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Implications for Defense Strategy Stemming From Geopolitical Transformation Fueled by Climate Change

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IMPLICATIONS FOR DEFENSE STRATEGY STEMMING FROM GEOPOLITICAL TRANSFORMATION FUELED BY CLIMATE CHANGE

A Master's Thesis

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For the Degree

Master of Science, Defense and Strategic Studies

By

Steven R. Burrows

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ABSTRACT

Climate change has quickly become one of the most globally significant geopolitical issues facing all of humanity. Left unfettered, climate change is poised to impact nearly every facet of our environment ranging from increasingly dangerous and damaging storms, rising sea levels, increasingly extensive droughts to glacial melting, loss of arctic sea ice and a myriad of other catastrophic events. While still evolving, the current identified environmental threats will initiate long standing impacts not only to the environment, but to the global geopolitical and security climate of nearly every nation on the Earth. This project will not provide a synthesis of the contested existence of climate change, nor will it provide an argument either for or against any particular climate change theory, rather it will examine the potential geopolitical ramifications resulting from the assortment of global impacts that could be experienced if global climate policies fail to slow its progression. The project will first identify the reported climate change status, as well as the various efforts by the global community to halt any worsening of these changes and reduce the impact of our industrialization on the planet. Next it will examine three specific regions that are forecast to experience elements of climate change, the predicted climate change impacts to that region, the regional geopolitical impacts of those changes, and finally the impact of those geopolitical changes to US strategic and security interests.

KEYWORDS: geopolitics, climate change, global warming, defense strategy, national security

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I dedicate this thesis to my good friend Theodore, whose love, encouragement, and companionship during this project were instrumental to its successful completion.

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"Climate change, in some regions, has aggravated conflict over scarce land, and could well trigger large-scale migration in the decades ahead. And rising sea levels put at risk the very survival of all small island states. These and other implications for peace and security have implications for the United Nations itself."

- Ban Ki-moon, Former General Secretary, United Nations

Global climate change has become one of the most contested political issues of our time. Climate change theory is split between those who believe mankind is generating changes detrimental to the climate and threaten our very existence[1], and others who believe the science behind human influenced climate change theory may not be as significant as reported, believing current global changes are the result of earth's natural course of climate evolution.[2] This project will not enter the hotly contested debate between climate change's existence or non-existence, rather its purpose is to explore the geopolitical changes that could result from climate change as it is occurring, and identify the challenges to U.S. defense strategy emerging from those changes. For this paper, a simple assumption that human influenced climate change exists sets the foundation for analysis, leading to a comprehensive overview of global geopolitical challenges. Should the predicted climatological changes come to fruition, the US national security enterprise would be irresponsible to not consider the potential impact to global and regional geopolitical issues.

Numerous programs have been initiated to reduce the impact humans are having on the environment. These programs rely on individual nations to invest in projects and policies aimed

[1] Jane A. Leggett & Richard Lattanzio. *Loss and Damage Associated with the Effects of Climate Change: Recent Developments.* Congressional Research Service, February 9, 2023. (pg. 2) Accessed on July 11, 2023 at: https://crsreports.congress.gov/product/pdf/IF/IF12324
[2] Steven E. Koonin. *Unsettelled; What climate science tells us, what it doesn't and why it matters.* BenBella Books, Dallas, TX (2021).

at reducing human influenced climate change by reducing carbon emissions. What happens if these programs are ineffective, and the climate continues to undergo measurable changes? Physical and geographic changes could transform and alter the global and geopolitical environment. These transformations may drive new threats and strategic challenges for the U.S. and its allies. A comprehensive analysis of geopolitical issues fueled by failed climate change initiatives is essential to driving long term U.S. defense strategy.

The following sections provide a brief overview of the topics analyzed by this project. To completely assess the impacts on national security strategy, separate chapters will provide a background of the United Nations climate change initiatives and their progress to date followed by separate sections exploring the expected physical impacts of climate change, the geopolitical changes resulting from those changes, and the strategic challenges that will emerge from several key regions including the South China Sea, South Asia, and the Arctic. Together, these sections will provide a linkage between climate change and geopolitical transformation which will lead to emerging strategic challenges.

Global Climate Change Initiatives

The United Nations Framework Convention on Climate Change (UNFCCC) is the foundation for global climate change initiatives. The Convention was established in 1994 and has been ratified by 198 countries. The Kyoto Protocol was adopted in 1997 and became the operational arm of the UNFCC. While the UNFCC requested states reduce their environmental impact, the Kyoto Protocol committed nations to follow through with their plans.[3] The most widely recognized climate change initiative is the Paris Agreement, an international treaty adopted by 196 Parties at the UN Climate Change Conference in Paris, France in December 2015. The purpose of the treaty is to reduce carbon emissions to halt global warming. The goal of the Paris agreement is to limit global warming to 1.5º Celsius by reducing carbon emissions by 43% by 2030.[4] A detailed review of these initiatives and their progress will follow in a later chapter.

A critical aspect to the success of these initiatives is the cooperation and commitment of all nations to pursue efforts to reduce carbon emissions. This is a global issue that requires buy in from the international community to prevent potential long term environmental damage. Unfortunately, achieving a consensus among all the nations, especially the most industrialized nations is a daunting task. Today's security climate is filled with an assortment of conflicts, wars, and other events that challenge the ability to gain any level of cooperation among all nations. As the divide between global powers deepens and the competition for global power increases, achieving success in climate change policy becomes an even bigger challenge.

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[3] United Nations. *What is the Kyoto Protocol.* Accessed on July 13, 2023 at https://unfccc.int/kyoto_protocol

[4] United Nations. *The Paris Agreement.* Accessed on July 13, 2023 at: https://unfccc.int/process-and-meetings/the-paris-agreement

Strategic Threats Fueled by Climate Change

The United States and its allies have come to the realization that irreversible physical and geographic changes to our planet have become a leading national security threat. The 2022 U.S. National Security Strategy names the climate crisis the "existential challenge of our time."[5] In October 2021 U.S Secretary of Defense Lloyd Austin states, "Every day, our forces contend with the grave and growing consequences of climate change…"[6] and in an April 2021 speech to the Leaders Summit on Climate he adds, "The climate crisis is a profoundly destabilizing force for the world."[7] At the global level, climate change is also recognized as a significant threat to international stability. In his September 2022 address to the General Assembly, UN Secretary General Antonio Guterres offers, "The climate crisis is the defining issue of our time. It must be the first priority of every government and multilateral organization."[8]

Both the predicted and unknown effects of unbridled climate change offer an assortment of strategic threats. Extreme flooding, droughts, heat waves, increasing storm intensity, and rising sea levels each contribute to the destabilization of the global security environment. The term "Loss and Damage" has been institutionalized to refer to the "now-unavoidable impacts that

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[5] The White House, "U.S. National Security Strategy," October 2022, https://www.whitehouse.gov/wp-content/uploads/2022/11/8-November-Combined-PDF-for-Upload.pdf.

[6] United States Department of Defense. October 7, 2021. "Statement by Secretary of Defense Lloyd J. Austin III on the Department of Defense Climate Adaption Plan." Lloyd J. Austin. https://www.defense.gov/News/Releases/Release/Article/2803761/statement-by-secretary-of-defense-lloyd-j-austin-iii-on-the-department-of-defen/

[7] David Vergun. April 27, 2021. *Defense Secretary Calls Climate Change an Existential Threat.* U.S. Secretary of Defense Lloyd Austin in a April 2021 speech to the Leaders Summit on Climate. Accessed on July 12, 2023 at: https://www.defense.gov/News/News-Stories/Article/Article/2582051/defense-secretary-calls-climate-change-an-existential-threat/

[8] United Nations. September 20, 2022. *Secretary-General's address to the General Assembly.* UN Secretary General Antonio Guterres. Accessed on July 12, 2023 at: https://www.un.org/sg/en/content/sg/speeches/2022-09-20/secretary-generals-address-the-general-assembly

many countries and communities are experienced as a result of climate change, extreme events such as hurricanes and typhoons, torrential floods, and out-of-control wildfires, as well as so-called slow onset impacts such as desertification, droughts, and sea level rise."[9] These changes, combined with other significant geopolitical issues, are one of the driving forces behind geopolitical change, resulting in emerging strategic challenges.

Rather than approach the issue from a geopolitical standpoint, many tend to focus on the less strategic impacts and steps necessary to protect infrastructure, resources, and capabilities. As stated by US Secretary of Defense Austin in October 2021, "The Climate Adaptation Plan will be our guide for meeting the nation's warfighting needs under increasingly extreme environmental conditions—and for maintaining force readiness and resilience well into the future."[10] While these measures are necessary to sustain a force capable of meeting the nation's defense strategies, it does not address the impending challenges created by geopolitical transformation.

[9] Testimony of Alden Meyer to the U.S. House of Representatives Select Committee on the Climate Crisis, Hearing on *International Climate Challenges and Opportunities.* October 28, 2021. Accessed on July 12, 2023 at https://docs.house.gov/meetings/CN/CN00/20211028/114181/HHRG-117-CN00-Wstate-MeyerA-20211028.pdf

[10] Lloyd Austin, *Statement by Secretary of Defense Lloyd J. Austin III on the Department of Defense Climate Adaption Plan.*

Significant State Actors

Climate change may offer an opportunity for China to expand its sphere of influence and increase their power over economically challenged states, increasing the global security challenges facing the United States. China's Belt and Road Initiative (BRI) is the nation's strategy for expanding its political and economic influence across the globe. China cooperates with various nations around the world and invests in a multitude of projects in those countries, increasing partnerships and other nations reliance on Chinese funding. Some of these investments could impact global climate change initiatives. In a January 2021 report for the Swedish Foundation for Strategic Environmental Research, Daria Ivleva offers that "China's Belt and Road Initiative (BRI) is a prime example of how decarbonization processes interact with geopolitical dynamics," and "the country's search for economic opportunities for its old industries in neighboring markets might indeed affect the decarbonization pathways of other countries."[11] These investments include projects that could increase carbon emissions in the nations they invest. For example, China invests heavily in the energy sector, which is heavily reliant on fossil fuels and could increase carbon emissions, with a concern that "China might be using outward investments to "export" its carbon-intensive industries."[12]

On the other hand, efforts to reduce carbon emissions also provide China an opportunity to capitalize on Climate change, as they could also use its BRI to invest in greener technology. Daria Ivleva's research focused on the China-Kazakhstan relationship and the BRI's influence on

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[11] Daria Ivleva, *The Belt and Road Initiative in Kazakhstan: Does the geopolitics of China's outward investments put the brakes on decarbonisation?* MISTRA - The Swedish Foundation for Strategic Environmental Research. January 2021. Pg. 6, 16. Accessed on July 11, 2023 at: https://www.mistra-geopolitics.se/wp-content/uploads/2018/06/Mistra-Geopolitics-adelphi_Report_BRI-China-Decarbonisation-in-Kazakhstan_final.pdf

[12] Ibid, Pg. 16.

the economy and geopolitics of Kazakhstan. The research realized the "emissions-intensive" energy sector of Kazakhstan and China's role in investing in that sector, but also acknowledged that China could also be willing to shift its investments into greener technology, should Kazakhstan decide to pursue those options.[13] China's global power aspirations make climate change and the resulting damage and economic degradation a prime opportunity to expand its influence and control. Utilizing its BRI strategy, China can spread economic and material support to locations most affected by climate change, by increasing investment in climate damaging projects, or investing in greener technology options. In either case the BRI and China's global power aspirations could impact geopolitics across the globe.

[13] Ibid, Pg. 6.

Regional Strategic Threats

Other strategic threats emerge from regional sources, which sometimes affect the strategic security within nuclear nations. An example of the impact of climate change on strategic security is displayed in Pakistan with its increased history of extreme flooding over the past decade and tense relations with India over freshwater resources. Pakistan experienced historic flooding in 2010, a benchmark that was recently eclipsed with even more extreme flooding in 2022. According to the United Nations, the 2022 event flooded approximately 30% of Pakistan, killed nearly 1,700 people and affected nearly 33 million people overall.[14] A report following historic Pakistani flooding in 2010 notes, "top-tier U.S. concerns regarding Pakistan included regional and global terrorism…nuclear weapons proliferation and security…The 2010 floods have exacerbated these concerns. The effects of flooding on the stability of the Pakistani government and its ability to suppress and contain militants within their borders is an issue of concern for the United States and others."[15] In an article for the Brookings Institute, Marvin Kalb comments that, "Governed by a shaky coalition of ineffective politicians and trained military leaders trying desperately to contain the challenge of domestic terrorism, Pakistan may be the best definition yet of a highly combustible threat that, if left unchecked, might lead to the nightmare of nightmares: jihadis taking control of a nuclear weapons arsenal of something in the neighborhood of 200 warheads."[16] Natural disasters in Pakistan, including historic flooding events like those recently experienced, could erode Pakistan's ability to defend its nuclear

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[14] United Nations. *UN continues to support Pakistan flood response.* Accessed on July 12, 2023 at: https://news.un.org/en/story/2023/03/1134302

[15] Congressional Research Service. *Flooding in Pakistan: Overview and Issues for Congress. Updated November 18, 2010. Pg. 1. Accessed on July 12, 2023 at: https://crsreports.congress.gov/product/pdf/R/R41424*

[16] Marvin Kalb, "The Agonizing Problem of Pakistan's Nukes," Brookings, September 28, 2021, https://www.brookings.edu/articles/the-agonizing-problem-of-pakistans-nukes/

weapons stockpile from any of the many militant groups occupying the nation, leading to a strategic challenge for the U.S. and its allies.

Pakistan's status as a nuclear nation elevates the risk changing climatological conditions pose to the region. Just as climate change threatens other physical resources such as water and agriculture, so could it place the physical security of its nuclear power plants and military resources in jeopardy by physically threatening security measures or increasing opportunities for terrorists to take advantage of compromised security measures during disasters. The Pakistani disaster creates a scenario where the security of Pakistan's nuclear arsenal could become compromised, leading to a significant strategic threat in the region. While "the security of Pakistan's nuclear arsenal, materials, and technologies continues to be a top-tier U.S. concern,"[17] additional extreme flooding events could further erode Pakistan's nuclear security and increase regional threats.

Both India and Pakistan are nuclear nations and tensions between the two states over the past 70 years have been tumultuous. Recent developments see a deterioration of relations, eroding the success of a 2021 cease-fire in the disputed region of Kashmir, with recent reports indicating new disputes over river sharing are on-going which could dissolve any recent successes.[18] Pakistan receives a large percentage of its fresh water supply from rivers originating in India, so any alteration of the water supply to Pakistan could increase tension between the nations. The combination of existing water resource disputes and nuclear security concerns coupled with worsening flooding conditions is a prime example of climate change's capability to

[17] K. Alan Kronstadt. May 22, 2023. Congressional Research Service. Pakistan and U.S.-Pakistan Relations. Pg. 6. Accessed on July 12, 2023 at: https://crsreports.congress.gov/product/pdf/R/R47565
[18] Ibid, Pg. 8.

transform the geopolitical and strategic security landscape. Climate change has the capability to place physical security measures at risk and deplete security forces to aid in natural disasters which could lead to scenarios of increased risk. Additionally, should climate change alter the availability of resources such as fresh water supplies to Pakistan, it could lead to further disputes between Pakistan and India, altering the geopolitical landscape and creating the potential for escalation to nuclear conflict. This project will feature a more in-depth review of specific geopolitical transformation and the resultant strategic challenges for the South China Sea, South Asia, and the Arctic.

This paper will explore the elements of climate change, which could lead to physical and geographic changes in several regions of the planet. Those changes could be the catalyst for changes to the geopolitical environment in those areas which in turn could cause impacts to U.S. defense and national security strategies. By conducting an analysis of expected climate change, the current status of climate change initiatives, and the geopolitical issues that will emerge from the physical and geographic changes, this project will link climate change to a transformation of the strategic security landscape across the globe.

PART I
GLOBAL CLIMATE CHANGE STATUS

Chapter 1
Link Between Climate Change and Global Geopolitics

"The climate crisis is about human security, economic security, environmental security, national security, and the very life of the planet ... It's more urgent than ever that we double down on our climate commitments. Russia's war only enhances the urgency of the need to transition the world off its dependence on fossil fuels."

- Joe Biden, President, United States, November 11, 2023

Climate change is predicted to cause sea level rises, extreme temperature and precipitation events, altered tropical cyclone activity, and Arctic Sea ice melt.[19] While each of these will undoubtedly change the physical landscape of our planet, how will these changes affect the security and strategic landscape? Economies crushed by climate change, land rendered useless due to the absence of fresh water, and masses of migrating people searching for resources will significantly impact global and regional geopolitics, transforming the strategic threat environment.

What does climate change really look like? According to data from the United States Office of the Director of National Intelligence, there have been an increase in global carbon dioxide production and global temperature increases over the last 140 years, shown in Figure 1 below. This trend is the impetus behind the concern over global warming and climate change. Each region of the earth will experience different effects from global warming. Later chapters will study specific regions in detail, but what are the overall changes that some scientists expect to see over the next decades to century? The Paris Agreement was established to halt global

[19] National Oceanic and Atmospheric Administration, "Climate Change Impacts," National Oceanic and Atmospheric Administration (NOAA, August 13, 2021), https://www.noaa.gov/education/resource-collections/climate/climate-change-impacts

warming at under 2º Celsius, but what can be expected if those efforts fail, and the global temperature continues to rise?

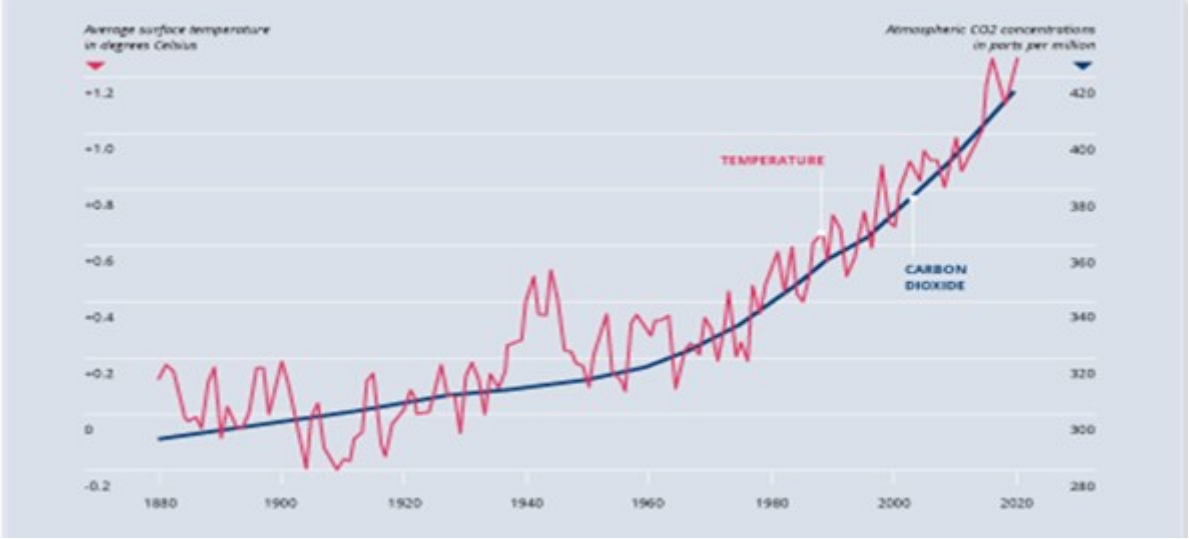

Figure 1 – Global Rise in Carbon Dioxide and Average Temperature, Office of the Director of National Intelligence, "Global Trends 2040"

As mentioned earlier, this project does not advocate one climate change theory over another but makes the simple assumption that climate change exists and assesses there will be extensive, if not catastrophic changes in the future strategic environment, such as seen in the 2010/2011 Arab Spring uprising. An example of previous geopolitical crises which were exacerbated by climate change is the Arab Spring protests and revolution that occurred in Egypt in 2010 through 2011 and included the ouster of Egyptian President Hosni Mubarak.

Several reports authored after the Arab Spring revolution draw a correlation between the climate and its impact on global geopolitical issues. Several areas of drought and other areas of excessive rainfall in the summer of 2010 resulted in the reduction of wheat supply across the international market.[20] Both Russia and China limited their export of wheat to conserve domestic

[20] Troy Sternberg. "Chinese Drought, Wheat, and the Egyptian Uprising: How a Localized Hazard Became Globalized," in *The Arab Spring and Climate Change,* ed. Caitlin E. Werrell (Center for American Progress, The Center for Climate and Security, February 2013), pg. 7.

supply, which had a detrimental effect on the global wheat prices. “The influence of Chinese drought on global wheat prices through wheat purchases, and market concern about Chinese wheat demand (such as speculation), connects the drought to world events.”[21] China’s actions caused the price of wheat to sky-rocket, resulting in a 300% increase in the cost of bread in Egypt.[22] By assuming the global warming continues on its course and provides a world suffering from human influenced warming with no chance at reversing course, a clearer picture of the geopolitical changes emerges and informs a more comprehensive approach to strategic planning.

Until April 2023, Egypt was the world’s largest importer of wheat, a metric that was recently overtaken by China. Although also the highest wheat producing nation, it is so populous it is unable to produce enough wheat domestically to meet its own demands.[23] The huge price increase in wheat and bread contributed to other political unrest in the Arab states, ultimately resulting in numerous protests across the region. The expected and predicted effects of climate change, including worsening droughts and increased instances of flooding, will increase the opportunities for environmental impacts to geopolitical issues. As seen in the Arab Spring case, the climate contributed to the ouster of a national leader, a situation that could yield significant defense and strategic challenges of the U.S. and its allies.

Further reporting on the Arab Spring crisis by Werrell and Femia indicates that “In the Arab world, climate change has acted as a threat multiplier, exacerbating environmental, social,

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Accessed on July 18, 2023 at: https://www.americanprogress.org/wp-content/uploads/sites/2/2013/02/ClimateChangeArabSpring.pdf

[21] Troy Sternberg. “Chinese drought, bread and the Arab Spring.” *Applied Geopgraphy, volume 34 (May 2012): 523*

[22] Sternberg. “Chinese drought, bread and the Arab Spring.” Pg. 520

[23] Sal Gilbertie, “World’s Largest Wheat Producer Now World’s Largest Wheat Importer Too,” Forbes, April 14, 2023, https://www.forbes.com/sites/salgilbertie/2023/04/14/worlds-largest-wheat-producer-now-worlds-largest-wheat-importer-too/?sh=7b1311693b97.

economic, and political drivers of unrest, including drought, water scarcity, food security, and migration, and it will likely continue to do so as the countries of the Middle East and North Africa region transition and change."[24] While the demonstrated correlation between climate and geopolitics cannot be wholly credited with the events surrounding the Arab Spring, it provides the necessary evidence of future geopolitical conditions that could be intensified by further extreme weather phenomenon. Werrell and Femia add, "What is clear is that environmental factors are only one—and are rarely decisive—contribution to a complex interaction of other political, social, and economic factors underlying conflict."[25] Even though climate change may not be the singular contributor to geopolitical challenges, failing to consider it could lead to an incomplete picture of the elements fostering change in geopolitics and cause missed opportunities to mitigate diplomatic challenges.

Considering the effects of human influenced climate change will offer a foundation for this project, providing at least the basic understanding of the catalyst fueling major geopolitical change over the next several decades. A synthesis of not just the forecasted changes, but the source of those changes can enable today's strategists and policy makers to implement preventative actions to reduce the impact of change or at least better prepare for it. In depth analysis will enable preventative actions in the event efforts to stop climate change fail, providing U.S. policy makers an opportunity to mitigate the risk associated with the geopolitical fallout associated with specific changes.

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[24] Caitlin Werrell & Francesco Femia, "The Arab Spring and Climate Change a Climate and Security Correlations Series Edited By," 2013, pg. 51. https://www.americanprogress.org/wp-content/uploads/sites/2/2013/02/ClimateChangeArabSpring.pdf.
[25] Werrel & Femia, "The Arab Spring and Climate Change: A climate and security correlations series." Pg. 20.

Climate change and strategic security are closely linked, beyond the concepts of sustainability and resilience, but from a geopolitical perspective. Strategic risks associated with climate change include nuclear security and threats, expanding spheres of influence, economics, mass migration, and militarization. These risks are generally regional in nature and very much depend on the type of impact associated with climate change. Figure 2 illustrates the 2021

- Shifts in agricultural production in one region can impact global food prices and availability, contributing to food shortages, protests, and instability in other parts of the world.
- Impacts to marine ecosystems and resources have implications for fisheries and food security across the globe, which could become a source of friction.
- As temperatures and precipitation patterns shift, distribution and range of vector-borne diseases, such as malaria, will change.
- Increasingly unpredictable rainfall related to climate change could make it harder to resolve disputes over transboundary rivers such as the Nile and Mekong Rivers.
- Climate change that exacerbates insecurity and instability in one region may disrupt nomadic population movements and/or contribute to temporary or permanent migration that impacts other regions.
- Global supply chains are at risk to extreme weather events exacerbated by climate change. For example, the 2011 floods in Thailand disrupted production of components for global companies including computer disk drives and cars.
- Policy responses to climate change could also have unintended consequences and become sources of dispute, such as policies that impact supply chains or critical minerals.

Figure 2 - U.S. Department of Defense Key Climate Risks

Climate Risk Analysis, where the U.S. Department of Defense identifies 7 key climate risks which could pose strategic threats to U.S. national security. Each risk represents opportunities for geopolitical transformation leading to changes in regional and global strategic security. As noted in the first risk identified in the Department of Defense analysis, climate induced change in agricultural production may lead to global geopolitical unrest and as seen in the Arab Spring

case, a revolution. Later sections of this project will detail specific regions and their associated climate change risk, emerging geopolitical issues, and resultant strategic transformation.

As previously noted, this project is not intended to argue climate change is the sole contributor to geopolitical change and strategic transformation, rather it is an influencer to already existing geopolitical crisis, forcing events that may not have occurred, or expediting crisis beyond what would have normally been expected.

The link between climate change and geopolitical change must be considered, otherwise a significant gap in defense strategic planning and preparation will present itself. As an example, the Office of the Director of National Intelligence has published several reports assessing the threat of various climate change related issues, including water security. Their assessment for the next 20 years finds, "declining water security is likely to exacerbate existing social grievances and divisions, potentially triggering or worsening conflict between societal groups and industry sectors and increasing the risk of political instability," and "Contestation over the management of shared river and groundwater basins probably will increase during the next two to three decades, as water demand, pollution, and environmental degradation increase."[26]

Assessing the impact of human induced climate change and its correlation to political and strategic stability is a critical task. But this is not an easy assessment. In a report to the U.S. House of Representatives, House Armed Services Subcommittee on Intelligence and Emerging Threats and Capabilities, Maria Langon-Riekhof, Director Strategic Futures Group, Office of the Director of National Intelligence states, "Complexities in Earth's systems, uncertainties in

[26] National Intelligence Council's Strategic Futures Group. April 2021, *Water Insecurity Threatening Global Economic Growth, Political Stability.* Office of the Director of National Intelligence, Pg. 8, NIC-2021-02489, https://www.odni.gov/files/images/globalTrends/GT2040/NIC_2021-02489_Future_of_Water_18nov21_UNSOURCED.pdf

modeling, and the unpredictability of human choices—including the level of greenhouse gas emissions—make it difficult to project when and where specific disruptive events and other climatological changes will have the most significant national security effects."[27] Additionally, predicting the future geopolitical and security environment are complex tasks as each will be influenced by the resolution or escalation of present day geopolitical issues and conflicts. For example, the resolution of Russia's war in Ukraine will have impacts on future geopolitical and strategic interests across the globe. China's military endeavors in the South China Sea will impact geopolitical issues throughout that region as well. However, while predicting specific issues will be difficult, there are a number of themes which will carry through the decades which will be discussed in the follow-on sections.

[27] U.S. Congress, House of Representatives, House Armed Services Subcommittee on Intelligence and Emerging Threats and Capabilities. December 11, 2019. Climate Change in the Era of Strategic Competition. Maria Langnon-Riekhof. https://docs.house.gov/meetings/as/as26/20191211/110298/hhrg-116-as26-wstate-langan-riekhofm-20191211.pdf

Chapter 2
Global Climate Change Initiatives

"The world is reaching the tipping point beyond which climate change may become irreversible. If this happens, we risk denying present and future generations the right to a healthy and sustainable planet – the whole of humanity stands to lose."[28]

- Kofi Annan, Former Secretary General of the UN, May 3, 2015

Climate change is the primary variable of this project. A successful international policy which mitigates the effects of climate change will have significantly different geopolitical considerations vice a failed global policy which results in loss and damage. This paper examines the results of failed global climate policy and the downstream effects. Failed climate change policy will transform the global geopolitical landscape, increasing instability and generating new national security risks.

Understanding the global efforts to reduce the human effects of climate change are key to this analysis. The primary source of global climate change policy originates from the United Nations. Highlighting the major efforts championed by the U.N. and assessing the progress being made to meet the goals and objectives of the global initiatives will drive this analysis, providing the necessary elements to inform strategic decision making.

Assessing the status of the major global initiatives is prudent for this project as it affects the level of risk, geopolitical changes, and strategic transformation which may occur in the next several decades. Global climate change policy successes will reduce global instability, lowering the risk of adverse strategic transformation. In contrast, policy failures will increase risk and

[28] Nicola Davis, "Kofi Annan: 'We Must Challenge Climate-Change Sceptics Who Deny the Facts,'" the Guardian (The Guardian, May 3, 2015), https://www.theguardian.com/environment/2015/may/03/kofi-annan-interview-climate-change-paris-summit-sceptics

transform the strategic environment negatively. The Final Report of the Defense Science Board Task Force on Trends and Implications of Climate Change on National and International Security provides the following, "Changes in climate patterns and their impact on the physical environment can create profound effects on populations in parts of the world and present new challenges to global security and stability. Failure to anticipate and mitigate these changes increases the threat of more failed states with the instabilities and potential for conflict inherent in such failures."[29]

As critical as it is to address climate change through global policies to reduce global carbon emissions, it is equally as important to assess the prospects of these policies and consider implications for policy failure. Policies that inadequately address climate change will result in geopolitical challenges leading to emerging strategic threats.

Climate change is a global issue, one that requires a global solution to prevent further damage to our planet. Adopted in 1992, the United Nations Framework Convention on Climate Change (UNFCC) is the parent organization for the United Nation's efforts to halt the continuing threat of global warming. According to NATO, "Focusing its early years largely on facilitating the intergovernmental climate change negotiations, the secretariat today supports a complex architecture of bodies that serve to advance the implementation of the Convention, the Kyoto Protocol and the Paris Agreement."[30] The UNFCC is the source of UN efforts to curb global warming. This is accomplished through two major efforts, the Kyoto Protocol and the Paris

[29] US Department of Defense, Office of the Under Secretary of Defense for Acquisition, Technology and Logistics, *Report of the Defense Science Board Task Force on Trends and Implications of Climate Change for National and International Security.* October 2011. Pg iii. https://permanent.fdlp.gov/gpo18260/ADA552760.pdf

[30] United Nations Framework Convention on Climate Change, *About the Secretariat,* https://unfccc.int/about-us/about-the-secretariat

Agreement. While these mechanisms represent the global initiatives to stop global warming, most efforts require local, regional, and international policies and programs to effectively meet UNFCC goals.

The Kyoto Protocol was the first agreement under the UNFCC and entered into force in February 2005. While the U.S. signed the agreement, they are not a party to the agreement because the U.S. did not ratify it.[31] While the UNFCC merely requested cooperation from its signing members, the Kyoto protocol provides an attributional arm by enacting commitments for certain goals. According to the UN website, "The Kyoto Protocol operationalizes the United Nations Framework Convention on Climate Change by committing industrialized countries and economies in transition to limit and reduce greenhouse gases (GHG) emissions in accordance with agreed individual targets."[32] A legally binding reduction of greenhouse gases by 5% below 1990 emissions levels was the established agreement under the Kyoto Protocol for each of the 37 high-income countries and the European Union.[33]

Following the Kyoto Protocol is the Paris Agreement. The agreement was developed during the UN Climate Change Conference (COP21) in Paris in 2015 and has 194 signatories to the agreement.[34] The Paris Agreement has the following long-term goals:

- Reduce greenhouse gas emissions to limit the global temperature increase in this century to 2 degrees Celsius while pursuing efforts to limit the increase even further to 1.5 degrees Celsius;
- Review countries' commitments every five years;

[31] Jeremy Legett, "The United Nations Framework Convention on Comate Change, the Kyoto Protocol, and the Paris Agreement: A Summary" (Congressional Research Service, January 29, 2020), https://crsreports.congress.gov/product/pdf/R/R46204.
[32] United Nations, "What Is the Kyoto Protocol? ," UNFCCC (UNFCCC, 2019), https://unfccc.int/kyoto_protocol.
[33] Legett, "The United Nations Framework Convention on Comate Change, the Kyoto Protocol, and the Paris Agreement: A Summary."
[34] United Nations, "The Paris Agreement," United Nations, 2016, https://www.un.org/en/climatechange/paris-agreement.

- Provide financing to developing countries to mitigate climate change, strengthen resilience and enhance abilities to adapt to climate impacts.[35]

Each country defines its commitment in a Nationally Determined Contribution (NDC). These objectives are updated every five years and represent each nation's efforts to reduce their individual greenhouse gas emissions. The Paris agreement quickly became the target of U.S. politics, centered around former U.S. President Donald Trump's decision to pull the U.S. from the agreement citing "lost jobs, lower wages, shuttered factories, and vastly diminished economic production,"[36] as some of his reason for pulling the U.S. out of an agreement that, "disadvantages the United States to the exclusive benefit of other countries."[37] The U.S. formally withdrew from the agreement in November 2019, while boasting about independent U.S. climate policy that reduced emissions by 74% between 1970 and 2018 and a reduction of 13% from 2005 to 2017.[38]

In February 2021, the U.S. rejoined the Paris Agreement, nearly a month after newly elected President Joe Biden took office.[39] In his statement on the official day of rejoining, Secretary of State Antony Blinken stated, "Addressing the real threats from climate change and listening to our scientists is at the center of our domestic and foreign policy priorities. It is vital in our discussions of national security, migration, international health efforts, and in our

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[35] United Nations. "The Paris Agreement."
[36] Donald Trump, "Statement by President Trump on the Paris Climate Accord – the White House," trumpwhitehouse.archives.gov, June 1, 2017, https://trumpwhitehouse.archives.gov/briefings-statements/statement-president-trump-paris-climate-accord/.
[37] Donald Trump, Statement on Paris Climate Accord.
[38] United States Department of State, "On the U.S. Withdrawal from the Paris Agreement," statement by Mike Pompeo. November 4, 2019. https://2017-2021.state.gov/on-the-u-s-withdrawal-from-the-paris-agreement/.
[39] United States Department of State, "The United States Officially Rejoins the Paris Agreement." Statement by Secretary of State Antony Blinken. February 19, 2021. https://www.state.gov/the-united-states-officially-rejoins-the-paris-agreement/

economic diplomacy and trade talks."[40] This decision and these statements signify the recognition of the impact climate change will have on the strategic environment if not addressed at a global level.

Climate change, driven by global warming, is clearly a high priority for many members of the international community. With extensive policy and program development comes implementation. What progress has taken place and what is the current outlook for success of these initiatives? U.N. Secretary General Antonio Guterres gives his less than optimistic take on the current state of climate change policy in a press conference on climate change given on June 15, 2023,

> "I am very worried about where the world stands on climate. Countries are far off-track in meeting climate promises and commitments. I see a lack of ambition. A lack of trust. A lack of support. A lack of cooperation. And an abundance of problems around clarity and credibility. The climate agenda is being undermined. At a time when we should be accelerating action, there is backtracking. At a time when we should be filling gaps, those gaps are growing. Meanwhile, the human rights of climate activists are being trampled. The most vulnerable are suffering the most. Current policies are taking the world to a 2.8-degree temperature rise by the end of the century. That spells catastrophe. Yet the collective response remains pitiful. We are hurtling towards disaster, eyes wide open—with far too many willing to bet it all on wishful thinking, unproven technologies, and silver bullet solutions."[41]

According to the 2022 U.N. Nationally Determined Contribution Synthesis Report, "The best estimate of peak temperature in the twenty-first century (projected mostly for 2100 when temperature continues to rise) is in the range of 2.1–2.9 °C depending on the underlying assumptions," and "despite some progress since the previous version of this report, an urgent need for either a significant increase in the level of ambition of NDCs between now and 2030 or

[40] Antony Blinken, *"*The United States Officially Rejoins the Paris Agreement"
[41] United Nations. Secretary-General's opening remarks to journalists at a press conference on Climate. Statement by Secretary General Antonio Guterres, June 15, 2023.

a significant overachievement of the latest NDCs, or a combination of both, in order to attain the cost-effective emission levels suggested in many of the scenarios considered by the IPCC for keeping warming likely below 2ºC or limiting it to 1.5ºC."[42]

One of the biggest challenges to global climate change policy is determining which nations are most responsible for harboring the largest percentage of human influence on the environment. Most carbon emissions come from the most developed nations. For most developed countries, investing in climate change initiatives is a manageable portion of their national budget, however for many underdeveloped countries, climate change efforts come at too high of a cost. Additionally, since most of the carbon emissions come from the developed nations, a policy that casts a wide net over all nations is met with apprehension, as many undeveloped nations feel it is unfair to invest in a problem created by much richer nations.

Utilizing the position of the U.N. as a barometer of the current progress of meeting the goals of the Kyoto Protocol and the Paris agreement yields the basis for further analysis in this project. This paper assumes the bleak assessment on global climate change is indeed accurate and attempts to study a scenario of failed global policies. Failing to analyze the geopolitical challenges which could occur via the worst-case scenario is irresponsible and presents opportunities for strategic vulnerability in the decades to come.

[42] U.N. 2022 NDC Synthesis Report. https://unfccc.int/ndc-synthesis-report-2022#Targets

PART II
SOUTH CHINA SEA

Chapter 3
Projected Environmental and Physical Impacts

Many regions around the world are poised to experience the impacts of failing climate change policies. One of the more complex regions is the South China Sea, hosting a strategically critical location linking the Pacific and Indian Oceans. An area already experiencing significant geopolitical challenges will have the added difficulty of environmental and geographic changes to contend with. The South China Sea is bordered by China, Vietnam, Malaysia, Taiwan, and the Philippines which will each experience different impacts from climate change (see Figure 3, a map showing an overview of the South China Sea region). Potential impacts from global warming include increases in rainfall and droughts, impacts on tropical cyclone activity, ocean salinity changes, and rising sea levels.

Exploring the predicted physical changes will inform further discussion on geopolitical transformation and strategic impacts. In a research paper on geopolitics and climate change in the Indo-Pacific published by the Australian Strategic Policy Institute, Robert Glasser echoes the impact climate change will have on geopolitics stating, "It is, in fact, a global systemic crisis with disruptions that will transform the geopolitical landscape."[43] The following three chapters will explore the expected climate change impact in the South China Sea region, the resultant

[43] Robert Glasser, Cathy Johnstone, and Anastasia Kapetas, eds., "The Geopolitics of Climate and Security in the Indo-Pacific," *ResearchGate* (Barton ACT, Australia: Australian Strategic Policy Institute, February 2022), https://www.researchgate.net/profile/David-Michel-2/publication/358904167_Water_Security/links/621ccf9f6051a16582ffe8a6/Water-Security.pdf

impacts to regional geopolitics and finally the strategic and national security challenges emerging from the identified geopolitical changes.

Figure 3 - South China Sea, https://www.nationsonline.org/oneworld/map/South-China-Sea-political-map.htm

The current corpus of knowledge on regional climate change is comprised of two primary categories of research--technical/scientific and policy issues. The technical/scientific category consists of hyper-granular studies of the impact of climate change on specific geography, organisms, and systems bristling with scientific data predicting future impacts. An example would be a study on the dispersion of a specific invasive algae species caused by a specific climate change hazard,[44] and another would be a study of the various model interpretations of sea level rise in the South China Sea.[45] The second category focuses on the political and diplomatic activities surrounding the efforts to halt, mitigate, and reduce the impacts of climate change on specific regions. Such work includes participation in the U.N. efforts to reduce carbon emissions and prevent a 2º Celsius increase in global temperature by the end of the century, and the studies exploring the progress being made towards those efforts. This paper utilizes research from both knowledge areas to develop a clear outlook on the expected climate change impacts that will drive geopolitical change.

Analyzing the potential environmental and physical changes created by a global temperature increase of 1.5-2.0º Celsius presents several challenges which highlight the uncertainty encountered when studying future climate change impacts. The variability of the climate in the South China sea, the various industries in the region, and the impact of the great landmass of South Asia all influence the analysis. The South China Sea is affected by a series of larger meteorological processes and Pacific Ocean currents. The El Nino/Southern Oscillation,

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[44] Ru Lan, Rongchang Chen, Hai Lin, et al., "Suitable Area of Invasive Species Alexandrium under Climate Change Scenarios in China Sea Areas," *Polish Journal of Environmental Studies* 32, no. 2 (December 23, 2022): 1199–1217, https://doi.org/10.15244/pjoes/156471.
[45] Noah Irfan Azran, Hafeez Jeofry, Jin Xiang, et al., "Southern South China Sea Dynamics: Sea Level Change from Coupled Model Intercomparison Project Phase 6 (CMIP6) in the 21st Century," *Journal of Marine Science and Engineering* 11, no. 2 (February 20, 2023): 458, https://doi.org/10.3390/jmse11020458.

the Pacific Decadal Oscillation and the Indonesian Throughflow are phenomena which impact the overall climate for the South China Sea region and have sparked a renewed interest in research due to their reaction to global temperature increases.[46] These meteorological weather events all effect the various sea currents and regional weather patterns and will be altered by climate change, thereby creating a regional climatological impact.

The analysis of the impacts of climate change on regional and global geopolitics is less extensive, with even less analysis of the strategic implications of the identified changes. Others have found that "the literature to date on climate and conflict is often inconclusive and contradictory, due to the huge differences in political, social, economic, geographic and military variables in the conflicts studied."[47] This is due to the complexity of changing climatological conditions and current changes in geopolitics which will alter the security landscaped over the next several decades. Understanding the geopolitics that will be encountered by projected climate changes in twenty to forty years is a daunting task for the strategic research community.

The potential climate impacts will affect each state differently based on their major areas of commerce, economic position, geography, and other associated factors. One such scenario is the impact of climate change and its correlation with the fishery industry in Taiwan. A report on the issue by Ching-Hsien Ho offers, "Issues including increases in sea surface temperature (SST), changes in typhoon patterns, extremely heavy rainfall, changes in ocean current patterns, and production suitability have exposed fishery production to higher risks and increased its

[46] Dunxin Hu, Lixin Wu, Wenju Cai, et al., "Pacific Western Boundary Currents and Their Roles in Climate," *Nature* 522, no. 7556 (June 1, 2015): 299–308, https://doi.org/10.1038/nature14504.
[47] Anastasia Kapetas, "China, Climate and Conflict in the Indo-Pacific," JSTOR, 2023, http://www.jstor.org/stable/resrep48485.

fragility, thereby heightening the risks to the associated marine fishery industry."[48] The report identifies four issues impacting the industry which are production, supply and demand, policies, and regulations.[49] The report also specifies certain environmental changes which increase the risk to the industry such as:

- Rising Sea Surface Temperatures (SST)
- Rising sea levels
- Changes in rainfall patterns
- Seawater acidification
- The flow potential of the main ocean current and its tributaries
- Depth changes in the distribution of the thermocline (layers of thermal differences)
- The intensity of up-welling (amount of cold water rising to the sea surface from greater depths)
- The duration of up-welling (the length of time deeper cold water infiltrates warmer surface layers)[50]

Impacts from these hazards could contribute to an expanding set of complex geopolitical challenges. An economic shortfall for a major commercial industry will produce a fiscal vacuum which will invite opportunities for other states to offer aid. Follow-on analysis in later chapters evaluates the geopolitical changes associated with these types of challenges and how they impact U.S. national security interests.

Each state within the South China Sea region could experience changes because of a failure to prevent a 1.5-2.0ºCelcius increase in global temperature. Malaysia is one of these states, with impacts expected from a rise in sea level. A report by Noah Azran and 11 other Malaysian scientists in the Journal of Marine Science and Engineering concludes the region will experience sea level rises in the range of 50-80 mm by 2100, a significant increase which will

[48] Ching-Hsien Ho, "Climate Risks and Opportunities of the Marine Fishery Industry: A Case Study in Taiwan," *Fishes* 7, no. 3 (May 21, 2022): 116, https://doi.org/10.3390/fishes7030116.
[49] Ibid, Pg. 9.
[50] Ibid, Pg. 9.

result in increasing erosion, freshwater inundation, and saltwater intrusion into groundwater.[51] Again, as with Taiwan, these changes may result in threats to coastal infrastructure leading to a nationwide crisis requiring mitigation of loss and damage. This presents another opportunity for a state, such as the U.S. or China, to provide relief funding, services, and/or investment in projects to mitigate or recover from the effects. The resultant financial and infrastructure crisis will alter Malaysia's geopolitical situation and could result in challenges to U.S. national security interests.

A third example of climate change's role in geopolitical transformation is the affect climate change may have on the Philippines, one of the South China Sea border nations. The Philippines occupies the fourth spot on Germanwatch's 2021 Long Term Global Climate Risk Index, recognizing the impact of extreme weather and climate change on the nation.[52] The Philippines will be vulnerable to several aspects of climate change, including impacts to its fisheries sector and agriculture. Some studies estimate tropical areas, with climates like the Philippines, could lose up to 200 growing days per year by the year 2100. These losses are largely due to extreme variations in rainfall rates causing extreme flooding events and extreme droughts, as well as tropical cyclone activity across the nation.

The Philippines is home to some of the largest coral reefs, comparable to those of the Great Barrier Reef of Australia.[53] Estimates of the productivity of the fisheries associated with

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[51] Noah Irfan Azran, Hafeez Jeofry, Jin Xiang, et al. "Southern South China Sea Dynamics: Sea Level Change from Coupled Model Intercomparison Project Phase 6" Pg. 12.
[52] David Eckstein, Vera Kunzel, and Laura Schafer, "GLOBAL CLIMATE RISK INDEX 2021," 2021, https://www.germanwatch.org/sites/default/files/Global%20Climate%20Risk%20Index%202021_2.pdf
[53] White, Alan T., & Susan M. Wells. "Coral Reefs in the Philippines." *Oryx* 16, no. 5 (1982): 445–51. doi:10.1017/S0030605300018123

the coral reefs indicate the Philippine and Malaysian reefs combined could yield nearly 20% of the total global fish production of 70 billion kilograms.[54] The latest Intergovernmental Panel on Climate Change AR6 Synthesis Report indicates coral reefs will face extinction with a 1.5º Celsius global temperature increase, experiencing a 70-90% decline.[55] A report by the National Integrated Climate Change Database and Information Exchange System estimates the Philippines could lose 6% of its gross domestic product (GDP) annually by 2100, potentially as a result of threated grasslands, declining rice yields, dying coral, and an increase in public health emergencies resulting from floods.[56]

Should the international efforts to halt global warming and prevent a 1.5-2.0º global temperature increase falter, the vulnerable communities surrounding the South China Sea will be faced with a myriad of weather and climatological challenges negatively impacting their economy, infrastructure, and livelihoods. Declining fiscal climates and loss of employment and resources will cause a mass movement of people from these areas as the civilian population seeks out better opportunities for income and food and water security. These challenges will lead to requests for aid and assistance from other more wealthy states, exposing opportunities for nations such as China to expand their economic and physical influence in these areas. As seen in the 2010/2011 Arab Spring crisis, the climate may have a direct impact on geopolitics and follow-on strategic issues. Further changes in the climate could increase the frequency or intensity of these issues in other regions, such as the South China Sea. Further research on the

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[54] Ibid, Pg. 1.
[55] IPCC. 2023. "Synthesis Report of the IPCC Sixth Assessment Report (AR6)." Pg. 36. https://report.ipcc.ch/ar6syr/pdf/IPCC_AR6_SYR_LongerReport.pdf
[56] Philippines Climate Change Commission. 2018. "Climate Change and the Philippines: Executive Brief." Executive Brief No. 2018-01. https://niccdies.climate.gov.ph/files/documents/Climate%20Change%20and%20the%20Philippines%20Executive%20Brief%202018-01.pdf

projected physical and environmental changes linked to climate change are critical to better understanding the geopolitical impacts of those changes and thus the potential impacts to U.S. strategic interests in the area.

Chapter 4
Geopolitical Transformation

Global warming and climate change will have effects far beyond the physical and environmental changes highlighted by the science community. Global and regional geopolitics will also be impacted, leading to emerging strategic and national security threats for the U.S. and its allies. China has already become the pacing defense challenger to the U.S. and is the primary strategic threat to the region.[57] A geopolitical climate transforming due to climate change effects will present China multiple opportunities to seize upon the needs of other South China Sea nations and expand its sphere of influence in the region. According to Chanlett-Avery, Kronstadt, and Lawrence from the Congressional Research Service, "China is increasingly asserting leadership in regional and financial initiatives. It is championing its 'Belt and Road' initiative, an effort to boost infrastructure development and economic connectivity—and expand China's influence—among more than 64 countries on three continents."[58] Climate change's impacts to the economies, labor market, industry, and infrastructure of nations such as Taiwan, the Philippines, and Malaysia will allow China to grasp the opportunity to guide the geopolitical environment into an opportunity heavily weighted in its favor.

As discussed in the previous chapter, global warming is expected to increase sea levels, alter rain/drought cycles, increase the occurrence of extreme weather events, alter sea surface salinity, and impact tropical cyclone activity. Climate changes in the South China Sea region are

[57] United States Department of Defense. 2022. "National Defense Strategy." Accessed on August 8, 2023. Pg.1. https://media.defense.gov/2022/Oct/27/2003103845/-1/-1/1/2022-NATIONAL-DEFENSE-STRATEGY-NPR-MDR.PDF

[58] Emma Chanlett-Avery, K. Alan Kronstadt, and Susan V. Lawrence. "The Changing Geopolitics of Asia: Issues for Congress." *Congressional Research Service.* May 12, 2017, Accessed on August 8, 2023. Pg. 1. https://crsreports.congress.gov/product/pdf/IF/IF10560

poised to have numerous impacts to a variety of industries, international trade, infrastructure, and geography. The area is already heavily laden with significant geopolitical challenges such as Taiwan's claims to sovereignty from China, China's continued claims to small islands in the South China Sea, China's island building campaign, commodity transportation through the region, unemployment, impacts to infrastructure, the mass movement of people, and a host of other regional geopolitical issues. The way physical changes manifest themselves into geopolitical transformation will play a major role in determining the strategic and national security challenges for the U.S. and its allies.

One of the challenges discovered by this project is attempting to predict specific geopolitical conditions in twenty to thirty years, when the more significant impacts of a global temperature increase of 1.5º to 2.0º Celsius are realized. Most areas of the globe, such as the South China Sea, are already experiencing turbulent geopolitical conditions, which will dictate the geopolitical conditions downstream. For example, the dispute between China and Taiwan over Taiwan's claims to sovereignty is escalating and will certainly have an impact on near term geopolitical issues. Determining the follow-on geopolitical conditions several decades in the future is complicated due to the unknowns exhibited by current diplomatic efforts. In that regard, geopolitical transformation resulting from predicted climate changes is difficult to project outside of general conditions. What is certain is the roles and influence of China and the U.S. will be significant in this region.

In addition to the conflict arising over Taiwan's sovereignty, Taiwan also holds the distinction of being home to the Taiwan Semiconductor Manufacturing Company (TSMC) which

produces 92% of small logic chips worldwide.[59] A 2023 RAND Corporation report notes that, "Because of the extreme concentration of global fabrication in Taiwan and the importance of semiconductors across the economy, economic vulnerability could provide the PRC with an asymmetric advantage."[60] While this project is focused on future climate induced geopolitics, it is easy to see how current events overshadow and muddy the waters of analysis, as Bradley et al. of the Rand Corporation note, "…because of integrated global supply chains, both economic and national security issues are inherent in any conflict with China. And the issues are likely opaque and difficult to predict in advance."[61]

Assuming Taiwan is successful in defending its claims to independence, one potential example of a geopolitical impact from climate change could be the effects on commodities such as those manufactured by TSMC and their ability to import materials and export their commodity, based on changing sea and weather conditions that could impact trade, infrastructure, the labor market, and resource acquisition. Examples of the way climate change could affect supply chains operations include altered tropical cyclone activity, inundation of ports from increase sea level rise, and increased access to Arctic shipping lanes. While TSMC's operations are unlikely to be affected by climate change in the next couple of decades, the U.S. and its allies must be cognizant of future commodity sectors with limited sources which could be adversely affected by changes to supply chain operations as a result of climate change.

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[59] Bradley Martin, Laura Baldwin, and Paul Deluca, et al., "Supply Chain Interdependence and Geopolitical Vulnerability the Case of Taiwan and High-End Semiconductors Research Report" (Santa Monica, CA: RAND Corp, 2023), Pg. v, https://www.rand.org/content/dam/rand/pubs/research_reports/RRA2300/RRA2354-1/RAND_RRA2354-1.pdf

[60] Ibid, Pg. 45.

[61] Ibid, Pg. 45.

U.S. involvement in the region is focused on several key issues, including trade, military power, and nuclear deterrence. The U.S. will need to ensure it sustains awareness of all current and future geopolitical challenges to counter the growing threat posed by China. Taiwan's status as a sovereign nation and the U.S. position on the issue is an added complexity, and any future climate change induced geopolitics, such as supply chain disruptions caused by changes to weather patterns, sea level rise, and increased access to Artic shipping channels could all play a role in future diplomacy.

Competition with China for trade and economic opportunities represents a larger share of the geopolitical environment in the region. A report to the U.S. Congress by Ben Dolven of the Congressional Research Service states, "China is the largest trade partner and a major source of in the region, including worries that China may use its economic leverage to achieve political goals and anger over China's efforts to exert control over much of the South China Sea, have strained relations among some ASEAN members."[62] China's Belt and Road Initiative (BRI) is the nations's program designed to "develop China-centered and controlled global infrastructure, transportation, trade, and production networks."[63] The BRI also, "seeks to expand China's state firms' presence overseas, create new markets for China's goods and services, and secure access to foreign sources of agriculture, energy, and strategic commodities required for China's economic development and policies.[64] Applying this information to the future geopolitical analysis yields a favorable environment for the BRI to achieve its objectives.

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[62] Ben Dolven, February 21, 2023, "The Association of Southeast Asian Nations (ASEAN)." Pg. 1.
[63] Karen M. Sutter, Andres B. Schwarzenberg, & Michael D. Sutherland, December 22, 2022, "China's 'One Belt, One Road' Initiative: Economic Issues," *Congressional Research Service*, Pg. 1, https://crsreports.congress.gov/product/pdf/IF/IF11735
[64] Ibid, Pg. 1.

As the climate changes and the states surrounding the South China Sea experience significant impacts to industry, economics, transportation, and infrastructure, China's BRI is already in place and ready to step in and alleviate some of the detrimental impacts those states may be experiencing. China currently utilizes its "national champion" corporations to position itself in these critical markets. For example, one such corporation is Alibaba, who has initiated a project in Malaysia to establish an internet platform to facilitate data, e-commerce, and financial services.[65] As of 2022, China's total BRI projects total nearly $100 billion USD in Malaysia.[66] As China increases its presence and influence in these states through the BRI, they may be able to provide necessary support and resources to counter climate change Loss and Damage affecting some of the less prosperous nations.

Singapore, another South China Sea border nation, has been a close strategic partner to the U.S. for over 50 years.[67] Lyn Kuok of the Brookings Institution explains, "The relationship, based on a shared belief that a strong U.S. presence in the region is vital for peace, stability, and prosperity, extends across the security, economic and people-to-people realms and has made important contributions to regional stability."[68]Singapore is not immune to the impending effects of climate change. While it is a small nation, the effects will be just as impactful as in other areas. According to its National Climate Change Secretariat, Singapore will certainly experience the impact of climate change, due to sea level rise, impacts to water resources, threats to

[65] Ibid, Pg. 2.
[66] Na Ren & Hong Liu, "Southeast Asian Chinese Engage a Rising China: Business Associations, Institutionalised Transnationalism, and the Networked State," *Journal of Ethnic and Migration Studies* 48, no. 4 (October 25, 2021): 1–21, https://doi.org/10.1080/1369183x.2021.1983952.
[67] Lynn Kuok, 2016, "The U.S.-Singapore Partnership: A critical element of U.S. engagement and stability in the Asia-Pacific," *Brookings.* Pg. 1. Accessed on August 16, 2023 at: https://www.brookings.edu/wp-content/uploads/2016/11/fp_20160713_singapore_partnership.pdf
[68] Ibid, Pg. 1.

biodiversity due to extreme weather events like flooding and drought, and health security.[69] These conditions will contribute to geopolitical changes in Singapore's sphere and again present additional opportunities for China to expand its BRI.

Singapore represents a unique geopolitical situation in the South China Sea region. The small nation is made up of 76% ethnic Chinese and has held strong diplomatic relations with China for over 30 years.[70] Singapore walks a fine line between the economic, extended deterrence, and strategic relationship with the U.S. and its economic and cultural relationship with China.[71] On the one hand, the U.S. boasts Singapore as a Major Security Cooperation Partner[72], hosting over 1,000 U.S. service members, while Singapore maintains the second largest military presence of any foreign military in the U.S.[73] On the other hand, Singapore has been one of China's largest trading and investment partners since 2013, with trade between the two nations growing by more than 2,000% between 1990 and 2014.[74] To add to the complexity, Singapore holds a very close relationship with Taiwan, which places it in a precarious position with regard to China's relationship with Taiwan and the continued dispute over Taiwan's

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[69] National Climate Change Secretariat, "Impact of Climate Change in Singapore," www.nccs.gov.sg (National Climate Change Secretariat, 2021), https://www.nccs.gov.sg/singapores-climate-action/impact-of-climate-change-in-singapore/.
[70] Lam Peng Er, "Singapore-China Relations in Geopolitics, Economics, Domestic Politics and Public Opinion: An Awkward 'Special Relationship'?," *Journal of Contemporary East Asia Studies* 10, no. 2 (July 19, 2021): 1–15, https://doi.org/10.1080/24761028.2021.1951480
[71] Ibid, Pg. 2.
[72] "U.S.-Singapore Joint Leaders' Statement," The White House, March 29, 2022, https://www.whitehouse.gov/briefing-room/statements-releases/2022/03/29/u-s-singapore-joint-leaders-statement/.
[73] "FACT SHEET: Strengthening the U.S.-Singapore Strategic Partnership," The White House, August 23, 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/23/fact-sheet-strengthening-the-u-s-singapore-strategic-partnership/
[74] Lam Peng Er, "Singapore-China Relations in Geopolitics, Economics, Domestic Politics and Public Opinion: An Awkward 'Special Relationship'?" Pg. 209.

sovereignty.[75] Climate change impacts, as noted above, could alter regional industry, commodity transportation, economic stability, and other factors which may act as the catalyst for geopolitical transformation.

As Singapore and the other nations in the South China Sea region begin to experience the more significant effects of climate change, the regional geopolitical environment will be impacted as well. China could utilize its BRI to expand its already extensive sphere of influence in the region by ushering in additional economic opportunities, investments in local government projects, and injecting itself into security and defense roles. When considering China's intent to capitalize on the opportunities for investment in the South China Sea region created by climate change, Renato Cruz De Castro offers this statement published in The Journal of Southeast Asian Affairs,

> "These countries lack technological expertise and stable financial institutions to raise the capital to fund massive infrastructure projects needed for their long-term development. Through the BRI, China is poised to make huge investments in Southeast Asian infrastructure, including railways, highways, seaports, power plants, and digital communication network facilities."[76]

As Ren and Liu discussed in their Journal of Ethnic and Migration Studies article, "…business associations have formed institutionalized transnational interaction with China by way of cross-border flowing of people, goods, capital, information, and practices."[77] China's integration into these nations will become more pronounced as climate changes are realized. A modification to

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[75] Ibid, Pg. 204.
[76] Renato Cruz De Castro, "The Limits of Intergovernmentalism: The Philippines' Changing Strategy in the South China Sea Dispute and Its Impact on the Association of Southeast Asian Nations (ASEAN)," *Journal of Current Southeast Asian Affairs* 39, no. 3 (July 23, 2020): 186810342093556, https://doi.org/10.1177/1868103420935562
[77] Na Ren & Hong Liu, "Southeast Asian Chinese Engage a Rising China: Business Associations, Institutionalised Transnationalism, and the Networked State," Pg. 17.

U.S. economic policies in the region will be necessary to slow the Chinese expansion in the region. As the geopolitics of the South China Sea transform, so will the strategic and national security interests of the U.S. China's expanded role in the region will contribute to security destabilization and an increase in tension in the region.

Chapter 5
Strategic and National Security Challenges

The impact of a 1.5-2.0º Celsius global temperature increase will cause an assortment of physical and geographic changes across South China Sea region and throughout the world. Those changes, some of which are already occurring, will transform the political and geopolitical landscape over the next two to three decades. This project has experienced the difficulty associated with predicting specific climate change impacts for individual nations and geographic areas due to the complexity of the unknown climatology and variability of impacts, which all exist in a dependent relationship.

The second challenge to this research is the complexity and volatility of the current geopolitical environment in the South China Sea region. Tensions between China and Tawain, the continued exploitation of the maritime region by China, and current disputes and crisis in other nearby states are impacting the regional geopolitics almost daily. The current events increase the difficulty in assessing the potential geopolitical climate decades from now as the assessment completely relies on the resolution of current affairs, for example what would be the geopolitical impacts of climate change on Taiwan if it remains a sovereign nation for the next thirty years versus the same impacts on a China governed Taiwan?

What cannot be disputed, however, is the increasing likelihood of China's role in future regional geopolitics. In fact, after considering the consequences of allowing China to continue its BRI politics throughout the region, the U.S. and its allies must realize the failure to address China's current expansionist tactics will only make it easier for China to continue its efforts when nations begin to experience more significant climate change impacts. Allowing China to expand its influence could force the U.S. out of the region, degrading its capability to provide extended deterrence and strategic stability to the Southeast Asia region. The 2022 U.S. National

Defense Strategy (NDS) characterizes the Peoples Republic of China (PRC) threat to the Indo-Pacific region, including the South China Sea, as:

> "The most comprehensive and serious challenge to U.S. national security is the PRC's coercive and increasingly aggressive endeavor to refashion the Indo-Pacific region and the international system to suit its interests and authoritarian preferences. The PRC seeks to undermine U.S. alliances and security partnerships in the Indo-Pacific region, and leverage its growing capabilities, including its economic influence and the People's Liberation Army's (PLA) growing strength and military footprint, to coerce its neighbors and threaten their interests."[78]

The 2022 NDS briefly touches on the growing strategic threat emerging from climate change, "Climate change is creating new corridors of strategic interaction…" and "Insecurity and instability related to climate change may tax governance capacity in some countries while heightening tensions between others, risking new armed conflicts and increasing demands for stabilization activities."[79]

As stated earlier, the intent of this project is to predict the strategic and national defense issues arising from climate change. Chapters 3 through 5 of this paper focus on the South China Sea region, which has highlighted the complexities of predicting region specific changes and future geopolitical issues. What the research uncovered is China poses a long-term threat to the strategic stability of the region through its use of its BRI to potentially drive a wedge between the U.S. and nations in the South China Sea region. The linkage between climate change and the regional strategic stability will be the continued degradation of many South China Sea nations to remain self-sufficient under changing climatological conditions and contain the China expansionist regime to manageable levels.

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[78] U.S. Department of Defense "2022 National Defense Strategy." Pg 4. https://media.defense.gov/2022/Oct/27/2003103845/-1/-1/1/2022-NATIONAL-DEFENSE-STRATEGY-NPR-MDR.PDF

[79] U.S. DoD, National Defense Strategy, Pg. 6

Establishing a baseline analysis of China's intentions is instrumental in understanding the long-term strategic challenges for the South China Sea region. As stated in the previous chapter, China's BRI could provide an avenue for it to expand its influence and power projection in response to climate change impacts. Through its investments which either hinder or help climate change policies, China could alter regional geopolitics, challenging U.S. strategic interests in the region. In her Annual Threat Assessment opening statement to the Senate Select Committee on Intelligence on March 8, 2023, the U.S. Director of National Intelligence, the Honorable Avril Haines made the following assertion:

> "The Chinese Communist Party, or CCP, under President Xi Jinping will continue efforts to achieve Xi's vision of making China the preeminent power in East Asia and a major power on the world stage. To fulfill Xi's vision, however, the CCP is increasingly convinced that it can only do so at the expense of U.S. power and influence, and by using coordinated, whole-of-government tools to demonstrate strength and compel neighbors to acquiesce to its preferences, including its land, sea, and air claims in the region and its assertions of sovereignty over Taiwan."[80]

The 2022 U.S. National Security Strategy advises, "Beijing has ambitions to create an enhanced sphere of influence in the Indo-Pacific and to become the world's leading power," and "The PRC is also investing in a military that is rapidly modernizing, increasingly capable in the Indo-Pacific, and growing in strength and reach globally—all while seeking to erode U.S. alliances in the region and around the world." [81] Reporting in early 2022 indicates China has developed

[80] Office of the Director of National Intelligence (ODNI), March 8, 2023, "Annual Threat Assessment Opening Statement," Remarks deliver by the Honorable Avril Haines, Director of National Intelligence. https://www.dni.gov/index.php/newsroom/congressional-testimonies/congressional-testimonies-2023/item/2373-dni-haines-opening-statement-on-the-2023-annual-threat-assessment-of-the-u-s-intelligence-community

[81] The White House. 2022. "U.S. National Security Strategy." Pg. 23, https://www.whitehouse.gov/wp-content/uploads/2022/11/8-November-Combined-PDF-for-Upload.pdf

military capabilities on several of the artificial islands it has created in the South China Sea.[82] This type of activity increases tension in the region and is a clear signal of China's intent to push U.S. military forces out of the area.

The intelligence community assesses China will continue to use its position in the region and its BRI to influence and undermine U.S. interests. This creates a critical strategic shortfall for the U.S. for a variety of reasons. The future degradation of U.S. influence and presence in the South China Sea region will yield a significant increase in national security threats.

North Korea poses a significant strategic threat to U.S. interests in the East Asia region. The U.S. sustains its nuclear protective umbrella for South Korea and Japan as a deterrent against North Korean aggression. China's continued influential expansion in the region will weaken the ability of the U.S. to effectively serve as the stabilizing force in the region. As Director Haines notes in her address, "North Korea similarly remains a proliferation concern as it continues its efforts to steadily expand and enhance its nuclear and conventional capabilities targeting the United States and our allies, periodically using aggressive and potentially destabilizing actions to reshape the regional security environment in its favor and to reinforce its status as a de facto nuclear power."[83] As North Korea continues its provocations over the next several decades, it is essential the U.S. continue to sustain a strong presence in the region.

This may not be possible, however, should climate change impact the regional geopolitics in a manner that forces nations in the region to succumb to further Chinese expansionist policies and programs. Again, referring to Director Haines' statement, "climate change remains an urgent

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[82] The Associated Press, "China Has Fully Militarized Three Islands in South China Sea, US Admiral Says," The Guardian (The Guardian, March 21, 2022), https://www.theguardian.com/world/2022/mar/21/china-has-fully-militarized-three-islands-in-south-china-sea-us-admiral-says

[83] ODNI Haines, statement to Select Intelligence Committee

threat that will increasingly exacerbate risks to U.S. national security as the physical impacts increase and geopolitical tensions mount over the global response to the challenge."[84] As climatological conditions in the South China Sea begin to experience climate change, the forces acting on the geopolitical conditions could cause a deterioration of economies, industries, infrastructure, and populations. China already has a substantial advantage over the U.S. due to its location and has already begun influencing the region with its BRI through investments in infrastructure and financial instruments used to support projects in the region.

According to the NDS, the Indo-Pacific region is, "the epicenter of the climate crisis but is also essential to climate solutions, and our shared responses to the climate crisis are a political imperative and an economic opportunity," and "No region will be of more significance to the world and to everyday Americans than the Indo-Pacific."[85] The U.S. and its allies should take a multi-pronged approach to this future strategic and national security issue. From the regional perspective, the U.S. must strengthen its partnerships in the region and implement policies enabling the associated nations to counter the current and continued expansionist influence of China.

From a global perspective, the U.S. must be a leader in the efforts to halt global warming, working with the international community to reduce carbon emissions to prevent some of the long-term impacts expected over the next few decades. These efforts may reduce the efficacy of the PRC's efforts to dislodge the U.S. from its position of stability and peace in the region.

[84] Ibid.
[85] U.S. 2022 NDS, Pg. 38.

A June 2023 report to the U.S. Congress provides the following threats China poses to the South China Sea region, should they be permitted to continue their expansionist policies. Climate change impacts to the surrounding nations will provide an environment more conducive to China's BRI programs, given it more power throughout the region and facilitating a shift away from U.S. support. Although some of these issues are current tactical threats, they will continue to impact future U.S. strategic considerations:

- Control fishing operations, oil and gas exploration activities, and seabed internet cable-laying operations in the South China Sea;
- Coerce, intimidate, or put political pressure on other countries bordering the South China Sea;
- Announce and enforce an air defense identification zone (ADIZ) over the South China Sea;
- Announce and enforce a maritime exclusion zone around Taiwan;
- Facilitate the projection of Chinese military presence and political influence further into the Western Pacific; and
- Help achieve a broader goal of becoming a regional hegemon in its part of Eurasia.[86]

The report also details a list of strategic deficiencies the U.S. and its allies will experience in the region should China succeed in expanding its sphere of influence and power in the region:

- Intervene militarily in a crisis or conflict between the People's Republic of China and Taiwan;
- Fulfill U.S. obligations under U.S. defense treaties with Japan, the Philippines, and South Korea;
- Operate U.S. forces in the Western Pacific for various purposes, including maintaining regional stability, conducting engagement and partnership building operations, responding to crisis, and executing war plans, and;
- Prevent the emergence of China as a regional hegemon in its part of Eurasia. [87]

At the strategic level, should the U.S. not be capable of meeting any or all of the responsibilities listed above, nations such as Japan and South Korea could reconsider the U.S.'s ability to

[86] Ronald O'Rourke, June 5, 2023, "U.S.—China Strategic Competition in South and East China Seas: Background and Issues for Congress." *Congressional Research Service.* R42784. https://crsreports.congress.gov/product/pdf/R/R42784
[87] Ibid, Pg. 2

provide its extended deterrence mission, and perhaps consider developing their own independent nuclear weapons capabilities.[88] This development would further escalate tensions in the region between Japan, North Korea, South Korea, and China resulting in a greatly destabilized region. While these are current strategic concerns in the South China Sea region, failure to prevent further global warming will contribute to an even greater strategic and national security threat. As noted in Figure 2 on page 14, the U.S. Department of Defense has identified marine ecosystems and threats to fisheries as a crosscutting climate change risk to U.S. defense strategy, assessing that impacts to these resources could lead some nations to experience both internal and external tensions which, in combination with other factors, may result in conflict resulting in an altered threat environment.[89] While it may seem far-fetched to identify marine eco-systems as a threat to U.S. defense strategy, the previous example of the Arab Spring scenario may provide some clarity into the impact an environmental trigger could have on regional geopolitics. providing another example of the link between climate change and U.S. national security.

A linkage between climate change and U.S. strategic and national security interests begins to take shape as the research and assessments of the science and intelligence community are analyzed together. This creates a complex cause-and-effect scenario beginning with global warming, and ending with China's domination in the South China Sea, generating a weakened and tumultuous strategic and national security environment. The potential then exists for adversaries such as North Korea to take advantage of the void in stability and take aggressive actions against their neighbors.

[88] Ibid, Pg. 2
[89] U.S. Department of Defense, 2021 Climate Risk Analysis, Pg. 8-9.

PART III
SOUTH ASIA

Chapter 6
Projected Environmental and Physical Impacts

The previous section of this project detailed the link between long term impacts of climate change on the South China Sea region and the potential strategic and national security implications for the U.S. and its allies. The major consideration for that scenario is China and their Belt and Road Initiative, which could be an initiator of destabilization in the region over the next several decades. Our focus now shifts west to South Asia, and analyzes Pakistan and India, including the disputed Kashmir region. The significant strategic and national security aspect of this region encompasses the nuclear weapons status of both nations and their history of aggravated disputes over the Jammu and Kashmir region as well as disagreements arising from the Indus River Treaty.[9091]

Figure 4 on the following page illustrates the location of the disputed Jammu and Kashmir region as well as the disputed border between Inda and China. The next several chapters will explore the link between climate change, geopolitics, and the resultant strategic and national security implications for the U.S. that will emerge from climate induced physical and geographical changes to this region.

[90] Agnieszka Kuszewska, "The India-Pakistan conflict in Kashmir and human rights in the context of post-2019 political dynamics," *Asian Affairs* 53, no. 1 (March 18, 2022): 198–217, https://doi.org/10.1080/03068374.2022.2041288

[91] John J. Vater, "The Indus Waters Treaty: Prospects for India-Pakistan Peace," *National University of Singapore, Institute of South Asian Studies,* (June 23, 2021), https://www.isas.nus.edu.sg/papers/the-indus-waters-treaty-prospects-for-india-pakistan-peace/

Figure 4-Disputed Kashmir Region, https://www.nationsonline.org/oneworld/map/Kashmir-political-map.htm

With its extensive coastline and mountainous region bristling with glaciers, South Asia is one of the Earth's most vulnerable regions for climate change.[92] The 2021 ODNI National Intelligence Council's National Intelligence Estimate on Climate Change lists both India and Pakistan as two of the top eleven nations to experience the impacts of climate change.[93] The report also notes that while India is one of the more susceptible countries to climate change, they are also the fourth largest producer of greenhouse gas emissions and continue to increase their emissions.[94] The report provides the following specific threats for the South Asian region, which includes Pakistan and India:

- Warm countries that rely on thermoelectric power plants for electricity generation are particularly vulnerable because more frequent and intense droughts and higher evaporation rates from rising temperatures are likely to interrupt their access to water to cool power plants. Rising temperatures also makes the plants less efficient and more costly to operate;
- More frequent and intense cyclones are likely to contaminate water sources and increase vector populations and the diseases they transmit. Models suggest dengue fever will increase in India and Pakistan;
- Rising temperatures and increased precipitation probably will amplify mosquito and diarrheal disease outbreaks in South Asian countries, worsening health outcomes and causing additional loss of life, according to scientific studies and the WHO.[95]

As previously mentioned in this project, Pakistan is recovering from historic flooding during 2022. The flooding, which covered nearly one-third of the nation, killed more than 1,700 people,

[92] Ruchir Agarwal, Vybhavi Balasundharam, Patrick Blagrave, et al., "Climate Change in South Asia: Further Need for Mitigation and Adaptation" (International Monetary Fund, August 20, 2021), https://www.imf.org/en/Publications/WP/Issues/2021/08/20/Climate-Change-in-South-Asia-Further-Need-for-Mitigation-and-Adaptation-464333.
[93] Office of the Director of National Intelligence (ODNI). "National Intelligence Estimate: Climate Change and International Responses Increasing Challenges to US National Security Through 2040," *National Intelligence Council.* NIC-NIE-2021-10030-A, Pg. 11, https://www.dni.gov/files/ODNI/documents/assessments/NIE_Climate_Change_and_National_Security.pdf
[94] Ibid, Pg. 5.
[95] Ibid, Pg. 13.

injured 13,000, and affected over 30 million others.[96] A research article authored by J.S. Nanditha, et al., on the 2022 Pakistani floods attributed the extreme flooding to several factors including an extreme heat wave in the early summer which affected 30 of Pakistan's 3,000 glacier pools.[97] The resulting floods from the glacier pools contributed to the historic flooding. Additionally, two anomalous atmospheric events caused the extreme precipitation event.[98] Climate change is expected to increase the frequency and severity of these extreme weather events in the South Asian region, producing additional catastrophic impacts.[99]

As discussed in the previous section, most climate change models focus on the global or macro scale, with a deficit of scholarly research conducted at the micro or regional level.[100] Several research projects have noted the absence of a clear understanding of the regional impact of climate change in South Asia, as noted in a peer reviewed study by Brahmananda Rao et al. They noted that "several aspects of monsoons, particularly, the Indian Monsoons are still not completely clear and hinder the mechanisms of prediction,"[101] and a report in the Journal of Asian Studies offers, "the specific ways in which climate change will play out over time are rich with uncertainty. Even as science has asked more questions in the region regarding how water

[96] K. Alan Kronstadt & Rhoda Margesson, "Pakistan's 2022 Floods and Implications for U.S. Interests." Pg. 1.
[97] J. S. Nanditha, Anuj Kushwaha, Rajesh Singh, et al., "The Pakistan Flood of August 2022: Causes and Implications," *Earth's Future* 11, no. 3 (March 2023), pg. 13, https://doi.org/10.1029/2022ef003230.
[98] Ibid, Pg. 13.
[99] Ibid, Pg. 13.
[11] Syed Sheraz Mahdi, B.S. Dhekale, Rukhsana Jan, et al., "Analysis and Farmers' Perception of Climate Change in the Kashmir Valley, India," *Theoretical and Applied Climatology* 149, no. 1-2 (May 8, 2022): 727–41, https://doi.org/10.1007/s00704-022-04072-x. [100]
[101] Vadlamudi Brahmananda Rao, Karumuri Ashok, and Dandu Govardhan, "Unprecedented Climate Change in India and a Three-Pronged Method for Reliable Weather and Climate Prediction," Frontiers in Climate 3 (November 15, 2021), pg. 5, https://doi.org/10.3389/fclim.2021.716507.

cycles through glaciers, snow, ice, and precipitation, the answers uncovered point to dramatic variability and additional factors that have not been accounted for."[102]

Water security relies heavily on the amount of precipitation received throughout the year and the importance of the monsoons is demonstrated by the previously referenced Journal of Asian Studies report which notes that, "the climate of South Asia, and to a great extent its water resources, is heavily influenced by the South Asian summer monsoon."[103] Another significant source of water for the region comes from the high mountain snow and ice pack of the Hindu-Kush Himalayan (HKH) mountain range. Climate change, and more specifically global warming, is poised to affect the type of precipitation that supports the water storage characteristics of the HKH, providing more periods of rain and less snow, thereby reducing the long-term storage capability of the ice pack in exchange for increase runoff of rainwater.[104] In addition, a research study by Wood et al., found that "even if global warming is kept below 1.5ºC, a third of the glaciers in the Hindu Kush-Himalayan region and more than half of those in the eastern Himalaya will likely be lost by the end of this century."[105] If that holds true, there will be a significant impact on the fresh water supply to the region.

A 2022 study published in Theoretical and Applied Climatology attempted to gain a more thorough understanding of the micro effects of climate changes being experienced in the Kashmir Valley. The study concluded that the region was experiencing both increasing and

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[102] Alāna M. Wilson, Sierra Gladfelter, Mark Williams, et al., "High Asia: The International Dynamics of Climate Change and Water Security," The Journal of Asian Studies 76, no. 2 (May 2017): 457–80, Pg. 473, https://doi.org/10.1017/s0021911817000092.
[103] Ibid, Pg. 459.
[104] Ibid, Pg. 461.
[105] Leah R. Wood, Klaus Neumann, Kirsten Nicholson, et al., "Melting Himalayan Glaciers Threaten Domestic Water Resources in the Mount Everest Region, Nepal," Frontiers in Earth Science 8 (April 29, 2020), https://doi.org/10.3389/feart.2020.00128

decreasing temperature and precipitation trends, which were identified through historical data analysis and anecdotal perceptions of local farmers.[106] The expected results of these changes could negatively impact the agricultural and water security in the region. Another research study published by the American Geophysical Union noted both Pakistan and India will experience increases in heatwaves and crop failure.[107] The study also suggests South Asia will experience the highest rate of population exposure to extreme weather events.[108] Increasing temperatures and decreasing precipitation will lead to reduced crop production and a decrease in the available water stores for some of the most populated areas on the planet, leading to food shortages, decreasing employment opportunities for farmers, and a push of migration from the region as people search for more secure water and food resources.

Climate change combined with other local factors such as flood and water management will worsen the effects moving forward. An example is highlighted in a report to the U.S. Congress on the 2022 Pakistan floods which suggests, "Following the 2010 floods, the government reportedly failed to implement plans that would have reduced the consequences of future floods by preventing rebuilding in and repopulating of flood-prone areas."[109] The Journal of Asian Studies report noted above also highlights the risk reduction efforts that have not been implemented effectively, "Risk reduction activities in mountain communities are largely limited to relocating from unstable slopes and out of flood plains, efforts that have not been widespread

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[106] Vadlamudi Brahmananda Rao, Karumuri Ashok, and Dandu Govardhan, "Unprecedented Climate Change in India and a Three-Pronged Method for Reliable Weather and Climate Prediction," Pg. 13

[107] Stefan Lange, Jan Volkholz, Tobias Geiger, et al., "Projecting Exposure to Extreme Climate Impact Events across Six Event Categories and Three Spatial Scales," Earth's Future 8, no. 12 (November 26, 2020), Pg. 11, https://doi.org/10.1029/2020ef001616.

[108] Ibid, Pg. 1.

[109] K. Alan Kronstadt & Rhoda Margesson, "Pakistan's 2022 Floods and Implications for U.S. Interests." Pg. 2.

to-date, particularly in cases where there is limited government assistance."[110] Failing to address current deficiencies in risk reduction, and a lack of implementation of corrective actions from previous disasters will increase the overall impact of weather extremes and disasters associated with climate change.

South Asia has been highlighted as a region particularly susceptible to the effects of climate change. The region is one of the most populated areas of the globe, which means climate change will expose more people to its effects and the ensuing disasters that will accompany them. Additionally, nearly one-third of the earth's population relies on water sourced from the HKH mountains,[111] which presents an enormous vulnerability should climate change adversely impact the water resources in the region. The various effects of climate change, which include extreme weather events, temperature and precipitation variations, and threats to water security will ultimately drive emerging geopolitical issues which could lead to additional challenges to U.S. strategic and national security interests in the region. Crop losses, failing freshwater resources, and the resulting mass movement of people will challenge regional stability and could ignite new crises, especially in regions already experiencing tension. Disputes in the Kashmir Valley region and other areas between Pakistan and India which rely on the various rivers for irrigation and fresh water supply could push both governments into precarious diplomatic scenarios. The following chapters will explore the geopolitical impacts from climate change and the resulting strategic and national security threats.

[110]Alāna M. Wilson, Sierra Gladfelter, Mark Williams, et al., "High Asia: The International Dynamics of Climate Change and Water Security," Pg. 473.
[111] Ibid, Pg. 458.

Chapter 7
Geopolitical Transformation

As one of the most populated regions on the planet, as well as one of the most vulnerable to the effects of climate change, South Asia presents a complex geopolitical challenge for strategists. While global warming continues to influence regional weather and geography, the people of South Asia will have to adapt to emerging threats to their livelihood, such as reduced agricultural production, lack of water security, a failing labor market, and increased exposure to natural disasters. These changes may enhance the geopolitical threats already impacting the area. Tension between Pakistan and India, especially in the disputed Kashmir region could be worsened as the glaciers and rivers supplying much of the region encounter increased effects from climate change. This chapter will focus on the issues surrounding water security and the associated geopolitics between Pakistan and India, specifically in the Kashmir region. The variability and uncertainty of climate change demands further study of other climate change impacts.

The following graph (Figure 5) represents the expected population growth for the Central and Southern Asia region. The median population growth is expected to increase from approximately 2 billion people in 2020 to nearly 2.75 billion people in 2070, or just over 25% over the 50-year period.[112] The increased population will place an even greater number of people at risk for exposure to the effects of climate change. The Himalayan mountains are one of the largest stores of freshwater in the world and are extremely vulnerable to climate change.[113] A

[112] United Nations, "World Population Prospects - Population Division - United Nations," 2022, https://population.un.org/wpp/Graphs/Probabilistic/POP/TOT/1831
[113] Leah R. Wood, Klaus Neumann, Kirsten Nicholson, et al., "Melting Himalayan Glaciers Threaten Domestic Water Resources in the Mount Everest Region, Nepal," Frontiers in Earth Science 8 (April 29, 2020), https://doi.org/10.3389/feart.2020.00128

2016 study on climate change impacts to the Upper Indus River basin (UIB) noted that region supplies water to one of the largest irrigation systems in the world.[114] Additionally, the study found the annual downstream water demands regularly exceed the supply which, "makes the Indus basin aquifer the most overstressed aquifer in the world."[115] The expected population increase will enhance the burden on water security in the area.

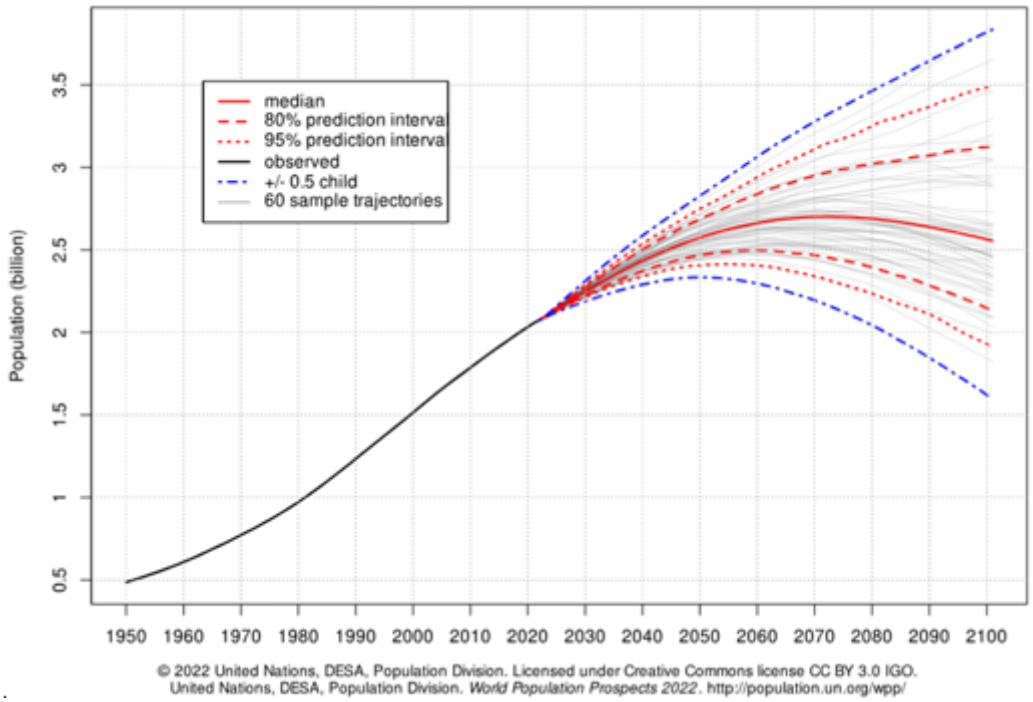

Figure 5 – Central and Southern Asia Total Population. United Nations.

The combination of population growth and already depleted water resources will create a significant geopolitical challenge in the coming decades. At minimum, this will generate a push for the mass movement of people from the region as they attempt to relocate to regions with more secure water resources. This will also contribute to increased tensions between Pakistan and India as their dispute over the shared resources in the basin begins to feel the pressure from

[114]A. F. Lutz, W. Immerzeel, P. Kraaijenbrink, et al., "Climate Change Impacts on the Upper Indus Hydrology: Sources, Shifts and Extremes," ed. Juan A. Añel, PLOS ONE 11, no. 11 (November 9, 2016): e0165630, Pg 1, https://doi.org/10.1371/journal.pone.0165630
[115] Ibid, Pg. 2.

the growing population and lack of available resources. In their article in The Journal of Asian Studies, Wilson et al., noted:

> "Transboundary water issues further complicate the region's water security with issues of allocation, particularly in regard to which stakeholders control flows both domestically and internationally. Water resources from transboundary rivers are not always clearly or fairly allocated, as deeply seated social, political, and economic relations limit the leverage of historically marginalized nations and communities… Negotiated compacts for water-sharing, or the lack thereof, continue to be a potential source of tension as 'hoarding water' through dam construction becomes a looming threat, particularly as water supplies diminish and demand from Asia's booming population only continues to increase."[116]

A significant factor contributing to the dispute over Kashmir is the allocation of water resources from the various rivers running through the Indian controlled territory in Kashmir to Pakistan. Most of Pakistan's water resources come from supply either originating or flowing through India.

The dispute between Pakistan and India over water resources began shortly after the British decolonization of the region in 1947. The dispute was settled by the Indus Water Treaty of 1960 which distributed rights to 6 rivers between the two nations and prohibited either nation from interfering with the water supplies associated with the rivers.[117] A 2017 case study on the dispute presented in The Penn State Journal of Law & International Affairs provides a comprehensive overview of the water conflict. According to the study, the treaty sustained a peaceful agreement between the nations until 1999, when India began the construction of several dams on two of the rivers allocated to Pakistan by the treaty.[118] The dams are located on the

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[116] Alāna M. Wilson, Sierra Gladfelter, Mark Williams, et al., "High Asia: The International Dynamics of Climate Change and Water Security,"
[117] Waseem Qureshi, "Water as a Human Right: A Case Study of the Pakistan-India Water as a Human Right: A Case Study of the Pakistan-India Water Conflict Water Conflict," *The Penn State Journal of Law &International Affairs,. 374*(2/6), 2017, Pg. 377 https://elibrary.law.psu.edu/cgi/viewcontent.cgi?article=1166&context=jlia#:~:text=The%20Indus%20Waters%20Treaty%20was
[118] Ibid, Pg. 379.

portions of the rivers in Indian territory, however, they would have a detrimental effect on the water flow in Pakistan.

The Penn State case study further details the significant harm India could cause to Pakistan by restricting the flow of water down several of the disputed rivers. Nearly forty-five percent of Pakistan's labor force is associated with agriculture, and seventy percent of the nation's agriculture originates from the Punjab region, which is supplied by the rivers running from India. Any significant impact on the water resources for the nation will create an insurmountable challenge. According to the report, India has the power to "directly threaten the very survival of the entire Pakistan population because the absence of irrigation could result in crop failure, as well as food and water shortages."[119]

India will experience similar threats to its agriculture and infrastructure. A National Intelligence Council report found that, "the impacts of climate change are likely to be felt first and foremost in the agricultural sector and associated water availability, with many people affected by lower food productivity."[120] Further studies also found pollutants such as ozone and black carbon negatively affected India's crop yields and will continue to decrease crop yields unless India and China begin to mitigate their emission of such pollutants.[121] Agriculture is not the sole climate threat to India. Just over 300 million people live in low lying coastal areas susceptible to flooding from increased sea levels and tropical cyclones.[122] Each of these climate

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[119] Ibid, Pg. 381.
[120] Joint Global Change Research Institute & Battelle Memorial Institute, "India: The Impact of Climate Change to 2030," *National Intelligence Council.* NIC 2009-03D, (April 2009), pg. 22 https://www.dni.gov/files/documents/climate2030_india.pdf
[121] Jennifer Burney & V. Ramanathan, "Recent Climate and Air Pollution Impacts on Indian Agriculture," *Proceedings of the National Academy of Sciences* 111, no. 46 (November 3, 2014): pg. 16323, https://doi.org/10.1073/pnas.1317275111
[122]Anthony Leiserowitz., Thaker, J., Carman, J., Neyens, et al., (2022). Climate Change in the Indian Mind, 2022. Yale University. New Haven, CT, pg. 5,

threats puts pressure on the local and national governments of India as they must then deal with an increasing population, decreasing food yields, and millions of people at risk of exposure to coastal flooding. Climate change is poised to worsen and/or increase the frequency and severity of each of these threats.

Reviewing the entire situation in South Asia allows us to begin to see the link developing between climate change and U.S. defense strategy and national security issues in the region. Both Pakistan and India rely on freshwater sourced from glaciers, lakes, and rivers which originate in the high mountain regions of South and Central Asia and run through India. As global warming begins to alter weather patterns and increases the frequency of extreme temperature events, the reliability and availability of water resources for the region will begin to change, significantly impacting agriculture and water security downstream for both nations. India has a strategic advantage over Pakistan as it has the capability to alter water flows for irrigation and building hydroelectric powerplants.

India has initiated several projects along the rivers in its territory in an effort to mitigate the impact of climate change influenced fluctuations in water supplies to its agricultural and water supply infrastructure. These projects could reduce water flow to Pakistan at the same time climate change is inflicting additional instances of drought, flooding, and extreme weather on the region. These events will be detrimental to Pakistan's agricultural sector and adversely affect most aspects of Pakistan's livelihood. For example, should India push forward with their projects to dam and/or divert water from rivers flowing into Pakistan, which could reduce water quantity downstream, while the region is experiencing climate change induced droughts, blame could be

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https://climatecommunication.yale.edu/wp-content/uploads/2022/10/climate-change-indian-mind-2022-d.pdf

placed on India for causing significant impacts to Pakistan's critical agricultural sector, increasing tensions between the two nuclear nations.

Climate change is expected to cause significant physical changes to the South China region. Those changes will most notably be felt in the disputed Kasmir region located between India and Pakistan. Climate change will exasperate an already tense dispute over water resources and allocation. Although a treaty has been in place for decades, India has recently started several projects that could jeopardize the treaty and ignite a larger feud with Pakistan. Not only is this problematic due to the nuclear weapon status of both nations, but India is also a U.S. strategic partner in its national security policy with China. This places the U.S. in a strategically complex scenario as there evolves a dichotomy between U.S. relations with India in affairs dealing with China, while on the other hand India continues to support Russia's war in Ukraine by abstaining from UN votes on the matter and sustaining a position of neutrality.[123] Any large-scale conflict between Pakistan and India will likely draw in both the U.S. and China, presenting a whole host of strategic challenges for the U.S. its global allies.

[123] Ashley J. Tellis, "'What Is in Our Interest': India and the Ukraine War," Carnegie Endowment for International Peace, April 25, 2022, https://carnegieendowment.org/2022/04/25/what-is-in-our-interest-india-and-ukraine-war-pub-86961.

Chapter 8
Strategic and National Security Challenges

The previous chapters in this section began the task of linking climate change in South Asia to U.S. strategic and national security challenges resulting from those changes. Research shows South Asia is one of the most vulnerable regions for climate change, with several billion people facing exposure to extreme weather events such as droughts and flooding, extreme temperatures, rising sea levels, and an altered pattern of tropical cyclones. Those changes will be the catalyst for geopolitical transformation, such as an increase in tensions over shared water resources, which may lead to new strategic challenges, including the risk of regional crisis escalating to nuclear conflict. The analysis becomes difficult due to the variability of the forecasted climate change impacts, the large area which will see an assortment of changes at a more regional level, and the resolution of current geopolitical issues.

As mentioned earlier in this paper, this study assumes the failure of climate change policies aimed at preventing a global temperature increase over 2.0º Celsius. As of March 2023, China, the U.S., and India rank as the top 3 greenhouse gas emitters respectively.[124] India's emissions grew nearly 10% between 2020 and 2021, marking one of the largest increases of any nation, and providing a justification for the pessimism facing climate change policy.[125] U.S. strategic analysts must begin to assess the national security implications that will become apparent as these policies continue to fail and the earth moves closer to the 2.0 Celsius mark.

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[124] Johannes Friedrich, Mengpin Ge, and Andrew Pickens, "This Interactive Chart Shows Changes in the World's Top 10 Emitters," *World Resources Institute*, December 10, 2020, https://www.wri.org/insights/interactive-chart-shows-changes-worlds-top-10-emitters

[125] International Energy Agency, "Global Energy Review: CO2 Emissions in 2021 Global Emissions Rebound Sharply to Highest Ever Level," 2021, Pg. 8, https://iea.blob.core.windows.net/assets/c3086240-732b-4f6a-89d7-db01be018f5e/GlobalEnergyReviewCO2Emissionsin2021.pdf

One such area for analysis is South Asia and the torrid relationship between Pakistan and India, and the ever-present tension from China on India's border. India and Pakistan are already mired in a conflict over Kashmir and have recently experienced disputes over water supplies from the high mountain region of Central Asia. The tension between India and China is the worst it has been since 1962.[126] The previous chapter highlighted several geopolitical issues, some of which are already occurring, that demand consideration as the climate continues to change over the next several decades. As with the previous section, forecasting the future geopolitical climate is difficult because there are a host of current issues whose resolution will set the foundation for future geopolitics, however, there are strategic issues laying beneath the surface which must be assessed, to ensure U.S. national defense interests are prepared to encounter them in the coming decades.

Following their emergence as nuclear weapons states in 1998, the India-Pakistan relationship remains steeped in uncertainty and instability.[127] In an article published in the Journal for Peace and Nuclear Disarmament, Chunhao Lao offers that, "Though both countries have very strict chain-of-command systems and show restraint concerning the use of nuclear weapons, the protracted rivalry between India and Pakistan may still pose the most serious risk for nuclear escalation in the world."[128] According to The 2023 Office of the Director of National Intelligence (ODNI) Annual Threat Assessment of the U.S. Intelligence Community, "Crisis between India and Pakistan are of particular concern because of the risk of an escalatory cycle

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[126] K. Alan Kronstadt & Shayerah I. Akhtar, "India-U.S. Relations: Issues for Congress," *Congressional Research Service,* (June 16, 2023), Pg. 16, https://crsreports.congress.gov/product/pdf/R/R47597

[127] Chunhao Lou, "Geopolitical 'Entanglements' and the China-India-Pakistan Nuclear Trilemma," *Journal for Peace and Nuclear Disarmament* 5, no. 2 (December 19, 2022): 1–15, https://doi.org/10.1080/25751654.2022.2156252.

[128] Ibid, Pg. 288.

between two nuclear-armed states."[129] Long standing feuds between two nations capable of escalating any conflict to a nuclear strike may be aggravated by the increased instability injected into the situation by climate change.

Should water and agricultural resources be so impacted as to motivate Pakistan to launch an attack against India, it could quickly escalate into a nuclear conflict, either intentionally or accidentally. In March 2022, India inadvertently launched one of their BrahMos cruise missiles into Pakistan, an incident that could have been mistaken for an intentional act and led to further counter attacks by Pakistan.[130] As climate change continues to contribute to increased tensions in the region and reduces the patience of both parties, the acceptable margin of error will decrease, and the threat of nuclear war may increase. Regional geopolitics pertaining to the disputed Kashmir region and the potential climatological changes that may threaten the life sustaining water resources running through the region could define the South Asian security landscape in the second half of the 21st century.

The longstanding India-Pakistan conflict is not the only nuclear shadow looming over the region. India and China have been actively engaged in a border dispute as well. The following map illustrates the multiple border conflicts involving India, (Figure 6). China and India have been entrenched in a dispute over the 2,500-mile border known as the Line of Actual Control (LAC), since a brief India-China war in 1962.[131]

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[129] Office of the Director of National Intelligence, *Annual Threat Assessment of the U.S. Intelligence Community*, (March 8, 2023), Pg. 34, https://www.dni.gov/files/ODNI/documents/assessments/ATA-2023-Unclassified-Report.pdf
[130] Chunhao Lou, "Geopolitical 'Entanglements' and the China-India-Pakistan Nuclear Trilemma," Pg. 289.
[131] Caitlin Campbell & K. Alan Kronstadt, "Conflict at the China-India Fronteir," *Congressional Research Service,* (June 17, 2020), Pg. 2, IN11425, https://crsreports.congress.gov/product/pdf/IN/IN11425

Figure 6 – Disputed borders – Pakistan, India, and China. Library of Congress. https://www.loc.gov/item/2002626371/

The border is not clearly defined in some areas and there have been many small skirmishes over the past 61 years. Recent incidents include a June 15, 2020, conflict which resulted in a Chinese territorial gain of approximately 40-60 square kilometers and confirmed casualties, the first such conflict since 1975.[132] A report to the U.S. Congress sites several potential reasons for China's role in that specific conflict may include a response to India's revocation of autonomy in Jammu and Kashmir, or perhaps response to India's construction of roads and infrastructure along the border.[133]

[132] Ibid, Pg. 1.
[133] Ibid, Pg. 3.

The India-China conflict along their border has escalated to the most dangerous levels since 2020. Skirmishes along the LAC in late 2022 involved hundreds of military personnel from each side, with both China and India amassing tens of thousands of soldiers in the region.[134] The previously cited 2023 ODNI Annual Threat Assessment reports that, "The expanded military postures by both India and China along the disputed border elevate the risk of armed confrontation between two nuclear powers that might involve direct threats to U.S. persons and interests, and calls for U.S. intervention. Previous standoffs have demonstrated that persistent low-level friction on the Line of Actual Control (LAC) has the potential to escalate quickly.[135] A 2023 report to Congress assesses China is lashing out at India due to its increased cooperation with the U.S. and other allies. India is one of the four nations which makes up the Quadrilateral Security Dialogue, also known as the "Quad."[136] The United States, Japan, and Australia are the other members of the coalition which, "claims a common platform of standing for a rules-based order, protecting freedom of navigation, and promoting democratic values in the region."[137]

The India-China border dispute may not be linked directly to climate change; however, as reported throughout this paper, climate change will affect regional geopolitics, which may drive conflicts not directly related to climate change. This conflict is one that could escalate due to indirect effects of water insecurity in Pakistan. The India-China conflict becomes significant should climate changes force Pakistan to take military action to preserve or recover water

[134] K. Alan Kronstadt & Shayerah I. Akhtar, "India-U.S. Relations: Issues for Congress," *Congressional Research Service,* Pg. 16
[135] Office of the Director of National Intelligence, *Annual Threat Assessment of the U.S. Intelligence Community*, (March 8, 2023), Pg. 34
[136] K. Alan Kronstadt & Shayerah I. Akhtar, "India-U.S. Relations: Issues for Congress," Pg. 16
[137] Emma Chanlett-Avery, K. Alan Kronstadt, and Bruce Vaughn, "The 'Quad'" Cooperation among the United States, Japan, India, and Australia," *Congressional Research Service* (January 30, 2023), IF11678, https://crsreports.congress.gov/product/pdf/IF/IF11678

resources from India. In this scenario, the 2023 ODNI Annual Threat Assessment states, "As temperatures rise and more extreme climate effects manifest, there is a growing risk of conflict over resources associated with water, arable land, and the Arctic."[138] The previous chapter highlighted the longstanding water resource dispute between Pakistan and India. As India continues to develop projects on rivers that supply Pakistan with its water, affecting the quantity of water flowing into Pakistan, the potential exists for a nation desperate to provide life sustaining resources to its citizens to resort to military options to preserve those resources.

In this case, Pakistan could threaten or use military force to coerce India into allowing more water to flow into Pakistan. The risk of an escalation to nuclear options between India and Pakistan cannot be ruled out. As India and Pakistan become involved in a significant military campaign, China's status as an ally to Pakistan could become a factor. Additionally, China could recognize the vulnerability of India and seize on the opportunity to strike India across the LAC. The U.S. could also be drawn in as it's security relationship with India grows through the continued cooperation and development of the previously mentioned Quad. India was also formally identified as a Major Defense Partner (MDP) by the U.S. Congress in 2016.[139] According to U.S. President Biden's administration, U.S. relations with India are, "among the most consequential of the 21st century" and has "reaffirmed the strength of the defense relationship,' and the 'unwavering commitment to India' as an MDP."[140]

As mentioned in the previous chapter, the U.S. finds itself mired in a quandary of strategic issues in this region. On the one hand, the current administration reinforces its

[138] Office of the Director of National Intelligence, *Annual Threat Assessment of the U.S. Intelligence Community*, (March 8, 2023), Pg. 22.
[139] Ibid, Pg. 5.
[140] Ibid, Pg. 5.

cooperative stance with India, while India continues to avoid condemning Russia's actions in Ukraine. Ashley Tellis authored an article for Carnegie Endowment for International Peace and states:

> "Whatever their views on the genesis and the precipitants of the Ukraine war, most Indian strategic elites would admit that their country's diplomatic neutrality ultimately signifies what one Indian scholar has called "a subtle pro-Moscow position." This seems particularly incongruous today because India stands shoulder-to-shoulder with the United States in opposing Chinese assertiveness in the Indo-Pacific while at the same time appearing tolerant of the vastly more egregious Russian belligerence in Europe."[141]

Here again lies another example of the complexity of forecasting future geopolitical and strategic issues. The U.S. will need to decide how far it is willing to trust India as a true partner in defense and military partnership given its stance on Russia's aggressions. How the U.S. resolves the conflicting positions of Indian foreign policy should impact what the geopolitical landscape looks like as the region begins to experience the effects of climate change.

The above scenario has direct strategic and national security implications for the U.S. and its allies. The strategic relationship between Pakistan, India, and China is complex and leads to much speculation over the future of the security climate in the region. All three nations are nuclear weapons states, and each are involved in some level of aggravated dispute with one another. In an article in the Journal for Peace and Nuclear Disarmament, Prakash Menon studies the relationship between the three nations finding, "Nuclear weapons have changed the bilateral character of military confrontations between India, China and Pakistan and supposedly played a

[141] Ashley J. Tellis, "'What Is in Our Interest': India and the Ukraine War," Carnegie Endowment for International Peace, April 25, 2022, https://carnegieendowment.org/2022/04/25/what-is-in-our-interest-india-and-ukraine-war-pub-86961.

role in most of India's major military confrontations with the two countries,"[142] and, "The development of nuclear capabilities by China, India and Pakistan in the last two decades has overlapped with growing geopolitical tensions being experienced by each."[143] Finally, Menon offers, "Though there is acceptance that nuclear wars should not be fought, the interconnectivity of geopolitical frictions, primarily born of China's rise, must be addressed holistically as part of one system."[144] This final statement strikes at the heart of the intent of this paper, to study the relationships between climate change, geopolitics, and defense strategy as an interconnected set of circumstances.

The growing list of complex geopolitical issues involving South Asia must be assessed against a backdrop of failing climate change policies. Deteriorating relationships between three nuclear armed nations is troubling, to say the least. Scholarly work on each of the diplomatic and security relationship between India, Pakistan, the U.S., and China are numerous, but fail to recognize the catalyst role climate change could portray. Insert the effects of unfettered climate change, and the list of geopolitical issues grows even longer, adding tension and pressure on local and state governments. As tensions rise, so does desperation, which can lead to rash decision making, misunderstandings, and mistakes. This paper has provided several reasons for pessimism in efforts to prevent global warming above the proposed 2.0º Celsius ceiling. Recognizing the destabilizing effect climate change will have on the South Asia region may demand a shift in diplomatic approaches to India, Pakistan, and China. Perhaps a more intense effort to aid in the dissolution of border conflicts, and an emphasis on conflict de-escalation to

[142] Prakash Menon, "The China–India–Pakistan Nuclear Trilemma and Accidental War," *Journal for Peace and Nuclear Disarmament* 5, no. 2 (October 13, 2022): 1–19, Pg. 13, https://doi.org/10.1080/25751654.2022.2134726
[143] Ibid, Pg. 9.
[144] Ibid, Pg. 17.

prevent misunderstandings and accidents from growing into something much bigger are in order.[145]

As in the previous section, this paper discovered the complexity in attempting to predict geopolitical issues several decades in the future without first addressing the current issues. The outcome of current geopolitical issues will influence the impact climate change may have on future challenges. While it may be difficult to predict future geopolitical challenges at the micro level in South Asia, several underlying themes will certainly remain in play, including the role of nuclear weapons and China's role as a growing strategic and economic global power. What is clear is climate change's role as a catalyst for future conflict in this region, and the linkage between climate change and strategic and national security issues for the U.S. in the decades ahead.

[145] Ibid, Pg. 17.

PART IV
THE ARCTIC

Chapter 9
Projected Environmental and Physical Impacts

There are few places on the planet where the link between climate change and U.S. strategic and national security issues are as evident as in the Arctic (Figure 7). As international efforts to quell the global warming trend continue to fail, the Arctic region will see some of the most pronounced physical and environmental changes as any other place in the world. While climate change is expected to impact all areas of the planet, the Arctic has benefited from the greatest depth of research, tracking, and observation of any of these places. These changes will lead to geopolitical shifts and challenges to already complex geopolitical issues. As Russia, China, and the U.S. continue to engage in the great power competition of the past decade, changes to the Arctic may impact that competition and set the stage for a transformed security environment.[146]

Reviewing the earlier clarification on the scope of this project, this paper is not intended to debate the existence, or lack thereof, of climate change. For purposes of this research, the assumption is that climate change is occurring and will continue to occur through the remainder of this century. It also assumes efforts to prevent global warming above 2.0º Celsius above pre-industrial levels fail to meet that objective, allowing the planet to experience an assortment of human induced climate changes. Both assumptions are plausible as evidenced by several examples provided in this paper thus far.

[146] Ronald O'Rouke, Laura Comay, John Fritteli, et al., "Changes in the Arctic: Background and Issues for Congress" (Congressional Research Service, July 5, 2023), https://crsreports.congress.gov/product/pdf/R/R41153

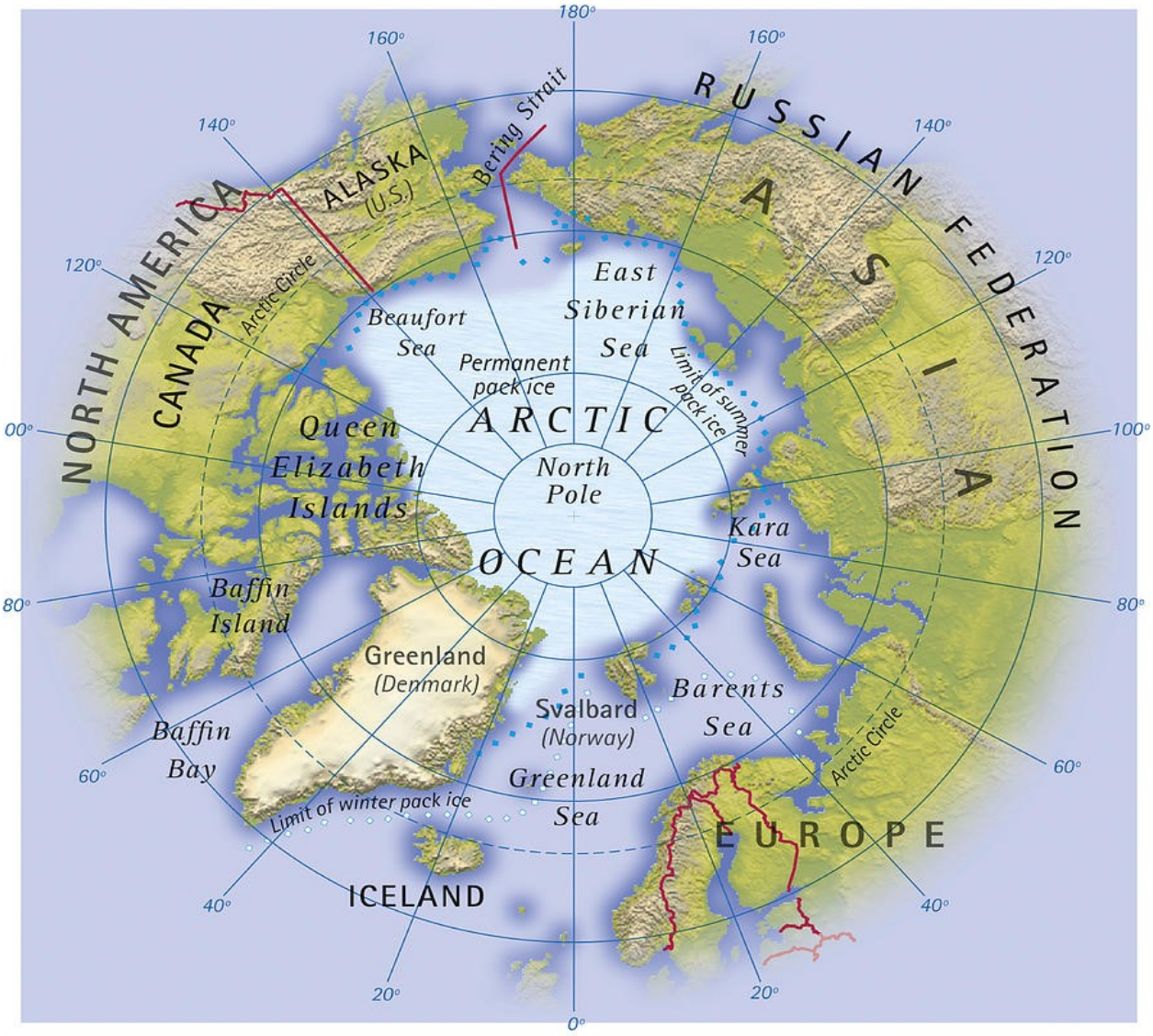

Figure 7 - Digital Illustration of Map Showing Position of Arctic Ocean and Surrounding Continents is a piece of digital artwork by Dorling Kindersley which was uploaded to Pixels.com on May 19th, 2013.

As with the previous two sections of this paper, this section will take a 3-part approach to demonstrating the linkage between climate change and U.S. strategic and national security interests. The first section will review the expected climate change impacts to the Arctic region, followed by an analysis of the geopolitical issues that could result from those changes, and finally the U.S. strategic interests that emerge from the transformed geopolitical changes. In contrast to the early sections, the analysis of the expected climate change impacts in this region

is extensive, as the Arctic has been a focal point of scientific research and exploration for many decades. This paper will merely scratch the surface in its assessment of the changes, as a more in-depth review is certainly worthy of its own study. Just like the other sections, the assumption remains that climate change policies are failing to prevent global warming and changes will occur. Again, as the scientific research in this region is more extensive, so is the evidence that change is occurring.[147]

The Arctic is experiencing climate changes at a much greater pace than other parts of the world. The Arctic Council, the governing body made up of representation from each of the Arctic Nations has implemented a program, the Arctic Monitoring and Assessment Program, to track climate and environmental changes due to global warming. Their bi-annual report provides extensive information on the trends and changes occurring in the Arctic region. According to the Arctic Climate Change Update 2021: Key Trends and Impacts, the near surface air temperature increased three times faster than the global average of the period from 1971 to 2019.[148] Over the period from 1979 to 2019, the level of sea ice in the month of September has decreased by 43% (shown in Figure 8 below), with a decrease in land ice of over 50% over the same reporting period. The report also indicates levels of rainfall and permafrost temperature increased across the same period while the terrestrial snow cover decreased.[149] One of the most visible changes to the region is the levels of land and sea ice.

[147] Ibid, Pg. 14.
[148] Arctic Monitoring & Assessment Programme, "Arctic climate change update 2021: Key trends and impacts summary for policy-makers arctic monitoring and assessment program," May 20, 2021, Pg. 5, https://www.amap.no/documents/download/6759/inline
[149] Ibid, Pg. 5.

A 2023 report to the U.S. Congress highlighted the latest in scientific and research on climate change in the Arctic. The report echoed many of the changes being reported by the Arctic Council, focusing on sea and land ice levels, temperature and precipitation variations, and changes to the near surface permafrost.[150] According to the report, "These changes continue to

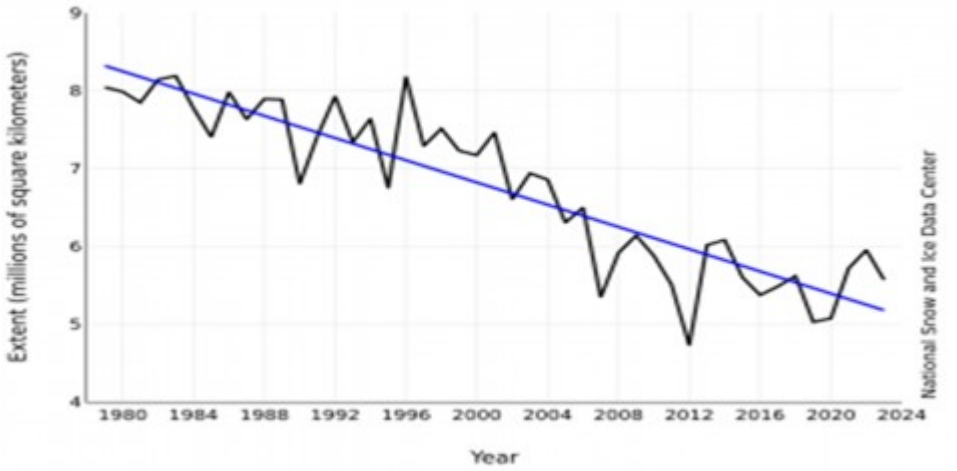

Figure 8 - Monthly September ice extent for 1979 to 2023 shows a decline of 9.9% per decade. Credit: National Snow and Ice Data Center

affect traditional livelihoods and cultures in the region, infrastructure, and the economy, as well as the distribution and health of animal populations and vegetation. The changes raise the risks of pollution, food supply, safety, cultural losses, and national security."[151] The report also acknowledges studies and modeling of future sea ice conditions which could provide transportation through the Northwest Passage and the Northern Sea Route which could lead to "increasing competition and security risks."[152] Referencing the map at the beginning of this section (Figure 7), it is easy to see how a shrinking ice sheet could open shorter maritime routes from Europe to East Asia and across North America to both the Bering Strait and potentially Europe.

[150] Ronald O'Rouke, Laura Comay, John Fritteli, et al., "Changes in the Arctic: Background and Issues for Congress."
[151] Ibid, Pg. 14.
[152] Ibid, Pg. 17.

In his opening remarks before the U.S. House of Representatives Committee on Foreign Affairs, Subcommittee on Europe, Energy, the Environment and Cyber on the National Security Implications of Climate Change in the Arctic, the Honorable William Keating (Massachusetts), chairman of the subcommittee, offered the following, "I believe that the protected access to resources and access to the sea lanes for transit are vital national security interests for the United States and the Arctic. Specifically, the diminishment of Arctic ice and potentially increased maritime access open the door for a race for Arctic resources between the United States and Arctic Council members, like Russia, or observers, importantly like China."[153] Climate change induced thawing and melting of polar ice will provide additional opportunities for shipping and maritime transit across the Arctic. While beneficial to the commercial shipping industry, and perhaps tourism, the governance and security over these new waterways will be complex.

In the same congressional hearing, Dr. Susan Natali, Arctic Program Director at the Woodwell Climate Research Center offered, "From a global climate change perspective, permafrost thaw is critically important because the permafrost region stores a vast amount of carbon. There is roughly twice as much carbon stored in permafrost as is currently contained in the entire Earth's atmosphere."[154] Not only will permafrost melt lead to physical hazards in the region such as damage to building foundations and hazardous conditions for local residents, it could potentially add as much carbon emissions to the atmosphere as a nation as industrialized as the U.S., requiring even stricter climate change policies than are already in place.[155] Additionally, the 2023 Climate Change Synthesis Report issued by the United Nations Intergovernmental

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[153] *Hearing before the Subcommittee on Europe, Energy, the Environment and Cyber,* National Security Implications of Climate Change in the Arctic, 117th Cong., 1st sess., November 16, 2021, https://www.congress.gov/117/chrg/CHRG-117hhrg46092/CHRG-117hhrg46092.pdf
[154] Ibid, Pg. 14.
[155] Ibid, Pg. 14.

Panel on Climate Change assess that permafrost thawing has already contributed to irreversible impacts in the Arctic region.[156] The 2023 Decadal Climate Update provided by the World Meteorological Organization predicts "The Arctic temperature anomaly, relative to the 1991-2020 average, is predicted to be more than three times as large as the global mean anomaly when averaged over the next five northern hemisphere extended winters."[157] Throughout this paper, research has painted a bleak picture of the status of climate change policies to inhibit global warming at the same time there are studies showing even our current policies may not be enough to prevent significant damage to the environment, which sets the stage for future geopolitical change.

The U.S. National Intelligence Council reported in its 2021 National Intelligence Estimate, Climate Change and International Responses Increasing Challenges to US National Security Through 2040 that commercial fishing could increase in the Arctic due to a push of Bering Sea fish into the region due to warming sea temperatures and more accessible fishing grounds.[158] Many climate change affects are detrimental to the region they are occurring, however in this case the northern migration of fish stock that normally reside farther south could benefit the population due to increased opportunity to secure food. On the other hand, as the fish move into the region and become more accessible due to retreating sea ice, competition in the region will increase among the fishing fleets of the various nations attempting to capitalize on

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[156] Intergovermental Panel on Climate Change, "Climate Change 2023 Synthesis Report," *United Nations,* (2023), https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_FullVolume.pdf

[157] World Meteorological Organization, *WMO Global Annual Decadal Climate Update,* (2023), Pg. 2, https://library.wmo.int/viewer/66224/?offset=4#page=1&viewer=picture&o=&n=0&q=

[158] Office of the Director of National Intelligence (ODNI), *Climate Change and International Responses Increasing Challenges to US National Security Through 2040,* (2021), Pg. 8, https://www.dni.gov/files/ODNI/documents/assessments/NIE_Climate_Change_and_National_Security.pdf

the expanded fishing grounds. Additionally, according to the National Intelligence Estimate, this increased commercial fishing activity could "exacerbate regional disputes between Arctic and non-Arctic states over fishing rights."[159] The linkage between climate change and emerging geopolitical issues is demonstrated by this example, where the potential physical changes to the environment coupled with the changes to fish migration could result in an increase in competition over those resources by an assortment of arctic and non-arctic states, such as China, which could lead to increased competition and disputes of territorial rights, potentially leading to an escalation into conflict.

As seen throughout this chapter, evidence suggests there may be a clear linkage between climate change, geopolitics, and national security in the Arctic region. In previous chapters of this paper the linkage was demonstrated in other regions, as climate changes begin to unfold over the next several decades, regional geopolitics will follow suit, leading to emerging strategic and national security challenges in the Arctic. While there appear to be the possibility of many types of physical changes in the Artic, the most significant change that is likely to affect U.S. national security and strategic interest is the expansion of shipping lanes and maritime accessibility. Those specific challenges will be discussed in the following chapters.

[159] Ibid, Pg. 8.

Chapter 10
Geopolitical Transformation

The previous chapter highlighted several physical changes expected to occur to the Arctic should climate change continue unabated. This chapter will take the next step and explore the potential geopolitical changes that could force emerging strategic and national security issues for the U.S. and its allies in the high north. As with the previous sections, the complexity in predicting future strategic threats is based on the realism of current geopolitical issues and their resolution over the next several decades. One of the more significant current geopolitical issues is Russia's invasion of Ukraine and the subsequent degradation of Russia's relationship with the other members of the Arctic Council. How this situation is resolved will influence future geopolitics in the Arctic region. There are also some other general themes that will be the undercurrent of the region and drive geopolitics in the decades to come.

Melting ice sheets, thawing permafrost, and increased deviations in temperature and precipitation is likely to lead to geopolitical changes in the Arctic region. An expansion of accessible shipping lanes and new access to abundant natural resources, estimated to be approximately 22% of the global fossil fuel stores, will drive competition in the region.[160] Russia is an Arctic state and a member of the Arctic Council and will certainly be a consideration in future geopolitics. The Arctic Council is the governing body of the Arctic, made up of representation from each of the Arctic nations, the United States, Russia, Canada, Denmark, Finland, Iceland, Norway, and Sweden as well as representation from regional Indigenous groups. The group's primary mission is to provide the main inter-governmental forum for Arctic affairs. Per the previously agreed upon rotation, Russia became the chair of the Arctic Council in

[160] Peter Hough, "Hotting Up? Geopolitical Rivalry and Environmental Security in the Arctic," *Insight Turkey* 24, no. 2 (July 15, 2022): 11–23, https://doi.org/10.25253/99.2022242.1

2021, but following its invasion of Ukraine in February 2022, the seven remaining Arctic nations decided to suspend further activity of the Arctic Council, in essence ending Arctic cooperation.[161]

Norway assumed the chairmanship of the Arctic Council in the spring of 2023, reigniting the inter-governmental cooperative opportunities for the region. According to the Council, "Norway will focus on the core issues the Council deals with, including impacts of climate change, sustainable development, and efforts to enhance the well-being of people living in the region."[162] The link between climate change and geopolitics is becoming more evident, even taking a high priority role in the Arctic Council's latest list of focus areas. As climate change continues to change the landscape of the Artic, the Arctic Council and other regional groups will not only have to deal with the physical changes, but also the growing competition for resources such as fish and petroleum reserves, access to new shipping lanes, and territorial disputes.

There are a handful of treaties and other cooperative groups such as the Svalbard Treaty, The Central Arctic Ocean fisheries agreement (CAOFA), the International Maritime Organization (IMO), the International Council for the Exploration of the Sea (ICES), and other treaties governed by the Arctic Council, which now must figure out how to deal with an aggressive Russian Federation who has already demonstrated their willingness to violate international law by invading Ukraine.[163] Russia's failure to adhere to the laws established under the legally binding treaties dealing with Arctic security and governance will influence stability in the region. One study published by Cambridge University explored Russia's level of cooperation

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[161] Timo Koivurova & Akiho Shibata, "After Russia's Invasion of Ukraine in 2022: Can We Still Cooperate with Russia in the Arctic?," *Polar Record* 59, no. e12 (2023), Pg. 1, https://doi.org/10.1017/s0032247423000049

[162] Arctic Council "Norway's Chairship, 2023-2025," Arctic Council, n.d., https://arctic-council.org/about/norway-chair-2/

[163] Timo Koivurova & Akiho Shibata, "After Russia's Invasion of Ukraine in 2022: Can We Still Cooperate with Russia in the Arctic?" Pg. 4-5.

with these treaties and agreements since their invasion of Ukraine. The study found that with respect to some of the agreements, such as the IMO Polar Code meetings, Russia still participates, however the relationships among the groups are strained.[164] Cooperation between member nations among these regulatory and governing bodies will continue to be critical to the security of the Arctic region as the climate changes. The treaties, international laws, and regulations governing the Arctic will have to adapt to the changing climate and account for the changes identified in the previous chapter, namely expanded shipping routes and seasons, as well as expanded fisheries. Russia's level of cooperation and adherence to the multiple legally binding agreements will play a role in the type and extent of geopolitical change to the region.

A July 2023 report to the U.S. Congress on the changes to the Arctic highlighted several additional concerns the Arctic nations have in reference to Russia's military actions in Ukraine and reports of Russian military modernization in the Arctic.[165] Additionally, Russia's invasion of Ukraine pushed Finland and Sweden into applying for membership of the North Atlantic Treaty Organization, both of which were approved, making all seven remaining Arctic nations NATO members. Again, the link between these concerns and climate change is focused on the changes to shipping routes and new access to untapped natural resources.

The extent to which Russia is willing to expand its military aggression becomes more complex as maritime transportation throughout the Arctic region becomes more abundant and Russian forces are able to increase their maritime presence in the region. Sanctions targeting the Russian energy sector could push them into expanding efforts into the Arctic region, endangering

[164] Ibid, Pg. 4.
[165] Ronald O'Rouke, Laura Comay, John Fritteli, et al., "Changes in the Arctic: Background and Issues for Congress," Pg. 23.

the environment by increasing the threat of oil spills.[166] With the remaining Arctic nations falling under the NATO umbrella, this could increase tensions in the region, leading to future strategic challenges. These issues will drive future U.S. strategic and national security implications which will be discussed in the next chapter.

Russia is not the only nation adding to the complex geopolitical environment in the Arctic. The July 2023 report to Congress states, "Over the past 10-15 years, China is emerging as a competitor in the Arctic, having gained status as a near Arctic state in 2017 and identifying the Arctic as part of its Belt and Road Initiative (BRI), calling it the Polar Silk Road."[167] China intends to work with Russia to, "both take part in and shape Arctic governance through domestic capacity building as well as bilateral and multilateral diplomacy in the region."[168] China desires an Arctic governance policy which is better suited to non-arctic states, such as themselves.[169] As it stands, the Artic is fully governed by the Arctic states, but China wants to play a role in future Artic policy to justify its existence in the region.

Research conducted for Brookings in April 2021 indicates China has several polar ambitions. According to the article, Chinese President Xi Jinping has stated that, "building China into a 'polar great power' by 2030 is China's top polar goal."[170] The July 2023 report to the U.S. Congress also notes that, "China's increased diplomatic and economic activities in the Arctic,"

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[166] Peter Hough, "Hotting Up? Geopolitical Rivalry and Environmental Security in the Arctic."
[167] Heljar Havnes, "The Polar Silk Road and China's Role in Arctic Governance," *Journal of Infrastructure, Policy and Development* 4, no. 1 (April 13, 2020): 121, https://doi.org/10.24294/jipd.v4i1.1166
[168] Ibid, Pg. 121.
[169] Ibid, Pg. 122.
[170] Rush Doshi, Alexis Dale-Huang, and Gaoqi Zhang, "Northern Expedition: China's Arctic Activities and Ambitions," *Brookings* (Brookings, April 2021), https://www.brookings.edu/articles/northern-expedition-chinas-arctic-activities-and-ambitions/

are a "source of competition and tension."[171] The same report assess that an increase in cooperation between Russia and China since Russia's invasion of Ukraine could impact the level of Chinese activity in the region.[172] Other Chinese activities impacting geopolitics in the Arctic region include an increase in diplomatic activities with several other Arctic nations, increased exploration through the Northern Sea Route, and increased investments in Russia's Arctic oil and gas industry.[173] The increase in diplomatic activities could also yield opportunities for increased cooperation with the Arctic nations, while also leading to challenges for each nation as they may have to work to defend their interests in the region.[174]

China's policy in the Arctic is classified under its maritime strategy due in large part to the importance of the expansion of shipping lanes and extended shipping season. In fact, both "polar regions are viewed as important components of China's maritime ambitions."[175] China has also declared the Arctic as a "strategic new frontier," which groups together the polar regions, the deep sea, outer space, and cyberspace as potential areas for strategic competition.[176] According to a study published in the Journal of Current Chinese Affairs, "Chinese academics portray SNF's [Strategic New Frontiers] as new domains of great power competition over strategic resources, development opportunities and international influence that have emerged because of technological progress, environmental degradation, and climate change."[177] According to this

[171] Ronald O'Rouke, Laura Comay, John Fritteli, et al., "Changes in the Arctic: Background and Issues for Congress," Pg. 20.
[172] Ibid, Pg. 31.
[173] Ibid, Pg. 33.
[174] Ibid, Pg. 34.
[175] Patrik Andersson, "The Arctic as a 'Strategic' and 'Important' Chinese Foreign Policy Interest: Exploring the Role of Labels and Hierarchies in China's Arctic Discourses," *Journal of Current Chinese Affairs*, August 3, 2021, 186810262110186, Pg., 3, https://doi.org/10.1177/18681026211018699
[176] Ibid, Pg, 13.
[177] Ibid, Pg. 17

study, China's foreign policy demonstrates a clear linkage between their strategy in the Arctic and climate change.

There is a great depth of scholarly research focused on China's diplomatic, economic, industrial, and military goals for the Arctic. China's President Xi Jinping's top goal in the Arctic is to be a "great polar power."[178] China's level of interest and involvement in the Arctic is likely to be impacted by climate change as expanding shipping routes and access to natural resources, especially fossil fuels, could motivate China to increase its presence and influence in the Arctic. China's declaration as a near-Arctic state and their concept of the polar silk road clearly indicate its interest in the region.

The geopolitics of the Arctic region are changing as this paper is being written. The expansion of NATO to include Sweden and Finland could lead to new cooperative agreements, Arctic policy, and impact diplomacy in the region. The complexity of the security environment will certainly be affected by the future actions of Russia in Ukraine. In reference to Russia's increase military aggression, the 2023 U.S. National Security Strategy notes, "It's aggressive behavior has raised geopolitical tensions in the Arctic, creating new risks of unintended conflict and hindering cooperation."[179] The growing competition with China and their relationship with Russia will challenge the geopolitical climate over the next several decades. The National Security Strategy also assesses China's activities, "The PRC has also sought to increase its influence in the Arctic by rapidly increasing its Arctic investments, pursuing new scientific activities, and using these scientific engagements to conduct dual-use research with intelligence

[178] Rush Doshi, Alexis Dale-Huang, and Gaoqi Zhang, "Northern Expedition: China's Arctic Activities and Ambitions," *Brookings* (April 2021), https://www.brookings.edu/articles/northern-expedition-chinas-arctic-activities-and-ambitions/.
[179] 2023 U.S. National Security Strategy, Pg. 44.

or military applications."[180] Each of these will feel the impact of climate change, but exactly how depends first on the resolution of the Russia-Ukraine war. All these changes will be reflected in a transformation of the strategic environment for the U.S. and its allies. The next chapter will examine the growing linkage that will emerge from Arctic geopolitical changes and the strategic and national security implications for the U.S. and its Artic allies in the decades to come.

[180] Ibid, Pg. 44.

Chapter 11
Strategic and National Security Challenges

The previous two chapters in this part illustrated the projected physical and geopolitical changes that are expected to occur in the Arctic if global warming continues trending towards a 1.5-2.0º Celsius global increase. Several effects are already being witnessed today and there is an air of pessimism among the scientific community that global leaders will be able to successfully implement measures to prevent further warming. These changes are likely to result in alterations to the geopolitical landscape over the next several decades. Those geopolitical changes will drive a transformation of the U.S. strategic and national security interests in the Arctic region. Strategic challenges from Russia and China will be the primary instigator of U.S. and allied policy for the Arctic region. Those challenges will be explored further in this chapter and will demonstrate the link between climate change and national security transformation.

The Arctic is unique in that it is already experiencing changes that are affecting the geopolitical and strategic environment, however, predicting the future strategic and national security challenges in the decades ahead is still a complex undertaking. As discovered in the previous parts of this paper, many of the future considerations will depend on the resolution of current geopolitical and strategic challenges. As such, Russia's invasion of Ukraine and the subsequent war will have a lasting impact on the geopolitical and strategic challenges in the region, for decades to come. China's strategic impact on the region will depend, among other things, on the status of its relationship with Russia through the course of the Ukrainian conflict and how that relationship evolves over the next several decades. Additionally, as detailed in the last chapter, the Arctic is a priority for China's future maritime strategy.

The projected physical changes for the Arctic are already occurring. The 2021 National Intelligence Estimate on Climate Change and International Responses Increasing Challenges to

U.S. National Security Through 2040 finds, "The reduction in sea ice already is amplifying strategic competition in the Arctic over access to its natural resources."[181] The same report makes the following assessment of the future Arctic security environment:

- We assess that Arctic and non-Arctic states almost certainly will increase their competitive activities as the region becomes more accessible because of global warming temperatures and reduced ice. Competition will be largely economic, but the risk of miscalculation will increase modestly by 2040 as commercial and military activity grows and opportunities are more contested.
- Military activity is likely to increase as Arctic and non-Arctic states seek to protect their investments, exploit new maritime routes, and gain strategic advantages over rivals.
- The increased presence of China and other non-Arctic states very likely will amplify concerns among Arctic states as they perceive a challenge to their respective security and economic interests.
- Contested economic and military activities will increase the risk of miscalculation, and deescalating tensions is likely to require the adaptation of existing or creation of new forums to address bilateral or multilateral security concerns among Artic states.[182]

This assessment recognizes the changing geopolitical environment and highlights several of the key issues that could lead to future conflict and a degradation of the security environment in the Arctic. Looking more specifically at the opportunities for military engagement in the region, the National Intelligence Estimate assess two scenarios that could lead to military conflict in the region, the first being a threat to the Russian supremacy over the Northern Sea Route by non-Arctic states operating in Russian territorial waters, and the second being a buildup of military assets in the region to protect the economic investments belonging to a non-Arctic state such as China.[183]

[181] U.S. 2021 National Intelligence Estimate on Climate Change and International Responses Increasing Challenges to U.S. National Security Through 2040, Pg. 7.
[182] Ibid, Pg. 8.
[183] Ibid, Pg. 16.

In response to the climate change induced geopolitical changes in the Arctic, the 2023 U.S. National Security Strategy states, "We will uphold U.S. security in the region by improving our maritime domain awareness, communications, disaster response capabilities, and icebreaking capacity to prepare for increased international activity in the region."[184] The 2022 U.S. National Defense Strategy states, "The Department will deter threats to the U.S. homeland from and through the Arctic region by improving early warning and ISR capabilities, partnering with Canada to enhance North American Aerospace Defense Command capabilities, and working with Allies and partners to increase shared maritime domain awareness."[185] In some aspects, the U.S. already recognizes the potential changes to the national security environment which will be dictated by changes in the Arctic, specifically through the reduction of Arctic sea ice and the resultant expansion of maritime activity.

The 2022 U.S. National Strategy for the Arctic Region provides the U.S. government's Arctic strategy through 2032. The document recognizes the "dramatic transformation" on-going in the Arctic due to climate change.[186] Other nations, including non-Arctic nations such as China, have recognized the benefits of the Arctic region and its "growing strategic importance," which "has intensified competition to shape its future."[187] The strategy recognizes the impending changes to the Arctic environment and the subsequent geopolitical and national security impacts. The document calls out the destabilizing impact Russia's invasion of Ukraine is having on the region, as well as China's efforts to increase its influence in the region.[188] Analysis of Russian

[184] U.S. 2023 National Security Strategy, Pg. 44.
[185] U.S. 2022 National Defense Strategy, Pg. 16
[186] The White House, "U.S. 2022 National Strategy for the Arctic Region" Pg. 5, https://www.whitehouse.gov/wp-content/uploads/2022/10/National-Strategy-for-the-Arctic-Region.pdf
[187] Ibid, Pg. 6.
[188] Ibid, Pg. 6.

and Chinese involvement in Artic geopolitics is critical to assessing the potential future security threats in the region.

One of the more critical strategic considerations for the Arctic is the future role of the North Atlantic Treaty Organization (NATO) and the benefits of the newly acceded Finland and Sweden to the alliance. It is important for the U.S. and the NATO alliance to recognize the climate induced deteriorating security environment in the Arctic and consider future strategic challenges. Now that Finland and Sweden have joined NATO, all the Arctic states, except for Russia, are now NATO member states. This presents bountiful opportunities for future Arctic defense policy. NATO's Strategic Warfare Development Command recognizes the impact the changes could make on the region, stating, "the High-North also carries new opportunities for cooperation, as NATO continues to ensure the collective security of its members, and preserve the safety and stability of the Arctic region."[189] In addition to the governing body of the Arctic Council, NATO can provide a unified, coordinated, and collaborative political forum for defense issues covering all non-Russian Arctic territory.

As mentioned above, the future strategic and national security implications in the Arctic will depend on the resolution of current issues. Currently there is no single strategy for overall defense of the non-Russian territory in the Arctic. Jim Danoy and Marisol Maddox authored a paper in October 2020 for the Atlantic Council's Scowcroft Center for Strategy and Security where they speak to the failure of NATO to take the necessary steps to keep pace with the emerging threats from Russia and China in the Arctic and develop a long-term strategy stating,

> "These developments suggest the Arctic is likely to be one of the twenty-first century's most contested arenas. Yet, NATO lags significantly behind its global

[189]NATO's Strategic Warfare Development Command, "The Future of the High North - NATO's ACT," NATO's Allied Command Transformation, May 12, 2023, https://www.act.nato.int/article/the-future-of-the-high-north/

> competitors, Russian and China, both of which have quickly recognized the economic and security implications of an increasingly ice-free Arctic and have engaged in a long-term effort to enhance their respective positions there."[190]

The same article also notes, "the absence of an overarching security concept for the Arctic is an obvious and increasingly urgent lacuna for the Alliance."[191] In developing a long-term solution, the article recommends NATO take a lead role in the region, developing a strategy that, "would have military, political, and environmental components and should detail approaches for establishing and maintaining a concept for credible deterrence."[192] An issue brief for The Heritage Foundation also notes that, "Ignoring the importance of the Arctic region for collective security is shortsighted."[193]

The strategic policy community is calling on NATO to build an Arctic Command to provide an overarching defense strategy for the Arctic. The Georgetown Security Studies Review, the official publication of the Georgetown University Center for Security Studies offers, "A NATO Arctic Command could help to realize and coordinate most of the Arctic countries' strategic and national security goals for the region. Their resources could be pooled and utilized in a more cohesive manner similar to other NATO commands such as the Joint Forces Commands in Brunssum or Naples or the Allied Maritime Command."[194] In an article in the

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[190] Jim Danoy & Marisol Maddox, "Set NATO's Sights on the High North," *NATO20/2020*, October 2020, pg. 76, https://www.atlanticcouncil.org/wp-content/uploads/2020/10/NATO-20-2020-Set-NATOs-Sights-on-the-High-North.pdf
[191] Ibid, Pg. 77.
[192] Ibid, Pg. 78.
[193] Luke Coffey & Daniel Kochis, "NATO Summit 2021: The Arctic Can No Longer Be an Afterthought," *The Heritage Foundation - Kathryn and Shelby Cullom Davis Institute for National Security and Foreign Policy*, June 10, 2021, https://www.heritage.org/sites/default/files/2021-06/IB6086.pdf.
[194] Gauti Jonsson, "NATO Needs a Unified Arctic Command," *Georgetown Security Studies Review*, April 10, 2023, https://georgetownsecuritystudiesreview.org/2023/04/10/nato-needs-a-unified-arctic-

Joint Forces Quarterly, Kevin Stringer writes that, "Considering Arctic climate dynamics and increased human activity on polar air, land, and sea routes, the assertion of sovereignty and the need for 'on the surface' situational awareness takes on strategic significance."[195] The uniqueness and complexity of the Arctic environment, both physical and political, demands a level of attention similar to the other domains of air, sea, land, space, and cyber.

In an article published by the Artic Institute's Center for Circumpolar Security Studies, Lee Mottola notes, "By forming a new command, NATO's Arctic Command (ARCCOM), with the purpose of fostering discussion and deterrence in the High North, NATO can demonstrate its commitment to ensuring the region does not become a flashpoint for international conflict."[196] The article also states, "While NATO's current Arctic capabilities are considerable because of its individual member's contributions, it can only stand to gain through increased cooperation and coordination," and "the alliance will benefit from a polar presence emboldened by a powerful, new command focused specifically on NATOs priorities in the Arctic, ARCCOM."[197] The creation of a comprehensive NATO led Arctic alliance would be an effective method to counter the growing threat emerging from Russia and China in the Arctic region. A more in-depth study of the effectiveness and viability of a NATO High North command is warranted, but outside the scope of this paper.

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command/#:~:text=A%20NATO%20Arctic%20Command%20could%20help%20to%20realize, Brunssum%20or%20Naples%20or%20the%20Allied%20Maritime%20Command..

[195] Kevin Stringer, "The Arctic Domain: A Narrow Niche for Joint Special Operations Forces," *Joint Forces Quarterly* 78, no. 2 (July 2015): 24–31, https://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-78/jfq-78_24-31_Stringer.pdf

[196] Lee Mottola, "NATO's Arctic Command: A Case for the Expansion of NATO's Mission in the High North," The Arctic Institute - Center for Circumpolar Security Studies, January 17, 2023, https://www.thearcticinstitute.org/nato-arctic-command-case-expansion-nato-mission-high-north/

[197] Ibid.

The Arctic region is currently experiencing the physical changes associated with climate change. Assuming international climate change policies fail to prevent further global warming, the Arctic will see physical and geographical changes that will impact regional and global geopolitics. Those geopolitical changes will transform the strategic environment and demand changes to U.S. and allied strategic and national security policies. As demonstrated in the previous parts of this paper, the physical effects of climate change are directly linked to U.S. defense and national security concerns. The Arctic's governance by a handful of sovereign nations presents its own set of defense and security challenges, however the expected physical changes expected from climate change will exasperate those challenges. The additional complexity of Russian and Chinese efforts to capitalize on the expanded shipping lanes and season will drive future strategic concerns.

The addition of Sweden and Finland to the NATO alliance will benefit the defensive and security portfolio of the NATO alliance. NATO should recognize the benefits of establishing an Arctic focused strategy, built around an Arctic command which perhaps could absorb the Arctic Council and create a singular body for governance and defense of the region. This of course impacts U.S. defense and national security policy as the U.S. is both an Arctic nation and a major contributor to the NATO mission. The necessity for the NATO transformation is borne directly from the increasing interest in maritime and natural resources shown by Russia and China. Those resources are becoming increasingly accessible due to global warming and climate change and are driving geopolitical change in the region, changes that will ultimately lead to further strategic and national security challenges.

CONCLUSION

There are many factors that will dictate future strategic and national security challenges over the next several decades and through the end of this century. Economics, enduring conflicts, and even the motivations and personality of individual leaders will shape the future geopolitical landscape and threat environment. One contributory element which is increasingly becoming a global priority issue is climate change. There are numerous scientific and sociological studies examining the existence and impacts of climate change. While the scholarly community will often recognize the link between climate change and geopolitics, there is little depth of research on climate change's role in future defense and national security issues. The challenge discovered by the research is the variability of future strategic considerations due to the complexity of the current day geopolitical and strategic environment. While a seemingly obvious observation, the future security environment will largely depend on the resolution of current challenges, however, what this paper uncovered is an undercurrent of general themes which will guide changes in the geopolitical climate and thereby influence future strategic and national security challenges.

Climate change and global warming are key elements of this paper. What this paper does not assess is the hotly contested argument for or against the existence and impact of climate change and the causes. This paper assumes that climate change is real and is occurring at a pace exceeding the capability of current international efforts to prevent further changes. Making that assumption is necessary as it provides an additional element of influence on future defense and strategic challenges. Failing to consider this as a possibility yields an incomplete threat picture for the future.

Again, just as the future strategic environment largely depends on the resolution of current conflicts and geopolitical challenges, it also depends on the success, or lack thereof, of

efforts to prevent further global warming beyond 1.5-2.0º Celsius. Should the international community succeed in reducing global carbon emissions and preventing a climate disaster, then the geopolitical changes discussed in this paper will certainly be altered, thereby changing the future strategic and national security environment. That seems to be less likely to happen as there is an air of pessimism surrounding current climate change prevention efforts.

Chapter 1 of this paper referred to the 2010/2011 Arab Spring crisis, a situation in which the climate may have been a catalyst for geopolitical turmoil and an eventual revolution in Egypt. Applying the elements of a situation like this could provide the foundation for analysis for future climatological impact to geopolitical and strategic interests. Climate change will alter the climate in ways which could exacerbate tension and conflict and result in emerging geopolitical and strategic challenges. This paper applies that fundamental to several regions which expect to experience the effects of climate change to show a direct correlation between climate change and U.S. strategic interests.

The South China Sea is expected to experience numerous impacts from climate change. Sea level rise, changes in sea surface temperature and salinity, increases in extreme temperature and precipitation events, and an altered level of tropical cyclone activity will cause changes to marine life, industry, agriculture, infrastructure, and water and food security among others. Degradation of the fishing and agricultural industries will result in unemployment and economies. With its currently implemented Belt and Road Initiative, China could expand its political and economic influence in the region, pushing U.S. influence out of the South China Sea region. Strategically, this could result in the loss of military resources and accessibility for the U.S. in the region, creating a void in its ability to project power to defend its allies from threats originating from adversaries such as China and North Korea. In this case, climate change

provides an opportunity for China to capitalize on changing geopolitics and expand its sphere of influence in the region, impacting U.S. defense strategy and national security.

Following the section on the South China Sea is an examination of the climate change to defense strategy linkage in South Asia, specifically the disputed Kashmir region between Pakistan and India as well as India and China, all nuclear nations. In this case, global warming will cause an increase in extreme temperature and precipitation events throughout the region, leading to increases in extreme flooding and drought. Additionally, the primary fresh water source for Pakistan comes from rivers which run through India and are supplied by glaciers to the north. Global warming could negatively impact the amount of water supplied by the glaciers. Disputes over the rivers between Pakistan and India have resulted in previous conflicts. India is considering energy and irrigation projects along the rivers that could reduce the quantity of water flowing into Pakistan. Any significant threat to Pakistan's water security could lead to further conflict and if desperate enough, an escalation to nuclear force. China plays a role as an ally of Pakistan and could become involved in any major conflict between the two nations. China and India also share a disputed border and any protracted and complex conflict between India and Pakistan could motivate China to take advantage of the situation and seize additional territory along the border.

The strategic implications for the U.S. and its allies cover multiple threats. Any serious armed conflict between two nuclear nations bears a risk of escalation to nuclear war, which is a humanitarian and environmental disaster for everyone. While India is not a formal ally of the U.S., they are a close economic and trade partner in the region. The U.S. may be pulled into any conflict with India as it could quickly lead to Chinese involvement. In this case, the climate change to national security linkage is demonstrated by climate change's impact on water security

in the South Asia region, which could be the catalyst for significant strategic threats for the U.S. and its allies.

In the final section, the paper explores the current and expected climate change induced physical and geographical changes in the Arctic. Global warming is reducing the sea ice extent throughout the Arctic and thawing the permafrost. The reduction in sea ice is expanding the accessibility to shipping lanes and the length of the shipping season through several critical channels. This provides new access to previously inaccessible natural resources and additional economic opportunities for commercial shipping. These elements combined with an increase in Russia's unlawful invasion of Ukraine has demonstrated its increased military aggressiveness and will lead to a degradation of the security environment in the Arctic. China has also demonstrated an interest in the region and is assessed to be partnering with Russia and their combined intentions and actions in the Arctic are of particular concern. Additionally, with the accession of Finland and Sweden into NATO, all remaining Arctic nations, except Russia, are now NATO nations.

The future actions of Russia and China as they work to capitalize on the climate change induced impacts to the Arctic could lead to a strategic threat to the Alliance. NATO should prepare for this future threat by increasing its prioritization of the Arctic as its own domain, worthy of its own command. Future geopolitical and strategic challenges in the Arctic will also be driven by the events currently taking place in and around the region. Resolution of Russia's ongoing war in Ukraine and NATO's policy decision on the Arctic will drive geopolitical transformation and the emergence of future strategic threats.

Assessing future strategic and national security threats is a daunting task, especially when attempting to predict events several decades away. Current events, enduring conflicts, and

improvements in efforts to reduce greenhouse gas emissions will all play a role in influencing future strategic challenges. What should not be disregarded during future strategic analysis is the impact climate change could have on national security challenges. The U.S. Department of Defense has identified 7 key climate change risks, identified in Figure 2 on page 13, which should be considered in strategic futures analysis. These assessments should drive policy decisions aimed at preventing future strategic threats through diplomatic efforts to guide and influence regional geopolitics. The U.S. government emphasizes efforts to reduce greenhouse gas emissions, reducing pollution, and leading efforts to combat climate change, however, considerations such as increasing investments in local governments and fisheries in the South China Sea, mediating water source disputes between Pakistan and India, and leading change in Arctic defense policy at NATO could be tools of statecraft which alleviate or reduce the level of future strategic threat. By recognizing the linkage between climate change and national security, the U.S. and its allies can take preemptive action to increase strategic stability and ensure the safety and security of future generations.

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