Action Plan* (Washington, DC: The White House, 2013), Table of Contents, accessed April 1, 2017, https://obamawhitehouse.archives.gov/sites/default/files/image/president27sclimateactionplan.pdf.

[42] Executive Office of the President, *Executive Order 13653 Preparing the US for the Impacts of Climate Change* (Washington, DC: The White House, 2013), November 1, 2013, accessed April 1, 2017, https://obamawhitehouse.archives.gov/the-press-office/2013/11/01/executive-order-preparing-united-states-impacts-climate-change.

climate change adaptation measures.[44] The DoD addressed the administrations' requests in its 2014 QDR and *Climate Change Adaptation Roadmap* (CCAR), published in the same year.

The 2014 QDR expanded on many of the same themes. Specifically, it noted that as "greenhouse gas emissions increase, sea levels are rising, the average global temperatures are increasing and severe weather patterns are accelerating."[45] The QDR acknowledged that climate change acted as a generator of instability by creating water scarcity situation and driving up food costs. According to the QDR, climate change acts as a "threat multipliers that will aggravate stressors abroad such as poverty, environmental degradation, political instability and social tensions — conditions that enable terrorist activity and other forms of violence."[46] Given these challenges, the QDR emphasized the necessity for the United States to cooperate with other nations through building partner capacity initiatives.[47] Finally, the QDR acknowledged the need to conduct a thorough analysis of climate change's impact on the operational readiness of units by restricting access to land, sea, or air training and test space.[48]

In response to Executive Order 13653, The DoD published its CCAR in 2014. In his introduction to the CCAR, Secretary of Defense (SECDEF) Chuck Hagel acknowledged that climate change constituted a "threat multiplier" and that its impacts on society and on the military

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[43] "Fact Sheet: Executive Order on Climate Preparedness," White House Office of the Press Secretary, November 1, 2013, accessed April 10, 2017, https://obamawhitehouse.archives.gov/the-press-office/2013/11/01/fact-sheet-executive-order-climate-preparedness.

[44] Executive Office of the President, *The President's Climate Action Plan* (Washington, DC: The White House, 2013), accessed April 1, 2017, https://obamawhitehouse.archives.gov/sites/default/files/image/president27sclimateactionplan.pdf; Executive Office of the President, *Executive Order 13653 Preparing the US for the Impacts of Climate Change* (Washington, DC: The White House), November 1, 2013, accessed April 1, 2017, https://obamawhitehouse.archives.gov/the-press-office/2013/11/01/executive-order-preparing-united-states-impacts-climate-change.

[45] Chuck Hagel, *Quadrennial Defense Review 2014* (Washington, DC: DoD, 2014), 8, accessed February 27, 2017, http://archive.defense.gov/pubs/2014_Quadrennial_Defense_Review.pdf.

[46] Ibid.

[47] Ibid., 25.

[48] Ibid.

were already being observed and experienced.[49] The CCAR further identified climate change as an "immediate risk" and that the DoD would respond to climate change in two ways: **Adaptation**, defined as efforts to plan for the changes that are occurring or expected to occur; and **Mitigation**, defined as efforts to reduce greenhouse gas emissions.[50] The SECDEF also stated the military could be called upon to execute more Humanitarian Assistance/Disaster Relief (HADR) mission at home and abroad and that the United States' military infrastructure was vulnerable to rising sea levels, wild fires, floods, and natural disasters. He continued that "climate change is a long-term trend, but with wise planning and risk mitigation now, we can reduce adverse impacts downrange."[51] The roadmap included three goals: 1) Identify and assess the effects of climate change on the DoD; 2) Integrate climate change considerations across the Department and manage associated risks; 3) Collaborate with internal and external stakeholders on climate change challenges. The CCAR listed four lines of effort to support these goals:

1. **Plans and Operations:** activities dedicated to preparing for and carrying out the full range of military operations.
2. **Training and Testing:** activities critical to maintaining a capable and ready force in the face of a rapidly changing strategic setting. Access to land, air, and sea space that replicate the operational environment for training and testing is essential to readiness.
3. **Built and Natural Infrastructure:** built infrastructure serves as the staging platform for the DoD's defense and humanitarian missions; natural infrastructure supports military combat readiness by providing realistic combat conditions.

[49] Office of the Assistant Secretary of Defense (Energy, Installations & Environment), *2014 Climate Change Adaptation Roadmap* (Washington, DC: US DoD, 2014), Foreword, accessed January 17, 2017, http://www.acq.osd.mil/eie/Downloads/CCARprint_wForward_e.pdf.

[50] Ibid., 1.

[51] Ibid., Foreword.

4. **Acquisition and Supply Chain:** the full range of developing, acquiring, fielding and sustaining equipment and services and leveraging technologies to meet the DoD's current and future needs.[52]

The 2014 QDR and CCAR were self-assessment initiatives aimed at analyzing the DoD's current and future capabilities and identifying potential existing gaps. The President further outlined climate change initiatives with his 2015 NSS.

The 2015 NSS identified climate change as a top strategic security risk to the United States for the first time. This NSS prioritized climate change as the sixth of eight security risks, ranking below catastrophic attacks on the homeland, threats or attacks against US citizens, global economic crisis or slowdown, proliferation or use of weapons of mass destruction, and severe global infectious disease outbreaks. However, the NSS ranked climate change above major energy market disruptions and significant security consequences associated with weak or failing states.[53] The document also put climate change in a different context, changing it from a phenomenon that is a danger to be dealt with in the future, to one that needs to be confronted in the present day.[54] This change in phrasing adopted a proactive stance and committed resources to adapting and mitigating the risks posed by climate change.

In 2015, the Obama Administration also released *The National Security Implication of a Changing Climate*. This document summarized climate change reports from other federal agencies such as the 2014 *Quadrennial Homeland Security Review*, published by the Department of Homeland Security (DHS), and the *Third National Climate Assessment*, published by the US Global Change Research Program. The document identified three security implications. The first implication was that coastal military installations are vulnerable to higher sea levels, storm

[52] Office of the Assistant Secretary of Defense (Energy, Installations & Environment), 1-2.

[53] Barack H. Obama, *National Security Strategy* (Washington, DC: The White House, 2015), 2, accessed February 27, 2017, http://nssarchive.us/wp-content/uploads/2015/02/2015.pdf.

[54] Ibid., 12.

surges, and flooding.[55] The second implication reaffirms the position that climate change is a threat multiplier and may contribute to social and political instability, which may potentially intensify refugee flows and stress governments with weak governing infrastructure and capacity in affected regions.[56] Finally, climate change may increase the demands on military resources and undermine military readiness.[57]

The DoD has not taken a stance on the cause of climate change and has rather argued that it is a phenomenon that requires urgent planning, action, and mitigation. There are other DoD reports and policy statements concerning climate change, but the above analysis shows the most relevant and influential. The Obama Administration treated climate change as an urgent strategic challenge rather than a distant problem. In the next section, the monograph will conduct DOTMLPF analysis regarding climate change's impact on the joint force's capabilities.

Joint Force Capability Analysis regarding Climate Change

The issue of climate change is still a relatively new phenomenon that the DoD is addressing. The discourse has evolved from merely analyzing the problem to implementing policies and solutions. This section will analyze the current capabilities the DoD has in reference to the joint force's response and adaption to climate change. DOTMLPF will serve as the broad analytical framework to conduct this analysis.

[55] Executive Office of the President, *Findings from Select Federal Reports: The National Security Implications of a Changing Climate* (Washington, DC: The White House, 2015), 4, accessed April 1, 2017, https://obamawhitehouse.archives.gov/sites/default/files/docs/National_Security_Implications_of_Changing_Climate_Final_051915.pdf.

[56] Ibid., 8.

[57] Ibid., 9.

Doctrine:

Doctrine serves as the "fundamental principles that guide the employment of US military forces in coordinated action toward a common objective and may include terms, tactics, techniques, and procedures."[58] Climate change is not explicitly defined in any military doctrine, with the exception of the *DOD Dictionary of Military and Associated Terms.* It defines climate change as "variations in average weather conditions that persist over multiple decades or longer that encompass increases and decreases in temperature, shifts in precipitation, and changing risk of certain types of severe weather events."[59] Although military doctrine does not have manuals and documents that specifically address climate change, it does have doctrine that addresses the responses the military is likely to perform. The Geographic Combatant Commands (GCC) believe that HADR and Defense Support of Civilian Authorities (DSCA) missions will be performed with increasing frequency due to severe weather events associated with global climate.[60] These missions are described in two Joint Publication (JP)s.

JP 3-28 *Defense Support of Civilian Authorities* is the doctrinal manual that explains the DoD's role when performing operations on the homeland of the United States. This document does not explicitly address or reference climate change, but as stated it is a mission. This manual uses terms such as "catastrophic events" and "catastrophic incident." A catastrophic event is defined as "any natural or man-made incident, including terrorism, which results in extraordinary levels of mass casualties, damage, or disruption severely affecting the population, infrastructure,

[58] US Joint Chiefs of Staff, *DOD Dictionary of Military and Associated Terms* (Washington, DC: US Joint Chiefs of Staff, 2017), 125.

[59] Ibid., 38.

[60] US Congress, Senate, Response to request contained in Senate Report 113-211, accompanying H.R. 4870, the DoD Appropriations Bill, 2015, *National Security Implications of Climate-Related Risks and a Changing Climate*. (Washington, DC: DoD, 2015), 4, accessed April 1, 2017, https://climateandsecurity.files.wordpress.com/2014/01/15_07_24-dod_gcc_congressional-report-on-national-security-implications-of-climate-change.pdf.

environment, economy, national morale, and/or government functions."[61] These are events that can occur as a result of climate change. Furthermore, as discussed previously, climate change can cause extreme weather events that contribute to other social conditions causing conflict, mass migration, and instability. The JP, although not explicitly referencing climate change, demonstrates that the military force must be prepared to respond to climate change linked events.

JP 3-29 *Foreign Humanitarian Assistance* similarly does not make specific reference to climate change events. However, it uses the term "complex emergency." A complex emergency is "a humanitarian crisis in a country, region, or society where there is a total or considerable breakdown of authority resulting from internal or external conflict and which requires an international response that goes beyond the mandate or capacity of any single agency and/or the ongoing UN country program."[62] The manual enumerates the following common characteristics of a complex emergency:

1) Many civilian casualties and populations besieged or displaced.

2) Serious political or conflict-related impediments to delivery of assistance.

3) Inability of people to pursue normal social, political, or economic activities.

4) High security risks for relief workers.

5) International and cross-border operations affected by diplomatic or political differences.[63]

Climate change can create the above situations in areas that do not have resilience to extreme weather events. Climate change has already been defined as an accelerant of conflict and

[61] Joint Publication (JP) 3-28, *Defense Support of Civilian Authorities* (Washington, DC: US Joint Chiefs of Staff, 2017), 32.

[62] JP 3-29, *Foreign Humanitarian Assistance* (Washington, DC: US Joint Chiefs of Staff, 2014), III-4.

[63] Ibid.

multiplier of instability.[64] It is thus curious that the Joint Force has not incorporated climate change and its associated extreme weather events, which drive complex emergencies, into its doctrine.

Army Doctrine Reference Publication (ADRP) 3-28 *Defense Support of Civilian Authorities* is the Army's doctrine on its disaster response responsibilities within the United States and its territories. This manual does not make specific reference to climate change or its corresponding effects on weather events. As already mentioned, HADR and DSCA are responses most likely conducted by military forces. ADRP 3-28 states, "When directed by the President or the SECDEF, DoD provides support to a primary agency as part of a coordinated federal response, following a request from civil authorities."[65] It also states that US Northern Command (NORTHCOM) and US Pacific Command (PACOM) have primary DSCA responsibilities. The other GCCs provide capabilities as required.[66] The manual explains that the DoD, when authorized to respond within the United States, focuses on Emergency Support Function (ESF) Three, Public Works and Engineering. This ESF directs the DoD to serve as the lead agency for activities within the scope of this function, including conducting pre- and post-incident assessments of public works and infrastructure; executing emergency contract support for life-saving and life-sustaining services; providing technical assistance to include engineering expertise and construction management; contracting and real estate services; and providing emergency repair of damaged public infrastructure and critical facilities.[67] The DoD is the

[64] Office of the Assistant Secretary of Defense (Energy, Installations & Environment), Foreword.

[65] Army Doctrine Reference Publication (ADRP) 3-28, *Defense Support of Civilian Authorities* (Washington, DC: Government Printing Office, 2013), 1-21.

[66] Ibid.

[67] *Emergency Support Function #3 – Public Works And Engineering Annex*, (Washington DC: Federal Emergency Management Agency, 2016), accessed March 21, 2017, https://www.fema.gov/media-library-data/1470148988566-5cc7d5a63192c921e08a3cd0cd5688d1/ESF_3_Public_Works_and_Engineering_20160705_508.pdf

supporting agency when performing DSCA activities. The DoD has a multitude of options it can employ when supporting civilian authorities. ADRP 3-28's publication date of 2013, which preceded Executive Order 13653 and the CCAR, probably explains the omission of "climate change" in its contents.

The most likely climate related security responses will be in the form of DSCA and HADR which are likely to be performed by US PACOM and US NORTHCOM. These GCCs will operate in support of a civilian authority. Military doctrine has addressed responses to potential climate change events without specifically referencing the role of climate change, which is unnecessary as long as the responses are addressed. In each of the GCCs, the risk of climate change has incorporated into their theater campaign plans through their planning cycles.[68]

Organization:

Organization is how the military organizes to fight and perform its required missions in expeditionary situations. This section will analyze the organization for DSCA and HADR as they are the two most likely responses required by the DoD. In a DSCA setting, any DoD organization will be in a support and subordinate role to the agency in charge of the disaster response zone. This subordinate role, played by the DoD, can be a number of requested emergency support activities including: engineering, intelligence, personnel services, logistics, public affairs, and health services support when authorized by the President or SECDEF. In 2012, in response to Super Storm Sandy in New York and New Jersey, over 14,000 DoD personnel mobilized to provide direct DSCA support.[69] This included US NORTHCOM and US PACOM, the only two GCCs that provide DSCA support since their Area of Responsibility (AOR) include the continental United States and US territories. All GCCs, however, are accountable for the HADR missions.

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[68] US Congress, Senate, Response to request contained in Senate Report 113-211, *National Security Implications of Climate-Related Risks and a Changing Climate*, 6.

[69] Ibid., 4.

To assist in coordinating HADR responses, in 1994, the Congress established the Center for Excellence in Disaster Management and Humanitarian Assistance (COEDMHA). The COEDMHA is under the authority of the DoD and "fulfills a worldwide mission to enhance civil-military coordination through collaborative partnerships, education and training, and applied research."[70] This organization operates worldwide, but US PACOM is its primary customer. COEDMHA has three lines of effort: 1) Training and Education, 2) Applied Research and Information Sharing, and 3) Regional Civil-Military Coordination.[71] The center serves as a liaison for partnerships throughout the Pacific AOR as well as with other governmental and international agencies to facilitate collaborative partnerships and build disaster relief capacity and resilience among partners.[72]

GCCs already account for HADR mission in their theater campaign, operation, or contingency plans planning processes.[73] GCCs provide a wide range of responses from engineering, strategic lift, logistics and distribution, health services, command and control, search and rescue.[74] When GCCs conduct HADR missions within their AOR, they are in a support role to the host nation or the lead government agency.[75] GCCs acknowledge the need to build and maintain habitual relationships with these various agencies within a HADR environment. They also acknowledge that building partner capacity and resilience to extreme weather events is vital in HADR response.[76]

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[70] JP 3-29, II-8.

[71] "CFE-DM Program Plan," Center for Excellence in Disaster Management and Humanitarian Assistance, no date, accessed April 13, 2017, https://www.cfe-dmha.org/About-CFE-DM/Program-Plan.

[72] "DMHA Partners," Center for Excellence in Disaster Management and Humanitarian Assistance, no date, accessed April 13, 2017, https://www.cfe-dmha.org/Partnerships.

[73] US Congress, Senate, Response to request contained in Senate Report 113-211, *National Security Implications of Climate-Related Risks and a Changing Climate*, 7.

[74] Ibid.

[75] JP 3-29, x.

The increasing trafficability of the Arctic region has some organizational challenges. Experts predict that the Arctic region will facilitate annual sustained maritime traffic in the very near future. By 2020, the Bering Strait is expected to see open water conditions for up to 160 days per year and a sustained open sea route through the Arctic is expected by 2030.[77] In August 2016, a luxury cruise ship, *Crystal Serenity*, navigated the Northwest Passage of the Arctic region without requiring any external ice breaking capability.[78] Many nations will also want access to this region for resource exploitation. The United States Geological Survey estimates that there are approximately 90 billion barrels of oil, 1,669 trillion cubic feet of natural gas, and 44 billion barrels of natural gas liquid to be recovered in the Arctic.[79] The accessibility and unexploited hydrocarbon resources make the Arctic region a vital new security concern. This may open up an entire region of the earth to exploitation, requiring accountability when planning operations. US European Command and US NORTHCOM both share the responsibility of the Arctic AOR. As the Arctic becomes accessible to commercial and touristic endeavors, so does the need to perform search and rescue operations in the region.[80] The US military has an organization for this capability, but it is not trained for Arctic conditions. The US Navy assesses

[76] US Congress, Senate, Response to request contained in Senate Report 113-211, *National Security Implications of Climate-Related Risks and a Changing Climate*, 6.

[77] Chief of Naval Operations, *The United States Navy Arctic Roadmap for 2014 to 2030* (Washington, DC: US Department of the Navy, 2014),11-12, accessed January, 17, 2017, http://www.navy.mil/docs/USN_arctic_roadmap.pdf

[78] Mark Thiessen, "Thanks to Melting Ice, Cruise Ship Travels Northwest Passage," US News & World Report, September 9, 2016, accessed April 12, 2017, https://www.usnews.com/news/news/articles/2016-09-09/giant-cruise-ship-makes-historic-voyage-in-melting-arctic.

[79] Kenneth J. Bird et al., *Circum-Arctic Resource Appraisal: Estimates of Undiscovered Oil and Gas North of the Arctic Circle* (Menlo Park, CA: US Geological Survey, 2008), 4, accessed March 24, 2017, https://pubs.usgs.gov/fs/2008/3049/fs2008-3049.pdf.

[80] Chief of Naval Operations, 13.

their current Arctic posture as appropriate to address near term defense requirements but acknowledges a capability gap in the mid and long-term.[81]

Current military organization for responding to climate change events appears adequate in the near term. Every GCC takes into account DSCA and HADR missions as part of their planning and risk processes. These current structures are adequate to support one crisis. If multiple crises or conflicts occur in different GCC AOs, the military systems may lack the needed redundancy to effectively respond. The Arctic presents many opportunities to increase the capacity of the US Navy. As more sea ice recedes, the sea lines of communication extend and stress the operational reach of the US military until the resolution of existing infrastructure and sustainment capability gaps.

Training:

According to Army Doctrine Publication 7-0, "The Army trains to provide ready forces to combatant commanders worldwide. Units train in garrison and while deployed to prepare for their mission and adapt their capabilities to any changes in an operational environment."[82] Climate change may affect the types of mission required of the military. Climate change can impact training in multiple ways. It will influence the missions being performed, access to training lands, and unit readiness. The DOD CCAR identities the following training categories as vulnerable due to forecasted impact of global climate change:

1. Increased number of "black flag" (suspended outdoor training) or fire hazard days.
2. Decreased training land carrying capacity to support current training rotation types or level.
3. Increased dust generation which may interfere with sensitive equipment, requiring greater repairs and dust control measures.
4. Increased operation health and safety risks to personnel.

[81] Chief of Naval Operations, 7, Near term is present to year 2020, midterm is 2020-2030, far term is beyond 2030.

[82] Army Doctrine Publication 7-0, *Training Units and Developing Leaders* (Washington, DC: Government Printing Office, 2013), 2.

5. Increased maintenance/repair requirements for training lands and associated infrastructure and equipment.[83]

These events will impact the military's ability to provide the GCCs with trained and ready forces. Cancelled training due to heat, flooding, or fires causes the unit to make up the training at another time. These extreme weather events will become more frequent and could cause more training losses. These delays have cascading impacts on the Army's overall training calendar. Possible adverse outcomes may include, deploying a unit that is not qualified to a GCC or potentially putting a service member's life at risk by training in extreme heat or other extreme weather conditions.

Extreme weather events are already impacting training events. Fort Irwin, one of the military's premier training bases that certifies brigade level units to deploy, experienced a three year-long drought that ended in one weather event that caused flash flooding and erosion, destroying many of the training ranges and complexes and cancelling a brigade live fire exercise.[84] This event disrupted the training cycle of the brigade and future training cycles. The storm also caused $64 million in damage, causing redistribution from an already strained budget to repair the damage caused by the flooding and erosion.[85] On bases located in the southern United States, the expectation is for training days during heat category IV or V to increase from 80 days to 130 days each year. The heat degrades these training days, causing the event curtailment or cancellation because of the increased threat of a heat related injury.[86] In addition to

[83] Office of the Assistant Secretary of Defense (Energy, Installations & Environment), 6.

[84] Todd Lopez, "Climate change affecting Army training," *US Army*, April 27, 2016, accessed February 27, 2017, https://www.army.mil/article/166803.

[85] US Government Accountability Office, *Climate Change Adaptation DOD Can Improve Infrastructure Planning and Processes to Better Account for Potential Impacts: Report to Congressional Requestors* (Washington, DC: US Government Accountability Office, 2014), 22-23, accessed February 27, 2017, https://www.gao.gov/assets/670/663734.pdf.

[86] Lopez, "Climate change affecting Army training".

the Mission Essential Tasks units are required to be trained in, more units will be required to perform mission of HADR and DSCA.[87]

For DSCA missions, the DoD relies heavily on reserve, National Guard, or the Army Corps of Engineers personnel.[88] Active units will need more training events focused on DSCA missions and the intricacies these missions entail. As the frequency of extreme weather events increases, which will likely require the use of National Guard or reserve forces, those forces will not be available for deployment to overseas contingencies. The operational tempo for these units will be too high to ensure their readiness and training. Additionally, active duty units will need training in HADR missions overseas. They will likely respond to flooding events requiring HADR, especially as demographic trends will force more people to move to cities located on coastlines.[89] HADR is a complex mission, "requiring a multi domain response for strategic lift, engineering, medical care, power grid restoration, search and rescue and port opening."[90] In addition to this mission, DoD units will need to build partner relations and host nation capacity and resilience so that those nations can respond.[91]

GCC staffs include HADR planning in their campaign plans, but they admit that having access to knowledgeable personnel on climate science in their AOR would be beneficial.[92] These personnel would assist in the planning processes for each GCC and provide the headquarters with expertise about climate change impacts on future strategic and operational environments.[93] This

[87] Office of the Assistant Secretary of Defense (Energy, Installations & Environment), 5.

[88] CNA Military Advisory Board 23.

[89] NIC, *Global Trends: Paradox of Progress*, 10.

[90] US Congress. Senate. Response to request contained in Senate Report 113-211, *National Security Implications of Climate-Related Risks and a Changing Climate*, 6.

[91] Ibid.

[92] Ibid., 7.

[93] The Climate and Security Advisory Group, *Briefing Book for a New Administration: Recommended Policies and Practices for Addressing the Security Risks of a Changing Climate*

capability provides the GCC a more accurate assessment of their AOR regarding potential climate aggravated flashpoints, giving the headquarters a better assessment of the costs, both human and monetary, associated with HADR or DSCA response. Having trained climate data analysts and scientists would assist the GCCs in their operational and climate assessments of their AORs to develop proper campaign and contingency plans.

Materiel:

Materiel consists of "all items (including ships, tanks, self-propelled weapons, aircraft, etc., and related spares, repair parts, and support equipment, but excluding real property, installations, and utilities) necessary to equip, operate, maintain, and support joint military activities without distinction as to its application for administrative or combat purposes."[94] Due to melting ice, the Arctic region is becoming a new frontier that the United States must be prepared to respond. As more Arctic ice recedes, sea-lanes may become navigable and accessible for commercial ventures. Additionally, the remoteness of the Arctic region requires the United States to reassess how it will sustain operations in that AOR.

The Navy acknowledges the need to operate in the Arctic and the need to prepare for search and rescue and freedom of navigation operations. In order to operate and build Arctic resilience, the Navy acknowledges a portion of their fleet needs retrofitting.[95] The Navy states that it has "the aptitude to meet current arctic requirements in the near term."[96] It also identified

(Washington, DC: The Center for Climate and Security, 2016), 13-14, accessed February 27, 2017, https://climateandsecurity.files.wordpress.com/2016/09/climate-and-security-advisory-group_briefing-book-for-a-new-administration_2016_11.pdf.

[94] Joint Capabilities Integration Development System (JCIDS) Manual, *Manual for the Operations of the Joint Capabilities Integration and Development System* (Washington, DC: Government Printing Office, 2015), C-4, accessed February 27, 2017, https://dap.dau.mil/policy/Documents/2015/JCIDS_Manual_with_errata_through_20151218.pdf.

[95] Jeff Goodell, "The Pentagon and Climate Change: Is National Security at Risk?," *Rolling Stone Magazine*, February 12, 2015, accessed March 24, 2017, http://www.rollingstone.com/politics/news/the-pentagon-climate-change-how-climate-deniers-put-national-security-at-risk-20150212.

[96] Chief of Naval Operations, 7.

capability gaps in communication equipment, Arctic resilient sea vessels, and a logistics infrastructure capable in an austere arctic environment.[97] There are gaps based on their required mission, but they have not been called to operate for any extended period of time in the Arctic to this point and the necessity is now emergent. The United States must consider the materiel implications of operating in such a difficult climate and region in the future.

Furthermore, defense of these resources and navigation lanes will become more prevalent, requiring Arctic resilient maritime vessels, which are in limited production and supply. The DoD acknowledges the need to have more ice breaking capability and will seek to coordinate through the DHS and the US Coast Guard (USCG) for this capability. The USCG owns only one Arctic capable icebreaker vessel. The need for more of these vessels will allow for adequate response to emergencies and other contingencies.[98]

There are vulnerabilities in the military force regarding equipping the force to respond to climate change emergencies. Primarily, those emergencies in the Arctic region pose the biggest challenges. The US Navy states that it can respond to any maritime situation in the next 5 years.[99] They acknowledge the requirement to have more Arctic resilient vessels capable of operating in the harsh Arctic conditions. The military also acknowledges the need to assess the logistics requirements and concepts to sustain a force should prolonged Arctic operations become necessary.[100] Finally, although not part of DoD, DHS has an ice breaking capability that is not robust. There is also potential for the US Navy to require this capability in order to increase responsiveness in the Arctic region in the future.

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[97] Ibid., 18.

[98] Jen Judson, "The Icebreaker Gap," September 1, 2015, accessed February 27, 2017, http://www.politico.eu/article/russia-france-arctic-icebreaker-defense/.

[99] Chief of Naval Operations, 4.

[100] Ibid., 16.

Leadership and Education:

US military leadership acknowledged that climate change will have a major impact on the future operating environment. In 2014, as already discussed, the DoD published its CCAR. The publication represented a watershed moment in the DoD's history because it recognized climate change's operational and strategic impacts. Using the CCAR, the GCCs incorporated the effects of climate change into their theater campaign plans. They acknowledge that climate change is a threat multiplier that will exacerbate already unstable regions and communities. They also contended that building partner capacity and resilient nations capable of responding to climate related events would improve the stability and security of their AORs.[101]

According to ADRP 6-22, "Through education, training and experience leaders develop into competent and disciplined professionals of the Army."[102] Leaders at all echelons require additional education about how climate change creates instability in the operational environment. This professional education can assist all leaders in building the capacity of partnered nations. Planners can also incorporate weather and climate data and use this as a lens to analyze the operational environment, identifying sources of conflict or anticipating when or where a conflict may occur due to natural resource scarcities, coastal flooding, refugee crises, and other climate related events. Additionally, staffs with personnel trained in identifying environmental security risks can apply that expertise in the planning process, bolstering commanders' understanding of the operational environment.

DoD Directive 4715.21 directed the military service's to integrate climate change effects on mission into their Professional Military Education (PME) system.[103] The Army's PME

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[101] US Congress, Senate, Response to request contained in Senate Report 113-211, *National Security Implications of Climate-Related Risks and a Changing Climate*, 6.

[102] ADRP 6-22, *Army Leadership* (Washington, DC: Government Printing Office, 2012), 1-2.

[103] Office of the Under Secretary of Defense (Acquisition, Technology, and Logistics), *DoD Directive 4715.21 Climate Change Adaptation and Resilience* (Washington DC: Department of Defense, 2016), 9, accessed April 1, 2017, http://dtic.mil/whs/directives/corres/pdf/471521p.pdf.

addresses climate change in its curriculum at several locations. At Fort Leavenworth's School of Advance Military Studies Advanced Military Studies Program (AMSP) and Advanced Strategic Leadership Studies Program (ASLSP), these programs include courseware and guest speakers that address climate related security issues. In both programs, students read books and professional journal articles about climate change and engage in subject matter expert facilitated discussions on the impacts of climate change and environmental security.[104] The ASLSP addresses the subject by reviewing the NSS's statements on climate change; as well as the North Atlantic Treaty Organization's Strategic Concept, which analyzes the security challenges in the Arctic and Baltic Seas posed by climate change. The AMSP has a lesson concerning the security challenges of climate change in its "Anticipating the Future" course of instruction.[105] Joint service PME institutions must continue to educate their students on how climate change can impact the future operating environment.

Personnel:

"The personnel component primarily ensures that qualified personnel exist to support capability requirements across the joint force."[106] Already stated in the training and doctrine portion of the analysis, the GCCs assessed the likely response to a climate change event is HADR or DSCA. The military has personnel trained to conduct these tasks. However, with the likelihood of these missions expected to increase, trained personnel for disaster response may become scarce. In addition to their military occupation specialty, every service member should be trained in basic HADR and DSCA tasks, as the likelihood of any function of military units performing these tasks is probable. The US PACOM GCC has established Pacific Augmentation Teams around its AOR to identify immediate HADR and DSCA requirements that the military will

[104] Memorandum, "School of Advanced Military Studies Education Programs and Topic of Climate Security" (Fort Leavenworth, KS: no publisher, 2016, in author's possession).

[105] Ibid.

[106] JCIDS Manual, C-4.

potentially have to respond to. These teams shorten disaster response times by allowing US PACOM to mobilize a response in anticipation of the SECDEF's request.[107] Additionally, each GCC should have a climate scientist working in their planning activities. These personnel will enable a military headquarters to see its AOR through the lens of climate interacting with natural resources and societal systems. There is opportunity for incorporation of these personnel teams by every GCC. In addition to DSCA and HADR missions, the geographic locations in which the military will operate in will expand.

The Arctic frontier also creates the necessity of military personnel able to conduct Arctic operations. According to the Navy's Arctic Roadmap, the Navy's submarine force is fully capable of operating in the Arctic. It conducts multiple exercises a year north of the Arctic Circle to maintain arctic resilience and preparedness.[108] They do not anticipate the near term need to have trained Arctic ground and air personnel, and they assess they can meet the current security threats with the current force posture.[109] They have identified the capability gap in their surface and air forces for more Arctic trained personnel and will be capable of performing sustained Arctic operations in the future as the Arctic becomes more accessible.[110] The Army has the 1-25 Stryker Brigade Combat Team and 4-25 Infantry Brigade Combat Team (Airborne), both capable of Arctic operations. They perform each of their military functions in arctic conditions.

Climate change will create the need for trained personnel in Arctic operations. In the next five years, the military has the personnel needed to respond to the GCCs Arctic requirements. In the next 5-15 years, as access to the Arctic region increases, this will require more personnel, across all services, trained in arctic operations.

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[107] US Congress, Senate, Response to request contained in Senate Report 113-211, *National Security Implications of Climate-Related Risks and a Changing Climate*, 12.

[108] Chief of Naval Operations, 7-8.

[109] Ibid.

[110] Ibid., 18.

Facilities:

Facilities "consist of real property that includes buildings, structures, utility systems, associated roads and other pavements, and underlying land. Definition of key facilities is of command installations and industrial facilities of primary importance to the support of military operations or military production programs."[111] Military infrastructure represents an area of readiness undermined by climate change. Coastal military infrastructure, including roads, rail lines, port facilities, and energy infrastructure, are at risk from storm surges and rising sea levels associated with climate change.[112] Military bases are projection platforms as well as training grounds. The ability of the military to defend the United States is directly related to the ability of the military's infrastructure and facility functioning without interruption or degradation. As discussed in the training section of this monograph, climate change is already impacting the training aspect of military infrastructure. Sea level rise has the ability to affect major transportation, command and control, intelligence and deployment hubs. The Strategic Environmental Research and Development Program states that "about 10 percent of DoD coastal installations and facilities are at or near sea level and are already vulnerable to flooding."[113] The SERDP did not identify impacted facilities, but the UCS reported there are 18 strategic installations along the east coast of the United States at risk of losing 50% of their land by 2100 due to rising sea levels and storm surge.[114] Studies showed that over the next three decades, these installations and surrounding civilian infrastructure will forced to manage ten times the amounts

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[111] JCIDS Manual, C-5.

[112] Strategic Environmental Research and Development Program, *Assessing Impacts of Climate Change on Coastal Military Installations: Policy Implications* (Washington, DC: US DoD, 2013), 5, accessed April 1, 2017, https://www.serdp-estcp.org/content/download/17219/192680/version/1/file/SERDP+Coastal+Assessment+White+Paper_January+2013.pdf.

[113] Strategic Environmental Research and Development Program, 5.

[114] Erika Spanger-Siegfried et al., 4.

of floods they experience today. Additionally, Naval Air Station Key West, Joint Base Langley-Eustis, Dam Neck Annex, and Parris Island are at risk of losing 75 to 95 percent of their land.[115] Other global military facilities such as radar sites, and naval atolls, are vulnerable to soil erosion or flooding caused by storm surge or rising sea levels.

These challenges not only impact military readiness and operations but fiscal operations as well. In US PACOM alone, the DoD estimates the replacement value of structures used in the Pacific to be nearly $180 billion dollars.[116] The US Government is already experiencing fiscal constraints, and this unplanned costs would cripple the nation's Pacific defenses. A conservative scenario of rising sea levels of three feet would threaten 128 coastal DoD installations in the US, of which 43% are naval facilities valued at over $100 billion dollars.[117]

Climate change has impacts on military logistics as well. The military has become leaner and more efficient doing more with less. The creation of this type of military force was under conditions that did not account for existential threats of climate change disrupting every aspect of just in time logistics. The military is not a resilient force if its logistical apparatus undergoes degradation or destruction. Extreme weather events will likely increase in frequency and intensity, inundating coastal military bases with storm surges causing flooding and erosion. Electricity supplies, cyber infrastructure, utility corridors, water supplies, storm water conveyance systems and other civilian infrastructure critical to military installations could see reduced reliability. Many of these facilities will cost billions of dollars to relocate the capability of the base or to harden the installation to make it more resilient to climate change events. These factors

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[115] Ibid.

[116] Constantine Samaras, *US Military Basing Considerations during a Rebalance to Asia: Maintaining Capabilities under Climate Change Impacts*, in *The US Asia-Pacific Rebalance, National Security and Climate Change* (Washington, DC: The Center for Climate and Security, 2015), 36, accessed January 17, 2017, https://climateandsecurity.files.wordpress.com/2015/11/ccs_us_asia_pacific-rebalance_national-security-and-climate-change.pdf.

[117] Samaras, 2.

have disastrous consequences for military readiness and its ability to respond and defend the nation's interests.

Conclusion:

The US Army Operating Concept (AOC): Win in a Complex World, defines complex as "an environment that is not only unknown, but unknowable and constantly changing."[118] Global climate change exacerbates the complexity of any operating environment. The unstated assumption underpinning the AOC is operating in a stable climatic environment.[119] The future operating environment can no longer anticipate a stable climate as a valid unstated or stated assumption. The climate will get a vote in the future and the US military must adapt its forces and thinking to account for a changing global climate.

This monograph concludes that the US military is vulnerable to a rapidly changing climate. The changing climate of the 21st century will pose significant global challenges. Extreme weather events will continue interact with the global population and social systems with increasing frequency and intensity. Even with the most ambitious climate change mitigation measures being implemented by the world's governments, climate change will still have drastic effects on the earth's climate. Although the precise impacts climate change will have on a society is uncertain, what is certain is it will have an impact and evidence suggests it will create conditions problematic for the United States.

The US military has created a force which is leaner, more agile and, lethal. This type of force requires a well-developed and robust infrastructure in order to support it. The assumption of this force is the ability to project power from the United States or its facilities abroad will not be diminished. This does not make a resilient force if that assumption proves no longer valid. The

[118] Training and Doctrine Pamplet 525-3-1, *The US Army Operating Concept: Win in a Complex World* (Fort Eustis, VA: US Army Training and Doctrine Command, 2014), Preface.

[119] Ibid., 8.

environmental conditions in which the US military was structured has and will continue to change requiring adaptation measures be implemented across all branches of the military.

The DoD has started to acknowledge the affects climate change can have on its force and the impacts it poses to national security. The GCC's across the force acknowledge the likelihood of an increase in HADR and DSCA missions. The force has doctrine for these missions and can respond if required. However, there is not enough depth in the force to respond to multiple disaster relief contingencies and fulfill its current obligations. For this reason, it is important for the military and other government agencies to work with other nations and local governments to build the capacity and resilience to climate change impacts. The military will likely also be called upon to respond to the uncharted frontier of the Arctic. The US Navy assesses it is likely necessary to either create an Arctic resilient fleet or retrofit a portion of its fleet to be able to conduct operations in the Arctic region. Both of these endeavors are costly and will take years to implement. GCC headquarters can also improve its education and proactive decision making capacity by incorporating personnel trained in analyzing and assessing an operational environment through the lens of environmental security. This capability will enhance the GCCs ability to identify emergent environmental contingencies.

The US military's readiness and coastal infrastructure is vulnerable to climate change impacts. Increasing frequency intensity of droughts, floods, and extreme heat already affect the ability of units to train their wartime tasks. Additionally, the coastal military facilities and its surrounding support infrastructure are at risk of being overburdened and its facility mission potentially degraded due to storm surge and rising sea levels. Planning and adaptation to these conditions must occur now in order for the US military force to remain able to defend and deter its enemies.

As already stated by the former SECDEF, Chuck Hagel, climate change exacerbates any stressed system. The United States and its military is not immune to the effects of climate change and must take action to adapt to the future conditions. Uncertainty is not a reason for inaction.

The military is starting to acknowledge climate change as a security threat and as a current problem that needs addressing. Acknowledging there is a problem is the first step in solving it and taking action.

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