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600 Chennault Circle
Maxwell AFB AL 36112-6010
email: JIPA@au.af.edu

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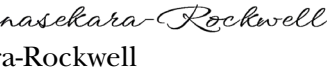
Editor's Note

The complex array of environmental and security challenges facing the Indo-Pacific region were the focus of the 2023 Indo-Pacific Environmental Security Forum (IPESF) held in Colombo, Sri Lanka last August. As the cornerstone event of the US Indo-Pacific Command's Environmental Security Program, the IPESF brought together military leaders, government officials, academics, and civil society members to discuss critical issues related to climate change, resource competition, resilience, and sustainable development across the region.

Inspired by the passionate dialogues and innovative ideas put forth at the conference, this thematic issue of the *Journal of Indo-Pacific Affairs* delves into some of the most pressing environmental and geopolitical dynamics shaping the region. As noted by IPESF co-organizer Chris Sholes, head environment officer with USINDOPACOM, environmental factors can exacerbate instability and conflict by increasing poverty, food insecurity, and migration pressures. These issues often traverse borders, requiring cooperative action. Building on this theme, the articles in this volume analyze environmental justice concerns, climate policy developments, projections for maritime trade and security, food systems, water resource disputes, mineral access, bioterrorism threats, and more from a range of disciplinary lenses.

It is our hope that by illuminating these multifaceted challenges through rigorous scholarship, policy analysis, and security assessments, we can encourage creative solutions and collective leadership to confront interlinked environmental and social crises. We thank the IPESF organizing team and presenters, particularly Chris Sholes, Hannah Thompson, and Admiral Piyal De Silva, for spearheading these critical conversations and influencing the direction of this special issue. Only through sustained dialogue, knowledge exchange, technological innovation and political collaboration can we achieve genuine security and sustainable peace across the Indo-Pacific in the face of unprecedented climate disruption.



—Dr. Achala Gunasekara-Rockwell

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FEATURE

Addressing the Diversity of Water Challenges in the Indo-Pacific

Need for Broad Cooperative Approaches

Dr. Ethan Allen

Abstract

This article examines the diversity of water challenges across the Indo-Pacific region resulting from climate change, geography, population growth, and other factors. It argues that collaborative, cooperative approaches involving both technological/scientific and political/governmental perspectives are needed to address threats to water security and resilience at scales from the individual to the transnational. After outlining key axes along which water challenges manifest, including scale, time, causation, quantity, and quality, examples of internal national and cross-border tensions tied to water are explored. The article then discusses current usage patterns in the agricultural, industrial, and domestic sectors, noting inefficiencies and lack of conservation. It advocates melding scientific and technological means for gathering, storing, distributing water with equitable political agreements among stakeholders that mandate transparent data sharing on water availability and quality. Only through such synergistic blending of science and policy, the article concludes, can solutions prove effective over the long term in the face of climate disruption impacts.

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Clean, fresh water plays a pivotal role in ensuring the survival and well-being of individuals, bolstering the resilience and sustainability of local communities, fortifying national security, and fostering international commerce and stability. Throughout the expansive Indo-Pacific region, climate disruption poses a significant threat to water security at individual, community, national, and international levels, carrying far-reaching implications for political stability, interstate tensions, and US interests.

The diverse landscapes of the Indo-Pacific region present a spectrum of water-related challenges, spanning from individual human security to transnational interactions. These challenges are shaped by the region's varied climatic, environmental, and geopolitical conditions, manifesting along multiple axes. While some challenges stem from natural factors, such as variations in surface and groundwater availability, others are influenced by human activities, including agriculture and industry, and, increasingly, climate and weather patterns. These water challenges can be internal, affecting residents of a single country, or they can contribute to and intensify transnational tensions.

Asia, in particular, faces pronounced water challenges, being home to 60 percent of the world's population yet having less fresh water per capita than any other continent. With freshwater availability at 2.7 m3/person/year— less than half the global average of 5.8 m3/person/year—Asia experiences some of the world's most rapid growth in freshwater withdrawals from rivers, lakes, and aquifers.[1]

Addressing geopolitical water challenges involves a spectrum of approaches, leaning either toward mitigation or adaptation. Such actions should, but unfortunately do not, consistently include collaborations to enhance water conservation and stewardship. Scientific and technological methodologies frequently come into play to tackle water challenges, alongside political negotiations that can occur within a single country or across borders. Given the swift changes induced by climate disruption in the Indo-Pacific and globally, future strategies for addressing water challenges will inevitably require a synergistic blend of innovative technical and scientific solutions, coupled with collaborative political and governmental efforts, to effectively advance water security and resilience.

Axes of Challenges

Water challenges encompass issues related to scale, time, and causative factors, along with concerns about quantity and quality, often addressable through scientific and technological means. These dimensions are interconnected, and multiple factors may be at play simultaneously in a given time or place.

In terms of scale, water challenges span from the individual level, where dehydration and the risk of death are tangible threats in certain areas, to local community levels, where water shortages can lead to illness, migration, and social disruption. These challenges extend to broader regional, national, and transboundary levels, introducing issues such as population migration, social tensions, and conflict. It is noteworthy that challenges at larger group levels carry the same risks as those at more individual levels. Additionally, financial aspects are prevalent across all scales, with the costs of treating, storing, and distributing water often proving unaffordable. Whether charging individual consumers for drinking water or constructing a dam, reservoir, or water treatment plant for a nation, basic economics frequently hinders access to sufficient quantities of suitable quality water for those with limited means.

Water challenges also unfold over a wide time scale. Immediate threats, such as drowning in a flood or succumbing to dehydration after three days without water,

[1] Brahma Chellaney, "Water shortages pose a threat to Asia's peace and stability," *Nekkei Asia,* 11 January 2018, https://asia.nikkei.com/.

pose risks for individuals. Commonly, challenges related to water quantity, like droughts or floods, occur over longer periods of weeks to months. However, climate disruption is accelerating some of these challenges; the emergence of *flash droughts* and the increasing speed of development of tropical cyclones illustrate this shift.[2] Gradual climatic shifts over years to decades can lead to persistent water-related challenges. Similar to challenges of scale, those related to time may have impacts ranging from basic individual health security, through local or regional unrest, to national or transnational resilience and stability.

The underlying *causative factors* contributing to water challenges include climate disruption, land usage, pollution, and economics. The significance of the first factor extends not only across the Indo-Pacific but globally. A prevailing trend of more prolonged and severe droughts interspersed with torrential rainfall seems to be supplanting the traditional, more predictable pattern of consistent wet and dry seasons in numerous regions. Examples such as the 2022 floods that submerged one-third of Pakistan after a severe drought and the 2019 drought that left Chennai, India (a city of nearly 12.5 million people), without water highlight this shift. While neither case escalated into kinetic revolutionary action, the scale of both instances underscores the potential for catastrophic social and/or political impact.

The impact of altered climate on water resource availability cannot be overstated. Warming oceans contribute to intensified tropical storms that generate extraordinary rainfall. Additionally, the increased heat in oceanic waters alters patterns such as the El Niño/La Niña cycle and the Atlantic Meridional Overturning Circulation (AMOC), leading to changes in regional precipitation that can persist over years. Notably, the warming-induced melting of Greenland's glaciers has weakened the AMOC to an estimated thousand-year low; while some view this slowdown as having the potential for global catastrophic impacts, others believe these systems may possess inherent resilience.[3]

Land use patterns influence water availability, with deforestation and desertification altering local water resources, often as direct outcomes of unsustainable rates of tree felling or poor farming practices. Climate change frequently plays a pivotal role in land usage, impacting crop yields and, consequently, local and regional

[2] National Oceanic and Atmospheric Administration, "Flash Drought," *National Integrated Drought Information System*, 2023, https://www.drought.gov/ and Yi Li et al., "Recent increases in tropical cyclone rapid intensification events in global offshore regions," *Nature Communications* 14 (24 August 2023): 5167, https://doi.org/.

[3] Rémy Bonnet et al., "Increased risk of near-term global warming due to a recent AMOC weakening," *Nature Communications* 12 (20 October 2021), 6108, https://www.nature.com/; and Sacha Sinet, Anna S. von der Heydt, and Henk A. Dijkstra, "AMOC Stabilization Under the Interaction With Tipping Polar Ice Sheets," *Geophysical Research Letters* 50 (2023), e2022GL100305, https://doi.org/.

economies over just a few years. Persistent shifts may necessitate significant changes in agricultural practices, leading to social and economic disruption that can strain and destabilize governments, potentially resulting in cascading effects. Pollution, linked to land usage, can directly degrade water quality through discharges into surface drinking water sources or indirectly, such as through aquifer contamination. This degradation can occur immediately, as in the case of chemical spills, or unfold over the long term.

As previously highlighted, economic factors restrict access to clean water, especially in developing countries. The construction of water infrastructure, particularly in rapidly expanding urban centers, is a costly and intricate undertaking. The associated expenses encompass not only providing adequate quantities and quality of water but also the means to dispose of and treat the inevitable wastewater. Neglecting or short-changing either aspect of the process can result in significant health costs.

The considerations of both water quantity and quality are best addressed collectively, as both are integral to any pragmatic approach to drinking water challenges. These aspects are of particular interest, as scientific and technical approaches can often offer at least partial solutions. (It is important to note that both aspects may also be influenced by climate change.) Insufficient water, especially in the form of rainfall, can lead to devastating droughts, while excessive water, particularly in short time frames, results in flooding, one of the most destructive natural disasters.[4] Technology-based solutions, such as drilling wells and damming rivers, are frequently employed to build up water reserves, with the latter also playing critical roles in flood control. Rainwater catchment, utilized since ancient times, continues to evolve with associated technologies. Inducing rainfall, for instance, through cloud seeding with halide salts, has been practiced since the mid–twentieth century, while rain-stimulating technologies involving electrical charges and laser pulses are currently under exploration. These dynamics could directly and negatively impact regional security and geopolitical stability.

Similarly, the quality of available water can be a matter of life or death. If the water designated for consumption contains more than very limited amounts of various contaminants, it is deemed nonpotable, requiring technological approaches ranging from low-tech to high-tech to address quality issues. Pollutants such as simple dirt or suspended matter may be removed through settling or basic filtering. Excess salt, an increasingly common contaminant in coastal regions due to rising sea levels, necessitates more sophisticated methods like reverse osmosis (RO) or

[4] Hannah Ritchie and Pablo Rosado, "Natural Disasters," *Our World in Data*, January 2024, https://ourworldindata.org/.

distillation. Chemicals such as pesticides and herbicides require RO or carbon block filtration, while heavy metals demand specialized decontamination methods like precipitation, cryogel filtration, or treatments based on adsorption, chemicals, electricity, or photocatalysis.[5]

Microbial contamination calls for chemical (e.g., halogens, silver) treatment, RO, distillation, or exposure to sufficiently prolonged and intense heat or ultraviolet radiation. As with other water quality issues, the specific approach employed may depend on the local context. For instance, in many Pacific island situations where municipal water supplies are unreliable or nonexistent, and microbial contamination of stored rainwater is a major challenge for residents, an innovative point-of-use approach emerged around 2012—the Madidrop®, an inexpensive, porous, silver-infused ceramic cake placed in a 5–10-gallon dispenser (topped off each night with untreated catchment water) provides microbe-free water for a year.

Central to the matter of quality, regardless of the water quantity within a state's boundaries or its cleanliness, those fortunate enough to have inherited abundant water resources do not have the right to waste or pollute it. Water is a limited resource; the water molecules we have today are essentially the same as those present on this globe about four billion years ago. Realistically, we cannot create more water, and we all bear a responsibility to exercise stewardship over the water we control.

Indo-Pacific Water Challenges: Internal

Several examples will illustrate the diversity of water challenges in the Indo-Pacific, although they by no means encompass the breadth of water issues within a country's borders.

Climate Change: Ongoing climate disruption is subjecting small Pacific Islands, particularly atolls like Pohnpei, Kosrae, and Majuro, to increasingly prolonged droughts. Dry seasons, once of moderate intensity and predictable length, are now more intense and extended beyond historical norms, compounded by higher temperatures. Atoll islands, highly dependent on rainfall, face devastating consequences, damaging their agro-forest food bases and threatening basic potable water supplies. In some cases, families and communities are forced to evacuate entire islands due to the severity of the impact.[6] (Numerous other climate-change-based water challenges could be cited.)

[5] Naef A. A. Qasem, Ramy H. Mohammed, and Dahiru U. Lawal, "Removal of heavy metal ions from wastewater: a comprehensive and critical review," *npj Clean Water*, 4 (2021), 36, https://doi.org/.

[6] *Republic of the Marshall Islands: Disaster Management Reference Handbook* (Honolulu: Center for Excellence in Disaster Management & Humanitarian Assistance, December 2022), https://www.cfe-dmha.org/.

Natural Contamination: In Bangladesh, the shift to tubewells in the 1970s led to a decrease in waterborne contaminant diseases. However, tubewells currently used by approximately 50 million residents tap into water with significant levels of arsenic, causing arsenicosis and various health issues. Arsenic levels in many areas are sufficient to induce cancer through long-term consumption of low-dose, arsenic-laden water.[7] (Beyond Bangladesh, at least 90 million people from around 50 countries, including Argentina, Chile, China, Hungary, India, Mexico, Nepal, Taiwan, and the United States, are exposed to arsenic through contaminated groundwater, according to World Health Organization.) Various technologies, including coagulation, sedimentation, and others, can remove arsenic from water.[8]

Human-Caused Pollution: China's "economic miracle," lifting millions out of poverty, has come at the cost of its water quality. Half of China's population lacks access to safe drinking water; two-thirds of rural residents rely on tainted water. Between 80 and 90 percent of China's groundwater is unfit for drinking, and half is too polluted for industry or farming.[9] Widespread wastewater discharge by factories into local waterways, enabled by poor environmental regulations, weak enforcement, and/or local corruption, contributes to toxic levels of arsenic, fluorine, and sulfates. China's water pollution is linked to high rates of cancer, and some villages near factory complexes are labeled 'cancer villages' due to elevated cancer and death rates. The World Bank warns of "catastrophic consequences for future generations" due to water pollution in China.[10] Many scientific and technological approaches are available to control water pollution, with on-site treatment or capture being most effective for point sources, though challenging for widely dispersed pollutants like fertilizers and pesticides.

Cross-border Water Tensions and Conflicts

Conflicts over water resources on an international scale have a long history, dating back to at least 2500 BCE.[11] The recognition of the necessity for geopolitical

[7] Sk Akhtar Ahmad, Manzurul Haque Khan, and Mushfiqul Haque, "Arsenic contamination in groundwater in Bangladesh: implications and challenges for healthcare policy," *Risk Management and Healthcare Policy* 11 (2018): 251–61, https://doi.org/.

[8] Sushil R. Kanel et al., "Arsenic Contamination in Groundwater: Geochemical Basis of Treatment Technologies," *ACS Environmental* 3, no. 3 (2023): 135–52, https://doi.org/.

[9] Henry Storey, "Water scarcity challenges China's development model," *The Interpreter*, 29 September 2022, https://www.lowyinstitute.org/.

[10] Carolyn Gibson, "Water Pollution in China Is the Country's Worst Environmental Issue," *Borgen Project*, 10 March 2018, https://borgenproject.org/.

[11] "Water Conflict Chronology," Pacific Institute, 2024, https://www.worldwater.org/.

entities to collaborate on water issues also has deep roots, extending to that same era and is sometimes credited as the subject of the earliest international treaties.[12]

Both conflicts and treaties persist today, with the frequency and persistence of conflicts seemingly outweighing the occurrence of treaties. Similar to the "internal" examples mentioned earlier, the following summaries are not exhaustive but aim to highlight key aspects of cross-border water tensions and attempts at resolution.

One of the most well-known water treaties is the Indus Water Treaty (IWT). Concluded in 1960, after the 1947 partition of India and Pakistan and water suspensions in 1948 (when the East Punjab province of India shut off water to the West Punjab province of Pakistan), and supported by approximately USD 1 billion from the World Bank, the IWT has withstood three wars between India and Pakistan. The IWT established a straightforward, physical division of watersheds, allocating the flow from three eastern tributaries of the Indus (Ravi, Sutluj, and Beas) to India, while the flow from three western tributaries (Indus, Jhelum, and Chenab) goes to Pakistan. The IWT lacks provisions or incentives for collaboration or data sharing. The designated flows may not be interrupted by either side (except for "customary use" and "limited agricultural diversion"), and any violation of the treaty is considered an act of war.[13] Canals built ostensibly for agricultural purposes also have security implications, serving as defensive barriers against invasion, illustrating how water rights agreements can spill over into other sectors. Recently, a renegotiation of the IWT has been proposed, but the process appears complicated, and concrete action has not materialized.[14]

The IWT serves as an illustration of both the strengths and weaknesses inherent in collaborative water agreements. On one hand, it has likely played a pivotal role in preventing kinetic conflict over water. However, as the populations of both nations continue to grow and the demand for water increases, the treaty's failure to address fundamental issues of conservation and data sharing seems likely to undermine its effectiveness. Given the historical hostilities between India and Pakistan and the projected decline of Indus watershed flows due to the shrinking glaciers (attributed to climate change), it is reasonable to question the long-term viability of the IWT.[15]

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[12] United Nations Department of Economic and Social Affairs, "Transboundary waters," International Decade for Action 'WATER FOR LIFE' 2005–2015, n.d., https://www.un.org/.

[13] Daanish Mustafa, "Hydropolitics in Pakistan's Indus Basin," United States Institute of Peace, Special Report 261, November 2010, https://www.usip.org/.

[14] Rahul Mahadeo Lad and Ravindra G. Jaybhaye, "Troubled Waters: India, Pakistan, and the Indus Water Treaty 2.0," *The Diplomat*, 11 April 2023, https://thediplomat.com/.

[15] "Water conflict and cooperation between India and Pakistan," *Climate Diplomacy*, n.d., https://climate-diplomacy.org/.

Equally noteworthy is the Mekong River, which exemplifies both the presence and absence of transboundary water agreements. With its headwaters and approximately one-fifth of its total watershed within its borders, China holds an undeniable upstream advantage over its downstream neighbors—Cambodia, Laos, Thailand, and Vietnam—all dependent on the river's resources. Without consulting or establishing agreements with these neighbors, China has constructed 11 major dams on the upper Mekong, with a combined capacity roughly two-thirds of the Chesapeake Bay. Primarily utilized for hydroelectric power, China restricts flows during the wet season to fill reservoirs, releasing stored water during the dry season. This disrupts the annual monsoon-driven flood pulse under which the Mekong and its ecosystems have evolved for millennia. Consequences include a drastic reduction in the river's fish stocks, a primary food source for many of the 60 million downstream residents, and a significant decline in sediment flow, altering the ecology of the river's delta and affecting agriculture and fisheries. Despite downstream countries forming the Mekong River Commission in 1955 and achieving positive outcomes in resource sharing through agreements, the lack of Chinese engagement limits their options.

The Mekong is a clear example of how the absence of transboundary agreements detrimentally impacts an entire region. Existing data enable close and continuous monitoring of rainfall and ground moisture conditions throughout the river's watershed.[16] Utilizing this data, along with historical figures, reveals the profound and possibly irreparable damage inflicted by China on the river and its dependent communities. The annual flooding-and-drying cycle is disrupted at both extremes, with downstream peak flows below historical norms, limiting natural expansion and 'defusing' annual fish population explosions. During the "dry" season, downstream forests, adapted to a period of drying, remain inundated from water released thousands of miles upstream. The downstream watersheds' ecologies, economies, and societal structures are being devastated. It is not an exaggeration to state that the absence of transboundary water agreements for the Mekong poses a threat to the political stability of Southeast Asia as a whole.

Iran, Afghanistan, and the Helmand River: Originating in the central highlands of Afghanistan, the Helmand River flows southwest, eventually forming part of the border with Iran, including Lake Hamoun and adjacent wetlands. Both the river and the lake have been crucial water sources in the arid region for both coun-

[16] Alan Basist, "Releases from China's Xiaowan Dam Significantly Impact Flow," *Eyes on Earth* (blog), 15 January 2023, https://monitor.mekongwater.org/.

tries, and various agreements and treaties have addressed them since at least 1939.[17] Amid governmental overthrows, dam construction, water diversion from the lake, and the impact of climate change, available water resources along the border have diminished.[18] Accusations of water "weaponization" have surfaced, leading to clashes between Iranian and Afghan forces earlier in 2023, sometimes involving mortar and machine-gun fire.[19] Given the likelihood of increased climate disruption impacting water availability in the upcoming years, urgent political negotiations are essential to avoid further violence.

Here, the weakness of transboundary water agreements becomes glaringly evident. Despite more than 80 years of such pledges, on-the-ground needs for water seem to prevail, with lethal force being employed in conflicts over access to this essential resource.

China, India, and the Brahmaputra River: Originating on the Tibetan plateau, the Brahmaputra River provides China with the "upstream advantage" over India and Bangladesh, through whose territories the downstream portions flow. However, the Chinese-controlled portion of the watershed contributes only a relatively small proportion of the river's flow, with figures of 7 percent and 30 percent commonly cited and debated.[20] China has built ~20 dams on tributaries and the further upstream portions of the Brahmaputra, and both China has constructed approximately 20 dams on tributaries and the further upstream portions of the Brahmaputra. While both China and India have announced plans to build mega-dams near their shared border, they have more often sought to "desecuritize" the issue, "moving of issues off the 'security agenda' and back into the realm of public political discourse and 'normal' political dispute and accommodation."[21] Despite maintaining memoranda on hydrological data sharing, they lack a formal treaty or agreement on water usage.[22] However, especially with deteriorating relationships between the two countries, the river remains a potential flashpoint for conflict.

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[17] Holly Dagres, "Iran and Afghanistan are feuding over the Helmand River. The water wars have no end in sight," *IranSource* (blog), 7 July 2023, https://www.atlanticcouncil.org/.

[18] Ruchi Kumar, "On the Afghanistan-Iran border, climate change fuels a fight over water," *Science*, 4 August 2023, https://www.science.org/.

[19] Jon Gambrell, "Iran, Taliban exchange heavy gunfire in conflict over water rights on Afghan border," *PBS News Hour*, 27 May 2023, https://www.pbs.org/.

[20] Mark Giordano and Anya Wahal, "The Water Wars Myth: India, China and the Brahmaputra," United States Institute of Peace, 8 December 2022, https://www.usip.org/.

[21] Michael C. Williams, "Words, Images, Enemies: Securitization and International Politics," *International Studies Quarterly* 47, no. 4 (2003), 523, https://doi.org/.

[22] Selina Ho, "The China–India Water Dispute: The Potential for Escalation," *Indo-Pacific Perspectives,* June 2021, https://www.airuniversity.af.edu/.

This presents an intriguing case where the absence of a formal transboundary water agreement does not appear to be detrimental and may even contribute to the situation's stability. Both sides have taken precautions to de-escalate potential water conflicts around the Brahmaputra River. Whether this fortuitous state of affairs is due to the lack of any formal covenant or caused by various external factors can be debated. The duration of this peaceful condition is also uncertain.

Even with positive intentions on all sides, establishing international water agreements can be challenging. Case in point: The Teesta River, a Brahmaputra tributary flowing through several Indian provinces before entering Bangladesh, is a vital water source for regional farmers in both countries. Despite repeated negotiations and the apparent imminent agreement in 2011, where Bangladesh's Prime Minister Sheikh Hasina and India's former Prime Minister Manmohan Singh were set to sign, West Bengal (India) Chief Minister Mamta Banerjee refused to sign at the last minute, citing concerns for West Bengal's farmers.[23] Despite ongoing efforts since then and the signing of other agreements on nearby transboundary rivers, no further progress has been made in advancing Teesta cooperation.

In these examples, a range of issues with transboundary water agreements becomes apparent. While they may have real value, as seen with the IWT, and may be desirable, as evident in the Teesta River negotiations, it is evident that such understandings have limited power. The basic human need for water or larger-scale geopolitical motivations may at times override any such pact. Given (1) the rapid shrinkage of Tibetan glaciers, the ultimate source of most major rivers in south, southeast, and east Asia due to climate change, and (2) the lack of built-in mechanisms in many agreements reflecting this declining dynamic, it is fair to question the efficacy of existing regional transboundary water agreements for the upcoming decades.

Water Usage

While it is both common sense and widely acknowledged that conservation, stewardship, and cooperation must be central themes in virtually any "solution" to water-related challenges, these attributes seem sadly lacking in the utilization and management of fresh water, both in the Indo-Pacific region and globally.

Worldwide and across the Indo-Pacific, approximately 70 percent of fresh water is used for agricultural purposes, primarily irrigation. In countries like India

[23] Seema Guha, "The Failure to Sign Teesta Water-Sharing Pact Remains a Blot in India-Bangladesh Ties," *Outlook India*, 7 February 2023, https://www.outlookindia.com/.

and Pakistan, this figure can exceed 90 percent.[24] Throughout much of the Indo-Pacific, farm irrigation systems often rely on outdated, highly inefficient techniques instead of modern, efficient drip irrigation. The loss of water through evaporation and run-off contributes to needlessly high levels of freshwater consumption.[25] Globally, about 60 percent of water used for irrigation is wasted.[26] The sensible conservation practice, supported by technological advances, of using treated wastewater for irrigation is rarely employed. Instead, the continued and excessive pumping of groundwater for irrigation remains common, negatively impacting groundwater levels, especially in areas like the Punjab region, the "breadbasket of India," and contributing to soil salinization in coastal regions.

Clearly, this is an area where the application of scientifically and technologically informed approaches could be of tremendous value. Improved irrigation systems are generally not politically controversial; it is largely an economic matter that hinders their adoption. Small-scale farmers, facing uncertainties related to climate, weather, and market conditions for their products, routinely lack the capital to invest in more efficient irrigation systems, despite the clear advantages that such systems offer.

Manufacturing industries account for the next largest share of global water usage, approximately 17 percent. However, this figure varies widely across Asia, ranging from about 2 percent in heavily agriculturally-based countries like India, Bangladesh, and Myanmar, to 22 percent in China, 29 percent in Malaysia, and 51 percent in highly industrialized Singapore.[27] Globally, industrial water use efficiency increased by 15 percent from 2015 to 2021.[28] As noted earlier, manufacturing can be a significant source of persistent, severe, and challenging-to-eradicate contamination of both surface and groundwater resources.

Domestic water use, accounting for about 12 percent of global consumption, also varies across the Indo-Pacific, depending on countries' economic bases. The differences are less pronounced than in the manufacturing realm. It is noteworthy that the two largest domestic water consumers by quantity, China at nearly 80 billion m3/yr and India at 56 billion m3/yr, use roughly the same amount of water

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[24] Hannah Ritchie and Max Roser, "Water Use and Stress," *Our World in Data*, July 2018, https://ourworldindata.org/.

[25] "Water in Asia and the Pacific: Your Questions Answered," Asian Development Bank, 2024, https://www.adb.org/.

[26] Rob Campbell, "More Food, Less Water: Top 6 Farming Practices to Better Manage Water Use," *foodtank*, March 2013, https://foodtank.com/.

[27] Ritchie and Roser, "Water Use and Stress."

[28] Marta Rica et al., *Progress on Change in Water-use Efficiency* (Rome: United Nations Water, 2021), https://www.unwater.org/.

domestically as the United States, 62 billion m3/yr, despite have populations more than three times as large.[29] This case of water use illustrates the larger issue of global inequities in contributions to climate and environmental disruption.

As demographic trends inexorably increase the population of Asia over the coming decades, water use and the inherent challenges it brings seem certain to increase both within and among nations. How can the region prevent rising tensions from erupting into kinetic conflict, as has been predicted?[30] Clearly, no one-size-fits-all solution exists; as should be evident from the preceding examples, the multiplicity and diversity of factors and situations across the extensive Indo-Pacific region deny any single, simple approach.

Approaches to Possible Solutions

From this brief analysis, we can begin to grasp the complexities involved in addressing water challenges. Approaches to meet these challenges can involve mitigation—such as shifting to more efficient agricultural irrigation technologies to reduce overconsumption of water—and/or adaptation, such as growing crops that require less water in the face of regionally declining rainfall. Both approaches are valuable, and the line between them may be blurred, but the promotion of water conservation and stewardship is a fundamental prerequisite for advancing water security and resilience at all scales.

Technological and scientific advances can be applied to a wide range of water challenges, including the gathering/storing of water resources, efficiency of use, and decontamination. Despite often being useful, and in many cases necessary, sci/tech "solutions" alone are often insufficient to address underlying political and governmental issues. Due to its necessity and limited accessibility, water all too often becomes a political tool or an instrument of power; water decisions are not, in many cases, made with the greatest good for the greatest number of people in mind, nor are they driven by what would be the ecologically sound and environmentally sustainable choice. Instead, water is controlled to serve industrial/economic and/or nationalistic purposes. Such politicization of water access is the reality, and most often the poor and powerless pay the price.

Given its central role in everything from basic human survival to national and international security, it seems peculiar that water is often overlooked in foundational government documents and policies. A notable exception to this can be

[29] Ritchie and Roser, "Water Use and Stress."

[30] David A. Andelman, Benjamin Pauker, and Jackie Simon, "Water Wars?: A Talk with Ismail Serageldin," *World Policy Journal* 26, no. 4 (2009): 25–31, http://www.jstor.org/.

found in the constitution of the State of Hawai'i, where Article XI, Section 7, mandates the creation of "a water resources agency" with broad responsibilities:

> The State has an obligation to protect, control and regulate the use of Hawai'i's water resources for the benefit of its people. The legislature shall provide for a water resources agency which, as provided by law, shall set overall water conservation, quality and use policies; define beneficial and reasonable uses; protect ground and surface water resources, watersheds and natural stream environments; establish criteria for water use priorities while assuring appurtenant rights and existing correlative and riparian uses and establish procedures for regulating all uses of Hawai'i's water resources.[31]

Such a clear, explicit statement acknowledges the central role of clean water in all levels of security and could serve as a model for other jurisdictions to recognize and assign responsibility for water stewardship.

When dealing with larger geopolitical and transboundary water challenges, international water agreements have proven invaluable. Over 3,600 of these agreements have been made during the past two millennia.[32] Yet, nearly half the world's international river basins lack cooperative management agreements that can reduce tensions among neighboring states.[33] While many agreements have doubtlessly helped avert conflict, they routinely have flaws or deficiencies that render them less than entirely successful, as seen in the case of the IWT; these shortcomings become particularly obvious in the face of rapid river flow and aquifer alterations due to climate change and increased population pressures.

While by no means a 'silver bullet,' such accords can help desecuritize water issues, as noted above in the brief description of the China, India, and the Brahmaputra River situation. Such approaches have the potential to resolve, or at least set aside, often long-standing issues tied to politics/nationalism and allow the focus to remain appropriately on clean water as a necessary resource for human health and communities' economic well-being.

Moving forward, the approaches to resolving water challenges should concentrate on synergizing the various aspects that advance water security and resilience for all. In many cases, this will require a blending of scientific/technological perspectives with those of political/governmental entities. Examples of such international

[31] Constitution of the State of Hawai'i, https://lrb.hawaii.gov/.

[32] United Nations Department of Economic and Social Affairs, "Transboundary waters."

[33] National Intelligence Council, "Climate Change and International Responses Increasing Challenges to US National Security through 2040," *National Intelligence Estimate*, 2021, https://www.dni.gov/.

agreements can be found in the International Environmental Agreements Database,[34] the ECOLEX database of international laws,[35] and NASA's Environmental Treaties and Resource Indicators (ENTRI) Datasets and Service.[36]

On the Scientific/Technological Side:

For optimum impact, all such agreements must be grounded in the best available scientific evidence about the water resources involved. Understanding how many people are using how much water, for what purposes, where, and over what time frames is crucial. Historical data should be incorporated into these indicators, as should future modeling that considers the impacts of climate disruption and population shifts. Agreements should stipulate the maximum possible transparent sharing of all relevant data among all stakeholders involved; failure to include such provisions will only lead to suspicions of nefarious motivations.

These agreements must address both the quantity and quality of the water involved, ensuring that parties neither divert nor degrade their water to the extent that it harms their neighbors. This is particularly important and especially challenging for upstream/downstream water sharing. The devastatingly obvious costs of not having such provisions in place are evident across the Mekong basin, highlighting the potential benefits of transparent data sharing.[37]

For the Political/Governmental Aspects:

Agreements must be equitable. They must explicitly recognize the fundamental human need for and right to clean water. At the end of the day, this is where water security matters most. If individuals do not have sufficient, reliable, ready access to adequate quantities of fresh, potable water, water security is absent, and discord and tensions are bound to arise.

At the same time, such agreements must acknowledge the realities of the situation—some locales are more richly endowed with freshwater resources than others. They can and will grow more water-intensive crops, have greater agricultural output, and be more insulated from water shocks (e.g., droughts). Water is a valuable resource, conferring power to its possessors.

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[34] Ronald R. Mitchell, "International Environmental Agreements Database Project," University of Oregon, 2024, https://iea.uoregon.edu/.

[35] "ECOLEX," 2024, https://www.ecolex.org/.

[36] NASA SEDAC, "Environmental Treaties and Resource Indicators (ENTRI) Datasets and Service," 2024, https://www.ciesin.columbia.edu/.

[37] Stimson Center, "Mekong Dam Monitor," 2024, https://www.stimson.org/.

Agreements must involve the full range of stakeholders. While political leaders, water experts, and major economic players (e.g., industries) will contribute, so must the less-advantaged whose voices are all too often ignored. All people, rich and poor alike, are affected by drinking water availability, and all must have a say in water governance. Here, too, maximum transparency is needed to ensure that everyone understands who can access what water at what cost, and who has what responsibilities for cleaning wastes from their water.

Conclusion

In summary, addressing the complex water challenges in the Indo-Pacific region demands a comprehensive and collaborative approach. Scientific and technological advancements, coupled with political and governmental perspectives, are indispensable in navigating the intricate landscape of water security. While the scientific community provides crucial insights, political and governmental entities play a pivotal role in implementing effective policies and agreements.

The case studies presented underscore the significance of international water agreements and the need for equitable, transparent, and inclusive solutions. Water security goes beyond mere resource availability; it is intricately linked to human rights, geopolitical dynamics, and environmental sustainability.

The Indo-Pacific's diverse water challenges require a nuanced understanding that transcends borders and engages all stakeholders. The melding of scientific knowledge with political realities is not just a necessity; it is the cornerstone for developing resilient, adaptive, and enduring solutions. As we navigate a future marked by climate change, population growth, and geopolitical shifts, fostering collaboration between science and governance becomes imperative for ensuring the sustainable management of water resources and securing a better future for the entire region. ✪

Dr. Ethan Allen

Dr. Allen is a leading educator and advocate for water security and STEM education. Currently a professor with the Daniel K. Inouye Asia-Pacific Center for Security Studies, he has a rich background, overseeing STEM programs in Pacific islands, leading National Science Foundation initiatives, and co-authoring the handbook *Water for Life*. With a biology degree and a doctorate in neuroscience, Dr. Allen's impactful career spans diverse roles, from directing science education programs to hosting the "Likable Science" TV show, promoting science accessibility. His commitment to community resilience is evident in his contributions to water science education and collaborative impact projects.

FEATURE

Democratic Deficiencies and the Price of Security

Diplomacy, Environmental Justice, and Genuine Security for Guam and the Mariana Islands

Dr. Sylvia C. Frain
Kieren Rudge
Nathan A. Tilton

Abstract

This article provides an interdisciplinary analysis of the interconnected challenges stemming from military deterrence strategies in the Indo-Pacific region, with a specific emphasis on their health and environmental impacts. The focus is on illuminating how military actions in the Western Pacific and South China Sea not only influence geopolitical stability but also carry profound implications for disabled veterans and Indigenous communities. Employing a diverse methodology that integrates federal documents, local news sources, scholarly literature, and fieldwork on Guam, this article utilizes the principles of procedural justice and genuine security as frameworks to comprehend the historical complexities and contemporary challenges in the non-self-governing Mariana Islands. Recommendations are put forth for inclusive dialogue and proactive policy changes that respect the voices and well-being of those most affected. This article serves as a clarion call for a paradigm shift in our approaches to security and justice, especially in contexts where military, health, and environmental concerns intersect.

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The Indo-Pacific region stands as a fulcrum of global geopolitics, witnessing a power struggle between superpowers such as the United States and China for influence and control. The strategic importance of this area, which encompasses vital sea routes and burgeoning economies, necessitates the implementation of various military deterrence strategies. While these strategies aim to maintain a geopolitical balance, their impacts often extend beyond the realm of international politics, raising pressing concerns about the health and well-being of disabled veterans and Indigenous communities connected to these contested spaces.[1]

[1] Tiara R. Na'puti and Sylvia C. Frain, "Indigenous Environmental Perspectives: Challenging the Oceanic Security State," *Security Dialogue* 54, no. 2 (2023): 115–36, https://doi.org/.

Through a critical lens, this article provides perspectives on democratic deficiencies and sovereignty limitations faced by two non-self-governing territories: Guam and the Commonwealth of the Northern Mariana Islands (CNMI). Situated within the US Indo-Pacific Command (USINDOPACOM), these communities continually navigate around and within US geopolitical maneuvers and Department of Defense (DOD) military construction projects. The case studies presented here are deeply relevant both to the local communities impacted by militarization in the locations and as examples of how processes are being felt elsewhere, such as in Okinawa, the Philippines, and Hawai'i.

Focusing on the everyday lived experiences of the people of the Mariana Islands, we highlight areas of concern regarding sovereignty, environmental impacts, and veterans' needs. Drawing from local news publications, interdisciplinary academic journal articles, government-created reports, military documents, as well as our lived experiences on Guam from 2023, we emphasize the imperative to understand the historical context in which military matters are decided and implemented in the region, with a specific focus on the island of Guam.

We highlight inconsistencies in the 2022 Indo-Pacific Strategy of the United States, which emphasizes a commitment to an Indo-Pacific region characterized by freedom, openness, connectivity, prosperity, security, and resilience. While the approach to accountable democratic governance deserves applause, and the statement supporting "Indo-Pacific governments' capacity to make independent political choices" merits celebration, the reality for the communities in the Mariana Islands differs significantly. The political context surrounding military construction unveils a complex culture with a lengthy history. Residents on Guam align with the Strategy that the US endorses, advocating for governments to "make their own sovereign choices, consistent with their obligations under international law."[2]

We conclude with policy recommendations for the United States, as the community persistently calls for procedural justice, genuine security, and fulfillment of veterans' requests. US federal government efforts must intensify to address the lack of representative democracy for the residents, broaden national security concerns to encompass genuine security, and acknowledge the contributions of island regional communities to preparing the US for war. Lastly, the US citizens of the Mariana Islands are serving in the US Armed Forces at the highest rates per capita and are owed veteran health care that is culturally appropriate and readily accessible.

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[2] *Indo-Pacific Strategy of the United States* (Washington, DC: The White House, February 2022), https://www.whitehouse.gov/.

A Strategic Location

Situated 900 miles north of the equator in the Western Pacific, Guam and the 14 islands to the north, politically organized as the CNMI, have played a central role for seafarers, conquistadors, Imperial Japanese marshal admirals, fleet admirals, and sailboat captains for nearly 4,000 years. Located approximately 2,000 nautical miles east of the Philippines, the Mariana Islands offer crucial resources, with land and fresh water being paramount in the vast Oceania region.

Figure 1. Andersen Air Force Base, the forward edge of the Indo-Pacific, as seen from the daily United Airlines commercial flight from Guam to Saipan in the Commonwealth of the Northern Mariana Islands. (Photo by Sylvia C. Frain.)

Guam is referred to as a *lynchpin* for US military strategy.[3] Today, Andersen Air Force Base (AAFB) on Guam boasts the greatest fuel storage capacity in the US Air Force, standing at 66 million gallons. Airmen refer to Guam as "the gas station

[3] Phill Leon Guerrero, "Underwood: Pelosi's Taiwan trip, after Guam stop, show island is 'lynchpin' for US military," *Guam Daily Post*, 2 August 2023, https://www.postguam.com/.

of the Pacific."[4] However, AAFB is not just an "unsinkable aircraft carrier";[5] it sits above the largest freshwater source on the island, the Northern Lens Aquifer. Moreover, AAFB is not just the "Forward Edge of the Indo-Pacific";[6] it occupies land controversially transferred between the US federal government agencies instead of returned to the original landowners pre–World War II (WWII).[7]

The US military history in the Mariana Islands is often presented through WWII successes, yet the tensions of military control over the lands, seas, and people persist and are more recent. Guam remained under the US Naval security clearance program, granting the Navy wartime authority to deny entry to civilian visitors for security reasons until 21 August 1962. Pres. John F. Kennedy signed an executive order rescinding the Secretary of the Navy's power to restrict entry to Guam, based on the 1941 Executive Order 8683 from Pres. Franklin D. Roosevelt, which established the Guam Island Naval Defensive Sea Area and Guam Island Airspace Reservation.[8]

Following the lifting of military control over civilians and the island of Guam, the US Congress passed the Elective Governor Act in September 1968. This act shifted direct control of Guam's government away from the US Department of the Interior and into the hands of local leaders who had long advocated "to break the colonial-style power of our executive branch."[9] The late 1960s witnessed a significant increase in economic development while moving toward enhanced political freedom.

Presently, the locally elected Governor of Guam, Lourdes "Lou" Leon Guerrero, operates within a limited political arrangement. Invited by the Defense Leadership Forum to be the keynote presenter for the 2023 Pacific Defense Conference, she confirmed the importance of Guam's location in her opening remarks. She reiterated that there is "no denying that Guam is arguably the most consequential territory within the Indo-Pacific for national security and missile defense, and

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[4] Abraham Mahshie, "Pacific Refueling," *Air & Space Forces Magazine*, 29 August 2022, https://www.airandspaceforces.com/.

[5] Arthur Webb, "An unsinkable aircraft carrier: Andersen as a wartime platform is key to security and deterrence in the Pacific region," *Andersen Air Force Base*, 20 July 2007, https://www.andersen.af.mil/.

[6] Kenneth Gofigan Kuper, "Understanding the Political Anatomy of the 'Forward Edge': The Case of Guam," *Asia Pacific Bulletin*, 29 June 2022, https://www.eastwestcenter.org/.

[7] Mike T. Carson, ed., *Lina'la'a: Portraits of Life at Litekyan* (Mangilao, Guam: Richard F. Taitano Micronesian Area Research Center, University of Guam Press, 2018), https://www.uog.edu/.

[8] Frank Quimby, "Security Clearance on Guam," *Guampedia*, 12 April 2023, https://www.guampedia.com/. Also see, Scott W. Barrett and Walter S. Ferenz, "Peacetime Martial Law on Guam," *California Law Review* 48, no. 1 (March 1960): 1–30, https://www.jstor.org/.

[9] Mary C. Torres, "Elected governor was important step for Guam government," *Pacific Daily News*, 3 May 2018, https://www.guampdn.com/.

medical services are essential to that security."[10] She seized the opportunity to emphasize the importance of medical services owed to US veterans on the island and accessible to US citizens who call Guam home. Through her speech, she provided insight into expanding the concept of security to *genuine security*. While the location is undoubtedly crucial, the United States has obligations to its citizens and veteran residents, who have the right to consent to what happens to their island.

Billions of dollars in military construction projects continue despite well-founded community concerns regarding the lack of political decision-making power and control over lands and freshwater resources, with ongoing and unremedied detrimental environmental impacts.[11] Furthermore, remaining on the periphery and often excluded from US federal social programs, health impacts—including compensation for nuclear testing, Agent Orange, and the lack of services offered to veterans—reflect neglect and unfulfilled previous promises.[12]

Below, we briefly highlight one element of the increased military presence in the Pacific region and the specific impacts on Guam concerning one individual DOD project. Presently, an extremely expensive Marine Corps relocation and the controversial Live-Firing Range Complex at the not preferred location are unfolding.

The current military expansion on Guam represents the largest peacetime military construction since WWII. The DOD's Future Years Defense Program (FYDP) includes USD 7.3 billion in military construction from FY2024 through FY2028. The Marine Corps is relocating 5,000 Marines currently stationed in Okinawa, Japan, to a new Marine Corps Base on Guam that opened in 2020.[13] The Missile Defense Agency is planning an additional USD 1.7 billion to implement an integrated missile defense system on Guam.

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[10] John O'Connor, "Governor returns from Hawaii summit," *Guam Daily Post*, 23 October 2023, https://www.postguam.com/.

[11] Ryan Thomson and Tameka Samuels-Jones, "Toxic Colonialism in the Territorial Isles—A Geospatial Analysis of Environmental Crime Across U.S. Territorial Islands 2013–2017," *International Journal of Offender Therapy and Comparative Criminology* 66, no. 4 (2022) 470–91, https://doi.org/.

[12] Robert N. Celestial "Nuclear Fallout/Nuclear Decontamination of Naval Vessels on Guam," *Teaching Ethics* 3, no. 2 (2003): 83–87, https://doi.org/; and "Appendix C: Radioactivity in Guam After Nuclear-Weapons Testing in the Pacific," in *Assessment of the Scientific Information for the Radiation Exposure Screening and Education Program*, ed. Robert A. Frosch and William J. Schull (Washington, DC: The National Academies Press, 2005), https://nap.nationalacademies.org/.

[13] Andrew Tilghman, *Guam: Defense Infrastructure and Readiness*, R47643, (Washington, DC: Congressional Research Service, 3 August 2023), https://sgp.fas.org/.

Relocation of the III Marine Expeditionary Force from Okinawa to Guam

The 2009 *Implementation of the Relocation of the III Marine Expeditionary Force Personnel and Their Dependents from Okinawa to Guam* was unilaterally signed and agreed upon between the Government of Japan and the Government of the United States of America.[14] This massive shift in military personnel and equipment occurred without any consultation, consent, or even knowledge from the local communities most impacted by the US military presence.

Commencing in the early 2000s, the US and Japan had been negotiating to relocate the Marine Expeditionary Force due to local resistance against the sexual violence committed by servicemembers against the Okinawan community.[15] Members of Guam's local leadership were unaware of these policy decisions and only learned of the military plans through Japanese-speaking newspapers.[16] Even the Governor of Guam's office was not involved nor offered any consulting process or mechanism.

In 2009, the *Draft Environmental Impact Statement (DEIS) for the Guam and Mariana Islands Military Relocation: Relocating Marines from Okinawa, Japan to Guam* was released in nine volumes, 22 chapters at 11,000 pages. Taking more than five years to create, it is the longest in US history, with the community and local agencies granted only 45 days to submit their comments. The DOD is required to hold these events and collect comments due to the National Environmental Policy Act (NEPA); however, the policy does not contain any binding language.

The community expressed their outrage about the project verbally at the public scoping hearings administered by the DOD. People were also requested to submit their written comments into white trash cans. The number of comments in opposition was extraordinary in DOD history, with more than 10,000 written comments submitted, second only to the 30,000 produced by residents in the CNMI in 2015.[17]

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[14] "Signing of the Agreement between the Government of Japan and the Government of the United States of America concerning the Implementation of the Relocation of the III Marine Expeditionary Force Personnel and Their Dependents from Okinawa to Guam" (press release, Ministry of Foreign Affairs of Japan, 17 February 2009), https://www.mofa.go.jp/; and Takahashi Kosuke, "Japan's Persistent 'Ameriphobia'," *The Diplomat*, 18 May 2012, http://thediplomat.com/.

[15] Kozue Akibayashi and Suzuyo Takazato, "Okinawa: Women's Struggle for Demilitarization," in *The Bases of Empire: The Global Struggle against U.S. Military Posts*, ed. Catherine Lutz (New York: New York University Press, 2009), 243–69, http://www.jstor.org/.

[16] Lisa Linda Natividad et al., "Fanhita 2023 Day 3: Security, Sovereignty, and the Path to Peace, Panel; The New Missile Age–Centering Guam's Genuine Security," Commission of Decolonization, *YouTube*, 31 October 2023, https://www.youtube.com/.

[17] Sylvia Frain, "'Make America Secure': Media, militarism, & climate change in the Marianas Archipelago," *Te Koakoa Pacific Journalism Review* 24, no. 2 (2018), 229, https://doi.org/.

In addition, federal agencies also expressed their concern. In February 2010, the US Environmental Protection Agency conducted a mandatory review of the DEIS, giving the document the lowest possible rating: "Unsatisfactory: Inadequate information (EU3)."[18] Even the nonpartisan RAND Corporation's study on "relative costs and strategic benefits" of the relocation found, "Guam is an expensive option, one that comes without proof that the investment would yield improved security. Marines also need training ranges to be ready to operate in these contingencies. Furthermore, if the Navy does not dedicate ships in Guam or close by in the region for those Marines to use for deployments, then Guam becomes more of a garrison than a launching pad for a quick reaction force."[19]

When the final environmental impact study was released, the only planning difference was wastewater treatment, which was spaced out over a longer period. No other community concerns were addressed, despite the 10,000 comments. While the community has used the US Department of Justice process to ensure the DOD follows the NEPA legally, the underlying issue remains— Guam's status as a non-self-governing territory. Even US federal legal frameworks are limited, and successful lawsuits only buy time.[20] Further, in international law, this form of *consultation* is not the same as *consent* as Blue Ocean Law outlined this year. Requesting from the United Nations, "we are asking the Committee to remind the United States that its militarization of Guam amounts to a violation of international law," due to the lack of "free, prior and informed consent."[21]

Brigadier General Vicente Tomas "Ben" Garrido Blaz, the first Indigenous Chamorro person from the Mariana Islands to become a general officer in the Marine Corps and a former (non-voting) delegate to the US House of Representatives, raised the issue of the disparities for US citizens in Guam and ongoing injustices. A WWII survivor himself, he wanted to be treated fairly, which guided

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[18] Jared Blumenfeld, regional administrator, US Environmental Protection Agency, to Roger M. Natsuhara, Acting Assistant Secretary of the Navy, letter, subject: EPA comments on the Draft Environmental Impact Statement (DEIS) for the Guam and CNMI Military Relocation, November 2009, 17 February 2010, https://archive.epa.gov/.

[19] Michael J. Lostumbo et al., *Overseas Basing of U.S. Military Forces: An Assessment of Relative Costs and Strategic Benefits* (Santa Monica: RAND Corporation, 2013), https://www.rand.org/; and Michael J. Lostumbo, "Should the U.S. Move the Marines to Guam?," *The Diplomat*, 28 February 2014, http://thediplomat.com/.

[20] Tiara R. Na'puti and Michael Lujan Bevacqua, "Militarization and resistance from Guåhan: Protecting and defending Pågat," *American Quarterly* 67, no. 3, (2015): 837–58, https://doi.org/.

[21] "Blue Ocean Law submits report to UN on US noncompliance with human rights obligations in Guam," *Pacific Daily News*, 3 October 2023. https://www.guampdn.com/. Full report: *Towards Decolonization & Repair: U.S. Territories, Self-Determination, and the Incompatibility of Colonialism and Human Rights* (New York: American Civil Liberties Union, 12 September 2023), https://www.aclu.org/.

his quest for equity and Guam's self-determination.[22] Ironically, instead of honoring his vision for the island and its people, the DOD chose to name the contentious new Marine base after him: Camp Blaz.[23]

Security, Sovereignty, and Democratic Deficiencies

The people, lands, and oceans of the Mariana Islands, along with over a million square miles surrounding them, continue to bear a disproportionate burden for the continental United States. Residents shoulder the weight of being utilized as a preparation location for geopolitical competition, navigating the impact of how the US approaches geopolitical tensions while claiming to promote national security through force.

The 2023 Commission on Decolonization's *Fanhita: Security, Sovereignty and the Path to Peace* conference engaged with the community to discuss Guam's role in geopolitics and its pursuit of sovereignty. [24] On the panel, "The New Missile Age–Centering Guam's Genuine Security," Dr. Kuper began by explaining traditional security ideologies, where there is a "thing" that must be protected by the US military. In Guam's case, it is, in fact, the *continental* United States that faces potential "threats."

The US military assumes responsibility for safeguarding this *thing* against *threats*, accomplished through security forces. Guam functions as merely a component of a broader plan—a staging location for the security response. The presence of the United States in Guam is exclusively for US security interests, not local Guam security. The United States prioritizes its own interests and utilizes Guam as needed to protect the mainland rather than ensuring the protection of Guam and its US citizens. Kuper concluded that what is "good for US security is not always good for Guam security—it is not zero-sum nor does security trickle down."[25] The panelists did share that representatives from Joint Region Marianas were invited to participate, contribute to the conversation, and respond to questions; however, no DOD personnel arrived to present.

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[22] Dana Williams and Manny Cruz, "Ben Blaz's generation 'set out on a quest to achieve our self-determination as people,'" *Pacific Daily News*, 11 November 2018, https://www.guampdn.com/.

[23] Irene Loewenson, "Marine Corps officially opens Guam base, with an eye toward China," *Marine Corps Times,* 29 January 2023, https://www.marinecorpstimes.com/.

[24] Natividad, Kuper, and Bettis, "Fanhita Day 3."

[25] Kuper, Bettis, and Underwood, "Strategic Island Thinking FORUM."

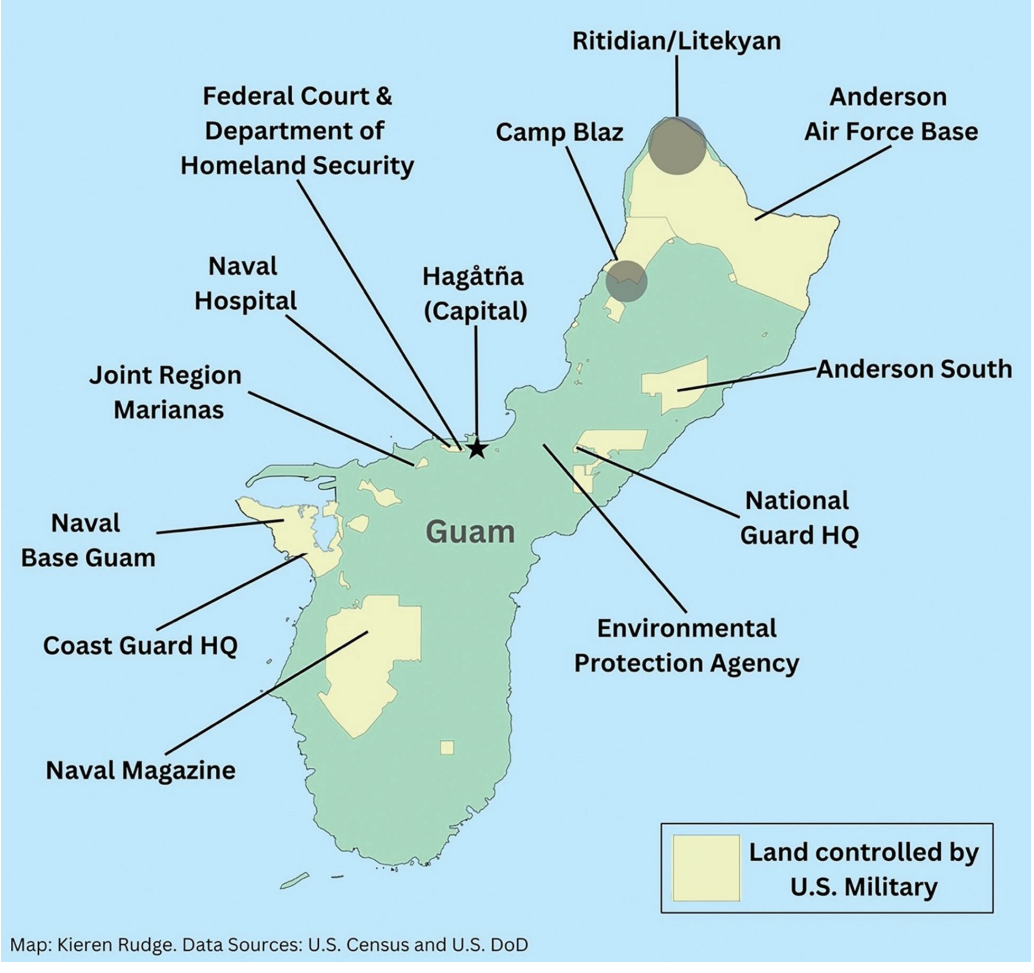

Figure 2. Map of Guam including land controlled by US Military and federal agencies. (Map created by Kieren Rudge, 2023.)

US allies in Japan and South Korea have the decision to fight and join US forces, along with a framework for engagement through Status of Force Agreements (SOFA). These agreements are negotiated, but since Guam lacks sovereignty and is considered "US soil," there is no SOFA, and even the US Constitution does not fully apply given Guam's status as an unincorporated territory. True representative democracy does not exist in Guam, significantly impacting its local security.[26] The Governor of Guam recently conveyed to the United Nations that "the military buildup and increasing military activity will impact the environment, culture, so-

[26] Natividad et al., "Fanhita Day 3."

ciety and economy on Guam. But the freely associated states of Micronesia and representatives from the US all have more say in how military activity in the region proceeds than Guam does."[27]

Throughout history, military strategic considerations have consistently been cited as a reason against local sovereignty, and efforts of self-determination are perceived as anti-American and antimilitary. Simultaneously, military construction continues, and recruitment into the Armed Forces is at the highest rate anywhere in the United States. The perception is that the United States recruits individuals to fight for freedom and democracy elsewhere, but upon returning to Guam, they can no longer vote for the commander in chief or receive full veterans' benefits.[28]

This duality as a democratic deficiency encompasses limitations at the international level, with no control over foreign policy—depriving the people of Guam of a say in "our international destiny, to live and thrive to our fullest extent."[29] Guam's local leaders are excluded from crucial policy decisions that directly and often destructively impact the island communities. Despite being US citizens, there is no representation in the US democratic system.[30] With these sovereignty limitations, it is asserted that "Democracy does not live here."[31]

To safeguard continental US national interests through defensive and offensive missile systems, there is an escalation in destructive impacts on the island and its people. The pursuit of guaranteed security and environmental threats in preparing for conflict overlooks the genuine security needs of the community and veterans.

The Duality of the Indo-Pacific Strategy

Guam serves as a refueling stop for airplanes carrying US officials on speaking tours expressing their "ironclad commitment to democracy."[32] The United States assures small island nations in the region that it will intervene if their sovereignty is infringed upon by others. The *Indo-Pacific Strategy of the United States* (2022)

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[27] Joe Taitano II, "Governor to UN: 'Genuine security' far beyond military plans, missile defense," *Pacific Daily News*, 7 October 2023, https://www.guampdn.com/.

[28] Sarah A. Topol, "The America That Americans Forgot," *New York Times Magazine*, 7 July 2023, https://www.nytimes.com/; and Glenna Gordon, "In Guam, the U.S. Military Presence Is in Full View," *New York Times*, 12 July 2023, https://www.nytimes.com/.

[29] Sylvia C. Frain, "(Inter)national legal frameworks in the Marianas Archipelago: The right to self-determination & the National Environmental Policy Act," *Journal of South Pacific Law* (2018), 1–22, https://www.usp.ac.fj/.

[30] Sylvia C. Frain, "How US defence democracy limits political representation in Guam," *Asia & the Pacific Policy Society*, Policy Forum, 21 January 2021, https://www.policyforum.net/.

[31] Natividad et al., "Fanhita Day 3."

[32] Huizhong Wu, "Pelosi tells Taiwan US commitment to democracy is 'ironclad'," *Associated Press*, 4 August 2022, https://apnews.com/.

states, "The United States is committed to an Indo-Pacific that is free and open, connected, prosperous, secure, and resilient" and opposes countries that employ "coercion."[33] However, the situation in Guam highlights a potential inconsistency with these stated goals.

The strategy's emphasis on a "free and open" Indo-Pacific without coercion underscores the importance of allowing island nations and territories (specifically Taiwan) to make sovereign choices. However, leaders in the Pacific region perceive these principles as "unevenly applied" depending on US needs.[34] The global praise for Guam, which lacks sovereignty due to the denial of those same rights by the United States, revolves around the island's strategic significance and geopolitical importance.[35]

The US national security mission, based on freedom and democracy, falls short on Guam and even negatively impacts military families. If the United States were genuinely committed to the Indo-Pacific strategy, efforts would be made, as human rights and international law require, to address these democratic deficiencies and provide genuine security.

Contemporary Security Issues: Genuine Security, Environmental Impacts, and Veterans' Requests

A Target without Bomb Shelters

Instead of fostering a sense of increased security, Guam finds itself as a major target consistently featured in war-game simulations.[36] China is well aware that the United States is poised to launch lethal power from Guam. Instead of prioritizing diplomacy, the DOD is proposing a USD 1.5-billion Enhanced Integrated Air and Missile Defense System.[37] The absence of shelters or comprehensive plans

[33] "Indo-Pacific Strategy of the United States" (fact sheet, The White House, 11 February 2022, https://www.whitehouse.gov/.

[34] April A. Herlevi, ed., *Charting a New Course for the Pacific Islands: Strategic Pathways for U.S.-Micronesia Engagement*, Special Report #104 (Seattle: National Bureau of Asian Research, March 2023), https://www.nbr.org/.

[35] "Indo-Pacific Strategy of the United States" (fact sheet).

[36] Mark F. Cancian, Matthew Cancian, and Eric Heginbotham, *The First Battle of the Next War: Wargaming a Chinese Invasion of Taiwan* (Washington, DC: Center for Strategic & International Studies, 9 January 2023), https://csis-website-prod.s3.amazonaws.com/.

[37] Missile Defense Agency, US Department of Defense, "Enhanced Integrated Air & Missile Defense (EIAMD) System on Guam," 15 July 2023, https://www.mda.mil/.

to manage an attack on Guam raises concerns that the ongoing construction and fortification efforts may, in fact, render the island (and its people) more of a target.[38]

While Taiwan and Japan have established shelter infrastructure and evacuation plans, Guam currently lacks any such provisions. The current advisor for Guam Homeland Security confirms that "there are no bomb shelters on Guam," while the previous advisor, George Charfauros, explained, "It's simply not feasible to have a bomb or fallout shelter as it only takes 14 minutes for a missile to reach Guam from North Korea."[39] This underscores why national security concerns should not solely focus on the continental United States but also address real, immediate threats and the preparations for war. Adopting a genuine security lens that centers on Guam, the next section outlines crucial considerations that must also be considered.

Genuine Security for Guam

The concept of security must undergo expansion and a shift from traditional to genuine. This involves incorporating locally relevant security concerns, encompassing environmental security, including typhoon preparation, climate change adaptation, and access to clean drinking water. It extends to economic security, access to education and employment, as well as food security, and access to affordable housing and a reasonable cost of living.

The Governor of Guam recently conveyed to the United Nations, "Our genuine security extends far beyond considerations of military and defense and encompasses the resilience of critical infrastructure, the mitigation of the ongoing impacts of climate change and the pursuit of regional peace and prosperity."[40] Similarly, the Center for Pacific Security recommends that DOD leadership adopt a different approach to national security, emphasizing genuine security and diplomacy first.[41]

In addition to genuine security, we contend that environmental justice, and specifically procedural justice, must take center stage in this context. *Environmental justice* is described as the achievement of both distributive and procedural forms of justice.[42] *Distributive justice* entails the equitable allocation of both environmen-

[38] Mar-Vic Cagurangan, "Guam fears becoming 'target' over planned $1.5bn US defence system," *The Guardian*, 26 July 2023, https://www.theguardian.com/.

[39] Esther J. C. Aguigui, "Letter: Emergency preparedness with a whole-community approach plans in place," *Pacific Daily News*, 5 October 2023, https://www.guampdn.com/; and Clynt Ridgell, "No fallout shelters on Guam; residents must shelter in place," *Pacific News Center*, 14 August 2017, https://www.pncguam.com/.

[40] Taitano, "Governor to UN."

[41] Pacific Islands Security Center, "About Us."

[42] Kieren Rudge, "Participatory Climate Adaptation Planning in New York City: Analyzing the Role of Community-Based Organizations," *Urban Climate* 40 (December 2021): 101018, https://doi.org/.

tal resources and negative impacts across different communities and within communities. *Procedural justice* involves the implementation of decision-making processes that are fair and inclusive to all impacted participants.[43]

Returning to Governor Leon Guerrero's keynote at the 2023 Pacific Defense Conference, she broadened the approach to security to include health. "Together, we can design and build human health security to support our people of Guam, as well as a steady state of peacetime, contingency and crisis operations. Beyond defense systems hardware, human health security is certainly a strategic attention item for my government, the US Indo-Pacific Command, the Department of Defense, and US Congress," she said.[44]

Environmental Impacts

The *Indo-Pacific Strategy of the United States* continues against countries that are "undermining human rights and international law, including freedom of navigation."[45] Simultaneously, boaters are endeavoring to document the diminishing access to fishing grounds due to the Live-Fire Training Range on the Marine base.[46] Immediate dangers include contamination of freshwater aquifers due to ammunition, the clearing of limestone forests, and the loss of endangered species.[47]

Moreover, the heightened restriction of access to ancestral lands and oceans produces a similar impact to the erasure of cultural knowledge. The environments in the Marianas carry profound significance beyond their strategic value. A future trajectory marked by substantial militarization is likely to jeopardize social-ecological systems that have already endured considerable harm.

Environments of the Marianas

Guam, the largest and southernmost island in the Marianas Archipelago, is part of a chain of islands including Rota, Tinian, Saipan, and Pagan to the North. The majority of freshwater reserves are located in the Northern limestone aquifer,

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[43] David Schlosberg, *Defining Environmental Justice: Theories, Movements, and Nature* (Oxford: Oxford University Press, 2009).

[44] "Governor returns from Pacific Defense Contracting Summit," *Guam Daily Post*, 25 October 2023, https://www.postguam.com/.

[45] "Indo-Pacific Strategy of the United States" (fact sheet).

[46] Joe Taitano II, "Fishers chart danger zone on waters off firing range complex," *Pacific Daily News*, 28 October 2023, https://www.guampdn.com/.

[47] Julian Aguon, "In Guam, even the dead are dying: the US military is building on the graves of our ancestors," *The Guardian*, 16 September 2022, https://www.theguardian.com/.

while the Southern section of Guam contains rivers that runoff into the ocean.[48] Crucial US military installations in the Marianas, such as AAFB and the new Marine Corps Camp Blaz, are situated in the Northern section where vital freshwater reserves lie.

Along the coasts, coral reefs play a crucial role in Guam's ecological health, with barrier reefs encompassing almost the entire island, excluding natural bays and areas dredged for military or industrial purposes.[49] These reefs are instrumental in sustaining thriving and diverse fisheries and coastal ecosystems relied upon by Chamorros and Carolinians for thousands of years. Notably, the reefs across the Marianas boast some of the richest biodiversity in any location within the United States.[50] Coastal strand and mangrove ecosystems are also prevalent throughout the Marianas, contributing to typhoon resilience and the prevention of coastal erosion.[51]

Terrestrially, the Marianas historically harbored significant biodiversity and numerous endemic species found nowhere else in the world. However, many of these species are now critically endangered, including fauna such as the Guam kingfisher, Guam rail (ko'ko'), and Mariana eight-spot butterflies, facing threats from ecosystem destruction and other stressors.[52] The little Mariana fruit bat and bridled white-eye, once prominent in the Marianas, were declared extinct in 2023.[53]

On Guam, Ritidian (also called Litekyan) is home to a limestone forest with deep cultural and ecological significance. This site in Northwest Guam faces significant degradation and land use conversion due to the construction of Camp Blaz. Currently, Ritidian is part of the Guam National Wildlife Refuge, safeguarding 370 acres of coral reefs and 830 acres of limestone forest and other terrestrial environments.[54] The *Serianthes nelsonii* tree species, commonly called the "North-

[48] Kimberly A. Puglise and Ruth Kelty, "NOAA Coral Reef Ecosystem Research Plan" (Washington, DC: National Oceanic and Atmospheric Administration, 2007), https://repository.library.noaa.gov/.

[49] James Evans Maragos, "Impact of Coastal Construction on Coral Reefs in the U.S.-affiliated Pacific Islands," *Coastal Management* 21, no. 4 (January 1993): 235–69, https://doi.org/.

[50] Robert H. Richmond et al., "Aspects of Biology and Ecological Functioning of Coral Reefs in Guam and the Commonwealth of the Northern Mariana Islands," in *Coral Reefs of the USA*, ed. Bernhard M. Riegl and Richard E. Dodge, vol. 1 (Dordrecht: Springer Netherlands, 2008), 719–39, https://link.springer.com/.

[51] Sheldon Plentovich et al., "Coastal Strand and Mangrove Swamps of the Mariana Islands," in *Encyclopedia of the World's Biomes*, ed. Michael I. Goldstein and Dominick A. DellaSala (Amsterdam: Elsevier, 2020), 185–97, https://doi.org/.

[52] *Center For Biological Diversity et al v. U.S. Department of the Navy et al* https://dockets.justia.com/.

[53] Fish and Wildlife Service, Department of the Interior, "Endangered and Threatened Wildlife and Plants; Removal of 21 Species From the List of Endangered and Threatened Wildlife," 17 October 2023, https://www.federalregister.gov/.

[54] Mike T. Carson, "Natural-Cultural Landscape Heritage at Ritidian, Guam," *Journal of Cultural Heritage Management and Sustainable Development* 4, no. 1 (13 May 2014): 35–56, https://doi.org/.

ern Tree" on Guam and "Fire Tree" on Rota, is another endemic species critically threatened by military development.[55] Many of the plant species in Ritidian and across the Marianas are crucial for traditional ecological practices and Indigenous medicine.[56] The relationships shared among the peoples and environments of the Marianas underscore the existence of interrelated social-ecological systems rather than a nature isolated and distinct from the people depending upon it.

Histories of Degradation

All these environments and social-ecological systems have undergone degradation and continue to face threats from processes of development and militarization. The essential environmental systems of freshwater aquifers, coastal ecosystems, and terrestrial ecosystems have all experienced harm throughout the Marianas.

Freshwater systems on islands, like those in the Marianas, are often precarious in the face of rapidly growing populations. Throughout the twentieth and twenty-first centuries, military bases on Guam and associated military activities on Tinian, Saipan, Pagan, Rota, and other islands have led to population increases, placing greater demand on freshwater resources. For instance, from 1970 to 2010, water extracted from the northern Guam aquifer nearly tripled.[57] Additionally, the operation of bases like AAFB exposes freshwater resources on Guam to potential pollution with various harmful chemicals. This was evident in the 1980s when hazardous waste led to the contamination of drinking water in and around AAFB with the carcinogenic trichloroethylene (TCE).[58] This includes polyfluoroalkyl substances (PFAS) in the drinking water and decades of toxins in the waterways.[59]

Similar patterns of contamination have unfolded across coastal areas in the Marianas. A stark instance of chemical exposure dates back to 1962 when the US Coast Guard Long Range Navigation Station on Cocos Island was destroyed by Typhoon Karen, leading to the dispersal of harmful pollutants, including polychlo-

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[55] *Center For Biological Diversity et al v. U.S. Department of the Navy et al.*

[56] Sahena Ferdosh, "Ethnobotanical Review of Selected Medicinal Plants in Guam for the Treatment of Urinary Tract Ailments and Their Pharmacological Properties," *Scientia Pharmaceutica* 91, no. 3 (1 September 2023), 43, https://doi.org/.

[57] Stephen Gingerich, "The Effects of Withdrawals and Drought on Groundwater Availability in the Northern Guam Lens Aquifer, Guam," Scientific Investigations Report 2013-5216 (Washington, DC: Department of the Interior, 2013), https://pubs.usgs.gov/.

[58] US General Accounting Office, *Hazardous Waste: Abandoned Disposal Sites May Be Affecting Guam's Water Supply*, Briefing report to the chairman, Subcommittee on Environment, Energy, and Natural Resources, Committee on Government Operations, House of Representatives (Washington, DC, GAO, 1987), https://www.gao.gov/.

[59] Tom Perkins, "Toxic PFAS from US military bases polluting drinking water, report finds," *The Guardian*, 13 October 2023, https://www.theguardian.com/.

rinated biphenyls (PCB) and heavy metals such as lead and cadmium. Researchers have illustrated that in Merizo Village, adjacent to Cocos Island, significantly higher concentrations of these pollutants persisted for decades, contributing to elevated cancer rates and cancer mortality in this village compared to the rest of Guam.[60] Additionally, disturbingly high concentrations of harmful PCBs, heavy metals, and polycyclic aromatic hydrocarbons (PAH) have been identified in sediments and marine organisms in multiple locations across Guam.[61] Similar heavy metals and organic contaminants have been detected in corals in Tinian due to military activities dating back to WWII.[62] Chemical contamination and unexploded ordinances from WWII and bombing range testing in preceding decades still persist in parts of Tinian and Saipan, both in marine ecosystems and on land.[63]

The erosion of landscapes across the Marianas has long been exacerbated by external factors such as bombing throughout WWII and the presence of persistent invasive species like wild boars. As early as the Spanish colonial period, invasive species were introduced, resulting in the decimation of local populations of birds, trees, and other species.[64] Further deleterious legacies of WWII have manifested through the destruction of cliffsides for strategic outposts, the clearing of beaches for amphibious assault landings, and other processes.[65]

The Marianas are also grappling with diverse impacts from climate change, which is deeply intertwined with militarization. Institutions such as the US military contribute significantly to emissions, and the processes of war and colonialism have consistently both exacerbated climate change and impeded climate change

[60] Robert L. Haddock, Grazyna Badowski, and Renata Bordallo, "Cancer Mortality Following Polychlorinated Biphenyl (PCB) Contamination of a Guam Village," *Hawaii Medical Journal* 70, no. 11 Suppl. 2 (November 2011): 40–42. https://www.ncbi.nlm.nih.gov/.

[61] Gary R. W. Denton et al., *Heavy Metals, PCBs, and PAHs in Marine Organisms from Four Harbor Locations of Guam*, Technical Report 87 (Mangilao: Water and Environmental Research Institute of the Western Pacific, University of Guam, 1999), https://www.weriguam.org/.

[62] David R. Whitall et al., *Chemical Contaminants in Corals (*Pocillopora Damicornis*) in Tinian, CNMI* (Washington, DC: NOAA, September 2016), https://doi.org/.

[63] Jon Mitchell, *Poisoning the Pacific: The US Military's Secret Dumping of Plutonium, Chemical Weapons, and Agent Orange* (Lanham, MD: Rowman & Littlefield, 2020), https://rowman.com/.

[64] Maria Kottermair et al., *Spatio-Temporal Dynamics of Badlands in Southern Guam: A Case Study of Selected Sites*, Technical Report 133 (Mangilao: Water and Environmental Research Institute of the Western Pacific, University of Guam, September 2011), https://weri-cdn.uog.edu/.

[65] National Park Service, "War in the Pacific: Connecting Guam's Natural Resources with Its Culture and History," National Historical Park Guam, 2017, https://www.nps.gov/.

adaptation in a just manner.[66] One climate impact facing the Marianas is increased flooding, which can have catastrophic effects on human life and physical infrastructure. Additionally, akin to other Pacific Islands, coastal resources like coral reefs face threats from warming ocean temperatures, ocean acidification, and storm surges.[67] Furthermore, extreme weather events such as typhoons are intensifying in severity and frequency due to climate change, compounding existing stressors on critical infrastructure.[68] As climate change continues to impact Guam, the CNMI, and other island territories, adaptation processes must be approached in ways that prioritize community engagement and procedural justice.[69]

Impacts of New Construction

The relocation of Marines to Guam, the construction of Camp Blaz, and the establishment of new training ranges on Tinian and Pagan will exert significant impacts on already vulnerable social-ecological systems.[70] Firstly, the influx of military personnel, their families, and support staff required for processes like construction will profoundly affect both built infrastructure and natural resources. For instance, the relocation will escalate demand on Guam's electrical grid, necessitating substantial financial investment and restructuring for effective operation.[71] Furthermore, due to the associated population growth and the need to support military infrastructure, freshwater demand will surge beyond the already high extraction rates.[72]

Native species will face additional challenges, and invasive species may proliferate due to the military relocation. The military's actions have clashed with civilian

[66] Oliver Belcher et al., "Hidden Carbon Costs of the 'Everywhere War': Logistics, Geopolitical Ecology, and the Carbon Boot-print of the US Military," *Transactions of the Institute of British Geographers* 45, no. 1 (March 2020): 65–80. https://doi.org/; and Kieren Rudge, "Leveraging Critical Race Theory to Produce Equitable Climate Change Adaptation," *Nature Climate Change*, 1 June 2023, https://doi.org/.

[67] Zena Grecni et al., *Climate Change in Guam: Indicators and Considerations for Key Sectors* (Honolulu: East-West Center, 9 November 2020), https://doi.org/.

[68] Tiara R. Na'puti, "Disaster Militarism and Indigenous Responses to Super Typhoon Yutu in the Mariana Islands," *Environmental Communication* 16, no. 5 (2022): 612–29, https://doi.org/; and Kieren Rudge, "Local Communities Drive Typhoon Recover and Climate Resilience in Guam," *Pacific Matters for America*, 5 July 2023, https://asiamattersforamerica.org/.

[69] Kieren Rudge, "Changing Climate, Changing Discourse: Analyzing Reporting of Climate Change and Economic Development in the U.S. Virgin Islands," *Climate Risk Management* 33 (2021): 100350, https://doi.org/.

[70] Kieren Rudge, "US Marines Departing Okinawa May Threaten Critical Ecosystems in The Marianas," *Pacific Matters for America*, 15 August 2023, https://asiamattersforamerica.org/.

[71] Tilghman, *Guam*.

[72] Gingerich et al., *Water Resources on Guam*.

government-led conservation programs in the Marianas, as seen with officials at AAFB denying access to conservation managers aiming to mitigate the spread of invasive species.[73] Expanding military land beyond current levels would grant the DOD greater control over the areas where conservationists operate, potentially impeding coordinated environmental protection efforts. Camp Blaz, with a footprint of 4,000 acres (excluding satellite training ranges), poses a direct threat to several endangered species, including the last wild håyun lågu tree on Guam.[74]

A pending lawsuit filed by the Center for Biological Diversity and Prutehi Litekyan/Save Ritidian asserts that the US Department of the Navy has failed to uphold agreements to protect and conserve specific species at risk of extinction due to the construction and operation of Camp Blaz This claim highlights not only environmental harm but also procedural injustices, akin to similar suits like *Tinian Women Association v. U.S. Department of the Navy*, decided in 2020. In that case, the community-based group Tinian Women Association argued that the construction of Camp Blaz and bombing ranges in the CNMI would cause significant harm to natural environments, diminish land and cultural value, expose communities to great risk, and alleged the Navy's violation of the NEPA by not producing an adequate environmental impact statement. The District Court of the Northern Mariana Islands ruled in favor of the Navy but emphasized the need to evaluate the combined impacts of Camp Blaz on Guåhan and the training ranges on Tinian and Pagan, which had been previously segmented in assessments.[75] Moreover, public pressure led the Navy to scale back its plans, focusing mainly on small arms training to minimize environmental and societal impact. Beyond these cases, researchers have demonstrated procedural issues hindering genuine community participation in the environmental impact assessment processes associated with the military relocation to the Marianas.[76]

The environmental consequences of the military relocation to the Marianas are expected to be substantial, although the full extent of the harm remains uncertain. Considering the historical patterns of chronic harm inflicted on social-ecological systems in the Marianas by prolonged military presence during both wartime and peacetime, it is crucial to focus on the careful assessment of environmental impacts. This includes attention to community consultation, empowering communities with

[73] Thomas E. Marler and Aubrey Moore, "Military Threats to Terrestrial Resources Not Restricted to Wartime: A Case Study from Guam," *Journal of Environmental Science and Engineering* 5, no. 9 (2011): 1198–1214, https://www.researchgate.net/.

[74] *Center For Biological Diversity et al v. U.S. Department of the Navy et al.*

[75] *Tinian Women Association v. United States Department of the Navy*, No. 1:16-cv-00022, https://cdn.ca9.uscourts.gov/.

[76] Frain, "'Make America Secure'"; and Na'puti and Bevacqua, "Militarization and Resistance from Guåhan."

greater decision-making authority, recognizing the value of non-human species, and addressing the reproduction of inequities through the siting and operationalization of new military installations.

Veterans Seek Justice and Genuine Security

This section aims to examine the environmental degradation and challenges faced by Indigenous communities within the Marianas and draws parallels to places such as Red Hill, Hawai'i, and Camp LeJeune, North Carolina. Furthermore, it explores these impacts, shedding light on how military actions can result in adverse health conditions, including Gulf War Syndrome and the consequences of Agent Orange, among veterans. By doing so, this section seeks to provide a multidimensional perspective that transcends conventional discussions focused solely on geopolitics or military strategy. We delve into the complex interplay between military activities, disability, and environmental justice, advocating for a more nuanced understanding that considers both genuine security and procedural justice.

The Health Cost of Deterrence: Unpacking the Impact of Military Strategies on Disabled Veterans

Military deterrence strategies in the Indo-Pacific have been an essential component of geopolitical maneuvering for decades. While these tactics aim to maintain regional stability, their health implications for veterans and military-civilian workers—especially those with disabilities—are often sidelined in political discourse. Three particularly salient examples are exposure to Gulf War Syndrome, burn pits, and Agent Orange, each of which has led to debilitating conditions among exposed military and civilian personnel.

Gulf War Syndrome refers to a cluster of medically unexplained chronic symptoms including fatigue, headaches, joint pain, insomnia, respiratory disorders, and others that can affect veterans of the Gulf War.[77] The condition has led to prolonged suffering for veterans, impacting their physical capabilities and mental well-being.

More recently, during Operation Iraqi Freedom, Operation Enduring Freedom, and other operations, burn pits—open-air combustion sites used for waste disposal in military combat zones—have gained attention due to their detrimental health effects.[78] Studies indicate an increase in respiratory issues, rare forms of cancer, and other unexplained illnesses among veterans who were stationed near these

[77] Han K. Kang et al., "Health of US veterans of 1991 Gulf War: a follow-up survey in 10 years," Journal of Occupational and Environmental Medicine51, no. 4 (2009): 401–10, https://doi.org/.

[78] "Military Burn Pits and Cancer Risk," *American Cancer Society*, 25 August 2022, https://www.cancer.org/.

pits.[79] Once again, those who were already disabled face the added burden of these newly acquired health complications, exacerbating their challenges.

Agent Orange, an herbicide deployed extensively during the Vietnam War, has been linked to a range of diseases, including different types of cancer, diabetes, and heart diseases.[80] Although used with the intent of eliminating forest cover for enemy troops, its long-term consequences have been catastrophic for those exposed, many of whom are veterans and civilians now grappling with chronic health issues.

Figure 3. Tarague (Talågi) Beach, restricted access by Andersen Air Force Base, is home to the endangered Marianas crow, Marianas Fruit Bat, and a nesting location for sea turtles. The same location where the US Air Force burns and detonates munitions. (Photo by Sylvia C. Frain.)

In summary, while military deterrence strategies, like those employed in the South China Sea, may be crucial for geopolitical stability, it is imperative to consider their

[79] Tyler C. Smith et al., "New onset and persistent symptoms of post-traumatic stress disorder self-reported after deployment and combat exposures," *BMJ* 336 (February 2008): 366–71, https://doi.org/.

[80] Institute of Medicine, *Veterans and Agent Orange: Health Effects of Herbicides Used in Vietnam* (Washington, DC: National Academies Press, 1994), https://pubmed.ncbi.nlm.nih.gov/.

collateral impact. Currently, the US Air Force submitted a permit renewal application for open burning and open detonation (OB/OD) on Guam—despite the exception and even after federal recognition of the detrimental health impacts.[81]

Veterans, especially those with disabilities, grapple with a myriad of medical conditions directly tied to their service. This prompts ethical questions about the intersection of military practices with disability issues and calls for a more nuanced approach that considers genuine security and procedural justice.

Agent Orange—Disavowed Responsibility and Indigenous Impact

Agent Orange exemplifies the dual challenges faced by Indigenous communities engaged in US military operations. The impact of Agent Orange goes beyond US veterans, affecting Filipino and Chamorro workers exposed to the chemical while working on specific US bases like AAFB on Guam and the former Clark Air Base in the Philippines before, during, and after US military interventions.[82]

While recent developments have allowed these communities to pursue compensation, the US government's reluctance to fully acknowledge the harmful effects of Agent Orange constitutes a denial of procedural justice.[83] This denial not only withholds financial compensation but also denies affected communities the recognition and dignity they deserve.

The reluctance to take responsibility for the use of Agent Orange has broader implications for environmental justice and human rights. The Chamorro and Filipino communities, traditionally stewards of their respective environments, not only face health complications but also witness the degradation of their lands and waters, complicating their historical and cultural connections to these spaces.

In cases like these, there is an urgent need for the application of the principle of genuine security—policies that prioritize and safeguard the lives, dignity, and environments of all affected communities, not just those politically expedient to acknowledge.[84]

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[81] Dan Ross, "Why the Military is Still Allowed to Use Open Burning and Detonation to Destroy Hazardous Waste Explosives in the US," *Newsweek*, 16 May 2017, https://www.newsweek.com/; and "Andersen AAFB's open burn pit for toxic waste raises health concerns," *Pacific Island Times*, 16 September 2021, https://www.pacificislandtimes.com/.

[82] Jeanne Mager Stellman et al., "A Geographic Information System for Characterizing Exposure to Agent Orange and Other Herbicides in Vietnam," *Environmental Health Perspectives* 111, no. 3 (2003): 321–28, https://doi.org/.

[83] Howard Frumkin, "Agent Orange and Cancer: An Overview for Clinicians," *CA: A Cancer Journal for Clinicians* 53, no. 4 (July–August 2003): 245–55, https://doi.org/.

[84] Iris Marion Young, *Justice and the Politics of Difference* (Princeton, NJ: Princeton University Press, 1990).

From Military Bases to Sacred Spaces: Understanding Environmental Challenges in Camp LeJeune and Red Hill

The environmental repercussions of military deterrence extend beyond the impact on veterans. Indigenous communities, frequently marginalized in discussions about military actions, also endure significant consequences. Two illustrative instances are the US military bases at Camp LeJeune and Red Hill.

Camp LeJeune, a US Marine Corps base in North Carolina, gained notoriety for contaminated drinking water that caused severe health issues, including cancer and birth defects. Hazardous chemicals were dumped between 1953 and 1987, contaminating the water supply.[85] Similarly, Red Hill in Hawai'i, serving as an underground fuel storage facility, has experienced leaks, posing a high risk to local water supplies and causing detrimental impacts on Indigenous populations and their lands.

In the Indo-Pacific region, Indigenous communities often reside in areas strategically significant for military activities, resulting in environmental challenges reminiscent of cases like Camp LeJeune and Red Hill. For instance, the Indigenous people of Okinawa have long protested against the presence of US military bases, expressing concerns over pollution and the destruction of sacred lands.[86]

The environmental harm, therefore, functions as a type of *collateral damage*, impacting both the ecosystem and the health of Indigenous communities. These actions hinder genuine security and procedural justice, essentially disenfranchising those who have inhabited these lands for generations. By scrutinizing the environmental challenges posed by military bases and activities, we can gain a deeper understanding of the complex web linking military deterrence, environmental justice, and the well-being of Indigenous communities in the Indo-Pacific region.

Converging Frontlines: The Intersectionality of Military Actions, Disability, and Environmental Justice

The discussion on military deterrence tends to prioritize geopolitical outcomes, often neglecting the human consequences that affect marginalized groups, such as disabled veterans and Indigenous communities.[87]

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[85] Morris L. Maslia et al., "Reconstructing Historical VOC Concentrations in Drinking Water for Epidemiological Studies at a U.S. Military Base: Summary of Results," *Water* 8, no. 10 (2016): 449, https://doi.org/.

[86] Jon Letman, "Poisoning the Pacific: An Interview with Journalist Jon Mitchell," *Inkstick*, 15 October 2020, https://inkstickmedia.com/.

[87] Kimberlé W. Crenshaw, "Demarginalizing the Intersection of Race and Sex," *University of Chicago Legal Forum* (1989): 139–67, https://scholarship.law.columbia.edu/; and J. Ann Tickner, *Gender in International Relations: Feminist Perspectives on Achieving Global Security* (New York: Columbia University Press, 1992).

For disabled veterans, the physical and psychological sacrifices made in the service of national security result in chronic health conditions from military actions, such as exposure to Agent Orange or the impact of burn pits.[88] This ironic twist sees those who fought for their nation grappling with lifelong disabilities and illnesses, often with inadequate medical support.[89]

Simultaneously, Indigenous communities find their ancestral lands targeted for strategic military deployments or subjected to environmental degradation.[90] While they may not engage in military service, their way of life is fundamentally altered, if not threatened, by geopolitical agendas.[91]

This complex scenario calls for a re-examination of procedural justice and genuine security. Procedural justice demands inclusive decision making, wherein all stakeholders, including veterans and Indigenous communities, have a voice.[92] Genuine security expands the traditional notion of national security to encompass human security, recognizing that the well-being of marginalized communities is integral to national and global stability.[93]

Incorporating an intersectional lens allows for a more nuanced understanding of the multifaceted impacts of military deterrence.[94] A paradigm shift that includes the voices and experiences of marginalized communities is not just ethical but necessary for redefining what security means in contemporary society.

Case Study: Guam—A Microcosm of Geopolitical Strains and Environmental Risks

Our fieldwork in Guam represents a significant intersection of military deterrence, environmental justice, and Indigenous sovereignty. The island's strategic location has made it a focal point for US military presence, aligning with broader Indo-Pacific geopolitics.[95] The most pressing issue at hand is the proposed military range over or near Guam's largest freshwater aquifer.

This proposal has faced intense scrutiny, particularly in the wake of similar incidents of military-induced environmental degradation. The recent 2022 and 2023

[88] Institute of Medicine, *Veterans and Agent Orange*; and Smith et al., "New onset and persistent symptoms."
[89] Kang et al., "Health of US veterans of 1991 Gulf War."
[90] Mitchell, *Poisoning the Pacific*.
[91] Maslia, et al.
[92] Young.
[93] Paris, R. 2001. "Human Security: Paradigm Shift or Hot Air?"
[94] Crenshaw.
[95] Storey, Ian. 2011. "The United States and ASEAN-China Relations: All Quiet on the Southeast Asian Front?"

water crisis in Hawai'i due to a fuel spill at Red Hill serves as a cautionary tale.[96] Our fieldwork affirms that Indigenous Chamorro communities in Guam vehemently oppose the plan, fearing the dilution or contamination of their primary water source—a concern supported by previous incidents at Camp LeJeune and Red Hill.[97] This Guam case is not an outlier but reflects a larger pattern where the imperatives of military strategy compromise environmental sustainability and Indigenous well-being across the Indo-Pacific.[98]

Figure 4. Voices of Veterans: Masterclass in Visual Storytelling workshop participants, at the University of Guam in Mangilao. (Photo shared with permission, Nate Tilton.)

Moreover, there are only rough estimates of the number of veterans on Guam by the Department of Veterans Affairs (VA). According to Michael Flores, who led a two-day workshop in visual storytelling for veterans at the University of Guam, the "official numbers of veterans on the island does not match up with what local veterans know there is—the VA thinks there are 3,000 veterans, while local veteran groups estimate there are about 24,000." [99] He shared insights into what the veteran group GY671 is doing by organizing "battle buddy" talks, providing a

[96] Axios. 2023. "Hawaii Navy 2021 Red Hill fuel spill water crisis."

[97] Maslia. et al.; and Davis, S., and P. Kildea. 2001. "The Army and the Defence of Darwin Fortress: Exploding the Myths of the Critical Phase, 'til September 1942."

[98] Mitchell, *Poisoning the Pacific*.

[99] Jolene Toves, "Workshop arms veterans with tools, skills to tell their stories," *Guam Daily Post*, 5 August 2023, https://www.postguam.com/.

potential model for how other veteran groups can support themselves when the VA overlooks them.

The workshop was hosted by the Veteran Independent Research Organization, "a group of military veterans who entered fields in academia, medicine, and journalism following their military service." Their mission is to "highlight the problems with Veterans Affairs and study how veterans can thrive with or without the VA's assistance."[100]

Navigating Security and Justice—An Imperative for Immediate and Inclusive Action

The Indo-Pacific region, with its intricate geopolitical tensions, transcends the conventional boundaries of national security to profoundly impact the health and lives of disabled veterans and Indigenous communities. Through the perspective presented in this article, it has been illustrated that the imperatives of military strategy are inherently linked to broader issues of social justice and environmental stewardship.

Reflecting on his experience as a retired sergeant first class in the US Army, co-author Nathan A. Tilton was always taught to "leave things better than we found them." This philosophy, emphasized in every range safety briefing that urged service members not to "mess with the wildlife," starkly contrasts with the collective failure of military initiatives to improve, or even preserve, the environmental and social landscapes they touch. Guam, the CNMI, and the communities that live in these island territories are dealing with these issues due to the rapid militarization of the Indo-Pacific and the complex histories that continue to influence the region. The case study central to this article demonstrates how genuine security, environmental justice, and democratic deficiencies are informing self-determination in non-self-governing territories. Importantly, these issues are impacting other islands across the region. Independent nations like the Philippines, provinces like Okinawa, and freely associated states like Palau are all sites of tension and diplomacy between local communities and the United States as militarization proceeds.

Local communities are interfacing with the United States military in myriad ways, such as those organizing for demilitarization and relocation of bases in Okinawa after years of controversy stemming from US Marines stationed on the island.[101] In contrast, some nationally elected officials, who have greater agency than

[100] Veterans Independent Research Organization, "About Us: Community Research and Advocacy for the Well-Being of Veterans," 2020, https://veteransresearch.org.

[101] Pilsu Jin, "The 'All Okinawa' Movement: Political and Legal Implications of the Okinawan Protest against the US Bases," *Journal of East Asian and International Law* 562 (2016), https://heinonline.org/.

their counterparts in territories like Guam, are interested in building closer military partnerships with the United States including the President of Palau who is in favor of a proposed radar facility and missile defense installation in his country. However, Palau's Senate President disagrees with this position and argues that establishing permanent US military weaponry in the island nation goes against the countries' interests and their exercise of sovereignty.[102] In these nations, much like any other, there is not complete consensus over what their relationship with the United States should be in the context of regional militarization, but better democratization of decision-making and attainment of sovereignty rather than having a non-self-governing political status lays the foundation for procedural justice and genuine security.

Large-scale changes to political status and international relationships concerning militarization must be considered for Guam, the CNMI, and other islands, particularly for non-self-governing territories. To further the production of environmental justice and genuine security in the Marianas and throughout the Indo-Pacific we present four recommendations in the final section of this article.

Recommendations

1. Immediate Inclusive and Sincere Dialogue. It is crucial for governments and policy makers to engage directly with disabled veterans and Indigenous communities, actively listening to their voices expressed through protests and other means. Governments must prioritize real-time decision-making processes, acknowledging the immediacy of the concerns raised by these communities.

2. Proactive Environmental Audits. Prior to any military initiative, there should be comprehensive and transparent environmental assessments. This proactive approach, disclosing the environmental impact assessments beforehand, sets a new standard for responsible engagement. The data delivery and process should be consistent, concise, and easily accessible to the public.

3. Accountability and Transparency. Establish robust mechanisms for real-time monitoring and public reporting of environmental and social metrics in military-engaged zones. Anything less than complete openness and responsibility is incompatible with the principles that should characterize national security efforts. Avoid framing information as "pre-decisional"

[102] David Brunnstrom and Kirsty Needham, "US missile defense proposal stirs debate in Palau," *Reuters*, 20 December 2023, https://www.reuters.com/.

without informing the community, recognizing the challenges faced as a non-self-governing territory.

4. Future Research with Present Concerns. Scholarly work should focus on the interlinked realities of military deterrence, disability, and Indigenous rights. This research should prioritize the lived experiences of those most affected, providing insights into the multifaceted impacts of these issues.

The first recommendation emphasizes immediate and inclusive dialogue, urging governments to actively listen to disabled veterans and Indigenous communities. Ignoring these voices now can lead to unjust repercussions later. Participation in events like the Commission on Decolonization *Fanhita* conference is crucial for understanding community concerns and fostering a genuine partnership.

The second recommendation suggests proactive environmental audits, advocating for transparency from the inception of military projects. The distinction between *consultation* and *consent* should be recognized, ensuring that comments are not just "duly noted" but directly contribute to decision making.

The third recommendation underscores the importance of accountability and transparency, advocating for real-time monitoring and public reporting of environmental and social metrics. This level of openness is vital for responsible national security efforts.

In terms of future research, there is a call to focus on the nexus of military engagement, disability, and Indigenous rights, prioritizing the experiences of those most impacted. This prioritization will contribute to a more nuanced understanding of the interconnected realities at play.

The urgency for a paradigm shift in approaches to security and justice is emphasized. The military must align with principles of improvement and stewardship, moving away from practices that contradict these ideals. The recommendation extends to reevaluating the heavy militarization of locations like Guam, proposing alternative uses that prioritize diplomacy and local contributions for regional peace and prosperity. This approach acknowledges the real impacts on the local community, fostering a more successful military presence in the Indo-Pacific. ✪

Dr. Sylvia C. Frain

Dr. Frain is an inaugural 2024 Indo-Pacific Leadership Lab fellow with the East-West Center in Honolulu, Hawai'i with support from The Japan Foundation, Tokyo. She is a cofounder of the Marianas Critical Research Initiative and was selected for the Rotary Positive Peace Activator Oceania Program in partnership with the Institute for Economics and Peace (IEP). From 2018 to 2023 she was a postdoctoral Research Fellow at Auckland University of Technology | Te Wānanga Aronui o Tāmaki Makaurau in Auckland, Aotearoa New Zealand. She earned her PhD in Peace & Conflict Studies at the University of Otago | Te Whare Wānanga Otāgo in Ōtepoti | Dunedin, Aotearoa New Zealand, and a Master of International Studies in the field of Peace & Conflict Resolution at the School of Political Science and International Studies at the University of Queensland in Brisbane, Australia.

Kieren Rudge

Kieren Rudge is a doctoral student at the University of California, Berkeley, in the Department of Environmental Science, Policy, and Management and holds a Master of Environmental Science (Yale University) and a BS in environmental science (Johns Hopkins University). Kieren researches issues of environmental justice, climate change adaptation, and militarization, primarily in US territories and is also a cofounder and active member of the Marianas Critical Research Initiative. Kieren is a former US Naval Academy Midshipman.

Nathan A. Tilton

Nathan "Nate" Tilton is a doctoral student at the University of California, Berkeley, specializing in cultural anthropology. His research primarily explores how institutions such as the Department of Veterans Affairs (VA) contribute to the social model of disability, particularly through his work with disabled veterans on Guam who face challenges in accessing VA benefits. Additionally, Nate is a cofounder and active member of the Marianas Critical Research Initiative and serves as the cofounder and CEO of the Veterans Independent Research Organization. He also holds the position of associate director at the UC Berkeley Disability Lab. Nate's academic background includes an MA focusing on medical anthropology and a BA in anthropology, both from UC Berkeley. His diverse career also includes serving as a retired federal air marshal and a retired Army sergeant first class.

FEATURE

Competition and Collaboration in the Environmental Security Domain

Dr. J. Scott Hauger

Abstract

Rising temperatures are redrawing the map of global power. *Climate space*, the environmental security landscape within this new geopolitical system, demands a fresh approach to securing our future. Analyzing the US–China dynamic in this domain, this study traces how security strategies have evolved (culminating in the 2022 *US National Security Strategy*) to address climate-induced threats. It then explores the delicate dance between competition and collaboration necessary for environmental security in this emergent system. Notably, cooperation—even with rivals—becomes key to national security. This challenges traditional thinking, potentially requiring a paradigm shift where securing the environment supersedes geopolitical rivalries. Creating a controlled space for competition within environmental security could be a critical step toward this paradigm shift, ultimately safeguarding national interests in a climate-altered world.

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Climate change, as an emergent phenomenon, alters the dimensions of the geopolitical system. Over the past half-century, the impacts of climate change have garnered increasing international attention. In 1974, the UN General Assembly tasked the World Meteorological Organization (WMO) with studying climate change. In 1979, the WMO convened a World Climate Conference, alerting nations worldwide to "foresee and prevent potential man-made changes in climate that might be adverse to the well-being of humanity."[1] In 1988, the WMO, in collaboration with the UN Environment Programme (UNEP), established the Intergovernmental Panel on Climate Change (IPCC) to review science-based knowledge of climate change and recommend response strategies.

The IPCC's first assessment report in 1990 found that greenhouse gas emissions were a likely contributor to global warming. It characterized *climate change* as "a challenge with global consequences and requiring international cooperation."[2] This report facilitated negotiations leading to the UN Framework Convention on Climate Change (UNFCCC) in 1992, providing a structure for such cooperation. By

[1] John W. Zillman, "A History of Climate Activities," *World Meteorological Organization, Bulletin* 58, no. 3 (2009), https://public-old.wmo.int/.

[2] IPCC. "History of the IPCC," n.d., https://www.ipcc.ch/.

2023, the IPCC's Sixth Assessment Report declared climate change to be "a threat to human well-being and planetary health."[3]

Concurrently, China's ascent as a regional and global power was reshaping the dimensions of the geopolitical system. In 1971, the current government of China gained recognition as China's representative in the UN. By 2010, China's gross domestic product surpassed that of Japan, making it the world's second-largest economy. Around 2014, China's navy became the largest military fleet globally in terms of the number of vessels.[4] In 2023, the US Department of Defense (DOD) summarized the trajectory of Chinese military modernization: "The PLA's [People's Liberation Army] evolving capabilities and concepts continue to strengthen the PRC's [People's Republic of China] ability to 'fight and win wars' against a 'strong enemy (强敌)' (a likely euphemism for the United States), counter an intervention by a third party in a conflict along the PRC's periphery, and project power globally."[5]

China and the United States currently stand as the world's largest national economies, boasting gross domestic products (GDP) of USD 18 trillion and USD 26 trillion, respectively. Together, they constitute 46 percent of the global economy.[6] These economic powerhouses also underpin the largest national defense establishments, estimated to be funded at USD 292 billion and USD 877 billion, making up 48 percent of the world's total.[7] Additionally, both countries are the planet's leading contributors to greenhouse gas emissions, with 12 gigatons and 5 gigatons of CO_2 emissions, respectively, accounting for about 46 percent of the world's total in 2022.[8]

The US security sector has historically grappled with the challenges of great-power rivalry since the Revolutionary War. However, the emergence of climate change presents a novel and distinctive challenge. In 2021, US Secretary of Defense Lloyd Austin labeled climate change as an existential threat, stating, "Today, no nation can find lasting security without addressing the climate crisis. We face all kinds of

[3] Intergovernmental Panel on Climate Change, *AR 6 Synthesis Report: Headline Statements*, 2023, https://www.ipcc.ch/.

[4] Andrew Scobell and Alex Stephenson, "Five Things to Know About China's Armed Forces," United States Institute of Peace, 2 August 2023, https://www.usip.org/.

[5] *Military and Security Developments Involving the People's Republic of China, 2023*, Report to Congress (Washington, DC: US Department of Defense, 2023), v, https://media.defense.gov/.

[6] "The 20 countries with the largest gross domestic product (GDP) in 2022" *Statista*, 2022, https://www.statista.com/.

[7] *SIPRI Military Expenditure Database*, 2023, https://www.sipri.org/.

[8] IEA, "CO2 Emissions in 2022," March 2023, https://www.iea.org/.

threats in our line of work, but few of them truly deserve to be called existential. The climate crisis does."[9]

If climate change is recognized as a transnational threat to human existence and, consequently, national security, it is indeed reshaping the dimensions of the geopolitical system, as discussed below. Climate change disrupts traditional conceptions of national security by reconfiguring the geopolitical system and making traditional security concepts and practices, evolved and attuned to historical cases, less relevant to the emerging situation.

This study delves into the challenges and potential collaborations between rivals within the emerging security paradigm. It traces the evolving understanding of climate change within the US security sector over the past 40 years, ultimately framing it as a security issue. The examination extends to the contemporary response to China's ascent as a global power, as reflected in US national security documents.

Subsequently, the study introduces and applies the concept of an environmental security domain, situated within the broader geopolitical system. This lens is employed to scrutinize the US national security strategy as it grapples with diverse security threats. The study poses a pivotal question: "Can a national security strategy be sustainable if it embraces traditional geopolitical competition between rival powers while simultaneously pursuing cooperation to address a global existential threat?"

Climate Change, China, and US National Security Strategy

Before the current century, climate change received minimal attention from the US security sector. Its primary focus on environmental issues was twofold: assessing their impacts on military readiness and operations, and engagement in humanitarian assistance and disaster relief missions.

Climate change initially entered the national discourse not as a security concern but as a scientific endeavor. The first US DOD document to recognize climate change as a potential security threat was published in 2000, during the Clinton administration. Titled *U.S. Department of Defense: Climate Change, Energy Efficiency, and Ozone Protection*, it asserted, "Changes in the global climate and depletion of the Earth's stratospheric ozone protection layers can have national and global implications, particularly on environmental, political, social, and economic structures. . . . As climate change affects the structures mentioned above, DoD is work-

[9] David Vergun, "Defense Secretary Calls Climate Change an Existential Threat," *DOD News*, 22 April 2021, https://www.defense.gov/.

ing to understand where and under what circumstances environmental issues may contribute to economic, political, and social instability and conflict."[10]

A decade later, the Obama administration issued the inaugural American policy document characterizing climate change as a security threat. The 2010 *Quadrennial Defense Review* (QDR) identified climate change as a "key issue" shaping the future security environment.[11] The DOD's perspective was further elucidated in the same year in the *National Security Strategy*, proclaiming, "The danger from climate change is real, urgent, and severe. The change wrought by a warming planet will lead to new conflicts over refugees and resources; new suffering from drought and famine; catastrophic natural disasters; and the degradation of land across the globe."[12]

The 2010 *QDR* did not depict China as a security threat, nor did it adopt a policy of strategic competition. However, it acknowledged the potential for conflict arising from China's growing influence in regional and global affairs. Instead, the *QDR* emphasized cooperation, asserting, "Our relationship with China must therefore be multidimensional and undergirded by a process of enhancing confidence and reducing mistrust in a manner that reinforces mutual interests."[13] Similarly, the 2010 *National Security Strategy* proclaimed, "We will not agree on every issue, and we will be candid on our human rights concerns and areas where we differ. But disagreements should not prevent cooperation on issues of mutual interest, because a pragmatic and effective relationship between the United States and China is essential to address the major challenges of the 21st century."[14]

Five years later, in 2015, the Obama administration's *National Security Strategy* elevated the management of climate change to one of eight national strategic goals.[15] While acknowledging China as a potential competitor, the document aimed to moderate potential conflict, stating, "While there will be competition, we reject the inevitability of confrontation. At the same time, we will manage competition from a position of strength while insisting that China uphold international rules and norms on issues ranging from maritime security to trade and human rights. We will closely monitor China's military modernization and expand-

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[10] *Climate Change, Energy, and Ozone Protection* (Washington, DC: DOD, 2000), https://p2infohouse.org/.

[11] *Quadrennial Defense Review* (Washington, DC: DOD, February 2010), 84, https://dod.defense.gov/.

[12] *National Security Strategy* (Washington, DC: The White House, May 2010), 47, https://history.defense.gov/.

[13] *National Security Strategy*, 2010, 60.

[14] *National Security Strategy*, 2010, 43.

[15] *National Security Strategy* (Washington, DC: The White House, February 2016), 12, https://obamawhitehouse.archives.gov/.

ing presence in Asia, while seeking ways to reduce the risk of misunderstanding or miscalculation."[16]

The Trump administration marked a significant shift in tone and perspective in its security strategy documents. The 2017 *National Security Strategy* declared a "competitive world," in which, "China and Russia challenge American power, influence, and interests, attempting to erode American security and prosperity."[17] In 2018, the *National Defense Strategy,* succeeding the *QDR,* assessed that, "China is a strategic competitor using predatory economics to intimidate its neighbors while militarizing features in the South China Sea."[18] It emphasized, "Long-term strategic competitions with China and Russia are the principal priorities for Department."[19] However, neither document acknowledged climate change as a security threat, and Pres. Donald Trump withdrew the United States from the UNFCCC's Paris Accords.

Upon assuming office in 2021, the Biden administration reentered the Paris Accords and issued Executive Order 14008, positioning climate change at the forefront of US foreign policy and national security:

> The United States and the world face a profound climate crisis. We have a narrow moment to pursue action at home and abroad in order to avoid the most catastrophic impacts of that crisis and to seize the opportunity that tackling climate change presents. Domestic action must go hand in hand with United States international leadership, aimed at significantly enhancing global action. Together, we must listen to science and meet the moment.[20]

The administration aimed to address the dual challenges posed by the rise of China and the emergence of climate change by formulating a security strategy that simultaneously embraced competition in the traditional security domain and cooperation in the environmental security domain. The 2022 *National Security Strategy* declared, "We will prioritize maintaining an enduring competitive edge over the PRC. . . . At the same time, the PRC is also central to the global economy and has a significant impact on shared challenges, particularly climate change and global

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[16] *National Security Strategy*, 2016, 24.

[17] *National Security Strategy of the United States of America* (Washington, DC: The White House, December 2017), 2, https://history.defense.gov/.

[18] *Summary of the 2018 National Defense Strategy of the United Sates of America* (Washington, DC: DOD, 2018), 1, https://history.defense.gov/.

[19] *Summary of the 2018 National Defense Strategy of the United Sates of America*, 4.

[20] Executive Order 14008, Tackling the Climate Crisis at Home and Abroad, 27 January 2021, https://www.regulations.gov/.

public health. It is possible for the United States and the PRC to coexist peacefully, and share in and contribute to human progress together."[21]

In the pursuit of national security, the United States Government has presented a strategy that seeks to balance competition and cooperation across various domains of the geopolitical system. This undertaking is challenging and, perhaps, inherently contradictory. In his cover letter to the 2022 *National Security Strategy*, Pres. Joe Biden acknowledged the difficulty, stating, "We are in the midst of a strategic competition to shape the future of the international order. Meanwhile, shared challenges that impact people everywhere demand increased global cooperation and nations stepping up to their responsibilities at a moment when this has become more difficult."[22]

The challenge primarily arises from the emergence of a new, unprecedented type of security threat within the geopolitical system. Throughout history, nations have engaged in competition with rivals and cooperation with allies. However, if climate change is recognized as an existential crisis for humankind, then cooperating with rivals becomes essential to achieve national security goals. This concept of collaboration with rivals contradicts traditional security strategies.

Approach: The Environmental Security Domain in a Complex Geopolitical System

To gain a deeper understanding of the security challenges posed by climate change, envisioning the components of a geopolitical system proves beneficial. Figure 1 illustrates a conceptual diagram of the global system, where nations actively pursue their geopolitical interests. The diagram emphasizes elements intricately linked to environmental security, profoundly affected by climate change. While various choices for selecting and interrelating elements in the model exist, this representation, influenced by Fritjof Capra's model, encapsulates the concept that climate change significantly influences the geopolitical system. [23]

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[21] *National Security Strategy* (Washington, DC: The White House, October 2022), 23–24, https://www.whitehouse.gov/.

[22] Joseph Biden, cover letter to *National Security Strategy*, 12 October 2022, https://www.whitehouse.gov/.

[23] Adapted from Fritjof Capra, "Interconnectedness of World Problems: A Conceptual Map," n.d., http://slideplayer.com/.

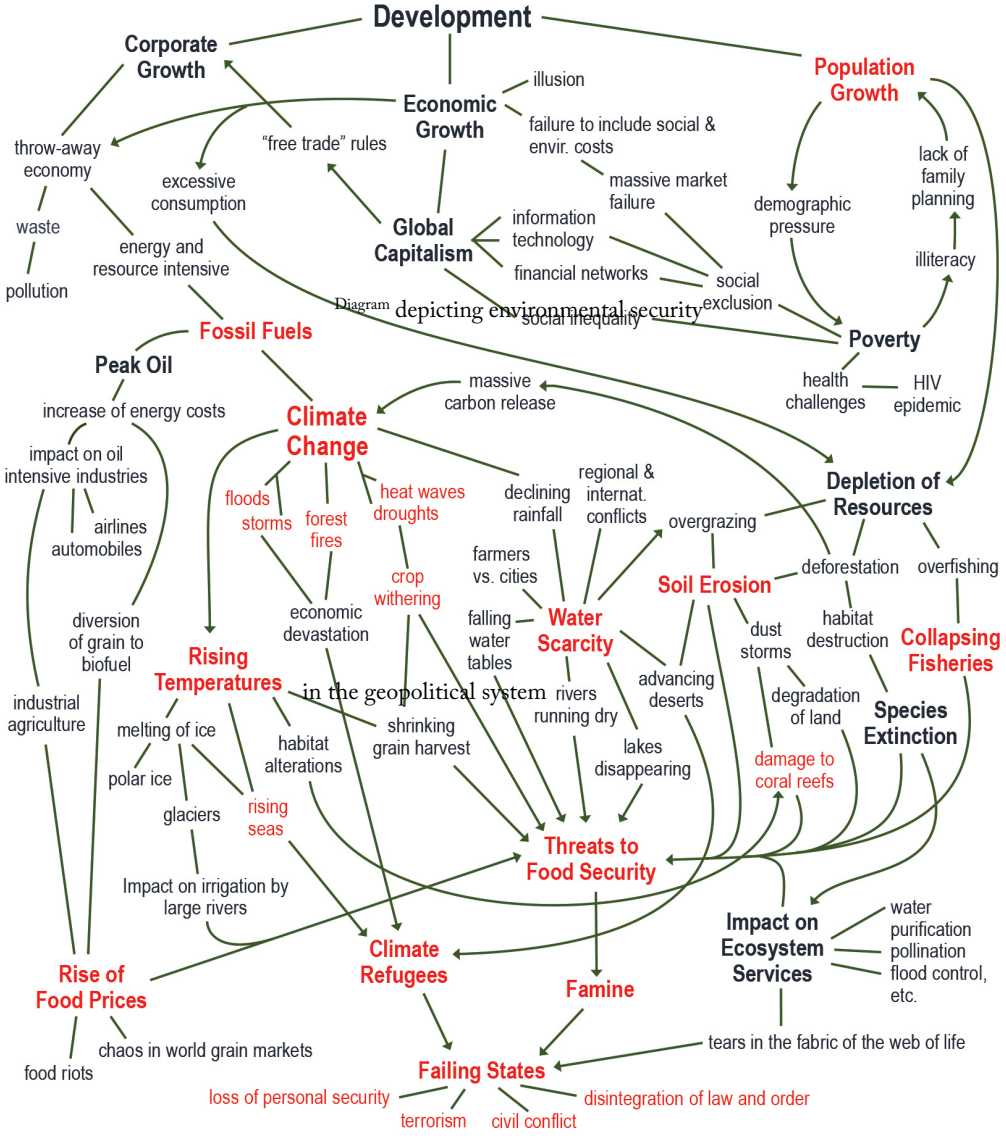

Diagram depicting environmental security in the geopolitical system

Figure 1. Environmental security in the geopolitical system.[24]

[24] While its focus is on the security impacts of climate change, this discussion uses the term *environmental security* throughout, except where cited sources use the term, *climate security*. UNEP's website (Home/LEO Thesaurus) states that "Environmental security examines threats posed by environmental events and trends to individuals, communities or nations." https://leap.unep.org/. As illustrated in figures 1 and 2, climate change is an environmental trend, and its human and societal impacts are felt through events presented by the related environmental phenomena such as drought and sea level rise. Given a systems approach to the security issues presented by climate change, the term *environmental security* seems to be most appropriate to the discussion.

To analyze environmental security issues within this intricate system, it is crucial to concentrate on the variables of utmost relevance and establish connections between environmental phenomena and their observable security consequences. Figure 2 introduces a conceptual model of such a domain.

The primary security threat posed by climate change is the escalation and heightened intensity of natural disasters resulting from global warming effects. The upper section of the model underscores the relationships between environmental phenomena and their impacts on human security. It asserts that national security is closely tied to the human security of the population, and the stability of regions and the globe is influenced by conditions at the national level.

The lower portion of the model outlines the actions available to policy makers to counter these threats. Its components align with the well-known disaster management cycle, with the addition of knowledge creation as a fitting response to an emerging threat. The arrows connecting the upper and lower sections signify that observations of phenomena and their impacts inform policy, and policy implementation can effectively manage the impacts of climate change.

The variables within the framework model are categorical, necessitating analysts to select and define specific variables of interest from within relevant categories that address the specific problem at hand. The depicted categories are not exhaustive but representative, and they are not necessarily discrete. Like other elements in the complex geopolitical system, they may possess overlapping or indistinct boundaries that fluctuate over time.

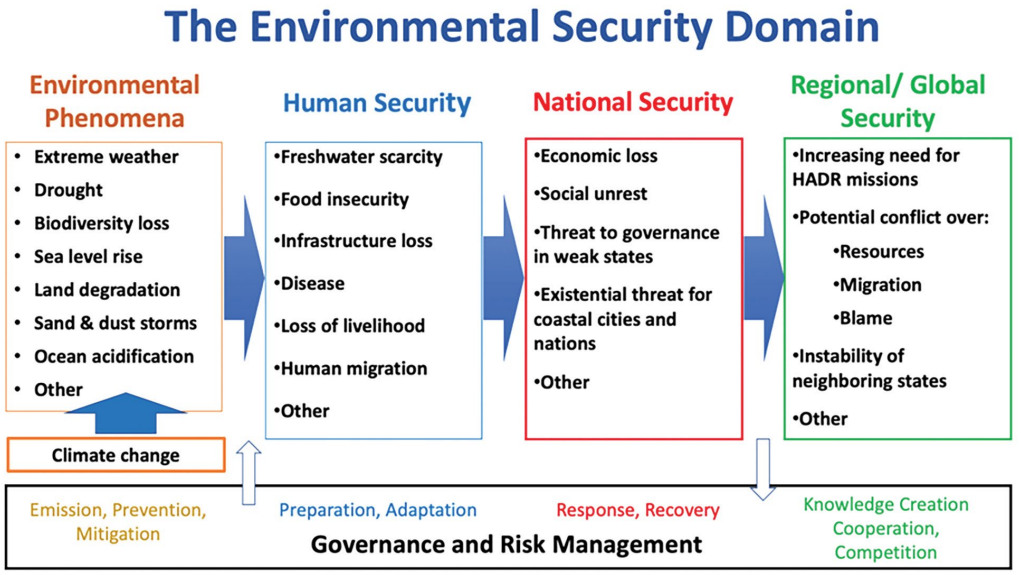

Figure 2. A Conceptual model of the environmental security domain

Exploring the Environmental Security Domain

The conceptual model of an environmental security domain establishes a framework to examine the intersections of climate change and the rise of China within a complex geopolitical system. It facilitates the exploration of potential security strategies involving both competition and cooperation within this domain. It is important to note that this discussion of competition and cooperation in the environmental security domain is exploratory. Given the numerous variables in the domain, a comprehensive study is not feasible in this preliminary exploration.

Mitigation of Environmental Phenomena

Climate change alters various environmental phenomena in ways that pose threats to human well-being and societal stability. A few examples include heat trapped by greenhouse gases causing thermal expansion of the oceans and melting ice caps, leading to sea level rise and coastal inundation. Warmer oceans result in increased evaporation, precipitation, and subsequent flooding. Elevated air temperatures can directly impact human health. As atmospheres and oceans are fluid and global, greenhouse gas emissions from any location can have environmental impacts elsewhere.

How do nations cooperate or compete to enhance their security by mitigating the destructive phenomena associated with climate change? The UNFCCC has served as an arena for cooperation in the environmental security domain since its ratification in 1992. The United States played a significant role in crafting the convention. Later, US Vice Pres. Al Gore played a crucial role in negotiating the 1997 Kyoto Protocol, which proposed legally binding limits on greenhouse gas emissions for developed countries but not for developing ones, including China. Although the US government signed the protocol, the Senate did not ratify it, fearing it conferred an unfair advantage to China.[25]

In November 2015, the Paris Accords to UNFCCC sought to overcome this concern by replacing mandated emission targets with intended nationally determined contributions (INDC) proposed by each signatory. The accords were enabled by an advance agreement by Pres. Barack Obama and Chinese president Xi Jinping, "emphasizing their personal commitment to a successful climate agreement in Paris and marking a new era of multilateral climate diplomacy."[26] The United States

[25] Aarthi S. Anand, "The Importance of Being Factual: The U.S., China, and the Future if the Kyoto Protocol," *Duke Environmental Law and Policy Forum* 24, no. 1 (Fall 2013), 8, https://scholarship.law.duke.edu/.

[26] "U.S.-China Joint Presidential Statement on Climate Change" (press release, The White House, 25 September 2015), https://obamawhitehouse.archives.gov/.

joined the agreement through executive action in September 2016. However, in January 2017, President Trump announced the US withdrawal from the accord, citing the competitive advantage it granted to China. In August 2022, climate collaboration faced a similar fate in the realm of geopolitical competition when China suspended its dialogue with the United States on climate issues in response to Speaker of the House Nancy Pelosi's visit to Taiwan.

Unregulated competition in other domains poses a threat to environmental security, particularly activities that increase greenhouse gas emissions. China's ascent to industrial power and domestic prosperity under a fossil fuel regime, mirroring the historical rise of the West, has inevitably intensified the climate threat. If nations persist in pursuing such gains through unrestricted or unsustainable development, such competition will contribute to an escalating climate threat.[27]

The DOD and its component services have committed to reducing greenhouse gas emissions in alignment with national goals, although they fundamentally prioritize mission objectives over emission reduction. As Assistant Secretary Ravi Chaudhary articulated in his cover letter to the *2023 Air Force Climate Campaign Plan*, "The Department of the Air Force exists for one purpose—deter our nation's adversaries—and if called upon, fly, fight, and win across multiple air and space domains." He further emphasizes, "Ultimately, this [Climate] Campaign Plan is about warfighting and responding at the point of effect for theater commanders."[28] This plan, akin to other DOD plans, concentrates on adapting facilities and operations to enhance the pursuit of traditional security goals under changing climate conditions. Climate mitigation assumes a lower priority. In essence, at the present time, environmental security is subordinate to traditional security, and structural preferences favor strategic competition over environmental cooperation.

There are, however, constructive ways to conceptualize competition among rivals in managing environmental phenomena. In other words, "friendly" competition can yield net positive benefits for rivals and global stakeholders. As an illustration of soft power, nations may engage in competition to surpass rivals in meeting or exceeding the emission goals of the Paris Accords or in providing assistance to developing nations to adapt to climate change.

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[27] This discussion is based upon the author's understanding of the science-based assessments of the Intergovernmental Panel on Climate Change (IPCC). Summary information may be found at: IPCC, "Summary for Policymakers," in *Climate Change 2023: Synthesis Report*, 2023, https://www.ipcc.ch/.

[28] *Department of the Air Force Climate Campaign Plan* (Washington, DC: Department of the Air Force, July 2023), i, https://www.af.mil/.

Human Security—Preparation and Adaptation

Governments have consistently prioritized preparedness for natural disasters, and security sector agencies have long shouldered responsibilities for disaster preparedness. In the United States, Congress assigned flood control projects nationwide to the Army Corps of Engineers in 1936.[29] Responsibilities in other areas, such as food security, rest with civil sector agencies like the Department of Agriculture.

The complexity of the geopolitical system and its interconnections between development and security has led to evolving boundaries and missions for the security sector over time. USAID, for instance, highlights on its website that "USAID and the Department of Defense have been partners since the 1960s."[30] Today, USAID officers serve on US Indo-Pacific Command's (USINDOPACOM) staff, and in August 2023, USAID Administrator Samantha Power addressed the command's Chiefs of Defense Conference, discussing "how defense and development actors can work together to combat perhaps the greatest threat to lasting peace: the existential threat of climate change."[31] Between 2014 and 2018, USAID provided nearly USD 400 million in climate adaptation assistance to developing nations. Funding was briefly halted during the Trump administration but resumed under Congressional initiative in 2020.[32] Thus, adaptation can be a cooperative security enterprise.

At the international level, several United Nations agencies leverage members' assets to offer development assistance. For instance, the UNFCCC established a Green Climate Fund to support mitigation and adaptation projects in developing countries, funding USD 2 billion in new projects in 2023.[33] The United States has been a significant contributor to this fund.[34]

While the policy framework exists for American mil-to-mil cooperation in climate adaptation projects, a web search reveals few, if any, ongoing projects with rival nations. The 2023 *U.S. Air Force Climate Campaign Plan*, for instance, commits to collaborating with allies and partners to "strengthen international collaboration

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[29] Joseph L. Arnold, *The Evolution of the 1936 Flood Control Act* (Washington, DC: Office of History, United States Army Corps of Engineers, 1988), https://www.publications.usace.army.mil/.

[30] USAID, "Office of Civilian-Military Cooperation," n.d. https://www.usaid.gov/, .

[31] Samantha Power, "Administrator Samantha Power Speaks at the U.S. Indo-Pacific Command Chiefs of Defense (CHOD) Conference" (speech, USAID, 16 August 2023), https://www.usaid.gov/.

[32] "Climate Change: "USAID Is Taking Steps to Increase Projects' Resilience, but Could Improve Reporting of Adaptation Funding," GAO-20-555 (Washington, DC: GAO, July 2020), https://www.gao.gov/.

[33] "Green Climate Fund: USD 736 million for new projects and readiness strategy to accelerate climate action" (press release, Green Climate Fund, 26 October 2023), https://www.greenclimate.fund/.

[34] Joe Thwaites, "Green Climate Fund Pledge Tracker," National Resources Defense Council, 5 October 2023, https://www.nrdc.org/.

on climate change through military-to-military engagements and bilateral and multilateral agreements."[35] However, its cover letter emphasizes that the USAF exists for the singular purpose of deterring the nation's adversaries, and the plan does not address potential cooperation with rival China.

Development assistance can evolve into a competitive enterprise. In 2021, Jennifer Hillman and Alex Tippett urged the United States to challenge China to "green" its Belt and Road Initiative (BRI).[36] In 2022, USINDOPACOM's Center for Excellence in Disaster Management observed that China is seeking increased geostrategic influence in Oceania by providing assistance to countries concerned about the impacts of climate change. The report recommended that the United States should compete with China for such influence, noting that "the U.S. has so far established a better track record of supporting climate initiatives and could stand apart by increasing investments in climate-related activities."[37]

In contrast, in 2018, Scott Morris of the Center for Global Development observed that Cold War competitive pressures were resurfacing in response to China's BRI. He suggested that "Rather than seek to lure countries away from China's money," US policy would do well to recognize it as a reality and seek to reform its problematic features. Achieving that," he advised, "will require cooperation, with like-minded countries—of which there are many—and with the Chinese themselves."[38]

Morris' perspective suggests a distinction between benign and destructive competition. Similar to competitive sports or international military games, rules-based competition can mitigate the destructive elements of unbridled competition and foster positive outcomes for all competitors in the geopolitical environment. One can envision, for example, robust military-to-military agreements to cooperate in a rules-based competition aimed at enhancing developing nations' preparation and adaptation to the threats of climate change.

National Security—Response and Recovery

In the environmental security domain, national security hinges on the effectiveness of mitigation and adaptation strategies employed by multiple actors. If miti-

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[35] *Department of the Air Force Climate Campaign Plan*, 2.

[36] Jennifer Hillman and Alex Tippett, "The Climate Challenge and China's Belt and Road Initiative," *Council on Foreign Relations* (blog), 31 March 2021, https://www.cfr.org/.

[37] Emilio A. Moreno, "China's Foreign Humanitarian Assistance as a Tool of Strategic Influence in Oceania," Center for Excellence in Disaster Management & Humanitarian Assistance, January 2022, 13, https://www.cfe-dmha.org/.

[38] Scott Morris, "What happens when development cooperation becomes development competition," *Brookings Commentary*, 16 November 2018, https://www.brookings.edu/.

gation and adaptation measures fail to reduce the threat, disaster relief becomes the responsibility of national governments. Conventionally and in practice, international disaster relief is provided upon the request of sovereign states and is subject to their coordination and regulation.[39]

In the United States, the security sector has long played a crucial role in humanitarian assistance and disaster relief (HADR) missions. Military resources, including equipment, personnel, and expertise, have frequently been vital assets for responding to natural disasters. In the late nineteenth century, the US Army Corps of Engineers first engaged in domestic disaster relief missions in reaction to catastrophic floods in the Mississippi River Valley and Johnstown, Pennsylvania.[40] Throughout the first half of the twentieth century, the War and Navy Departments routinely contributed supplies and provided transportation for humanitarian aid overseas. Between 1900 and 1945, US military personnel participated in relief efforts for survivors of floods, earthquakes, and tropical storms in numerous nations worldwide.[41] HADR missions, managed in-country by USAID, now stand as standing missions for US combatant commands.

In China, flood fighting and emergency rescue are the responsibilities of 19 national teams, with the PLA and the Armed Police Hydropower Troops serving as the main task force.[42] The PLA has held the responsibility to assist in major natural disasters since the founding of the PRC in 1949.[43] Since 2003, China has deployed an International Search and Rescue Team in response to natural disasters globally.[44] In the twenty-first century, China and the United States have consistently engaged in cooperative disaster response training. From 2005 through 2020, the US Army Pacific (USARPAC) and the PLA conducted an annual Disaster Management Exchange (DME) to explore how they might respond to a large-scale

[39] *See for example*, International Committee of the Red Cross, "Guidelines for the Domestic Facilitation and Regulation of International Disaster Relief and Initial Recovery Assistance," November 2007, https://www.icrc.org/.

[40] US Army Corps of Engineers, "A Brief History," n.d., https://www.usace.army.mil/.

[41] Julia F. Irwin, "The Origins of U.S. Foreign Disaster Assistance," *American Historian*, n.d., https://www.oah.org/.

[42] Ministry of Water Resources, People's Republic of China, *Flood Control, Drought Relief and Disaster Mitigation in China*, undated, sections 1.3 and 2.2, http://www.mwr.gov.cn/.

[43] Dou Ding, "PLA's Disaster Relief Works: Review and Reform," *East Asian Policy* 2, no. 3 (July–September 2010), 49–57, https://research.nus.edu.sg/.

[44] Steven A. Zyck, "Crisis preparedness and response: the Chinese way," *ODI Creative Commons*, n.d., https://odi.org/.

natural disaster in a third country.[45], Recent "exchanges have included field exercises, or practical field exchange."[46] China and the United States also regularly participate in multinational exercises. notably Cobra Gold, hosted by Thailand.[47]

However, cooperation for disaster response in the environmental security domain has been influenced by other events in the geopolitical arena. During the Trump administration, from 2017 through 2020, DME remained the sole bilateral exercise between the two nations.[48] The exchange was conducted remotely in 2020, during the COVID epidemic, and was not held in 2021. [49] In 2022, in response to Speaker of the House Nancy Pelosi's visit to Taiwan, China suspended the exchange and also canceled bilateral climate change talks at the national level. Thus, environmental security cooperation was subordinated to competition in the broader geopolitical arena.

Nevertheless, such pauses in environmental security cooperation have proven to be reversible. In November 2022, Climate Envoys John Kerry and Zhenhua Xie resumed informal climate discussions, and in November 2023, announced that the rivals would resume formal climate talks.[50] Subsequently, President Biden and President Xi agreed to resume mil-to-mil communications, including at the combatant command (COCOM) level, so we might expect a resumption of DME in 2024.

Regional and Global Security—Knowledge Production

Both China and the United States engage in global-level treaties and agreements to address the threat of climate change. In fact, bilateral agreements between the US and Chinese governments have frequently preceded and facilitated international agreements. In November 2014, for instance, President Xi and President Obama

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[45] Angela Kershner, "China, US Disaster Management Exchange," *PACOM News*, 15 January 2015, https://www.pacom.mil/; and Oliver Schuster, "US-China hold 15th Annual Disaster Management Exchange," US Army, 27 November 2019, https://www.army.mil/.

[46] For a short video of the 2019 exercise, *see*, First Army, "U.S.–China Disaster Management Exchange," 23 November 2019, https://www.first.army.mil/.

[47] Li Jiayao, "Cobra Gold 2022 HADR Exercise Wraps Up," *China Military*, 3 March 2022, http://eng.chinamil.com.cn/; and Grant Peck, "Thailand, US resume Cobra Gold exercises at full scale," *Military Times*, 28 February 2023, https://www.militarytimes.com/.

[48] Caitlin Campbell, *China Primer: U.S.-China Military-to-Military Relations* (Washington, DC: Congressional Research Service, 4 January 2021), https://crsreports.congress.gov/.

[49] Kevin Knodell, "American Troops Train Remotely With Chinese Army From Schofield," *Honolulu Civil Beat*, 10 November 2020, https://www.civilbeat.org/; and *Military and Security Developments Involving the Peoples' Republic of China, 2022* (Washington, DC: DOD, 29 November 2022), 157, https://media.defense.gov/.

[50] Christian Shepherd, "In a breakthrough, U.S. and China agree to restart climate talks," *Washington Post*, 15 November 2023, https://www.washingtonpost.com/.

agreed on approaches to the management of climate change, laying the groundwork for the Paris Accords a year later.[51]

On several occasions, these rivals have returned to the negotiating table after lapses caused by geopolitical conflicts. In January 2021, the Biden administration announced that the United States was rejoining the Paris Accords and, in April, hosted a virtual Leaders Summit on Climate attended by 40 world leaders, including President Xi. In November 2022, Xi and Biden announced a return to cooperation following China's withdrawal from climate discussions, which were suspended in response to Speaker Pelosi's visit to Taiwan. As reported by *Climate Home News*,

> The US government's summary of the meeting said: "President Biden underscored that the United States and China must work together to address transnational challenges—such as climate change." The Chinese government's summary said the two sides "agree to work together to promote the success of Cop27" and that climate change is one of their "common interests" and is "inseparable from the coordination and cooperation between China and the United States."[52]

Because climate change is an emergent phenomenon and only partially understood, and because mitigation and adaptation strategies can benefit from new technologies, science-based research and development (R&D) become a critical enterprise for addressing environmental security. American and Chinese research institutions have been actively involved in climate-related R&D, spanning from basic research and climate modeling to technology development and the dissemination of renewable energy systems. Working individually, Chinese and American scientists have made significant contributions to IPCC reports.[53]

Chinese and American researchers have also collaborated on issues of climate change. For instance, in 2016-17, Georgetown University and Tsinghua University convened a Georgetown US-China Research Dialogue on Climate Change.[54] In 2021 however, David G. Victor observed that, "Ten years ago, . . . the two countries funded joint research projects and exchanged best practices with regulators and

[51] "U.S.-China Joint Announcement on Climate Change" (press release, The White House, 11 November 2014), https://obamawhitehouse.archives.gov/.

[52] Joe Lo, "Biden and Xi unshackle Cop27 climate teams to formalise talks," *Climate Home News*, 14 November 2022, https://www.climatechangenews.com/.

[53] Robert McSweeney, "Analysis: The gender, nationality and institution of IPCC AR6 scientists," *Carbon Brief*, May 2028, https://www.carbonbrief.org/.

[54] Georgetown University, Initiative for U.S.-China Dialogue on Global Issues, "Research Group: Climate Change," https://uschinadialogue.georgetown.edu/.

academics . . . today that cooperation is gone."[55] As with national-level climate discussions, joint R&D projects have declined and revived depending on the course of geopolitical competition. In July 2023, in their meeting at Sunnylands, California, climate envoys Kerry and Xie agreed to conduct a policy dialogue on the climate crisis and to "support enterprises, universities, and research institutions of both sides to engage in discussions and collaborative projects."[56]

Indeed, numerous opportunities exist for cooperative actions to bolster environmental security. These opportunities encompass joint HADR mission planning and execution, proactive planning for climate migration, coordinating support for recovery in affected states, and collaborative research and development across various disciplines. Cooperation between China and the United States has taken place in all these areas—and has at times been disrupted by conflicts in the geopolitical arena. However, these cooperative initiatives have generally been low-key and tentative, and as of now, there have been no sustained and intense research collaborations for environmental security between the rivals.

Discussion

Robert Litwak, Director of International Security Studies at the Woodrow Wilson Center, observed that "New York Times columnist Thomas L. Friedman [has] stated that the central challenge of climate change to humanity is now 'to manage what is already unavoidable and avoid what will truly be unmanageable.' To that compelling formulation can be added a corollary reflecting the new nexus: avoiding unconstrained geostrategic competition is a prerequisite for managing the climate threat."[57]

Litwak here evokes the fundamental way in which climate change is reshaping the geopolitical system: Competition to achieve strategic advantage ceases to be advantageous when its pursuit increases the systemic threat to national security. In the emergent geopolitical system, achieving national security requires constrained competition and cooperation—not only with partners but also with rivals. This seemingly paradoxical situation represents a challenging adjustment to strategic thinking and the conduct of international relations.

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[55] David G. Victor, "Rebuilding US-Chinese cooperation on climate change: The science and technology opportunity," *Brookings*, 28 October 2021, https://www.brookings.edu/.

[56] "Sunnylands Statement on Enhancing Cooperation to Address the Climate Crisis" (press release, Department of State, 14 November 2023), https://www.state.gov/.

[57] Robert S. Litwak, "Geostrategic Competition and Climate Change: Avoiding the Unmanageable," *Insight and Analysis*, 5 September 2021, https://www.wilsoncenter.org/.

Over the past decades, US national security strategy has responded to a growing awareness of the dilemma in a series of discontinuous adjustments toward managing the climate threat. The second Obama administration proposed the securitization of climate change and emphasized cooperation with China to address the threat. The Trump administration denied that climate change comprised an existential threat and withdrew from the Paris Accords. The Biden administration has articulated a national security strategy that advocates competition with China across traditional security issues while simultaneously pursuing cooperation to address the transnational threat of climate change.

But how can a national security strategy pursue cooperation to confront a global existential threat while simultaneously embracing traditional geopolitical competition between rival powers? The Biden administration's early climate discussions with China illustrate the dilemma. As reported by Litwak:

> Contrasting positions on the nexus—the linkage between geopolitical competition and climate change—were evident in an exchange between Chinese Foreign Minister, Wang Yi and former Secretary of State John Kerry, . . . during his visit to China in August 2021. Wang warned that cooperation on climate change "cannot possibly be divorced" from other geopolitical tensions, while Kerry countered that climate change is neither "a geostrategic weapon" nor "ideological" . . . but "a global, not bilateral, challenge."[58]

Robert Daly, Director of the Kissinger Institute on China and the United States, observed the ongoing dilemma in 2023, "The broader context of competition makes it difficult for China and the U.S. to engage in any productive form of cooperation on climate change. . . . In fact, both sides are likely to seek military, economic, or political advantages based on the other's climate policies."[59]

It appears that a fundamental framework, or security paradigm, of geopolitical competition inhibits or subordinates cooperation toward mutually beneficial goals. Indeed, within the U.S. security sector, a competitive mindset often frames the discussion of issues in the environmental security domain. For example, Richard Kidd, Deputy Assistant Secretary of Defense for Environment and Energy Resilience, recently stated that "China has made it very clear that clean energy technology also results in geostrategic power." Accordingly, "The Defense Department is

[58] Litwak, "Geostrategic Competition and Climate Change."

[59] Robert Daly, "China's Climate Security Vulnerabilities," Wilson Center, 11 April 2023, https://www.wilsoncenter.org/.

investing in a range of technologies that will help keep pace with or stay out in front of China." [60]

As another example, a recent (2023) US Army War College publication advised,

> Climate change offers the United States a unique opportunity to flex soft power in Southeast Asia. . . . To counter China's influence and grow U.S. influence in the region, Indo-Pacific Command should actively plan for operations to respond to and combat climate change. . . . Envisioning climate change within the framework of competing for influence in the region provides opportunities for engagement with nations reticent about closer military cooperation and leverages US-Chinese competition for the betterment of the world." [61]

Similarly, a recent study sponsored by USINDOPACOM's Climate Change Impacts Program addressed the topic of "Great Power Competition and Climate Change" in this way: "Climate change adds another layer of complexity to this competition as countries compete to secure resources and influence vulnerable communities (while others look to exploit these communities)."[62]

Cooperation with China to address transnational issues is a salient element of U.S. national security strategy. Yet, in practice, given an underlying competitive framework, security sector collaborations for environmental security are mostly limited to projects with allies and partners. The *Department of Defense Climate Action Plan*, for example, designates one of its five lines of effort to "Enhance adaptation and resilience through collaboration." It calls for cooperation with allies and partners, but it overlooks the possibility of cooperation with rivals such as China as if they do not share common interests in environmental security.[63]

Although the highest-level U.S. security policy documents acknowledge climate change to be an existential threat, the security sector as a whole has yet to experience a paradigm shift that sees cooperation with rivals as a principal mission and pathway to national security. The concept of a paradigm shift can be helpful toward

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[60] David Vergun, "U.S. Should Not Surrender Clean Energy Technology to China, DOD Official Says," *DoD News*, 25 August 2022, https://www.defense.gov/.

[61] Catherine A. Reppert, "Climate Change: An Opportunity for INDOPACOM," Parameters 53, no. 1 (2023), 78–79, https://press.armywarcollege.edu/.

[62] Joseph Green et al., *Indo-Pacific 2050 Climate Change Impact Analysis* (Honolulu: Pacific Disaster Center, 2023), 54, https://www.cfe-dmha.org/.

[63] *Department of Defense Draft Climate Adaptation Plan*. Report Submitted to National Climate Task Force and Federal Chief Sustainability Officer (Washington, DC: DOD, 1 September 2021), https://www.sustainability.gov/.

resolving the dilemma that a fundamental framework of unconstrained competition inhibits cooperation toward mutually beneficial goals.

A *paradigm* is a fundamental framework of knowledge—assumptions, principles, and methods—within which the members of a knowledge community work. Thomas Kuhn characterized a paradigm as knowledge expressed through practice—a community's way of knowing and doing things. Paradigm shifts, then, require more than a change in policy. They involve a radical and integral change in professional understanding and practice—in our way of doing things. [64]

As we have seen, US–China relations in the geopolitical domain have been characterized by a competition of rivals in a largely zero-sum game. Cooperation for mutual benefit has been subordinate to the contingencies of competition. The logic of an emergent, global, existential threat implies the possibility, even a necessity, of a paradigm shift in the security sector's knowledge and practice, where win-win cooperation becomes the fundamental relationship and competition the subordinate relationship. Such a seismic change in worldview cannot be an easy one.

According to Kuhn, paradigm shifts are not simple events, nor is the adoption of a new paradigm merely a subject of logical persuasion, in part because the integrity of a paradigm is based on the historically successful practices and vested interests of the knowledge community. Comparative evaluation of paradigms is complicated because knowledge that makes rational sense within the historical paradigm may be incoherent in the emergent paradigm and vice versa. There may be no external criteria or authority for the comparative evaluation of alternative paradigms. Sometimes a generational change is required for a knowledge community to change its way of knowing things. Kuhn quotes an observation of Max Planck, "A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it."[65]

Kuhn's concept of a paradigm shift in scientific knowledge and practice serves as an exemplar that elucidates the dilemma of security practice, as identified by Litwak and others. It emphasizes that there are significant intellectual, social, and psychological barriers to the security sector's adoption and implementation of a strategy that calls for cooperation between rivals—or even recognition that a change in security practice is desirable or needed. It implies that we should anticipate

[64] Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 50th ed. (Chicago: University of Chicago Press, 2012).

[65] Kuhn, *The Structure of Scientific Revolutions*, 151.

significant inertia and resistance to change, even if change seems to be logically entailed, because such entailment is paradigm-dependent.[66]

In the case at hand, however, there are some factors that may facilitate the possibility of a paradigm shift:

1. There is an external referent for the comparison of candidate paradigms—the empirical impacts of climate change on the environmental security domain. If science-based climate change scenarios are predictive, the existential threat to security will become increasingly clear, and the motivation for a paradigm shift increasingly impactful to security professionals.

2. Certain traditional security issues, such as the strategic accessibility of the Arctic Ocean, its resources, and sea routes, mean that the security sector has a vested interest in aspects of climate change. These elements of the traditional paradigm provide a kernel for the continuity of perspective in the face of a broader paradigm shift.

3. The knowledge and practices of the security sector are part of the larger society and are subject to the influence of other knowledge communities, for example, that of the environmental science research community. These stakeholders can influence security sector professionals, their knowledge, and, ultimately, their practice through agencies such as the IPCC assessment reports and DOD representation at the annual conferences of the parties to the UN Framework Convention of Climate Change.

4. A new security paradigm need not (and should not) abjure competition. It must only recognize a need to constrain competition where such competition is destructive to the environmental security domain.[67]

These factors provide touchstones that can bridge the gap between the traditional ways of knowledge and practice for national security and the shifts required for effectively managing security challenges in the emergent geopolitical system.[68]

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[66] The contentious paradigm shift in security strategy advocated by Brig Gen William (Billy) Mitchell in the 1920s, in the face of emergent airpower, provides an exemplar.

[67] Such constraint has historical precedent, most notably in the negotiation of nuclear arms limitations and test ban treaties.

[68] It should be noted here that climate change is not the only systemic trend impacting the geopolitical system that indicates a growing need for cooperation between rivals to achieve national security in the face of emergent and existential transnational threats. This is a rich subject for further research and analysis.

A Way Ahead

In a July 2023 editorial, William J. Burns, Director of the US Central Intelligence Agency, observed, "These two threats—geopolitical and transnational—are impossible to disentangle. Competition makes cooperation more difficult. But we're going to have to have both."[69] This statement captures the essence of the security dilemma resulting from emergent climate change and its impact on the geopolitical system.

Litwak argues that it is impossible to have both unconstrained strategic competition and cooperation, proposing a corollary that avoiding unconstrained geostrategic competition is a prerequisite for managing the climate threat. The history of US–China rivalry in the environmental security domain suggests that the traditional security paradigm—ways of thinking about security sector knowledge and practice—is incompatible with the need for rivals to cooperate. Applying the insights of Kuhn, we suggest that managing the emergent threat of climate change will require a paradigm shift of security sector knowledge about how to manage geopolitical rivalry in the emergent geopolitical system—a shift to a paradigm where competition between rivals is constrained and subordinate to cooperation in the environmental security domain.

But how is such a change in our knowledge and practice to come about? In the absence of some mystical transformation of professional perspective or the too-slow process of generational change in the face of ever-mounting environmental disasters, how is such a shift to be achieved?

This review of the environmental security domain suggests a potential entry point that aligns with traditional knowledge and practice, specifically the differentiation between benign and destructive competition. In a 2022 article, Michael Spence examined this differentiation, arguing that,

> Anxiety about Sino-American competition, particularly in the technological domain, reflects a belief on both sides that a national-security-based, largely zero-sum approach is inevitable. This assumption steers decision-making in an unconstructive, confrontational direction and increases the likelihood of policy mistakes. In reality, there are good and bad forms of strategic competition. To understand the benefits of good

[69] William J. Burns, "CIA Director Burns: What U.S. intelligence needs to do today — and tomorrow," *Washington Post*, 7 July 2023, https://www.washingtonpost.com/.

> competition – and how to reap them – one need only consider how competition fuels innovation within economies [70]

A parallel argument can be made for the case of environmental security.

Competition within the environmental security domain exacerbates the existential risks of climate change, leading to a lose-lose outcome. On the other hand, benign competition fosters innovation to enhance environmental security, exemplified by the mitigation of environmental disasters or the improvement of adaptation to their increasing destructiveness, resulting in a win-win outcome. Rivals engaging in benign competition can enhance their own security as well as the security of the entire geopolitical system. This increased environmental security may even reduce drivers for conflict, such as resource scarcity or climate-induced migration. Conversely, the pursuit of destructive competition degrades the geopolitical system as a whole and heightens a nation's vulnerability to the threats of climate change.

The security sector, including the armed services, excels at benign competition with rivals. In 2019, the United States sent 250 military athletes to compete in the Military World Games, a quadrennial event held that year in Wuhan, China.[71] In 2014 and 2016, China was invited to participate in the Rim of the Pacific (RIMPAC) exercise, although in 2017, the Pentagon disinvited the PLA Navy in protest against China's militarization of shoals in the South China Sea.[72]

The US and Chinese security sectors have cooperated in the past when it was perceived to be in their mutual interest. According to the US Congressional Research Service (CRS), from 1979 to 1989, facing a mutual threat from the Soviet Union, the two nations "generally engaged in high levels of military cooperation," which the United States suspended after the Tiananmen Square crackdown. CRS also describes manifold military-to-military ties that resumed in 1993, but which have been sporadically interrupted by competitive retribution for political or economic events. Even so, the United States and China have cooperated in military operations in the face of a mutual security threat, such as antipiracy patrols in the Gulf of Aden.[73]

The DOD possesses the technical skills, organizational infrastructure, manpower, and equipment to conduct joint missions to mitigate, adapt, and respond to

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[70] Michael Spence, "Good U.S.-China Strategic Competition," *Project Syndicate*, 2 May 2022, https://www.project-syndicate.org/.

[71] US Department of Defense, "Military Athletes Take World Stage," 24 October 2019, https://www.defense.gov/.

[72] Tara Copp, "China was just uninvited from a massive naval exercise. Here's why," *Military Times*, 23 May 2018, https://www.militarytimes.com/.

[73] Campbell, *China Primer*.

climate-related disasters and consequent threats to human and national security. They have long accepted HADR missions as second-level priorities and train for such missions with allies, partners, and even rivals, depending on geopolitical exigencies. However, they have not yet embraced a new security paradigm challenging the geopolitical axiom that rivals compete while partners collaborate. Planning and doctrine at the combatant command level and below still favor environmental security cooperation with allies and partners, with collaboration with rivals considered the conditional exception while competition remains the default posture.

In the quest for international cooperation to surpass geopolitical competition, consensus among national governments and populations that climate change poses an existential threat to national security is essential. This perception is evident through the growing political influence of IPCC reports, the incremental progress of international agreements under UNFCCC, and an increasing public awareness of extreme weather events linked to climate change. The resumption of cooperation between the US and Chinese governments on climate issues after suspending collaboration in pursuit of unrealized geopolitical advantage also underscores this evolving perception.

Achieving a higher level of trust among rivals is a prerequisite for the inherently conservative security sector to take the risk of a paradigm shift toward cooperation with rivals. Distrust and assumptions of illicit intent prevail on both sides, making it challenging yet crucial for national security in the changing geopolitical system to establish greater mutual trust. This trust could be built, in part, on a shared understanding that climate change is reshaping the geopolitical landscape.

One strategy to enhance confidence and reduce mistrust in 2024 is to leverage the renewed military-to-military dialogue between China and the United States. Exploring the establishment of competitive climate challenges or "games" could be a promising avenue—cooperation within competition for common benefits in national security. Numerous forms of such competitions or challenges are possible, ranging from research competitions by military and other national laboratories to competitive civil engineering projects addressing sea-level rise in small island nations, or contests aimed at reducing operational fossil fuel consumption. Cooperation in competition could seamlessly transition to competitive cooperation, with participation in exercises like RIMPAC and Cobra Gold extending to preplanned cooperation in actual HADR missions. Competitive research and development projects could pave the way for collaborative initiatives. Structuring an arena for constrained competition among rivals in the environmental security domain might serve as a valuable step toward a broader security sector paradigm shift, ultimately benefiting national security within the emergent geopolitical system shaped by climate change. ✪

Dr. J. Scott Hauger

Dr. Hauger is an expert in climate change and environmental security. He holds a PhD in Science and Technology Studies from Virginia Tech and has more than 30 years of experience conducting research and providing analysis, assessment, and strategic planning services related to environmental policy, technology innovation, and national security. Currently, Dr. Hauger serves as the principal and CEO of Climate and Environmental Security, LLC, providing consulting services to clients such as the USINDOPACOM Climate Change Impact Program. He has held various academic positions, including at the Daniel K. Inouye Asia-Pacific Center for Security Studies in Hawai'i. Dr. Hauger has authored numerous publications and delivered invited presentations on topics spanning climate change, desertification, and science policy.

FEATURE

Women Parliamentarians' Impact in Indo-Pacific Gender-Responsive and Climate-Compatible Security Policy Making

Maryruth Belsey Priebe

Abstract

This study examines whether women's legislative representation enhances the likelihood of a country developing a gender-responsive climate strategy or a climate-compatible Women, Peace, and Security (WPS) National Action Plan (NAP). It investigates how women's substantive representation alters state policy outcomes by emphasizing gender in climate-security policies and focusing on climate change in WPS policies. Using empirical analysis of UN Nationally Determined Contributions (NDC), WPS NAPs, Interparliamentary Union (IPU) rank and percentage, and qualitative analysis of Indo-Pacific policies, findings indicate that higher IPU metrics correlate with WPS NAP adoption, NDC implementation, or both, and with increased cross-references in WPS NAPs and NDCs. However, comparison of IPU Rank to qualitative policy text analysis reveals no clear correlation to women parliamentarians' impact on policy making, suggesting that achieving gender-responsive climate strategies or climate-compatible WPS policies necessitates more than increased women's representation in legislatures. The study concludes by briefly exploring the importance of incorporating a gender perspective in policy making.

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In the years 2021, 2022, and 2023, the stark realities of climate change, long warned of by many climate scientists, have come into sharp focus. Global warming has led to widespread destruction, accelerating more rapidly than anticipated due to humanity's excessive use of fossil fuels. The impacts of climate change, arriving a decade earlier than projected, have proven more severe than previously anticipated.[1] Describing The Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Report as a "code red for humanity," the UN Secretary General underscored the urgency of the situation.[2] Urgent state

[1] Jacob Greber, "World to Hit Temperature Tipping Point 10 Years Faster than Forecast," *Australian Financial Review*, 6 August 2021, https://www.afr.com/.

[2] UN Secretary-General, "Secretary-General Calls Latest IPCC Climate Report 'Code Red for Humanity', Stressing 'Irrefutable' Evidence of Human Influence" (press release, United Nations, 9 August 2021), https://www.un.org/.

action is imperative to address these alarming trends and mitigate the most pressing security threats posed by climate change. However, political will to enact necessary policies remains lacking in most countries.

Could bolstering women's representation in legislative bodies lead to improved outcomes in climate-security and gender policies?[3] Specifically, would increased women's representation in national governments enhance the probability of a country developing a gender-responsive climate change nationally determined contribution (NDC) or a climate-compatible Women, Peace, and Security (WPS) National Action Plan (NAP)? This study builds upon existing literature to propose that the presence of women in national legislatures influences a state's policy priorities, resulting in greater emphasis on *gender-responsiveness* in climate-security policies and climate compatibility in WPS policies. Despite progress, women continue to be underrepresented in national legislatures worldwide. According to the Interparliamentary Union's (IPU) 2020 data, women hold only 25 percent of all national parliamentary seats, with gender parity achieved in only four countries in their single or lower houses of parliament (Rwanda, Cuba, Bolivia, and the United Arab Emirates).[4]

However, women and men often hold differing perceptions of climate change and exhibit varying levels of climate risk tolerance. Thus, incorporating women's perspectives into policy-making processes may enhance the likelihood of crafting legislation that adequately addresses the urgency of the current climate crisis. Globally, women typically express higher levels of concern about climate change, display less skepticism toward climate science, and are more inclined to believe that climate change will personally harm them.[5]

Research in international relations and feminist political economy indicates that increasing women's substantive representation in national government can influence a state's foreign policy priorities by placing greater emphasis on social and gender justice.[6] Diane Elson and other feminist political economists argue that governance and policy-making processes may be influenced by masculine

[3] This paper uses *legislative/legislature* and *parliament* interchangeably, referring in either case to a state's national lawmaking body.

[4] "Monthly Ranking of Women in National Parliaments" (IPU Parline, 2020), https://data.ipu.org/.

[5] Hani Zainulbhai, "Women, More than Men, Say Climate Change Will Harm Them Personally," *Pew Research*, December 2015, https://www.pewresearch.org/; and "Gender and Environmental Statistics: Exploring Available Data and Developing New Evidence" (OECD, March 2020), https://www.oecd.org/.

[6] Joshua S. Goldstein, "A Conflict-Cooperation Scale for WEIS Events Data," *Journal of Conflict Resolution* 36 (1992): 369–85, https://doi.org/ and "Gender Climate Tracker," Text (WEDO, October 27, 2016), https://www.genderclimatetracker.org/gender-ndc/introduction; Mary Caprioli, "Gendered Conflict," *Journal of Peace Research* 37, no. 1 (1 January 2000): 51–68, https://doi.org/.

biases, resulting in an oversight of how institutions and policies favor men while disadvantaging women.[7] Additionally, the theory of "more women, more substantive representation" suggests that an uptick in women's representation is likely to lead to a greater consideration of women's issues in policy making.[8] For instance, Orlando C. Richard and Carliss D. Miller observe that women politicians are less inclined to support military spending over welfare programs that stabilize communities.[9]

Numerous studies corroborate the notion that women legislators are more prone to introduce and co-sponsor policies addressing the needs of women, children, and families. These policies encompass improvements in education, healthcare, the economy, employment, women's rights, and childcare.[10]

Of specific relevance to this project, several studies indicate that augmenting women's representation in parliament yields superior environmental policies. For instance, an analysis reveals that nations with higher proportions of women in parliament demonstrate greater propensity to ratify environmental treaties.[11] Additionally, research by Astghik Mavisakalyan and Yashar Tarverdi establishes a positive correlation between heightened levels of women's representation in parlia-

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[7] Julia Smith et al., "More than a Public Health Crisis: A Feminist Political Economic Analysis of COVID-19," *Global Public Health* 16, no. 8–9 (2 September 2021): 1367, https://doi.org/.

[8] Karen Celis, "Substantive Representation of Women (and Improving It). What Is and Should It Be About?," *Comparative European Politics* 7 (2009): 95–113; and Susan Franceschet and Jennifer M. Piscopo, "Gender Quotas and Women's Substantive Representation: Lessons from Argentina," *Politics & Gender* 4, no. 3 (September 2008): 393–425, https://doi.org/.

[9] Orlando C. Richard and Carliss D. Miller, "Considering Diversity as a Source of Competitive Advantage in Organizations," *Oxford Handbook of Diversity and Work*, 9 January 2013, https://doi.org/.

[10] Leslie A. Schwindt-Bayer, "Still Supermadres? Gender and the Policy Priorities of Latin American Legislators," *American Journal of Political Science* 50, no. 3 (2006): 570–85, https://doi.org/; Mark P. Jones, "Legislator Gender and Legislator Policy Priorities in the Argentine Chamber of Deputies and the United States House of Representatives," *Policy Studies Journal* 25, no. 4 (1997): 613–29, https://doi.org/; Susan J. Carroll, *The Impact of Women in Public Office* (Indiana University Press, 2001); Kathleen A. Bratton and Leonard P. Ray, "Descriptive Representation, Policy Outcomes, and Municipal Day-Care Coverage in Norway," *American Journal of Political Science* 46, no. 2 (2002): 428–37, https://doi.org/; Kathleen A. Bratton, "Critical Mass Theory Revisited: The Behavior and Success of Token Women in State Legislatures," *Politics & Gender* 1, no. 1 (March 2005): 97–125, https://doi.org/; Cindy Simon Rosenthal, *Women Transforming Congress* (University of Oklahoma Press, 2002); Michelle M. Taylor-Robinson and Roseanna Michelle Heath, "Do Women Legislators Have Different Policy Priorities than Their Male Colleagues?," *Women & Politics* 24, no. 4 (1 January 2003): 77–101, https://doi.org/; and Michele L. Swers, "Connecting Descriptive and Substantive Representation: An Analysis of Sex Differences in Cosponsorship Activity," *Legislative Studies Quarterly* 30, no. 3 (2005): 407–33, https://doi.org/.

[11] Kari Norgaard and Richard York, "Gender Equality and State Environmentalism," *Gender and Society* 19, no. 4 (2005): 506–22.

ment and the implementation of more stringent climate change policies.[12] Furthermore, empirical findings from Ergas and York illustrate that as women's political standing (reflected in parliamentary seats) increases, per capita carbon dioxide emissions decrease.[13]

These instances suggest that, when considered individually, discrete policies pertaining to security, climate, and gender equality generally yield enhanced outcomes in the presence of higher percentages of women in parliament. However, no studies to date have investigated whether women's parliamentary representation influences cross-cutting issues such as the triple nexus of gender-climate-security.

The following analysis aims to apply a theoretical framework formulated by Susan Franceschet and Jennifer M. Piscopo, which examines the potential impact of higher levels of women's parliamentary representation on policy making. These scholars propose two dimensions for assessing women's substantive representation: as a process, to determine if women policy makers are more inclined to *act* for women's interests, and as an outcome, to assess whether the presence of women in parliament leads to tangible changes in policies.[14] Given the escalating pace of climate change and its potential ramifications for international security, elucidating whether increased representation of women in national government can enhance policy outcomes holds significant importance. To commence, however, this analysis will provide background information on the significance of the gender-climate-security nexus.

Gender-Climate-Security: Why the Triple Nexus Matters

Conflict and Climate: Compounding Risks

There exists a prevailing consensus within the realms of security and international relations that climate change serves as a catalyst for threats. The United Nations Security Council (UNSC) initially acknowledged the interconnectedness of climate and security in 2007, subsequently issuing analyses on the anticipated amplification of global security risks due to climate change.[15] Research indicates that the trajec-

[12] Astghik Mavisakalyan and Yashar Tarverdi, "Gender and Climate Change: Do Female Parliamentarians Make Difference?," *European Journal of Political Economy* 56 (1 January 2019): 151–64, https://doi.org/.

[13] Christina Ergas and Richard York, "Women's Status and Carbon Dioxide Emissions: A Quantitative Cross-National Analysis," *Social Science Research* 41, no. 4 (1 July 2012): 965–76, https://doi.org/.

[14] Franceschet and Piscopo, "Gender Quotas and Women's Substantive Representation."

[15] "S/PV.5663" (United Nations Security Council, 17 April 2007), https://undocs.org/; and UN Security Council, "63/281. Climate Change and Its Possible Security Implications," A/RES/63/281 § (2009), https://undocs.org/.

tory of global warming is poised to instigate heightened levels of conflict and violence worldwide, potentially destabilizing even ostensibly stable states when confronted with abrupt shocks or significant pressures.[16] Both direct stressors, such as rising sea levels and scarcity of freshwater and ocean resources, and climate-induced extreme weather events, alongside indirect stressors like internal population displacements and migrations, disruptions in food supply, and fluctuations in prices, are forecasted to jeopardize human safety and security.[17] Security scholars Chantal de Jonge Oudraat and Michael E. Brown expound upon the overarching trends indicative of escalating climate-security threats: "Rising sea levels threatening the existence of small island nations along with the world's coastal cities and populations; intensifying naval and resource competitions in the Arctic; the impact of extreme weather and rising temperatures on the viability of human habitats; and the impact of climate-generated population movements on governmental viability, national security, and regional stability."[18]

These trends, particularly the role of climate change in exacerbating low-intensity conflicts, have been evident since as early as 2000.[19] For instance, Scott Greenwood highlights a case where Syria plunged into civil unrest due to governmental failure in addressing resource scarcity and severe drought from 2006 to 2010, suggesting a potential link between these climate-related environmental changes and the outbreak of civil war, although dispute this connection.[20] A recent study by Ide et al. indicates that a flood in June 2015 in Northeast India may have escalated tensions and sporadic skirmishes among various ethnic groups, including the Garo National Liberation Army (GNLA) in Meghalaya state and the National Democratic Front of Boroland (NDFB), involving migrants from different parts of India

[16] World Bank Group, "World Development Report 2011: Conflict, Security, and Development," *Understanding Poverty*, 2011, xvi, 74, https://documents.worldbank.org/.

[17] The Center for Climate and Security, "Is Climate Change a Security Risk?," *Climate Security 101*, 16 February 2015, https://climatesecurity101.org/.

[18] Chantel de Jonge Oudraat and Michael E. Brown, "Gender, Climate Change, and Security: Making the Connections," *Wilson Center* (blog), 25 January 2022, https://diplomacy21-adelphi.wilsoncenter.org/.

[19] Tobias Ide et al., "Gender in the Climate-Conflict Nexus: 'Forgotten' Variables, Alternative Securities, and Hidden Power Dimensions," *Politics and Governance* 9, no. 4 (22 October 2021): 44; and Eran Bendavid et al., "The Effects of Armed Conflict on the Health of Women and Children," *The Lancet* 397, no. 10273 (6 February 2021): 522–32, https://doi.org/.

[20] Scott Greenwood, "Water Insecurity, Climate Change and Governance in the Arab World," *Middle East Policy* 21, no. 2 (June 2014): 140–56, https://doi.org/; and Jody M. Prescott, *Armed Conflict, Women and Climate Change* (London: Routledge, 2018), https://doi.org/.

and Bangladesh, as well as straining relations between the Indian government and northeastern states.[21]

Additionally, climate change is projected to impede military readiness, endangering bases and rendering equipment inoperable. The financial toll of climate-related disaster responses, coupled with damages to equipment, amounts to billions annually.[22] For instance, the 2018 Hurricane Michael in Florida inflicted USD 4 billion in damage to Tyndall Air Force Base, underscoring the fiscal ramifications for the US Department of Defense.[23] As one of the biggest carbon-emitting sectors in the world, the military's carbon footprint exacerbates climate-related security threats, further intertwining conflict and climate challenges.[24]

Gender in Conflict and in Climate Change: Intersecting Vulnerabilities

While the concept of human security is relatively recent within traditional security frameworks, it is increasingly recognized as fundamental for examining the gendered origins of both national and international instabilities. The adverse impacts of conflict and violence on women's human security are well-documented: women often face heightened risks of displacement and forced migration, encounter elevated rates of battle-related fatalities, and suffer from indirect health consequences such as increased disease transmission in conflict zones.[25] Conflict tends to escalate rates of sexual- and gender-based violence (SGBV) and forced marriage among women, with rape frequently utilized as a weapon of war.[26] Conversely, numerous studies demonstrate that enhancing women's rights through investments in gender equality fosters greater social resources and networks, ultimately promoting more peaceful conflict resolution mechanisms.[27] In essence, gender equity plays a pivotal role

[21] Tobias Ide et al., "Multi-Method Evidence for When and How Climate-Related Disasters Contribute to Armed Conflict Risk," *Global Environmental Change* 62 (1 May 2020): 102063, https://doi.org/.

[22] Neta C. Crawford, *Pentagon Fuel Use, Climate Change, and the Costs of War* (Boston: Boston University, 13 November 2019), https://watson.brown.edu/.

[23] US Department of Defense, "Combating Climate Change Factors Into Defense Budget Request," 2 June 2021, https://www.defense.gov/.

[24] Crawford, "Pentagon Fuel Use, Climate Change, and the Costs of War."

[25] Mayra Buvinic et al., *Violent Conflict and Gender Inequality: An Overview*, Policy Research Working Papers (The World Bank, 2013), https://doi.org/; and C J L Murray et al., "Armed Conflict as a Public Health Problem," *BMJ* 324, no. 7333 (9 February 2002): 346–49, https://doi.org/.

[26] Anna Applebaum and Briana Mawby, "Gang Violence as Armed Conflict:" (Georgetown Institute for Women, Peace and Security, November 2018), https://giwps.georgetown.edu/; and Cassandra Clifford, "Rape as a Weapon of War and It's Long-Term Effects on Victims and Society" (7th Global Conference: Violence and the Contexts of Hostility, Budapest, Hungary, 5 May 2008), 7, https://www.peacewomen.org/.

[27] Erika Forsberg and Louise Olsson, "Examining Gender Inequality and Armed Conflict at the Subnational Level," *Journal of Global Security Studies* 6, no. 2 (17 June 2021), https://doi.org/.

in understanding the foundations of state security and peacefulness. As Valerie M. Hudson and her colleagues have aptly remarked, the treatment of women mirrors the condition of a nation.[28]

Moreover, gender considerations should be integrated into security assessments due to the increased involvement of women in extremist and armed group activities, including acts of violence—often in subordinate roles within hierarchical structures.[29] While still in its infancy, some national policy-making initiatives have begun to adopt a gender perspective to enhance state stability. However, despite the escalating importance of the triple nexus, traditional security policy making rooted in gender and human security remains relatively uncommon, with climate-security policies seldom incorporating gender perspectives.

Carol Cohn and Claire Duncanson have delineated four essential ways in which national and international security discourse should center on climate change and gendered human security.[30]

1. In discussions confined to traditional conceptions of warfare and international security, climate change must be factored in due to its intricate interactions with socioeconomic and political factors, complicating and exacerbating drivers of armed conflict.

2. Given the multifaceted ways in which climate change disrupts the peacebuilding process and intersects with various aspects of human and international security, climate change will serve as the overarching context within which all peacebuilding efforts take place.[31]

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[28] Valerie M. Hudson et al., "The Heart of the Matter: The Security of Women and the Security of States," *International Security* 33, no. 3 (January 2009): 7–45, https://doi.org/.

[29] Jennifer Philippa Eggert, "Female Fighters and Militants During the Lebanese Civil War: Individual Profiles, Pathways, and Motivations," *Studies in Conflict & Terrorism* 46, no. 7 (November 5, 2018): 1042–71, https://doi.org/.

[30] Carol Cohn, "The Women, Peace and Security Agenda and the Climate Crisis: Inextricable Links" (presentation, Nordic Africa Institute, Uppsala, Sweden, 9 March 2020), https://genderandsecurity.org/; and Carol Cohn and Claire Duncanson, "Women, Peace and Security in a Changing Climate," *International Feminist Journal of Politics* 22, no. 5 (19 October 2020): 742–62, https://doi.org/.

[31] First, climate change will impact the effectiveness of peacebuilding: peacebuilding requires jobs and livelihoods while climate change destroys the conditions for providing jobs and livelihoods; peacebuilding requires addressing reforms for land rights and restitution, while climate change reduces the quantity and quality of land available; peacebuilding requires addressing the health crises and injury caused by war, while climate change adds pressure on health services. Second, every decision within the context of peacebuilding will have impacts on climate change; specifically, standard economic strictures placed on post-recovery systems tend to worsen rather than ameliorate climate change by relying on extractive economic development. Carol Cohn and Claire Duncanson, "How the Women, Peace and Security Agenda Must Change in Response to the Climate Crisis," *International Feminist Journal of Politics* (blog), 3 December 2020, https://www.ifjpglobal.org/.

3. Climate change is poised to divert resources away from peacebuilding initiatives toward the recovery of climate-damaged economies, restoration of disrupted public service systems, and repair of deteriorating infrastructures.
4. While women's human security formed the core of UNSCR 1325, safeguarding women's human security will prove unattainable without addressing the challenges posed by climate change.

As a result, any national or international security policy would lack comprehensiveness without addressing both climate change and gender, particularly gendered human insecurities. Below are examples illustrating the interplay and intersectionality of gender, climate, and conflict:[32]

- Early Warnings: Women often face limitations in their ability to make timely decisions and relocate due to factors such as lower access to mobile phones, internet technology, electricity, and education. These constraints may hinder women's capacity to respond to early warnings about natural disasters, exacerbating the impact of such events on women. Governmental failure to provide early warnings for climate disasters can incite public discontent and destabilize governments.
- Healthcare: Climate change is expected to elevate the prevalence of diseases such as asthma, cardiovascular disease, malnutrition, and heatstroke among women, particularly pregnant and breastfeeding women. Climate crises may also lead to an increase in rates of child marriage and SGBV. Health crises can further amplify gender-specific rates of individual and organized crime, corruption, and economic and political instability, contributing to state fragility.
- WASH (water, sanitation, hygiene): Water scarcity and poor-quality water sources are anticipated to heighten women's unpaid care and domestic workload, diminish women's health outcomes, and elevate the risk of physical injury for women, including injuries related to carrying heavy fuel and water loads. Clean water shortages may result in militant or terrorist control of water sources, often with hypermasculine undertones, escalating tensions between groups.
- Education: Climate change is likely to disrupt educational infrastructure, lead to loss of teachers, and cause psychological distress in children, all of which

[32] Maryruth Belsey Priebe, "Gender All the Way Down: Proposing a Feminist Framework for Analyzing Gendered Climate Security Risks" (master's thesis, Cambridge, MA, Harvard University, 2022), https://dash.harvard.edu/.

may impede overall educational attainment, especially for girls. Reduced educational opportunities for boys may perpetuate norms that reinforce gender inequality, such as female genital mutilation/circumcision and other discriminatory practices like child marriage. Girls with limited access to education are more likely to experience child marriage at younger ages and higher fertility rates, diminishing their long-term human security. Moreover, education can be manipulated to perpetuate ideologies of othering through ethnocide (erasure of minority languages, traditions, and cultural values), dissemination of authoritarian or chauvinistic ideologies, and denial of education to marginalized groups (such as rival tribes or the marginalized gender group, typically women), serving as a weapon of warfare.

These and numerous other intersecting gender-climate-security risks are poised to undermine human stability and resilience in profound ways. The compromised human security experienced by women as a result of climate change is likely to result in fewer systemic resources and strategies to bolster climate security and mitigate climate-related conflicts. Moreover, the breakdown of climate and gender norms may influence the extent to which women and men are drawn into climate-related violence and conflict.

In sum, both gender and climate change warrant inclusion in national and international security deliberations. Indeed, addressing gender and climate in tandem is crucial for comprehending the intervening variables at the climate-security nexus, acknowledging "invisible" forms of violence within security paradigms, and fostering a more comprehensive understanding of climate resilience.[33] Consequently, the intricacies of the triple nexus should be integrated into policies that transcend the limitations of traditional policy silos.[34]

Women's Political Leadership in Cross-cutting Policy Making

Building upon prior scholarship, this study seeks to investigate whether augmenting women's substantive political representation enhances the integration of climate and security policies. Given that gender equality and climate change exert significant influence on political stability, both policy priorities are pertinent to the

[33] Ide et al., "Gender in the Climate-Conflict Nexus," 44.

[34] António Guterres, "Deputy Secretary-General's Remarks to International Conference on Sustainable Development—'Breaking Down Silos: Fostering Collaborative Action on the SDGs' [as Prepared for Delivery]" (presentation, Sixth International Conference on Sustainable Development, New York, 27 September 2018), https://www.un.org/.

development of foreign policy. Consequently, two instrumental policy-making mechanisms come into focus in this discourse.

Firstly, a WPS NAP delineates a country's strategy for implementing the WPS agenda, outlining how various WPS objectives will be financed, executed, and monitored. Essentially, a WPS NAP endeavors to mainstream gender considerations across government policies and structures, playing a pivotal role in formulating gender-transformative measures for preventing and responding to conflicts.

Secondly, a NDC represents a country's policy framework for implementing its commitments under the Paris Agreement on climate change. Analogous to a WPS NAP, an NDC serves as the government's blueprint for mainstreaming climate change considerations across all sectors, essential for achieving carbon reduction targets, devising climate hazard mitigation strategies, and fortifying resilience against climate-related disasters.

The quantitative findings of this study corroborate existing scholarship demonstrating how a higher level of gender equality in parliament may influence the nature and effectiveness of policy making regarding women and climate change. However, upon qualitative examination of policy documents from Indo-Pacific countries, the impact of increased women's representation in policy making appears less evident. These findings suggest that while women's meaningful participation in policy making is imperative, a robust application of gender perspectives is indispensable for crafting more efficacious WPS and climate-security policies.

Methodology

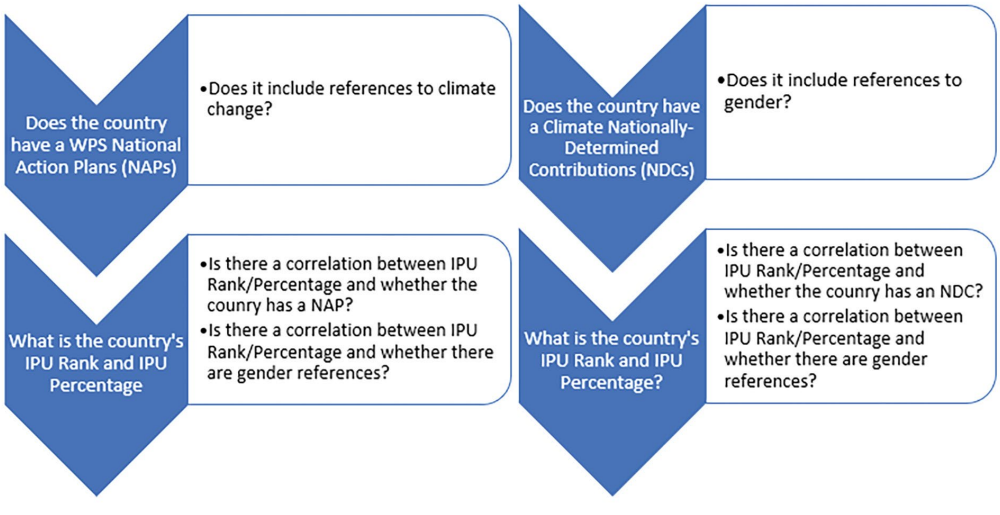

Figure 1. Flowchart of this study's research objectives

This secondary data study employs a multi-step methodology, comprising two quantitative preparatory stages followed by a third quantitative assessment of the paper's hypothesis, alongside a qualitative analysis of cross-references within a sample of policies. Subsequently, a brief analysis is conducted on cross-references within WPS NAP and NDC policies from the Indo-Pacific region to evaluate the quality of cross-references therein.

The initial quantitative preparatory phase involves analyzing which countries have adopted a *gender-responsive* NDC, a *climate-compatible* WPS NAP, both, or neither. This entails conducting a content analysis of English-language WPS NAPs to identify documents referencing climate change, as well as analyzing English-language NDCs to ascertain references to gender.

A second preparatory quantitative analysis investigates whether countries with higher IPU Rank (IPU Parline's ranking of countries based on averages of women in national parliaments) or higher IPU Percentage (IPU Parline's reported percentage of women in upper house/senate and lower/single house in national parliament) are more inclined to have an NDC, a WPS NAP, or both.

A third quantitative examination of the central hypothesis of this study involves analyzing whether countries with higher IPU Rank and/or IPU Percentage of women in national parliament exhibit a greater likelihood of including cross-references to gender in their NDCs, cross-references to climate change in their WPS NAPs, or both. Statistical analysis is employed to explore the bivariate relationship between the presence of a climate-compatible NAP or gender-responsive NDC (or both) and a country's IPU 'women in national parliaments' Rank and Percentage

Narratives within NDCs were individually scrutinized to identify references to terms such as "women," "gender equality," "gender," and "gender equity," which were then coded as either 'yes' (containing a gender cross-reference) or "no" (lacking a gender cross-reference). Similarly, NAP narratives were reviewed for mentions of terms such as "climate change" and "global warming," coded as either "yes" (including a climate cross-reference) or 'no' (without a climate cross-reference).

The final phase of this study entails a concise qualitative analysis of cross-references within Indo-Pacific policies. This involves examining a sample of WPS NAP and NDC policies' texts to evaluate the quality of cross-references contained therein.

For the purposes of this study, the following UNESCO definition of *gender-responsiveness* is used in relation to NDCs: "Refers to a policy or program which fulfills two basic criteria: a) gender norms, roles, and relations are considered and b) measures are taken to actively reduce the harmful effects of gender norms,

roles, and relations—including gender inequality" (GPE (Global Partnership for Education) and UNGEI.[35]

Additionally, the qualitative analysis proposes a definition of *climate-compatible security* derived from the concept of *climate-compatible development* put forth by the Climate & Development Knowledge Network.[36] In this context, *climate-compatible security* refers to measures that mitigate the harm inflicted by climate change, particularly for fragile states, while maximizing the numerous opportunities to enhance national and human security through low-emission, resilient future endeavors.

This study builds on research done by Seymour Smith and that of Women's Environment and Development Organization's (WEDO) Gender Climate Tracker.[37] It utilizes more recent data and juxtaposes its findings with these earlier results concerning the influence of women's representation on the adoption of gender-responsive NDCs and climate-compatible WPS NAPs, and/or both.

Quantitative Analysis

Countries with NDCs and NAPs

Out of the 194 countries examined, 186 (95.9 percent of all countries) possess an NDC, while 87 (44.8 percent of all countries) have a WPS NAP. Eighty-six countries (44.3 percent) possess both an NDC and a WPS NAP, indicating a high likelihood that countries with WPS NAPs also have NDCs. The majority, constituting 100 countries, have an NDC but no NAP, whereas only one country, Yemen, possesses solely a WPS NAP without an NDC. Additionally, seven countries, comprising 3.6 percent, have neither an NDC nor a WPS NAP. Visual representations of these findings are provided in figures 2 and 3.[38]

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[35] GPE (Global Partnership for Education) and UNGEI (United Nations Girls' Education Initiative), "Guidance for Developing Gender-Responsive Education Sector Plans. Washington D.C." (The Global Partnership for Education, 2017), https://www.globalpartnership.org/.

[36] Tom Mitchell and Simon Maxwell, "Policy Brief: Defining Climate Compatible Development" (Climate & Development Knowledge Network, November 2010), https://cdkn.org/.

[37] Elizabeth Seymour Smith, "Climate Change in Women, Peace and Security National Action Plans," *SIPRI Insights on Peace and Security 2020*, no. 7 (June 2020): 32; and "Gender Climate Tracker."

[38] It is important to note here that 27 countries included in the "Has an NDC" category are part of the European Union (EU). Rather than having 27 individual NDCs, all 27 EU member states share a joint NDC. Furthermore, 10 of the 27 EU member states (37 percent of all EU member states) have both individual *climate-compatible* NAPs as well as a shared *gender-responsive* NDC. Efforts have been taken in future steps of the study to control for this potentially confounding variable.

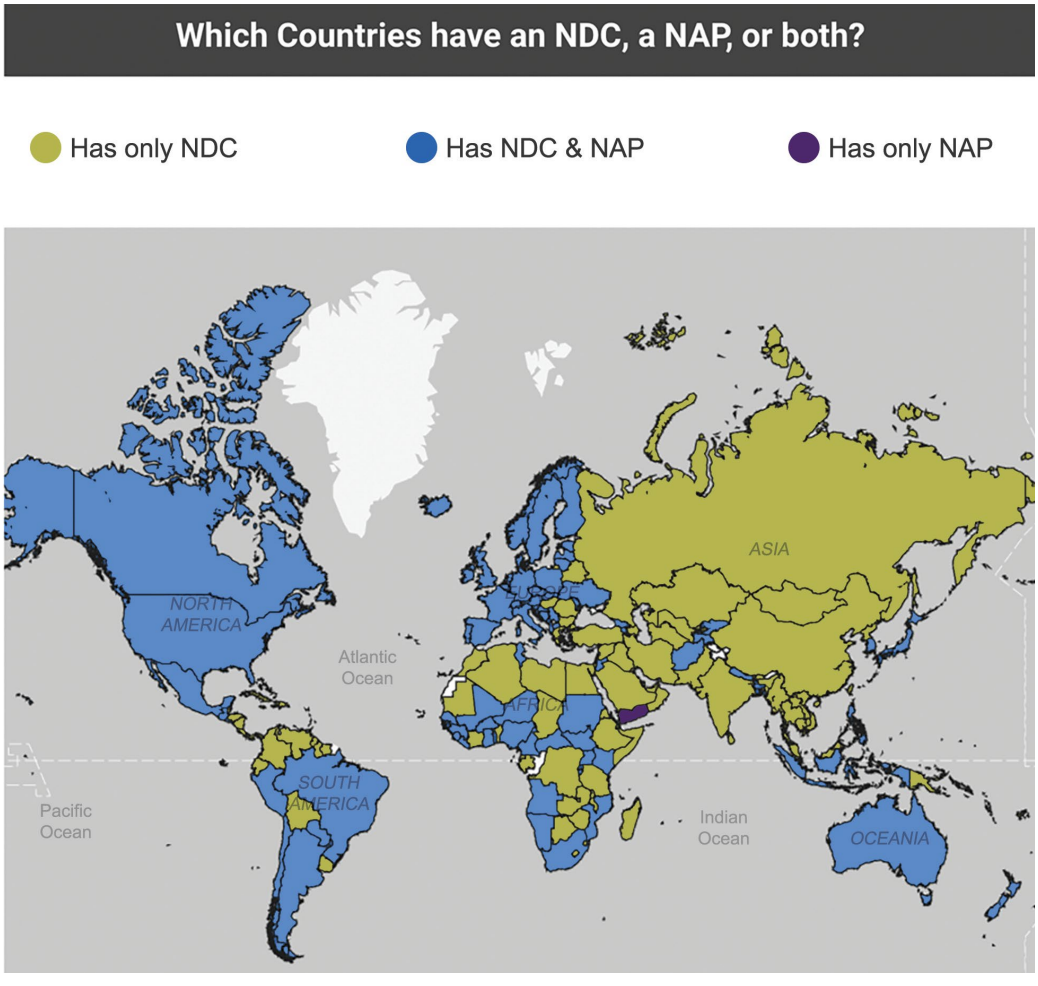

Figure 2. Illustration of which countries have only an NDC, only a NAP, both an NDC and a NAP, or neither an NDC or a NAP

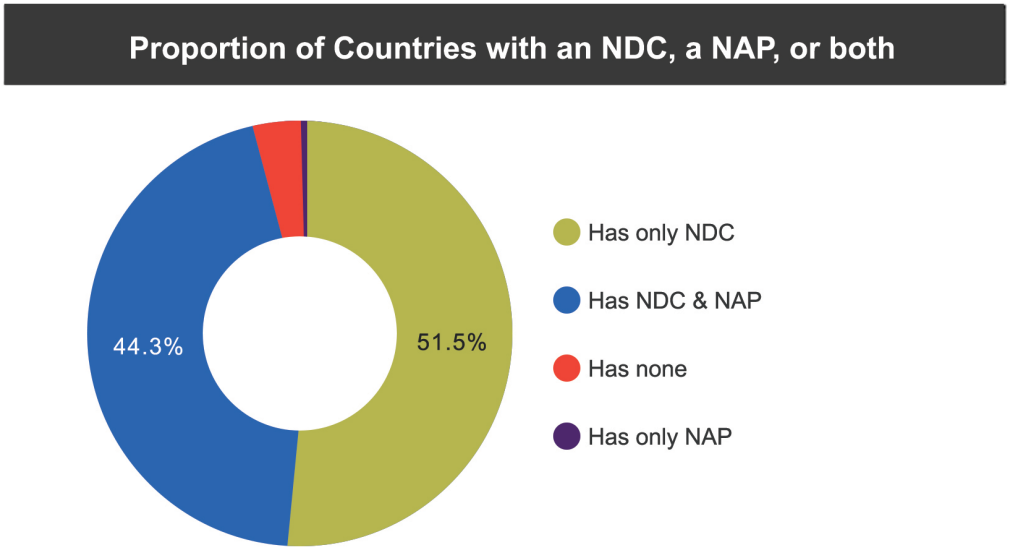

Figure 3. Showing percentage of countries with only an NDC, only a NAP, both an NDC and a NAP, or neither an NDC or a NAP

Presence of Climate and Gender Cross-references

Examination of the texts of all English-language NDCs for gender terms such as "women," "gender equality," "gender," and "gender equity" revealed that out of 186 countries with an NDC, 99 (53.4 percent of countries with an NDC) incorporate gender cross-references (Appendix data: table 3). Analysis of the English-language WPS NAP narratives for climate terms such as "climate change" or "global warming" found that among the 87 countries with a NAP, only 22 (25.9 percent of countries with a WPS NAP) make reference to climate change (Appendix data: table 4). Merely 17 countries (9.3 percent of all countries) possess both an NDC with gender cross-references and a NAP with climate cross-references (Croatia,* Denmark,* Finland,* Germany,* Ireland,* Italy,* Kenya, Latvia,* Liberia, Mali, Netherlands,* Nigeria, Norway, Poland,* Senegal, Slovenia,* Tajikistan).[39] Visual representations of these findings are available in figure 4.

[39] These findings approximately corroborate previous research conducted by Women's Environment and Development Organization (WEDO): https://genderclimatetracker.org/.

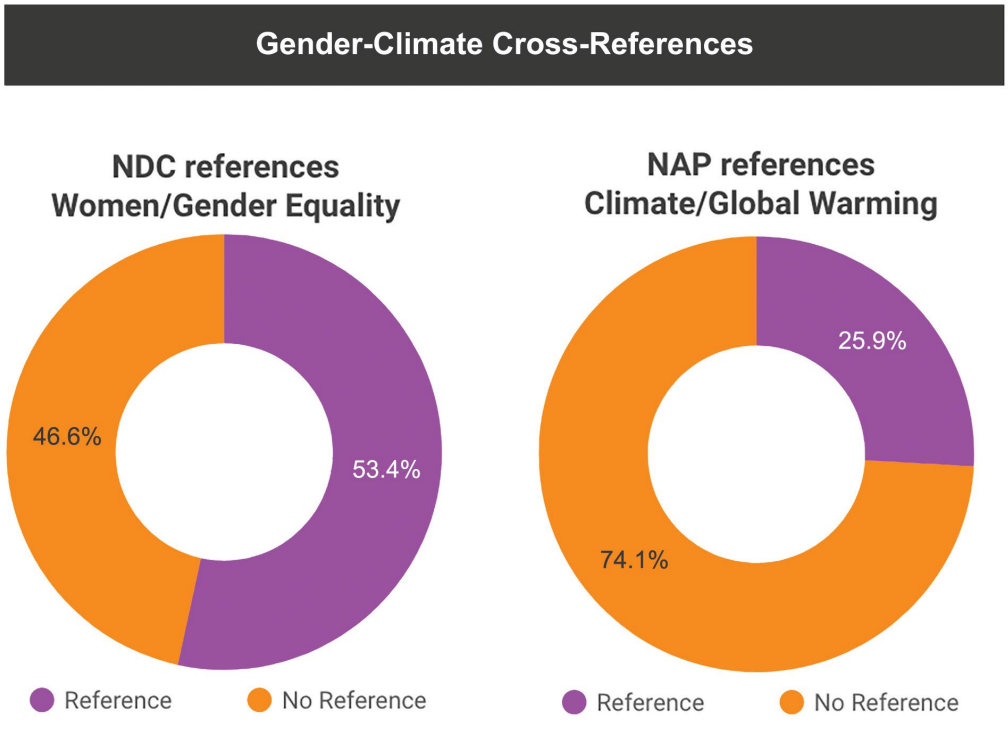

Figure 4. Visualization of proportion of countries with an NDC that includes gender cross-references, or a NAP that includes climate cross-references. (Note: results shown combine all EU member states into one entity)

Cross-referenced Terms in NDCs and WPS NAPs against IPU Metrics

The preceding data was subsequently scrutinized in relation to IPU Parline's global and regional averages of women in national parliaments, denoted as *IPU Percentage*, and monthly rank, denoted as *IPU Rank*).[40]

Upon comparing IPU Rank with the adoption of an NDC, WPS NAP, or both, a weak, negative correlation was observed (coefficient -0.29, p-value = 0.0000616). Countries possessing both an NDC and a NAP exhibited an average rank of 76, while countries with solely an NDC had an average rank of 105. Conversely,

[40] "Monthly Ranking of Women in National Parliaments," *IPU Parline*, 1 June 2021, https://data.ipu.org/. The IPU ranking system is compiled by the IPU based on data provided by national parliaments. It ranks countries according to the average number of seats occupied by women in their respective parliaments. This ranking considers the percentage of women in both lower or single houses and upper chambers. A lower numerical score indicates a higher rank, reflecting a greater representation of women in parliament. However, it is essential to note that a high ranking does not guarantee meaningful roles for women in government.

countries lacking either an NDC or a WPS NAP displayed an average rank of 127, with one country possessing solely a NAP ranking 184. These findings are illustrated in figure 5.

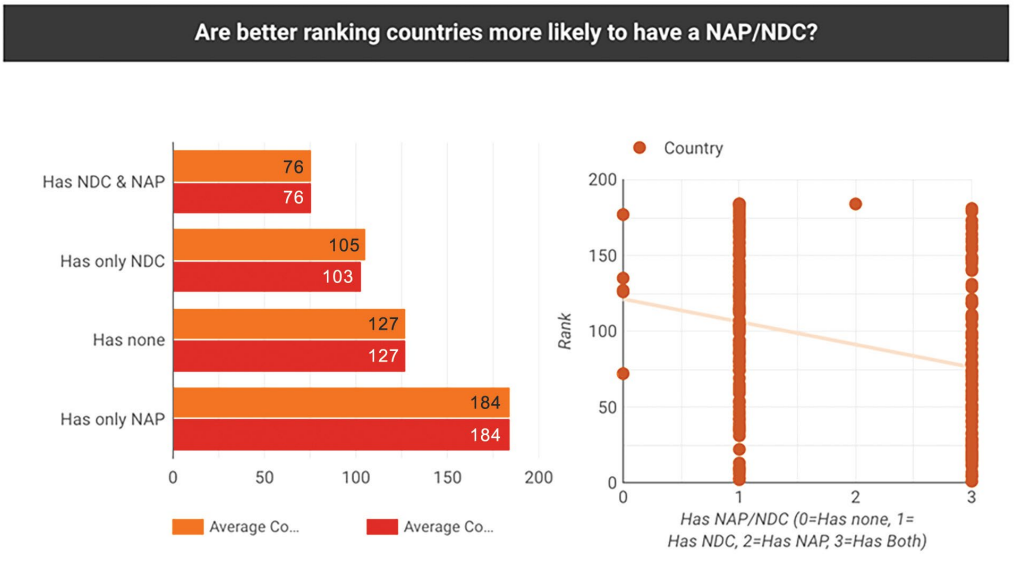

Figure 5. Visualization of IPU Monthly Rank and presence of an NDC, a WPS NAP, both, or neither, comparing all EU member states counted individually (top numbers, lighter orange) to all EU member states counted as one combined entity (lower numbers, darker orange)

Upon comparison of the IPU Percentage (of only lower or single houses) with the adoption of an NDC or WPS NAP, a moderate, positive correlation emerged (coefficient 0.42, p-value = 0.000099). Countries possessing both an NDC and a WPS NAP exhibited an average IPU Percentage of 28 percent women in their lower/single houses. In contrast, countries with solely an NDC (the majority) demonstrated an average IPU Percentage of 22 percent women. Conversely, one country possessing solely a WPS NAP had 0 percent women in its lower/single houses, while countries devoid of both an NDC or WPS NAP displayed an average IPU Percentage of 12 percent women. Figure 6 provides a visual representation of these calculations, with all EU members combined into a single unit.

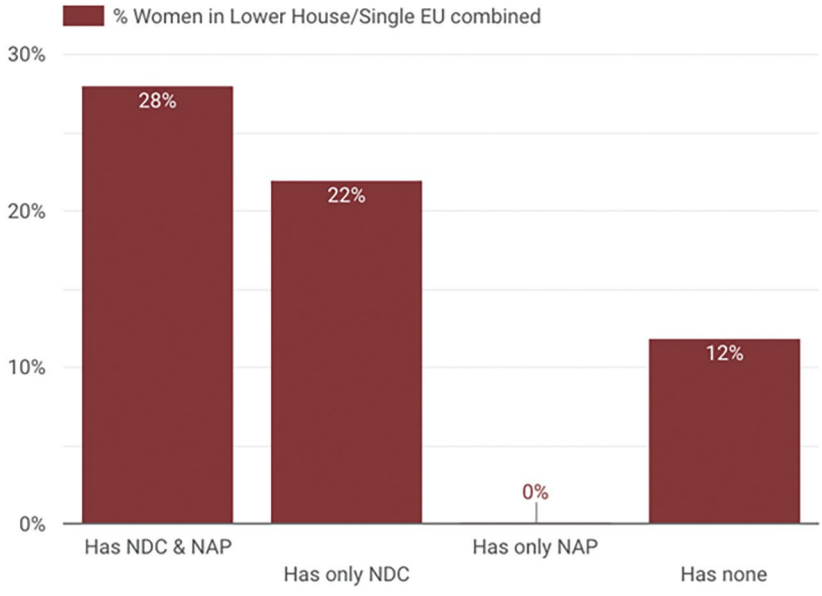

Figure 6. Visualization of IPU Percentage of women in lower/single house and presence of an NDC, a WPS NAP, both, or neither, including all EU member states counted as one combined entity

Finally, IPU Rank was examined in relation to whether a country's NDC included gender references and whether a country's WPS NAP included references to climate change. Countries that had either an NDC or a WPS NAP but lacked cross-references exhibited an average IPU Rank of 100, representing the lowest group in this study. Countries with solely an NDC containing gender references demonstrated an average IPU Rank of 90. Given that 86 out of 87 countries with a NAP also possessed an NDC, it is perhaps unsurprising that the countries in the two remaining categories ranked similarly: countries with references to climate change in their WPS NAP had an average rank of 63, while countries with both an NDC with gender references and a WPS NAP with climate change references had an average rank of 66. These findings suggest that countries with an NDC or WPS NAP with cross-references generally exhibit a higher IPU Rank on average. However, no correlation at the 95-percent confidence level was identified for this relationship; this could be attributed to the fact that this group comprises countries with similar IPU Ranks, making it challenging to discern variation among them. Furthermore, these results suggest that countries with greater representation of women in parliament are more inclined to have a WPS NAP mentioning climate change, potentially enhancing the likelihood of the same country including gender references in their NDC. These findings are depicted in figure 7.

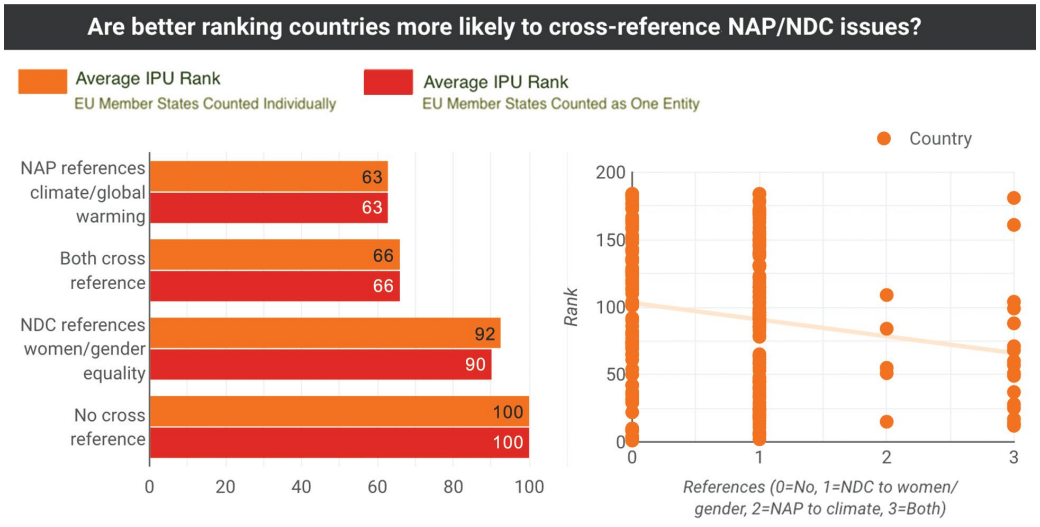

Figure 7. Visualization of IPU Monthly Rank and presence of a gender-responsive NDC, a climate-inclusive WPS NAP, both, or neither, comparing all showing EU member states counted individually (top numbers, lighter orange) to all EU member states counted as one combined entity (lower numbers, darker orange)

The percentage of women in upper or lower parliamentary houses (combined) was also assessed in relation to whether a country possessed an NDC or WPS NAP with cross-references, both, or neither. Countries with cross-references in their WPS NAP demonstrated a combined average of 38.37 percent women (the highest). Those with both a WPS NAP and NDC with cross-references exhibited a combined average of 25.17 percent women, while countries with solely an NDC with cross-references had a combined average of 27.42 percent women. Conversely, countries lacking cross-references recorded a combined average of 23.18 percent women. No correlation at the 95-percent confidence level was discerned for this relationship, although the similarity among countries in IPU Percentage may account for this outcome. Note: Countries with cross-references in both their NDC and WPS NAP, on average, have nearly 7 percent more women in parliaments than those lacking cross-references. The results of this analysis are presented in table 1.

Table 1. Breakdown of results comparing IPU Percentage of women in upper or lower house and presence of a gender-responsive NDC, a climate-inclusive WPS NAP, both, or neither

Cross Reference	Number of Countries	Average Country Rank	% Women—Lower House/Single	% Women—Upper/Senate
NAP references climate/global warming	5	62.8	30.1%	38.37%
Both cross references	17	66.0	29.68%	25.17%
NDC references women/gender equality	92	92.4	24.28%	27.42%
No cross references	68	100.3	22.82%	23.18%

Qualitative Analysis: Sample Analysis of Three Gender-Responsive NDCs and Climate-Compatible NAPs in Indo-Pacific Countries

Merely tallying cross-referenced terms is insufficient for evaluating a policy's effectiveness in terms of commitments made to mainstream gender or address climate change. Indo-Pacific nations have been identified as facing some of the most significant climate risks globally, coupled with consistently low Gender Inequality Index scores.[41] How do their IPU scores and policies align with this study's definitions of gender-responsive NDCs and climate-compatible NAPs? While conducting a comprehensive analysis of the quality of all gender and climate change cross-references in policy documents adopted by Indo-Pacific countries exceeds the scope of this article,[42] the following offers a brief qualitative analysis of select Indo-Pacific countries' policies to assess whether they meet the criteria for *gender-responsive* NDCs and *climate-compatible* WPS NAPs according to this study's definitions. The subsequent analysis employs a simple scoring matrix for each country to evaluate the extent of meaningful engagement with the gender-climate-security nexus:

0 Rating: No relevant policy (NDC or WPS NAP) or no cross-referenced terms;

1 Rating: Cursory mention of cross-referenced terms;

[41] Maryruth Belsey Priebe, "Compound Gender-Climate-Security Threats and Vulnerabilities within the Indo-Pacific," *Pacific Forum, Issues & Insights*, 22, no. WP2 (January 2022): iv, 9.

[42] In-depth analysis of the quality of references to gender in NDCs (including examination of commitments to mitigation, capacity-building, budgeting, planning, and monitoring) has been conducted by groups such as WEDO (*WEDO Gender Climate Tracker*, 2018).

2 Rating: All references included in a "1 Rating," as well as mention of connections between cross-referenced terms and the harm that exists at the gender-climate-security nexus; and

3 Rating: All references included in a "2 Rating," as well as mentions of specific policies for addressing harm caused at the gender-climate-security nexus.[43]

Table 2. Indo-Pacific Countries with the Highest and Lowest Gender-Climate-Security Risks Compared to NDC with Gender-Responsive Cross-References and/or WPS NAPs with Climate-Compatible Cross-References

	NDC Gender-Responsive Cross-References Score	WPS NAP Climate-Compatible Cross-References Score	IPU Rank	IPU % Women in Lower/Single House
New Zealand	0	0	6	49.2
Australia	0	2	24	41
Timor-Leste	0	0	27	40
Nepal	1	0	49	33.6
Vietnam	2	0	62	30.3
Singapore	0	0	66	29.1
Philippines	1	0	79	27.3
China	0	0	95	24.9
Laos	0	0	104	22.0
Indonesia	1	0	106	21.9
Bangladesh	0	2	109	20.9
Cambodia	2	0	110	20.8
Fiji	0	0	119	19.6
South Korea	0	0	124	18.6
Bhutan	0	0	131	17.4
Mongolia	0	0	133	17.1
Thailand	0	0	137	15.8
Malaysia	0	0	140	15

[43] Refer to table 3 in the appendix for comprehensive textual details.

	NDC Gender-Responsive Cross-References Score	WPS NAP Climate-Compatible Cross-References Score	IPU Rank	IPU % Women in Lower/Single House
India	1	0	142	14.9
Samoa	0	0	152	13
Japan	0	0	164	9.9
Brunei	0	0	165	9.1
Sri Lanka	1	0	178	5.3
Maldives	0	0	179	4.6
Tonga	2	0	182	3.7
Papua New Guinea	1	0	185	1.7

Overall, the cross-references found in the WPS NAPs are brief and lack detailed mandates for tracking, measurement, or funding, indicating a general lack of substantive engagement with the triple nexus. Specifically, when compared against this study's definition of a *climate-compatible* policy,[44] it becomes evident that none of the documents adequately address climate change to be considered *climate-compatible*. Vietnam, positioned in the middle with an IPU Rank of 62, stands out as one of the most effective countries in linking climate insecurities to gender issues. Its WPS NAP covers gender-specific impacts such as bodily harm during disasters, adaptation risks, livelihood and education impacts, public health risks, and loss and damage risks. Australia, with one of the highest IPU Ranks, acknowledges the link between climate change and transboundary security challenges, fragility, and conflict in its WPS NAP. However, it fails to outline policies addressing compound risks. Neither country's text defines policies to mitigate climate-induced harms experienced by women or connects policies for reducing greenhouse gas emissions to positive impacts on national security or women's human security. No other countries in the Indo-Pacific list have WPS NAPs referencing climate change.

[44] A *climate-compatible security policy* is one that minimizes the harm caused by climate change, especially for fragile states, while maximizing the many opportunities to increase national and human security offered by a low emissions, more resilient, future.

Turning to NDCs, once again, policies show limited language regarding the detrimental impacts of gender norms, roles, and relations in a warming world.[45] Bangladesh (IPU Rank 109) references various policies in its NDC (Standing Order on Disasters, Bangladesh Climate Strategy and Action Plan, Climate Gender Action Plan) that delve deeper into gender considerations. Similarly, Tonga (IPU Rank 182, near the bottom) references several gender-focused policies in its NDC, including The Family Protection Act, the National Policy on Gender and Development, and the Strategic Plan. Cross-reference scores for NDCs are distributed fairly evenly across countries along the IPU Rank spectrum.

Discussion

The results of the preceding quantitative analysis suggest that an increase in women's representation in national parliaments may influence whether a state adopts cross-cutting gender-climate-security policies such as gender-responsive NDCs or climate-compatible WPS NAPs. As the average IPU Rank and IPU Percentage of women's involvement in national parliament increases, countries are more likely to have developed an NDC, a WPS NAP, or both. Similarly, as the average IPU Rank and IPU Percentage of women in a national parliament increases, countries are more likely to have developed gender-responsive NDCs, climate-compatible WPS NAPs, or both, evidenced only by the presence of specific gender or climate-security terms.

However, despite these quantitative findings, the qualitative analysis of the texts does not strongly support this conclusion. For Indo-Pacific countries, there is no discernible pattern indicating that a higher IPU Rank would predict whether a country has a gender-responsive NDC or a climate-compatible NAP. Conducting a comprehensive study of all complete texts against IPU scores is beyond the scope of this research but could provide further insights into whether the presence of more women in parliament improves gender-climate-security policy outcomes. Unfortunately, this analysis cannot determine whether women parliamentarians' participation in NAP and NDC policy making was meaningful, or whether sincere attempts were made to incorporate a gender perspective in such policies. The lack of conclusive evidence in the qualitative analysis may simply point to a failure to thoroughly and meaningfully engage women and their perspectives.

[45] A *gender-responsive policy* is one that, "fulfills two basic criteria: a) gender norms, roles, and relations are considered and b) measures are taken to actively reduce the harmful effects of gender norms, roles, and relations—including gender inequality" (GPE (Global Partnership for Education) and UNGEI (United Nations Girls' Education Initiative), 2017).

Further research could investigate possible confounding variables that explain these findings or explore the mechanisms by which women's increased parliamentary representation translates into a higher likelihood of having a gender-responsive NDC or a climate-compatible WPS NAP.

Indeed, it is not guaranteed that more women in parliament lead to more substantive representation of women's issues in policy outcomes. Some scholars argue that a critical mass of women legislators (often set at 30 percent) must be reached for women's presence to make a difference, while others suggest women's impact may stem from "critical actors" brokering agreements across parties and genders.[46] However, even when women's representation increases, barriers may prevent women from substantially influencing policy outcomes. Feminist political economists suggest that the continued domination of political institutions and practices by men, through 'shadowy arbitrary arrangements' and chummy networks, often limits the effectiveness of women legislators by excluding them from the clientelistic, old-boys social and political networks through which many decisions flow.[47] Therefore, whether women legislators can influence policy development to foreground intersectional concerns requires addressing the underlying patriarchal practices and institutions foundational in most political systems worldwide.

Moreover, even when states with higher percentages of women in parliament enact laws addressing intersectional concerns, the resultant policies may lack the depth and specificity needed to bring about distinct outcomes. Therefore, while enhancing gender parity in national legislatures is a moral obligation, employing a rigorous gender perspective may prove more effective in crafting policies with tangible benefits for climate resilience and women's security.[48] As posited by Cali Nathanson and Amy Myers Jaffe,

> Part of women's contribution to global climate diplomacy has been their integration of a gender perspective, which has been shown to increase the efficiency and efficacy of climate policy by ensuring that it addresses rather than hinders gender equity. If climate policies are to meet the moment, they will need to go beyond economic and technological considerations to

[46] Sarah Childs and Mona Lena Krook, "Analyzing Women's Substantive Representation: From Critical Mass to Critical Actors," *Government and Opposition* 44 (March 2009): 125–45, https://doi.org/.

[47] Justin Esarey and Gina Chirillo, "'Fairer Sex' or Purity Myth? Corruption, Gender, and Institutional Context," *Politics & Gender* 9, no. 4 (December 2013): 362, https://doi.org/; and Daniel Stockemer, "Women's Parliamentary Representation in Africa: The Impact of Democracy and Corruption on the Number of Female Deputies in National Parliaments," *Political Studies* 59, no. 3 (19 July 2011), 697, https://doi.org/.

[48] A perspective that calls for challenging gendered power structures and reconceptualizing dominant understandings of security by questioning the idea that security is a universally enjoyed phenomenon, and by asking gender-sensitive questions about who is secure and who is a threat.

address more holistic ones linked to human values, such as equity and the interests of underrepresented groups."[49]

Conclusion and Policy Recommendations

This article followed four steps: (1) analyzing which countries had a gender-responsive NDC, a climate-compatible WPS NAP, both, or neither; (2) assessing whether countries with higher IPU Rank and IPU Percentage of women in lower/single houses had an increased likelihood of developing an NDC, a WPS NAP, or both; (3) examining whether countries with higher IPU Rank and/or IPU Percentage of women in lower/single houses had an increased likelihood of having a gender-responsive NDC, a climate-compatible WPS NAP, or both; and (4) qualitatively analyzing Indo-Pacific countries' NAPs and NDCs and comparing those texts to IPU Rank to determine whether IPU Rank is predictive of developing a gender-responsive NDC, a climate-compatible WPS NAP, or both.

On the first objective, among the 186 countries with an NDC, 112 (60.2 percent of countries with an NDC) included gender cross-references. Of the 87 countries with a NAP, only 23 (26.4 percent of countries with a WPS NAP) referred to climate change. Merely 18 countries (9.3 percent of all countries) had both an NDC with gender cross-references and a NAP with climate cross-references (including Croatia, Denmark, Finland, Germany, Ireland, Italy, Kenya, Latvia, Liberia, Mali, Netherlands, Nigeria, Norway, Poland, Senegal, Slovenia, and Tajikistan). In essence, countries are least likely to have both a climate-compatible NAP and a gender-responsive NDC, while they are most likely to have only a gender-responsive NDC.

On the second objective, overall, this study provides evidence that countries with higher IPU Rank and higher IPU Percentage are more likely to have passed an NDC, a WPS NAP, or both an NDC and a WPS NAP. A higher IPU Rank did not increase the likelihood of a country having only a WPS NAP, though IPU Percentage did.

On the third objective, countries with only a climate-compatible NAP (5 total countries) had the highest IPU Rank (average of 63) and the highest IPU Percentage of women in lower/single houses (average of 30.1 percent). Countries with both a climate-compatible WPS NAP and a gender-responsive NDC (17 total countries) had the second-highest IPU Rank (average 66) and the second-highest IPU Percentage of women in lower/single houses (average of 29.7 percent). Finally,

[49] Cali Nathanson and Amy Myers Jaffe, "Women and Gender in Climate Diplomacy," Center on Global Energy Policy, 5 October 2022. https://www.energypolicy.columbia.edu/.

those countries with only a gender-responsive NDC (92 total countries) had the third-highest IPU Rank (average 92) and the third-highest IPU Percentage (average of 24.3 percent women in lower/single houses). These results suggest that it may be easier for parliamentarians to argue for cross-cutting policy outcomes starting from a gender perspective (beginning with a NAP), whereas adding gender considerations to climate policies may be a more challenging change to effect.

On the fourth objective, no discernible patterns were found indicating that a better IPU Rank would predict whether a country would adopt a gender-responsive NDC, a climate-compatible WPS NAP, or both. Further analysis of these findings is required to identify whether increasing women's meaningful participation in measurable ways in policy making would produce more intersectionally sensitive climate and gender policies.

The reality remains that gender, climate, and security are overlapping in increasingly complex ways, necessitating more nuanced, culturally contextual policies to address these pressures effectively. Diverse perspectives will be required from all levels of society. The results of this study are too ambiguous to suggest that increasing women's participation in parliaments would not substantively improve cross-cutting policies to ensure more gender-equitable and climate-compatible outcomes. Furthermore, as a matter of human rights, states should continually strive to increase women's full and meaningful national political participation. Numerous strategies have been identified as effective tools for increasing the number of women in government, including mentorship programs, public awareness campaigns, increased financial support for women's campaigns, quotas, and fostering women's caucuses.[50] Given the existential hazards found at the gender-climate-security nexus, the international community must be encouraged to continue to push for greater women's inclusion in these important decision-making circles. ✪

Maryruth Belsey Priebe

Maryruth Belsey Priebe (CAN) is the director for the Women, Peace and Security (WPS program and a senior fellow at Pacific Forum International, a Harvard international relations graduate student, and the author of numerous articles. Using social science, feminist foreign policy perspectives/analyses/theories, and data analysis, her research focuses on the nexus of gender, climate change, and peace and security in the Asia-Pacific. Maryruth's circular food economy policy work has been selected for inclusion in the OpenIDEO Food Systems Game Changers Lab, and she has held several research and fellowship positions focused on women's leadership. She is also a member of Harvard's Climate Leaders Program and the Research Network on Women, Peace and Security, and is a volunteer for multiple gender-climate causes. Maryruth tweets @greenwriting.

[50] Edwin Ng and Carles Muntaner, "The Effect of Women in Government on Population Health: An Ecological Analysis among Canadian Provinces, 1976–2009," *SSM - Population Health* 6 (16 August 2018): 141–48, https://doi.org/.

Appendix

Table 3. Country NDC cross-references to gender/gender equality/women[51]

Country	NAP mentions of gender/women/gender equality/gender equity
Angola	The underlining policies supporting the implementation of the Intended Nationally Determined Contribution (INDC) mitigation and adaptation contributions and actions to be implemented in this context include cross-cutting issues which are gender sensitive and therefore will take into account women as important decision makers regarding energy consumption in particular.
Argentina	Likewise, special attention will be paid to the effects on populations in a situation of vulnerability, such as women and diversities, youth, indigenous peoples and people with disabilities, considering that these groups have a limited participation in decision-making and access to resources, and that they are overrepresented in the informal economy and unemployment. By 2030, policies will have been developed in such a way that gender is not a reason for social, political and economic inequality. In this regard, the physical, political and economic autonomy of women and LGBTI +, the sovereignty over their bodies, lives and territories, and their ability to make decisions will have been strengthened. Policies would be implemented so that women and LGBTI + have social and environmental conditions of habitability of the territories. To this end, it is considered essential—and will be promoted—an active participation of women and diversities in the consultation and decision-making processes in all aspects of climate policy. The voice and representation of women and LGBTI + over the territories they inhabit will be strengthened through access to material, educational, informational, training, financial and technological resources; and the construction of strategic alliances that strengthen their role as agents of change in the processes of adaptation and mitigation to climate change will be promoted.
Armenia	Public consultation process of the NDC update has been carried out in line with the government procedures, including involvement of the civil society, in a *gender-responsive* manner followed by a parliamentary debate. The implementation of the NDC will be supported on subnational level by involving local communities and encouraging all stakeholders to take action, including NGO's, taking into account the needs of the youth, vulnerable groups, in a *gender-responsive* manner. Maintaining participatory process in the NDC review and public consultation mechanism during preparation of the next NDCs, in a *gender-responsive* manner.
Austria	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.

[51] NDCs from the following countries are not in English; in some cases, unofficial translated versions have been included: Argentina, Cameroon*, Comoros*, Congo, Cote d'Ivoire, Democratic Republic of Congo*, Ecuador, El Salvador, Equatorial Guinea, Gabon, Guatemala*, Haiti*, Honduras*, Mali*, Mauritiana, Nicaragua, Oman, Panama*, Paraguay*, Senegal*. Those whose text in is highlighted in yellow were sourced from: "Country Profiles," WEDO Gender Climate Tracker, 9 July 2018, https://www.genderclimatetracker.org/. All other texts were sourced from original NAPs.

Country	NAP mentions of gender/women/gender equality/gender equity
Barbados	The BRIDGE (Building Capacity and Regional Integration for Development of a Generation of Entrepreneurs) in Sustainable Energy Information and Communication Technologies project is focused on developing human capital, while encouraging gender equality, to meet the expected future demand for technicians, professionals and entrepreneurs in sustainable energy and information and communication technology sectors; The sectors identifies as most vulnerable to climate change are agriculture, fisheries tourism, water, human health, coastal resources and human settlements. Climate change will also impact vulnerable groups disproportionately, including youth and gender perspectives, which are cross-cutting concerns in Barbados' national development planning.
Belgium	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Benin	Benin's NDC will be implemented under the authority of the Ministry responsible for the environment which plays the role of National Focal Point of the United Nations Framework Convention on Climate Change with the effective participation of all the stakeholders, namely the Technical and Financial Partners, governmental and nongovernmental stakeholders with a consideration for gender and social inclusion (sector Ministries, local communities, private sector, civil society, etc.) Improving Benin's agricultural performance to enable it to ensure durably food and nutritional sovereignty, to contribute to the economic and social development of the men and women of Benin and to hit the Sustainable development Goals (SDGs) in particular the SDGs 1,2, 12, and 13. Rehabilitating irrigation schemes (i) 1,000 ha of developed irrigated areas with perfect water control, (ii) 3,500 ha of swampy areas including up to 2,800 has of plain development in flood zones and 700 has of rice growing swamps developed by the company, (iii) 300 has of market-gardening for women. Increasing by at least 50% by 2025 the current levels of agricultural productivity (improving professional knowledge and technological innovations for men and women; promoting the development of water schemes. Reducing pregnant women and under five children's vulnerability to diseases related to climate risks in Benin.
Brazil	Domestic Institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner: Articles 5, 231 and 232 of the Brazilian Constitution establish ample rights and guarantees for all Brazilian citizens, paying due attention to the special needs of women and indigenous peoples.
Bulgaria	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Burkina Faso	The households, and principally the women can then save the costs incurred for health care. The Coordination Unit will work with the above departments and other cross-cutting ministries, such as the Ministry of Economy and Finance, the Ministry of the Promotion of Women and Gender and the Ministry of International Cooperation, within the framework of the financing agreements.

Country	NAP mentions of gender/women/gender equality/gender equity
Burundi	Strengthen the aptitudes of actors (especially women and farmers) in new technical processes, in the interest of intensified, sustainable production methods (new crop systems and techniques); Gender, youth and vulnerable groups are concerns that have not always been taken into account in Burundi's national and sectoral socioeconomic development plans. In its Vision 2025, the Government of Burundi considers these to be cross-cutting issues to be incorporated into all development programs. The same will apply to the implementation of the INDC.
Cabo Verde	The update deepens and moves beyond the initial set of actions and commitments with respect to scope, sector ambition, balancing of mitigation and the adaptation action, climate justice and gender equality, as well as transparency and governance. Finally, Cabo Verde needs inclusive and gender-sensitive strategies to enhance the adaptive capacity of all of its communities and economic sectors, including food production and tourism. They will go substantially beyond the commitments put forward in Cabo Verde's initial NDC submission, i.e. in terms of scope, sector ambition. coherence between adaptation and mitigation, horizontal themes, including gender equality, and notable transparency. Develop a gender analysis of women and men in the blue economy (promoting entrepreneurship, developing jobs for the young, encouraging innovation) by 2022 and identify priority gender-specific actions. Women, as raisers of the next generation, can be important stewards of intergenerational natural resources preservation. While many gender equality targets have been met by Cabo Verde, gender roles continue to deny women full equality to access to resources. The key issues that lock the majority of women in poverty and low productivity are their lack of time—for productive labor, of land—for building assets, of financing—for extending businesses, and of knowledge to increase production and market access. The key to the next great progress on gender equality in Cabo Verde is women's economic empowerment. For this NDC the sectors of energy, water, land use/agriculture, blue economy and tourism are the focus of gender equality. By 2022, integrate climate issues and Action for Climate Empowerment (ACE) into the updated gender equality plane and strategies...
Cambodia	Summary of gender reference Cambodia's Climate Change Strategic Plan includes a strategic objective to "reduce sectoral, regional, gender vulnerability and health risks to climate change impacts."
Cameroon	Summary of gender reference - Gender-mainstreaming in adaptation (agriculture);—Women as a vulnerable group (WVG): The INDC mentions Cameroonians—particularly women, children and vulnerable people—and economic sectors of the country acquire greater resilience and greater resilience to negative impacts of climate change.—Women as stakeholders (S) whereby women have an important role to play in the thematic Program 13, under the jurisdiction of the Ministry of Water and Energy (MINEE), by: Strengthening and securing access to water resources and sanitation services in a changing climate; securing environmental services; management of surface and groundwater for water, protection of source of heads; Fixing the banks and soils; role of women; plans for using surface water or deep; struggles against pollution (agricultural, industrial, medical, etc.); Prevention of extreme events (floods) ; conservation of aquatic biodiversity.—Women as beneficiaries of projects (B): Increasing the resilience of productive (agricultural) practices—Strengthening the capacity of actors (especially young women and elderly, indigenous peoples, farmers, etc.) concerning new crop as part of intensified and sustainable production methods .—Also, in the mitigation efforts within the sectors of "Agriculture / Fisheries / Livestock / Forests, women are said to be co-beneficiaries of agricultural development and deforestation mitigation strategies; whereby, the empowerment of women and protection of vulnerable populations and minorities is highlighted in the text.
Central African Republic	Vulnerability profile: Extreme Hazards (torrential rains, floods and drought), most vulnerable areas *south, north, northeast) and most vulnerable populations (women, children, indigenous peoples and the aged, i.e. around 75%).

Country	NAP mentions of gender/women/gender equality/gender equity
Chad	Implementation of Chad's INDC will place particular emphasis on better taking account of human rights and equality between sexes. Reinforce stakeholder attitudes, (in particular in relation to women and farmers), with regards to new techniques in terms of intensive and sustainable methods of production. Women and children are identified among the vulnerable group together with the elderly people and the disabled heads of the family.
Chile	The proposed targets will include a focus on gender, enabling development of more transparent, inclusive and targeted initiatives to decrease and eradicate existing gender gaps, and recognizing the role of women as agents of change, capable to provide significant contribution in climate action. Gender equality and equity: The design and implementation of this NDC must consider a fair allocation of charges, costs and benefits, with a focus on gender and special emphasis on sectors, communities and ecosystems vulnerable to climate change. It will be developed and implemented considering sustainable development goals and criteria of age and gender equity and just transition, integrating knowledge as specific needs of vulnerable communities.
Comoros	Women mentioned in the adaptation profile stakeholders (S), specifically as a long-term strategy for adaptation by increasing the involvement of women and communities in environmental protection in terms of decision-making given their growing role in the development of the domestic economy; and (iv) develop resilience of populations to disasters and climate change.
Costa Rica	Summary of gender reference References to women/gender in relation to all climate policies and actions, including monitoring and review framework. Both climate policies and the actions that derive from them will base themselves in the country's historical commitment to universal human rights and gender equality principles. Costa Rica favors a transformational approach to gender in public climate change policy, and supports the participation of women (AC) in policy making and climate actions implementation. This will require a full compliance with Cancun's safeguards on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+), as well as securing indigenous peoples' Principle of Free, Prior and Informed Consent (FPIC). Also, it's expected to increase citizen forums through the pre-2020 period to define the best climate governance arrangements to deliver on the commitments acquired in this National Contribution. In relation to Means of Implementation: The government will confirm its role as a facilitator of enabling conditions which will allow the different sectors, communities and society in general define their mitigation and adaptation goals, based on their own economic, social and cultural, gender-sensitive options for the well-being of a low-emission economy.
Cote d'Ivoire	Women mentioned in the mitigation context as beneficiaries of projects (B) (agriculture/forestry) through the development of sustainable energy solutions for domestic populations cooking needs by improving the living conditions of women in rural areas. Women mentioned in the adaptation context as vulnerable groups (WVG) (strengthening agricultural, animal and fisheries sector): promoting women's access to rural land. Women mentioned as stakeholders (S) in the "Means of implementation to adaptation measures of the INDC": projects highlight capacity building of stakeholders (especially women, farmers, etc.) to new technical routes in the context of intensified and sustainable modes of production.
Croatia	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.

Country	NAP mentions of gender/women/gender equality/gender equity
Cuba	From a social standpoint, working and living conditions will improve, mainly for women, by improving cooking conditions and working conditions.
Cyprus	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Czech Republic	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Democratic Republic of Congo	Summary of gender reference Women mentioned in the adaptation context as a vulnerable group (WVG) and as beneficiaries of projects (B) through the PANA—AFE (2015-2020): strengthening resilience of women and children to address climate change. It is the commitment of the Democratic Republic of Congo to protect the most vulnerable to climate risks.
Denmark	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Dominica	Under priorities for building climate resilience: Creating the supportive enabling framework whereby communities and vulnerable segments of society (women, youth elderly, people with disabilities) can manage their own climate change risks, thereby addressing climate change impacts on vulnerable sectors (particularly agriculture, fisheries and water resources) and threats to food security, human health, poverty alleviation, sustainable livelihoods and economic growth; Legal establishment of Climate Change Trust Fund in addition to US5 million seed funding to the Climate Change Trust Fund to provide support to priority community climate change risks management measures identified through community vulnerability mapping and adaptation planning and establishment of micro-finance for private sector and vulnerable segments of society (farmers, fisher-folk, women and vulnerable communities in particular the Kalinago people).

Country	NAP mentions of gender/women/gender equality/gender equity
Dominican Republic	Summary of gender reference Women as vulnerable group and as agents/drivers of change: Aware that climate change will impact vulnerable groups of people in different ways, the gender perspective is a cross-cutting issue in the national development model. Therefore, the role of women as agents of change is recognized, and their participation is encouraged in the transformation of society toward a low-carbon and resilient development. The National Development Strategy (NDS) articulates strengthening human resources, with emphasis on youth and future generations.
Ecuador	Gender mainstreaming implies the integration of the gender approach from the preparation, design, implementation, monitoring and evaluation of policies, regulatory measures and initiatives, with the aim of promoting equality between women and men and combating discrimination. To carry out an adequate incorporation of the gender approach and its mainstreaming in the formation of the NDC, one of the strategies implemented in the permanent methodology of relevant actors in the subject at the national level, such as the Council for Gender Equality. In this way, in the participatory process based on the gender approach, the reflection and formulation of proposals that promote the involvement of women and men from civil society, community and private organizations and representatives of the different levels of the administration were sought.
Eritrea	Besides reducing the pressure on the forest resources, the advantages of these stoves lie in the use of waste biomass as well as securing the health and well-being of women and children. This includes various administrative regions of the country with the aim of reducing social and geographical inequality as well as narrowing the gaps between women and men's rights. Identification of the technical support needed to introduce new and additional policies and actions that stimulate and enable invest and mitigation actions for the period at all levels of government, as well as to strengthen the gender issues into capacity building, prioritize south-south cooperation to enhance regional cooperation.
Estonia	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Eswatini	Underlying this vision is a focus on sustainable economic development, social justice, political stability, poverty eradication, employment recreation, gender equity, social integration and environmental protection.
Finland	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.

Country	NAP mentions of gender/women/gender equality/gender equity
France	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Gabon	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Gambia	Among the priorities identified for sound environmental management is: ensuring the participation of the private sector, CSO, nongovernmental organization, and youth and women's groups in sustainable natural resource consumption
Georgia	The observation of impacts of extreme weather events on Georgia's population, induced by the climate change during the last decades reveals the following vulnerable groups requiring urgent adaptation measures: children and adolescents, women, elderly persons, persons with disabilities, person with chronic diseases, and eco-migrants displaced as a result of disasters caused by climate change or those, who are threatened to be eco migrated due to the climate change. Georgia, within its framework of national adaptation plan, commits to identify the needs of children and women and set priorities within the climate change adaptation measures; Georgia's updated NDC acknowledges the nationalization of targets 5.1-4.6 and 5.1 and 5.b of Sustainable Development Goal 5 on the achievement of gender equality and empowerment all women girls. Given that the majority of teachers at primary and secondary schools, 58% lecturers at universities, and 65% of doctors are women, Georgia intends empowering women as agents of change through involving them in decision-making processes addressing healthcare issues induced by climate change and related activities and programs, such as awareness raising on climate change, capacity building and knowledge sharing aiming at changing behavior. Georgia further considers to empower women as agents of change through their participation in decision-making processes related to energy efficiency measures and efficient use of water resources in households. Georgia's updated NDC invites all stakeholders and relevant domestic organizations to provide adaptation resources channeled toward women wherever their vulnerability level is high. Georgia's updated NDC is in compliance with Article 11 of the Constitution of Georgia on the right to equality, Law of Georgia on Gender Equality, Decision 21/CP.22 on Gender and Climate Change, and enhanced Lima work program on gender and its gender action plan. Georgia's updated NDC intends to collect, manage, report and archive information on gender-disaggregated relevant data in its national reports related to the greenhouse gas mitigation and climate change adaptation. In addition, Georgia intends to carry out gender analysis capacity building and knowledge sharing within the climate-related projects. For taking into consideration the particular interests, needs, capabilities, roles and responsibilities of the key stakeholders, especially the vulnerable groups, the meetings with the vulnerable groups and civic organizations working on the climate change and gender issues have been conducted during the process of updating the document.

Country	NAP mentions of gender/women/gender equality/gender equity
Germany	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Ghana	Under the INDC Adaptation Policy Actions: Resilience for gender and the vulnerable: Implementation of community led adaptation and livelihood diversification for vulnerable groups
Greece	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Guatemala	Summary of gender reference Women mentioned as vulnerable group (WV), since the most impacted population groups are indigenous peoples, subsistence farmers and artisanal fishermen, including women and children. Note also that the Framework Law on Climate Change also safeguards human rights and gender equality.
Guinea	Summary of gender reference Women mentioned in the National Adaptation Programmes of Action (NAPA) as a vulnerable group (WVG), stating the most vulnerable groups to climate change in different regions of the country include poor communities in rural areas such as farmers and small producers (men and women) and people whose livelihood mainly depends on the use of natural resources (hunters, fishermen, salt producers, etc).
Haiti	Summary of gender reference Women are taken into account in the implementation phase: gender will need to be mainstreamed throughout the NDC implementation process.
Honduras	Summary of gender reference Women mentioned as vulnerable groups (WVG). The Republic of Honduras believes necessary policies and measures to combat global warming focus on the 'human face' of climate change. To do this, the actions to take should improve the living conditions of the people whose situation may be more vulnerable to climate change. These actions should ensure a transversal perspective of human rights and gender equality, ensuring that women, indigenous peoples and Afro-Hondurans have full and effective participation in decision-making. This message of hope is already included in the policies of the Republic of Honduras within the strategic plan of government " Plan of All for a Better Life ". Also, a gender perspective is essential to include in a model of sustainable national development aspect. Therefore, recognizes the role of women as agents/drivers of change, which must be taken into account in making decisions that allow the development of a low-carbon society and resistant to the effects of climate change.

Country	NAP mentions of gender/women/gender equality/gender equity
Hungary	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Iceland	Men and women shall have equal rights in every respect. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples in a *gender-responsive* manner. Iceland's NDC is prepared in the context of commitments to gender equality and cross--cutting priorities and sustainable development. Act on equal gender right and gender equality No 150/2020 is to prevent gender discrimination and to create and maintain equal rights and opportunities for all genders in all aspects of the community.
India	India's contribution takes into account its commitment to conservation of nature as well as the imperatives of meeting the competing demand of resources for addressing the challenges of poverty eradication, food security and nutrition, universal access to education and health, gender equality and women empowerment, water and sanitation, energy, employment, sustainable urbanization and new human settlements and the means of implementation for the enhanced action for achieving among others, the sustainable development goals for its 1.2 billion people.
Indonesia	In line with the Paris Agreement, Indonesia respects, promotes and considers its obligations on human rights... as well as gender equality, empowerment of women. The preparation of the NDC has taken into account the post 2015 SDG particularly on taking urgent action to combat climate change... achieving gender equality. Indonesia has taken significant steps to reduce emissions in land use sector by instituting a moratorium on the clearing of primary forests...which include social forestry through active participation of the private sector, small and medium enterprises...and the most vulnerable groups, especially Adat communities (Indonesia: Masyarakat Hukum Adat, internationally known as Indigenous People), and women in both the planning and implementation stages.
Ireland	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Italy	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.

Country	NAP mentions of gender/women/gender equality/gender equity
Jamaica	Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples in a *gender-responsive* manner. Besides climate action (SDG 13), Jamaica is making particularly substantial progress on health and well-being (SDG 3), quality education (SDG 4), and gender equality (SDG 5). It will be subject to all relevant laws, guidelines, policies and programs which are designed to increase inclusiveness and fairness, including the Code of Consultations and the National Policy for Gender Equity.
Jordan	The Strategy provides a road map to the health sector, as well as the many involved public agencies and organizations to work jointly to improve the health of the Jordanian population in particular the vulnerable groups (infants and children <5 years, the elderly >65 years, and pregnant women) in rural, desert, remote areas, and poverty pockets, and the environments in which they live, work, and play. The pre-2020 contribution of Jordan in this regard is obvious from Jordan's position portrayed om the Climate Change Policy of Jordan 2013-2020 and the actions and activities lead by Ministry of Social Development (MoSD); National Aid Fund, and MoSD's partners addressing vulnerability and impact of climate change on socioeconomic development particularly vulnerable groups (mainly the poor and women with emphasis on those living in rural areas) Though gender issues are still under-investigated in Jordan, the role of women in economy of rural areas is known to be substantial. Women in these areas are traditionally responsible for the household economy and are active in field work as well. Any negative impact of climate change will be most senses by women. Women make crucial contributions in agriculture and rural enterprises in drylands as farmers, animal husbandry, workers and entrepreneurs through their indigenous knowledge. Ensuring financial mechanisms on mitigation and adaptation address the needs and conditions for implementation of poor women and men equally. Building capacity at all levels to design and implement *gender-responsive* climate change policies, strategies and programs; Special attention will be put on linking the mitigation and adaptation measures specified in the INDC and beyond to SDGs from 1-5 which focus on addressing challenges of poverty, education, health, gender equality and other socioeconomic conditions;
Kenya	Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples in a *gender-responsive* manner. Kenya has various laws to promote gender equality and provide for the protection against discrimination on the basis of gender, with equal opportunities in education, work, and in cultural and professional development. Develop social safety net structures for women, youth and other vulnerable groups within the CCCFs; Strengthen access of women, youth, other vulnerable groups to enterprise funds, climate finance and credit lines Promote gender-responsive technologies and innovations in the private sector through financing, capacity building and start-up services; Consolidate successful technologies and develop a transfer strategy to women, youth and other vulnerable populations.
Kiribati	Summary of gender reference In its analysis of vulnerable sectors of society, it notes: The effects of climate change are felt first and most acutely by vulnerable and marginalized populations, including (inter alia) women. Violence against women and children is a widespread issue within Kiribati society, which can be exacerbated in times of disasters when normal social protection may be missing. All strategies and actions in the Kiribati Joint Implementation Plan on Climate Change and Disaster Risk Management are inclusive of vulnerable groups, considering gender, youth and children, the elderly and people with disability.

Country	NAP mentions of gender/women/gender equality/gender equity
Latvia	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Lebanon	Lebanon considers the SDGs 5 (gender equality), 13 (climate action), 16 (peace, justice and strong institutions) and 17 (partnerships for the goals) to be inherent in the successful achievement of the adaptation priorities and are therefore considered relevant to all actions. Moreover, Lebanon acknowledges that vulnerable groups, especially women, are disproportionately impacted by climatic events, and will therefore commit to render climate adaptation action gender responsive. Lebanon prioritizes a just transition through the consideration of the socioeconomic status of the most vulnerable, adopting a *gender-responsive* approach.
Lesotho	The rural electrification program will reduce greenhouse gas emissions (GHG), promote rural development local entrepreneurship, reduce poverty, reduce rural exodus through job creation, strengthen social cohesion, improve education and health, improve access to new information and communication technologies and energy equipment and alleviation of women's domestic duties. Create a market for clean and efficient household cooking solutions to save lives, improve livelihoods, empower women, and protect the environment. To this effect the adaptation interventions proposed in this NDC are meant to a) recognize and respond to the differentiated needs, experiences, priorities and capacities of women and men; b) enhance gender balance and inclusiveness in various adaptation programs and projects. Promote gender mainstreaming in policies, programs and projects.
Liberia	Liberia has ensured that key relevant stakeholders (government agencies and ministries, civil society, local leaders, private sector, women groups, youth and student representatives, nongovernment organizations) were included and fully participated in its INDC preparation process. For the most part, women and children are particularly vulnerable to the impacts of climate change. However, their unique knowledge and perspectives also provide opportunities for inclusive, equitable and efficient adaptation responses and coping strategies. It provides a framework for enhancing gender equality in both climate adaptation and mitigation activities including decision-making processes, capacity building, implementation of policies and measures to ensure that climate change vulnerabilities are addressed with gender equity and youth development.
Lithuania	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.

Country	NAP mentions of gender/women/gender equality/gender equity
Luxembourg	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Malawi	Women and girls are particularly impacted, as they have to walk further in search of basic commodities for the family such as firewood and water. Yet, women may not have the authority to decide an alternative and climate-resilient solutions for the household. The adaptation interventions proposed in this INDC are meant to enhance gender inclusiveness in the adaptation programs and projects. Promote gender mainstreaming in policies, programs and projects.
Mali	Summary of gender reference Women mentioned as vulnerable group (WVG) for the period of 2015-2020. Women mentioned in the adaptation context as stakeholders (S) in the management of national adaptation policy. Also mentioned, along with men, as beneficiaries of projects (B) related to rural population's human right to water. Also, gender mentioned as a target and beneficiaries of projects (B) in capacity building programs (adaptation context). along with actors from the private and public sector and the youth.
Malta	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Mauritius	Coordination of the INDC plans, programs and projects for both adaptation and mitigation actions will be under the responsibility of MOESDDBM and will involve the participation of all stakeholders *sectoral ministries, private sector, CBOs/NGOs, women's organizations, etc.
Mexico	The consequences of the adverse effects of this global phenomenon are even more serious for individuals and groups in vulnerable social, economic and environmental situations, including women, indigenous and Afro-Mexican communities, children, youth, migrants, people with disabilities, sexual minorities, low-income groups, and the elderly. Reports on the progress of the NDC's implementation will incorporate the objectives and goals of the Lima Work Program on Gender and the United Nations Convention to Combat Desertification (UNCCD) Gender Action Plan. As a signatory of the Escazu Agreement, Mexico will abide by the objectives of the Universal Declaration of Human Rights under the principle of equal rights between women and men, as well as the elimination of all forms of discrimination against women. Actions undertaken to protect tangible cultural heritage from the effects of climate change will consider the respect for spiritual or religious beliefs, as well as for the roles of women and men. Recognizing the legacy of a structural system that has systematically placed vulnerable groups, especially women, at a disadvantage, this NDC update is based on *gender-responsive* approaches that will contribute to a more just and egalitarian society by prioritizing the needs of the vulnerable communities and promoting the inclusion and recognition of the knowledge of indigenous communities, under the principle of intergenerational equity. The Mexican Government ratifies its commitment to implement the NDC respecting human rights, integrating a gender equality approach, prioritizing the needs of the vulnerable groups, and promoting the inclusion and recognition of science and traditional knowledge of native indigenous communities under the principle of intergenerational equity.

Country	NAP mentions of gender/women/gender equality/gender equity
Morocco	Revegetation of bare or eroded lands with 128,600 has of cacti in drylands to enhance smallholder farmers and women's cooperative income. Morocco's integrated approach to NDC will include respect for human rights and gender equality, as enshrined in Morocco's 2011 Constitution.
Mozambique	Population was estimated at 20.6 million , 48% are men and 52% are women.
Myanmar (Burma)	In addition, Myanmar recognizes a number of important emerging themes which are key to addressing both future emission reductions and adaptation to climate impacts, including the need for sustainable urban development; a more consistent inclusion of civil society perspectives; the empowerment of groups at risk of the short and long-term impacts of climate change, (such as children and other younger members of society); and the integration of gender considerations into climate change policy design. Ultimately, the effort to mitigate and adapt to climate change is seen as a contribution to alleviate suffering caused by climate change and enable sustainable and durable development of the poor, both in rural and urban areas.
Nauru	At the regional level, Nauru is also involved in a relatively low but increasing number of adaptation projects and programs and through the regional projects and programs, some actions are being implemented on the ground that addresses the needs in relation to coastal zone management, water, capacity building, gender, policy and planning.
Nepal	The Nepal Biodiversity Strategy and Action Plan recognizes legitimate rights of all Nepali people including indigenous people and local communities, women, Dalits and other disadvantaged social groups over local biological resources.
Netherlands	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Nicaragua	Gender equity: Considering that women are protagonists in all economic sectors of the country, including the production and commercialization of agricultural and fishery products, activities that are receptive to the impacts of climate change and climate variability, adaptation and mitigation measures Faced with climate change, they will incorporate all the rights set forth in the different national legal instruments on gender equity. As part of the actions developed in the process of updating the NDC, communication with vulnerable sectors was strengthened, expanding the dialogue with indigenous people, groups of women and youth at the national level.
Niger	Niger's strategy is based on the vision of climate-smart agriculture an on access to modern energy services for everyone in 2030. Concerning the latter point, Niger has adopted the Regional White Book of the Economic Community of West African States (ECOWAS), which recognizes that access to modern energy services make a major contribution to improved access to basic social services (health, education, potable water); to uncreased productivity of households in cooking, lighting and transportation; to giving impetus to the creation of income-producing economic activities; to freeing women from chores such as gathering wood and water and shelling peas and beans to preserving the environment and improving the quality of life of rural populations; and to promoting local jobs and stabilizing populations to contain rural exodus and check uncontrolled urbanization. The co-benefits in the energy sector relate to improvement in the people's living conditions as a result of increased income through social welfare, access to potable water, education and health, as well as access to new information and communication technologies (NICT) and energy equipment, development of local entrepreneurship, alleviation of women's domestic duties and reduction of the rural exodus through job creation.

Country	NAP mentions of gender/women/gender equality/gender equity
Nigeria	Reinforcing social safety nets through support systems that reduce vulnerability and improve livelihood conditions for the vulnerable, especially women and children. Those who rely on fuel wood and charcoal for cooking and heating, primarily women, are exposed to serious indoor air pollution. Providing affordable clean alternatives is the only way forward. Women and youth, but also remote communities, still have less economic, political and legal clout than, for example, men and the urban middle class. Women benefit most from clean efficient cook stoves, gaining in health and in productive time where these are introduced. Similarly, agricultural extension services have proven to reach more men than women. The measures included in the Nigeria INDC were deemed to at a minimum be gender neutral and / or to enhance social inclusion. This puts a significant brake on development and the empowerment of women in particular. a further aim of the 2021 NDC update is to mainstream gender across all sectors. To this end, the Federal Executive Council in 2020 approved the National Action Plan on Gender and Climate
North Macedonia	Finally the process of the enhanced NDC determination involved 25 women to conduct analytical and technical work and 403 women to provide data and discuss and validate the assumptions and results Based on the types of the newly created jobs, very basic analysis indicated that at least 27% of the jobs in 2035 can be assigned to women. Engage United Nations Framework Convention on Climate Change (UNFCC) and Gender Focal Points, Gender Machinery and Parliamentarian Commission on Equal Opportunities to promote leadership roles for women in climate action; The NAP will incorporate cross-sectorial and sector-specific adaptation actions and measures, along with identified adaptation investment priorities based on the review of national and sectorial development policies and plans, and the outcomes of an extensive consultation process, including stakeholders from all sectors and levels of governance, climate-related institutions and agencies, along with the private sector, civil society, academia and women associations and youth NGOs representatives. Introduction of the gender-indicators in some of the policies and measures (PAM) with an aim to make them more *gender-responsive*.
Norway	In 2018, a new and comprehensive Equality and Anti-Discrimination Act entered into force. The Act's purpose is to promote gender equality. The act provides protection against discrimination on the basis pf gender, pregnancy, leave in connection with birth or adoption and care responsibilities. Women and men are to be given equal opportunities in education and work, and in their cultural and professional development.
Panama	Summary of gender reference Women mentioned in the context of stakeholders or decision makers (S) (DM) in the public participation process. This was carried out based on the criteria defined by Article No. 25 of Law 6 of 2002 laying down the procedures for public participation, where the mechanism of public hearing for the participation of various sectors was used, highlighting gender equality, the presence of minority groups, young and old, literate and illiterate.
Papua New Guinea	Vision 2050 is underpinned by seven Strategic Focus Areas: 1. Human Capital Development, Gender, Youth and People Empowerment; 2. Wealth Creation; 3. Institutional Development and Service Delivery; 4. Security and International Relations; 5. Environmental Sustainability and Climate Change; 6. Spiritual, Cultural and Community Development; and 7. Strategic Planning, Integration and Control
Paraguay	Summary of gender reference Women mentioned as stakeholders (S) in a summary of the National Development Plan with attention to indigenous peoples, strong role of women; young visionaries and trained with leading the country.

Country	NAP mentions of gender/women/gender equality/gender equity
Peru	Summary of gender reference The NDC states under 'Crosscutting Approaches': Mitigation and adaptation national policies and instruments incorporate a gender perspective to promote and ensure active, continuous, full and equal participation of women and men in the consultation and decision-making processes for the control and access to natural resources, management of GHG emissions and generation of mitigation and adaptation strategies. This is currently based on the implementation of the National Plan for Gender Equality 2012-2017 (PLANIG in Spanish) and the future Peruvian Action Plan on Gender and Climate Change (PAGCC-Peru in Spanish) which is framed in the National Strategy on Climate Change (Estrategia Nacional ante el Cambio Climático or ENCC in Spanish). Women mentioned in the adaptation context as vulnerable groups focusing on people and their livelihoods – the vulnerable populations that need to be addressed on a priority basis has been determined. These are: rural populations related to subsistence family farming and/or weak market linkages, many of them grouped in peasant and indigenous communities; small farmers; artisanal fishermen; native communities; small forest producers; and, from a health perspective, infants, women and seniors. In relation to adaptation, 'gender and intercultural approach' is stated as a cross-cutting goal. This involves the formulation and approval of an Action Plan on Gender and Climate Change.
Philippines	Recognizing the critical and complex challenges posed by climate change, the Philippines continuously pursues institutional reforms factoring sustainable and responsible use of natural resources, respect for, protection, promotion, and fulfillment, as well as, the full enjoyment of human rights by all, including the indigenous peoples and local communities, gender equality and the full and equal participation of women, intergenerational equity, biodiversity conservation, food and water security.
Poland	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Portugal	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.

Country	NAP mentions of gender/women/gender equality/gender equity
Republic of Moldova	In support to climate action, the adaptation component incorporates cross-sectorial and sector-specific adaptation actions and measures to be implemented, along with identified adaptation investment priorities based on the view of national and sectorial development policies and plans, and the outcomes of an extensive consultation process, including stakeholders from all sectors and levels of governance, in particular, Central Public Authorities and Local Public Authorities, climate-related institutions and agencies, along with private sector, society, academia and women associations and youth NGOs representatives. The national legal framework on equality between women and men is in line with international gender standards. The National Climate Change Commission (NCCC) is seen as a permanent formalized body with the highest representation of key stakeholders:...taking into consideration gender dimension through including representatives of women's associations and considering gender equality and social inclusion in all supervising activities of NCCC. The National Strategy on Ensuring Equality between women and men (2017-2021) in the Republic of Moldova and the Action Plan for its implementation aims at greater reduction of gender gaps due to social, economic and environmental vulnerabilities exacerbated by climate change. The gender policy is supported by the Law No. 5 XVI of 09.02.2006 on ensuring equal opportunities between women and men, which stipulates that in the Republic of Moldova, women and men enjoy equal rights and freedoms and are guaranteed equal opportunities for their exercise Develop and implement focused trainings, other types of education on Common Country Analysis (CCA) targeting women, youth, other vulnerable groups. Improved and expanded Ministry of Agriculture, Regional Development and Environment (MARDE) climate-related capacities, including inclusiveness and gender equality approach Promotion of gender equality on the CCA approach...
Romania	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Rwanda	In this context, the Government of Rwanda plans to promote and encourage the mainstreaming of gender considerations in climate change issues.
Saint Lucia	The Climate Change adaptation Policy has identifies that its success will in part depend on the extent of stakeholder (including women and vulnerable groups) ownership and participation in the implementation of the Climate Change Adaptation Policy (CCAP) priorities. To foster equality on adaptation benefits, Saint Lucia's NAP and associated Sectoral Adaptation Strategy and Action Plans (SASAP) focus on vulnerable groups. While they include activities focusing on women and men generally based on a number of vulnerability factors, they don not identify activities that are specific to either women or men, owing to the lack of data on differential needs. In line with Saint Lucia's commitment to SDG %: Gender Equality, Saint Lucia continues the process of mainstreaming gender in national strategic planning and programming across government and specifically within climate change considerations, including Nationally Appropriate Mitigation Actions and National Adaptation Plan initiatives. Saint Lucia's Gender Relations Department is developing the national gender equality policy and strategic plan, which includes environmental sustainability with focus on climate change as a thematic priority. The EnGenDER (Enabling *Gender-responsive* Disaster Recovery, Climate and Environmental Resilience in the Caribbean will be the starting point for a more substantive gender integration in climate change and should act as a catalyst for the acceleration of gender equality initiatives in Saint Lucia.

Country	NAP mentions of gender/women/gender equality/gender equity
Saint Vincent and the Grenadines	Summary of gender reference Among the main activities being implemented at a national level to facilitate adaptation include the Pilot Program for Climate Resilience includes the following strategy: Design and implement gender-sensitive disaster risk management initiatives.
Senegal	Summary of gender reference Women mentioned in the context of mitigation signaling particular importance to using modern forms of energy production in homes so as to reduce the workload of women and help in improving the academic performance of children (B).
Seychelles	The National Climate Change Strategy 2009 addresses specifically, and although some progress has been made, it was highlighted at the stakeholder workshop that improved gender-sensitive capacity building, research and education was needed to underpin all climate change adaptation efforts to make them effective and resilient. This vision is nested in the country's broader aspiration of sustainable development: finding strategies to realize the nation's economic, social and cultural potential through an innovative, knowledge-led and gender-sensitive approach. Seychelles' aims to build gender-sensitive capacity and social empowerment at all levels to adequately respond to climate change. The process of implementing the Vision to build gender-sensitive capacity, education and awareness, research and monitoring across critical sectors will be nationally monitored, reviewed , updated, and reported by the Ministry of Environment, Energy and Climate Change and will be focused on short-term monitoring of activities and process, and outputs rather than on longer-term outcomes.
Sierra Leone	Pillar eight (8) of Sierra Leone's five year development plan considers Gender and Women's Empowerment. Therefore, in addressing climate change issues, public entities are required to undertake public awareness and consultations, and ensure gender mainstreaming.
Slovakia	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Slovenia	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Solomon Islands	On the achievement of Millennium Development Goals (MDG) a range of social indicators show that the country is likely to meet Goal 2 (Achieve universal primary education) and Goal 5 (Improve maternal health). Females still have less access than males to secondary and tertiary education while women have poor access to health and family planning services in the rural areas. According to the Asia Development Bank (ADB) (2010) much of the improvement in the Human Development Index (HDI) was the result of significant overseas financial and technical assistance, with aid levels increasing from 22% of GDP in 1990 to 66% of GDP in 2005.
Somalia	The primary target of this program is pastoralists and farming communities with limited access to assets and resources, including an emphasis on women and youth among these communities.

Country	NAP mentions of gender/women/gender equality/gender equity
South Africa 1	This plan is informed by an assessment of sectoral, cross-sectoral and geographical vulnerabilities to the adverse impacts of climate change, and it will quantify and present pathways for adaptation, toward an inclusive and just transition to a climate-resilient economy and society, taking into account local and indigenous knowledge, gender considerations as well as social, economic and environmental implications.
South Sudan	Adapting Vulnerable Communities to Climate Change. This also has to take into account gender equality and human rights. Furthermore, it is fundamental to incorporate a gender and human rights approach into capacity building, prioritizing the most vulnerable groups to reduce social inequality. Ensure capacity building and participation of the society, local communities, indigenous peoples, women, men, youth, civil organizations and private sector in national and subnational climate change planning.
Spain	"As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Sri Lanka	Sri Lanka will also take steps to ensure internal equity by maintaining inclusivity. Inclusivity will be focused through the participation of groups such as gender, youth, vulnerable communities, and providing opportunities to these groups to engage, benefit from the ambitious targets.
Sudan	Empowerment of women facing increased occurrence of severe droughts and degradation of natural resources, scarcity in water and loss of livelihood sources: Women empowerment and promotion of gender mainstreaming approach in all interventions Women saving groups, women income and food opportunities (household garden), diversified livelihood sources.
Sweden	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
Switzerland	Switzerland fully subscribes to the view that Parties should, when taking into action to address climate change, respect, promote, and consider their respective human rights obligations, including due consideration for gender equality and gender-sensitive policies.
Tajikistan	The introduction of climate change adaptation measures will be carried out by means of active role of women and civil society on the issues of climate change and disaster risk reduction.
Togo	Togo's population... adult literacy rate (with a clear disparity between sexes: 74.0% for men and 47.9% for women
Tonga	In relation to Tonga's national response to climate change, it notes that Tonga's Strategic Development Framework 2015-25 has seven national outcomes, including: A more inclusive, sustainable and empowering human development with gender equality. In an Annex to the NDC, it also notes legislation and policies that are 'aligned with a Resilient Tonga'. This includes: The Family Protection Act, the National Policy on Gender and Development and the Strategic Plan, all in the focal area of Women.

Country	NAP mentions of gender/women/gender equality/gender equity
Uganda	Women are especially vulnerable in terms of food insecurity, water shortage and fuel wood scarcity. Contributions under this INDC include cross-cutting respect for human rights and *gender-responsive* climate change actions. The protection of vulnerable groups, including women, is a cross-cutting priority. Promote and encourage the mainstreaming of gender considerations in climate change issues. Mainstreaming gender into development policies, plans and strategies as well as observance of human rights in all climate change adaptation and mitigation actions.
United Kingdom	As the Council of the European Union has highlighted, nature-based solutions play an important role to solve global challenges such as biodiversity loss and ecosystems degradation, poverty, hunger health, water scarcity and right, gender inequality, disaster risk reduction and climate change. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a *gender-responsive* manner. The EU NDC is prepared in the context of the EU's commitment to gender equality and cross-cutting priorities as articulated in commitments such as the European Pact on gender Equality... and the integrating dimensions of human rights and gender equality by member states into their national plans, strategies under the EU Energy Union Governance Regulation.
United States of America	Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples in a *gender-responsive* manner.
Uruguay	To make available, by 2025, georeferenced information of social vulnerabilities associated to adverse climatic events, adopting human rights and gender perspectives and looking at childhood, population below the poverty line and/or indigence, homeless people, older adults, disabled people, afro-descendants, migrants and rural population.
Uzbekistan	Widening the participation of the public, scientific institutions, women and local communities in planning and management, taking into account approaches and methods of gender equity.
Vanuatu	Climate change may affect all areas of life for Ni-Vanuatu people and impact women, men and young people in different ways.
Vietnam	Adaptation: Climate change, increased natural disasters and climate extremes produce different impacts on women and men. While men are exposed to more risks due to their involvement in search and rescue operations, women are generally more vulnerable to health and socioeconomic problems; Climate-induced risks: The poor, ethnic minority groups, people whose livelihoods depend on the climate, the elderly, women, children, and people with chronic illnesses have the highest level of vulnerability. Women, especially ethnic minority women, are highly vulnerable due to limited access to education and fewer opportunities to participate in non-farm employment; Public health: Increased temperatures, hot and prolonged heat waves, air pollution, as well as other climate extremes negatively affect human health, leading to increased vulnerability especially among the elderly, women, children and people with existing conditions; Loss and damage: Since the end of 2014, increased temperatures due to the impact of El Niño have caused drought and saline intrusion, seriously damaging production activities and people's lives, including those of women.
Zambia	Gender equality: In 2008, the Government Republic of Zambia with support from cooperating partners developed and launched a Climate Change Gender Action Plan (CCGAP) which ensures that Zambia's climate change processes mainstream gender considerations to guarantee that women and men can have access to, participate in, and benefit equally from climate change initiatives. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples in a *gender-responsive* manner.
Zimbabwe	Mainstreaming gender-responsive climate policies and emphasize special efforts to support vulnerable groups (women, youth and children) in climate change adaptation efforts within all sectors of the economy.

FEATURE

Future of Maritime Security

Navigating Complex Waters in the Indo-Pacific

Zubeda Anjum Niazi

Abstract

In the dynamic realm of international relations, maritime security holds enduring significance, particularly within the ever-evolving Indo-Pacific sphere. This research article aims to assess the trajectory of maritime security in the Indo-Pacific region up to the year 2040, with a specific emphasis on the shifting geopolitical landscape. Given the escalating strategic significance of the Indo-Pacific, comprehending the diverse challenges affecting the area is of utmost importance. Accordingly, this article examines the roles of pivotal actors such as China and the United States in addressing both existing and potential traditional and nontraditional security concerns through the lens of Alfred Thayer Mahan's theory of sea power. It seeks to illuminate regional cooperation mechanisms and their efficacy in addressing security challenges, notably considering emerging technologies' impact on naval strategies, cybersecurity, and environmental concerns. Finally, by navigating the intricate waters of regional security challenges, this research endeavors to outline potential strategies and solutions to safeguard maritime interests.

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The Indo-Pacific region constitutes a pivotal maritime crossroads of immense global significance, where crucial sea routes, strategic interests, and economic prowess converge, shaping the indispensable framework of international security and global trade.[1] While the term *Indo-Pacific* had primarily been utilized by foreign policy experts, particularly in India, Australia, and Indonesia, the vast expanse had long been denoted as the *Asia-Pacific* by most Western nations. More readily adopted in the 2000s, the term reflects the escalating strategic and economic significance of the region.[2]

Geographically vast, this area spans from the western coasts of the Americas to the eastern reaches of Africa, enveloping both the Pacific and Indian Oceans. In essence, it serves as a central hub for transnational commerce, connecting major economies through vital sea lanes.[3]

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[1] Udayan Das, "What Is the Indo-Pacific?," *The Diplomat*, 13 July 2019, https://thediplomat.com/.

[2] Maria Siow, "What Is the Indo-Pacific Region and Why Does the US Keep Using This Term?," *South China Morning Post*, 26 August 2021, https://www.scmp.com/.

[3] Rishav Kaundal, "Why Is Indo-Pacific Region Important for the World?," *Xamnation*, 17 February 2022, https://www.xamnation.com/.

Notably, the Indo-Pacific grapples with a myriad of complex security challenges. These encompass longstanding territorial disputes over sea and land boundaries, alongside contemporary concerns regarding resource utilization, as well as emerging threats such as cyberattacks, environmental degradation, and piracy.[4]

A thorough examination of regional history, geography, and stakeholder interactions is essential for grasping the intricacies of regional dynamics. Within this context, it is pertinent to consider the evolving currents of international relations to underscore the enduring importance of maritime security within the evolving global landscape, particularly in the vital Indo-Pacific region.

Furthermore, environmental challenges, including overfishing, pollution, and the impacts of climate change, have emerged as critical maritime security concerns. Extreme weather events, rising sea levels, and the degradation of marine ecosystems not only directly threaten coastal areas but also have broader implications for maritime activities and infrastructure.

Hence, this research aims to delve into the complex evolution of maritime security dynamics in the Indo-Pacific and project trends until the year 2040, with a focus on the region's shifting geopolitical terrain. The research will comprehensively examine the key roles played by primary stakeholders, primarily the United States and China, in addressing both existing and potential traditional and nontraditional security concerns. These concerns encompass cybersecurity, the transformative effects of emerging technologies on naval strategies, and the environmental landscape within the maritime domain. Accordingly, the objective is to highlight cooperation mechanisms and assess their effectiveness in managing diverse security challenges in the region. Ultimately, the research will offer future implications tailored for international actors, policy makers and military strategists engaged in navigating strategic complexities.

The significance of the Indo-Pacific extends beyond its geography; it holds strategic importance as well. Economic powerhouses like China, South Korea, India, and Japan consider it home. Furthermore, global heavyweights like the United States and Russia significantly influence the regional dynamics. It is crucial to note that within the ever-evolving dynamics, each stakeholder distinctly contributes to shaping the region's balance of power.[5]

In this regard, China's ascendancy is evident, demonstrated by ambitious economic endeavors such as the Belt and Road Initiative (BRI), aimed at fostering

[4] Rajan Kochhar, "Indo Pacific Region: Challenges and Opportunities," *Taazakhabar News*, 25 November 2021, https://taazakhabarnews.com/.

[5] Patrick Wintour, "Why Britain Is Tilting to the Indo-Pacific Region," *The Guardian*, 15 March 2021, https://www.theguardian.com/.

connectivity and showcasing economic strength. Conversely, the United States seeks to safeguard its interests in the region, as evidenced by its longstanding naval presence.[6] Additionally, other significant players like Japan, India, Australia, and numerous Southeast Asian countries each contribute uniquely to shaping regional dynamics.[7]

Mahan's Theory of Sea Power

One of the key theories that significantly impacts the domain of maritime security and is relevant to the research is Mahan's theory of sea power. Developed by Alfred Thayer Mahan, a US naval officer and an influential theorist of sea power, the theory emphasizes the crucial role of maritime power in shaping a country's geopolitical and strategic influence and its global dominance.[8]

The theory underscores the importance of naval strength, arguing that a strong navy is paramount for a country's security, global influence, and economic prosperity. Mahan asserts that controlling sea routes, possessing a powerful fleet, and establishing naval bases are crucial to securing maritime interests and dominating international trade routes.[9]

Mahan distinctively listed six primary elements of sea power:

- Physical conformation;
- Geographical position;
- Extent of territory;
- The character of the people;
- Size of population; and
- The character of the government.

Concerning the Indo-Pacific, the sea power theory holds immense relevance due to the region's extensive coastline, vital sea lanes, and strategic waterways. Historically, regional countries have acknowledged the value of naval power and maritime dominance, aligning with Mahan's principles.

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[6] "Indo-Pacific Strategy of the United States" (fact sheet, The White House, 11 February 2022), https://www.whitehouse.gov/.

[7] Mohd Akhter Ali and M. Kamraju, "Indo-Pacific Significance: A Study on Geopolitical Impact on India and China," ResearchGate, 20 June 2019, https://www.researchgate.net/.

[8] Alfred Thayer Mahan, *The Influence of Sea Power upon History* (Boston: Little, Brown, and Co., 1890).

[9] Thomas Jamison, "Alfred Thayer Mahan: 'The Influence of Sea Power upon History' as Strategy, Grand Strategy, and Polemic," *Classics of Strategy and Diplomacy* (blog), 23 August 2023, https://classicsofstrategy.com/.

Applied to the power struggle between China and the United States in the region, the theory provides insights into how the two have contested and projected their maritime interests in the Indo-Pacific.[10] It illuminates their respective strategies for maintaining naval supremacy, projecting power, and establishing naval bases across the regional maritime arena.

Furthermore, Mahan's theory elucidates the significance of controlling key chokepoints like the Strait of Malacca, Strait of Hormuz, Lombok Strait, Bab el-Mandeb, Sunda Strait, and Taiwan Strait. This control ensures the security of trade routes and the strategic dominance of maintaining a formidable naval presence.[11]

Historical Context of Maritime Security in the Indo-Pacific

Historically, maritime security in the Indo-Pacific region is deeply intertwined with the rich regional history of trade, geopolitical dynamics, and exploration. Traditionally, it served as a maritime hub, facilitating cultural exchanges and trade routes spanning expansive stretches across the Pacific and Indian Oceans.[12]

In antiquity, regional maritime activities were largely driven by the ancient trade networks of civilizations such as China, Mesopotamia, the Mediterranean, and the Indus Valley powers. These routes fostered the exchange of cultures, ideas, and goods, contributing to the region's cultural diversity and economic prosperity.[13]

During the colonial era, European powers like the British, Dutch, Portuguese, Spanish, and French exerted control over various parts of the Indo-Pacific, establishing trading outposts and exploiting resources. Colonization brought significant changes to regional maritime dynamics, including the establishment of naval bases, trading posts, and dominance over crucial maritime lanes.[14]

The Indo-Pacific gained strategic importance during the twentieth century, particularly during World War II, when intense military engagements and naval battles, especially in the Pacific theater, occurred.[15] This resulted in a shift in power dynamics and shaped subsequent maritime security concerns.

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[10] Camilla Tenna Nørup Sørensen, "U.S.-China Strategic Rivalry in the Indo-Pacific," *DIIS Policy Brief*, 27 April 2020, https://pure.diis.dk/.

[11] Benedetta Girardi, Paul van Hooft, and Giovanni Cisco, *What the Indo-Pacific Means to Europe: Trade Value, Chokepoints, and Security Risks* (The Hague: The Hague Centre for Strategic Studies, 20 November 2023), https://hcss.nl/.

[12] Dhruva Jaishankar, "Maritime Connectivity and Security in the Indo-Pacific," Brookings, 25 September 2023, https://www.brookings.edu/.

[13] Jaishankar, "Maritime Connectivity and Security in the Indo-Pacific."

[14] Jaishankar, "Maritime Connectivity and Security in the Indo-Pacific."

[15] Gurpreet S. Khurana, "The 'Indo-Pacific' Concept: Retrospect and Prospect," Center for International Maritime Security, 14 November 2017, https://cimsec.org/.

Following World War II, the region experienced decolonization, leading to the emergence of independent nations amid Cold War dynamics. Military alliances and strategic bases were established throughout the region, thrusting it into the center stage of global geopolitics, with the United States playing a dominant role in maintaining maritime security through naval presence and coalitions.

In the post–Cold War era, the US has pursued a comprehensive strategy aimed at containing China's rise and influence in the Indo-Pacific region. Conversely, China's approach to the Indo-Pacific has sparked much discussion and debate.[16] Some Chinese scholars contend that the US *Indo-Pacific Strategy* aims to constrain China's geopolitical ascent while safeguarding American leadership and interests in the region.

Hence, the historical evolution and contemporary power struggles related to maritime security in the Indo-Pacific reflect a complex tapestry of colonization, trade, conflicts, and power dynamics. Understanding this historical backdrop is imperative for comprehending the intricate interplay of geopolitical forces in the region and addressing contemporary maritime security challenges.

Regional Disputes and Territorial Claims

The Indo-Pacific region is characterized by numerous regional disputes and territorial claims with significant implications for security and stability.[17] These disputes often revolve around strategic waterways, maritime boundaries, and natural resources. The lack of resolution poses serious challenges to freedom of navigation, regional stability, and adherence to international maritime laws, notably the United Nations Convention on the Law of the Sea (UNCLOS).

Efforts to resolve these disputes persist through diplomacy, legal frameworks, and multilateral dialogues, recognizing that any upheaval could have far-reaching consequences beyond the region.[18] However, due to a myriad of reservations stemming from historical grievances, geopolitical rivalries, and national interests among the involved countries, finding mutually acceptable solutions has remained a complex and elusive challenge.

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[16] "Reinventing the Indo-Pacific," *The Economist*, 4 January 2023, https://www.economist.com/.

[17] Arzan Tarapore, "Three Dilemmas Facing the Indo-Pacific's Regional Order," *Asia Pacific Bulletin*, 29 June 2021, https://www.eastwestcenter.org/.

[18] Tarapore, "Three Dilemmas Facing the Indo-Pacific's Regional Order."

South China Sea Dispute

The South China Sea is a critical area of contention, with overlapping territorial claims by China, the Philippines, Vietnam, Malaysia, and Brunei. Central to the dispute are China's expansive claims, notably its assertion of sovereignty over much of the region through the Nine-Dash Line, a claim that has been deemed illegal by international rulings, including the Permanent Court of Arbitration's landmark decision in 2016.

China's claim of control over the South China Sea has contributed to heightened regional tensions and prompted concerns among neighboring countries and the international community. The delineation of the Nine-Dash Line, overlapping the territorial waters and EEZs of other claimant states, has contributed to these concerns. This strategically vital area is rich in natural resources, including oil and gas reserves, and hosts critical sea lanes through which a significant portion of global trade passes. As such, the South China Sea has become a focal point for geopolitical competition, with countries vying for control over its resources and maritime routes.

In addition to disputes over sovereignty and maritime boundaries, incidents of maritime standoffs and confrontations have occurred, further exacerbating tensions in the region. China's construction of artificial islands and military installations in disputed waters has raised alarm bells among neighboring countries and the international community, as it undermines efforts to resolve the dispute through peaceful means and violates international law.

The South China Sea dispute underscores the importance of upholding the principles of international law, including the UNCLOS, in resolving maritime disputes and maintaining regional stability. The Permanent Court of Arbitration's ruling in 2016, which invalidated China's claims based on historical rights, serves as a legal precedent that should guide efforts to peacefully resolve the dispute and uphold the rights of all claimant states in accordance with international law.[19]

East China Sea Dispute

The conflict between China and Japan over the sovereignty of the Diaoyu/Senkaku Islands presents a significant challenge to regional stability and adherence to international law in the East China Sea. Both countries assert ownership of these uninhabited islands, which are strategically located and surrounded by rich fishing grounds and potential oil and gas reserves.

[19] Center for Preventive Action, "Territorial Disputes in the South China Sea," *Global Conflict Tracker*, 28 February 2024, https://www.cfr.org/.

From an international law perspective, the legal status of the Diaoyu/Senkaku Islands remains ambiguous. While China claims historical sovereignty over the islands dating back centuries, Japan argues that it has maintained effective control over them since the late nineteenth century. The lack of a clear legal basis for either claim complicates efforts to resolve the dispute through established legal mechanisms, such as international arbitration or mediation.

The dispute has escalated tensions in the region, leading to intensified maritime patrols, occasional confrontations between naval vessels and coast guard ships, and violations of airspace. These actions not only heighten the risk of conflict but also undermine efforts to promote peaceful resolution through diplomatic channels and adherence to international law.

Both China and Japan have a responsibility to abide by international legal principles, including those outlined in the UN Charter, which emphasizes the peaceful settlement of disputes and respect for the sovereignty and territorial integrity of all states. Any attempts to unilaterally alter the status quo or assert control over disputed territories without legal justification are inconsistent with these principles and risk destabilizing the region.

Efforts to address the Diaoyu/Senkaku Islands dispute should be guided by a commitment to upholding international law and promoting peaceful resolution through dialogue and negotiation. The involvement of impartial third-party mediators and adherence to established legal frameworks, such as the UNCLOS, could help facilitate a resolution that respects the rights and interests of all parties involved while contributing to regional stability and cooperation.[20]

India–China Border Dispute

The ongoing border dispute between China and India in the Himalayan regions, notably Arunachal Pradesh and Aksai Chin, presents a complex issue with differing perspectives. China maintains its claims over these areas, asserting historical and geographical grounds, despite India's sovereignty claims. Arunachal Pradesh is viewed by China as disputed territory, challenging India's assertion of it being an integral part of its territory. Similarly, Aksai Chin's occupation by China following the 1962 Sino-Indian War is perceived as legitimate by China, citing historical association. China's perspective emphasizes its commitment to safeguarding its territorial integrity and national security interests in the region. However, these disputes contribute to periodic standoffs and military tensions, affecting

[20] Sun-won Park, "The East China Sea Dispute: Short-Term Victory and Long-Term Loss for China?," *Brookings*, 28 July 2016, https://www.brookings.edu/.

regional stability. Additionally, China's support for Pakistan, including infrastructure projects in Pakistan-occupied Kashmir, adds complexity to the situation, influencing regional dynamics and exacerbating Indo-China border tensions.

India consistently emphasizes the pursuit of a peaceful resolution to the border dispute through diplomatic channels, underscoring the importance of respecting established borders and international law. In contrast, China asserts a different stance, emphasizing its own considerations and positions in these negotiations. The challenges in achieving a lasting resolution stem from the complex dynamics and differing perspectives of the involved parties.

Considering these challenges, India remains committed to safeguarding its territorial integrity and sovereignty. The Indian government prioritizes strengthening border infrastructure, enhancing military capabilities, and fostering strategic partnerships with like-minded nations to address what it perceives as China's expansionist agenda and maintain regional stability. India emphasizes the importance of upholding principles such as sovereignty, territorial integrity, and respect for international law in seeking a peaceful resolution to the border dispute.

On the other hand, from the Chinese perspective, the country views its activities in the region as legitimate efforts to protect its territorial sovereignty and maintain stability along its borders. China asserts its rights to develop infrastructure and enhance security measures in areas it claims as its own, including those disputed with India. From China's viewpoint, these actions are consistent with its commitment to safeguarding its national interests and ensuring regional security. China also advocates for peaceful negotiations based on mutual respect and adherence to international law to resolve the border dispute with India.[21]

Maritime Boundaries in the Indian Ocean

Maritime boundary disagreements and territorial disputes in the Indian Ocean region highlight the complexities of maintaining stability and upholding international law. While disputes between neighboring countries are not uncommon, it is essential to address them through peaceful means and in accordance with established legal principles, rather than resorting to revanchism or irredentism.

The disputes between India and Sri Lanka, India and Pakistan, and unresolved maritime claims between Myanmar and Bangladesh are illustrative examples of the challenges faced in delineating maritime boundaries and resolving territorial disputes in the Indian Ocean. These disagreements often stem from historical

[21] "India-China Dispute: The Border Row Explained in 400 Words," *BBC News*, 13 December 2022, https://www.bbc.com/.

grievances, competing territorial claims, and resource competition, further complicated by overlapping EEZs and continental shelf claims.

In addressing these disputes, it is imperative to adhere to the principles of international law, including the UNCLOS, which provides a comprehensive legal framework for resolving maritime disputes. UNCLOS establishes rules for the delimitation of maritime boundaries, the determination of EEZs and continental shelf rights, and the peaceful settlement of disputes through negotiation, mediation, or arbitration.

Resorting to revanchism or irredentism, which involve seeking to regain or assert control over territories based on historical claims or ethnic affiliations, only serves to exacerbate tensions and undermine efforts to promote peace and stability in the region. Instead, all parties involved should demonstrate a commitment to dialogue, cooperation, and respect for international law in addressing maritime boundary disputes.

By engaging in constructive dialogue and adhering to established legal mechanisms, countries in the Indian Ocean region can work toward mutually beneficial solutions that uphold the rights and interests of all parties involved while fostering trust, cooperation, and regional stability. This approach is essential for ensuring the peaceful and sustainable management of maritime resources and promoting the rule of law in the Indian Ocean.[22]

Andaman and Nicobar Islands

The Andaman and Nicobar Islands hold immense strategic significance for India, serving as a vital outpost in its maritime defense posture and projecting its influence in the Indian Ocean region. However, China's increasing assertiveness in the region has raised concerns regarding its intentions and actions vis-à-vis these strategically located islands.

The border dispute between India and China concerning the Andaman and Nicobar Islands underscores India's sovereign rights and territorial integrity. They are considered integral to India, and any actions by China that challenge or undermine India's control over them are seen as contentious and may elicit strong opposition.

Given their strategic location at the entrance to the Malacca Strait, one of the world's busiest maritime chokepoints, the Andaman and Nicobar Islands are critical for controlling and monitoring maritime traffic in the Indian Ocean. Indian

[22] Harshit Bhimrajka, "Maritime Boundaries and Disputes in the Indian Ocean Region," *iPleaders* (blog), 7 December 2020, https://blog.ipleaders.in/.

warships and aircraft routinely patrol the waters around these islands to safeguard India's maritime interests and ensure the security of vital sea lanes.

China's interest in the Andaman and Nicobar Islands raises concerns about its intentions in the Indian Ocean region. China's ambitious BRI includes plans for infrastructure projects in the Indian Ocean, raising suspicions about its strategic objectives and potential encroachment on India's sphere of influence.

The Andaman and Nicobar Islands hold significance in India's maritime defense strategy and regional security framework. Potential challenges from China to India's control over these islands are expected to be met with a determined response, potentially serving as a point of concern in the ongoing maritime dynamics between the two nations in the Indian Ocean region.[23]

Geopolitical Dynamics in the Indo-Pacific

The shifting power dynamics among key players in the Indo-Pacific have significantly shaped the regional geopolitical landscape. China's rapid economic growth and military modernization have profoundly altered the balance of power in the region. The evolution of China's naval capabilities and the construction of artificial islands in the South China Sea, coupled with initiatives like the BRI, exemplify its aspirations to assert regional influence. This ascent has raised considerable concerns among other stakeholders, particularly the United States and other regional powers, regarding China's intentions and their ramifications for regional stability.

As a longstanding power in the region, the United States has pursued a strategy of rebalancing, pivoting its focus toward the Indo-Pacific. This strategic realignment aims to enhance its presence, reinforce alliances, and counterbalance China's expanding influence. Initiatives such as the Indo-Pacific Command (INDOPACOM) and increased military engagements and partnerships in the region underscore the US commitment to maintaining its role as a major actor.[24]

Furthermore, alongside China and the US, other regional powers like Japan and India have been asserting their influence. Japan's Free and Open Indo-Pacific (FOIP) vision and India's Act East Policy reflect their endeavors to foster connectivity, ensure regional stability, and enhance strategic partnerships.[25] It is worth

[23] Abhinav Singh, "EXPLAINED: How India Developing a Naval Base at Andamans Chokes China in the Region," *WION*, 15 March 2023, https://www.wionews.com/.

[24] "Reinventing the Indo-Pacific," *The Economist*.

[25] "Japan's Foreign Policy by Region," in *Diplomatic Bluebook 2021* (Tokyo: Ministry of Foreign Affairs [Japan], 2021), https://www.mofa.go.jp/.

noting that these regional powers are increasingly assuming pivotal roles in shaping the geopolitical dynamics of the Indo-Pacific.

Correspondingly, territorial disputes among countries in the East China Sea, South China Sea, and Indian Ocean have spurred the formation of coalitions and strategic alignments. As a result, regional countries such as the Philippines, Japan, Vietnam, and Australia have sought closer ties with the United States and other regional powers to counterbalance China's expanding influence in response to perceived threats.

Along these lines, countries in the Indo-Pacific have expanded their alliances to navigate the evolving geopolitical landscape.[26] This includes engaging with nontraditional partners like European countries and pursuing multilateral collaboration to address common challenges such as maritime trade, security, and infrastructure development.

This signifies the intricate web of strategic interactions and power dynamics among key stakeholders in the Indo-Pacific, which continually experiences a complex interplay of alliances, interests, and competition, profoundly influencing the regional security architecture and carrying far-reaching implications for cooperation and stability.

Furthermore, the multifaceted roles of the United States, China, and other key players significantly impact the geopolitical landscape. Historically, the United States has been a linchpin in the Indo-Pacific in terms of regional security, economic development, and stability, as evidenced by its presence characterized by alliances, military partnerships, and a purported commitment to ensuring a rules-based order in the Indo-Pacific.[27]

However, US involvement has been viewed cautiously by some nations, primarily considering its strategic interests and military presence. Some perceive US policies as contributing to regional tensions, particularly in its responses to China's growing influence. Moreover, shifts in US foreign policy priorities and occasional inconsistencies have raised concerns among regional partners regarding the credibility of its commitments.[28]

On the other hand, China's ascension as a global powerhouse has been accompanied by rapid economic growth and a determination to pursue its strategic interests, as evidenced by its economic initiatives like the BRI and the construction

[26] Siow, "What is the Indo-Pacific region?"

[27] Sanjay Pulipaka and Mohit Musaddi, "In Defence of the 'Indo-Pacific' Concept," *Observer Research Foundation*, Issue Brief no. 493, 21 September 2021, https://www.orfonline.org/.

[28] "Indo-Pacific Strategy of the United States" (fact sheet, The White House).

of artificial islands in the South China Sea, demonstrating its ambition to expand influence and enhance connectivity across the region.[29]

While China's economic engagement has offered opportunities for infrastructure development and trade, its assertive actions in regional territorial disputes, notably in the South China Sea, have sparked concerns among neighboring countries and major stakeholders. Some critics highlight China's increasing military presence in the region as a potential threat to adherence to international norms and regional stability.[30]

In addition, other regional players such as Australia, Japan, India, and Southeast Asian nations also play significant roles in shaping the Indo-Pacific. They promote economic cooperation, forge strategic alliances, and enhance defense capabilities through nuanced approaches aimed at maintaining a delicate balance for regional stability.

Policy Initiatives and Regional Cooperation Mechanisms

Significant policy initiatives and regional cooperation mechanisms have been instrumental in shaping maritime security dynamics in the Indo-Pacific. Major stakeholders in the region have established cooperation frameworks and initiatives to address joint maritime security concerns:

ASEAN-led Mechanisms

The Association of Southeast Asian Nations (ASEAN) has taken proactive steps to address maritime security concerns in the Indo-Pacific region by establishing important platforms such as the ASEAN Regional Forum (ARF) and the East Asia Summit (EAS). These fora serve as crucial avenues for promoting confidence-building measures, fostering cooperation, and facilitating dialogue among major stakeholders and member states.

The ARF and the EAS play pivotal roles in enhancing regional security architecture by providing opportunities for open discussions and collaboration on maritime security issues. Through these platforms, participating countries can share information, exchange best practices, and coordinate responses to common challenges, thereby contributing to the maintenance of peace and stability in the region.

One notable aspect of ASEAN's efforts in promoting maritime security is the conduct of joint naval exercises among Indo-Pacific countries. These exercises serve

[29] Associated Press, "China Has Fully Militarized Three Islands in South China Sea, US Admiral Says," *The Guardian*, 21 March 2022, https://www.theguardian.com/.

[30] Associated Press, "China Has Fully Militarized Three Islands."

as practical demonstrations of cooperation and interoperability among regional navies, enhancing their collective capacity to address maritime threats and challenges. By participating in joint exercises, countries not only strengthen their military capabilities but also build trust and confidence among themselves, laying the groundwork for future collaboration in ensuring maritime security.

Overall, the initiatives spearheaded by ASEAN, including the ARF and joint naval exercises, underscore the importance of multilateral cooperation in addressing maritime security challenges in the Indo-Pacific. Through sustained efforts and engagement, ASEAN and its partners can continue to build a robust framework for regional security that promotes peace, stability, and prosperity for all stakeholders in the Indo-Pacific region.[31]

Shangri-La Dialogue

The Shangri-La Dialogue, organized annually by the International Institute for Strategic Studies (IISS), holds significant importance as a premier platform for fostering dialogue and cooperation among military chiefs, policy makers, and defense ministers from major stakeholders in the Indo-Pacific region. Representatives from countries such as the United States, China, Japan, and others gather at this forum to deliberate on pressing regional security issues, exchange perspectives, and build mutual understanding.

As a high-level security forum, the Shangri-La Dialogue provides a valuable opportunity for key decision-makers to engage in open and frank discussions on a wide range of security challenges facing the Indo-Pacific region. These discussions cover various topics, including maritime security, territorial disputes, military modernization, counterterrorism, and nontraditional security threats such as cybersecurity and climate change.

One of the primary objectives of the Shangri-La Dialogue is to promote transparency and confidence-building measures among regional stakeholders. By facilitating face-to-face interactions and dialogues, the forum helps to reduce misunderstandings, manage tensions, and foster trust among participants. This, in turn, contributes to the maintenance of peace and stability in the region.

Moreover, the Shangri-La Dialogue serves as a platform for the exchange of views and perspectives on strategic developments and security challenges. Partici-

[31] John Bradford, "Evolving Conceptualizations of Maritime Security in Southeast Asia," Asia Maritime Transparency Initiative, 4 November 2021, https://amti.csis.org/; and Adriana Elisabeth, "ASEAN Maritime Security and Power Interaction in the Region," in *ASEAN Maritime Security*, ed. Faudzan Farhana Khanisa (Singapore: Springer, 2022), 93–110, https://doi.org/.

pants can articulate their respective countries' policies, priorities, and concerns, allowing for a better understanding of each other's perspectives and interests.

In addition to formal discussions, the Shangri-La Dialogue also provides valuable opportunities for informal networking and bilateral meetings on the sidelines of the main event. These interactions enable participants to deepen their relationships, explore areas of cooperation, and build personal rapport, which can be instrumental in addressing security challenges and advancing regional cooperation.

Overall, the Shangri-La Dialogue plays a vital role in promoting dialogue, enhancing trust, and fostering cooperation among major stakeholders in the Indo-Pacific region. By facilitating constructive engagement and exchange, the forum contributes to the development of pragmatic solutions and strategies for maintaining peace, stability, and prosperity in the region.[32]

The Quadrilateral Security Dialogue's Initiatives

The Quadrilateral Security Dialogue, commonly known as the Quad, is a strategic partnership comprising the United States, Japan, India, and Australia. Originating from informal discussions in the aftermath of the 2004 Indian Ocean tsunami, the Quad has evolved into a significant forum for like-minded Indo-Pacific powers to address regional security challenges and promote shared interests.

At its core, the Quad seeks to uphold a FOIP vision, which emphasizes the promotion of a rules-based international order, respect for international law, and the preservation of freedom of navigation and overflight in the Indo-Pacific region. By championing these principles, the Quad aims to counterbalance any attempts by authoritarian powers to assert unilateral dominance and undermine the established norms and institutions that underpin regional stability and prosperity.

One of the primary areas of focus for the Quad is maritime security. Given the strategic importance of maritime trade routes and the increasing militarization of the Indo-Pacific region, the Quad members recognize the imperative of safeguarding maritime domains against various security threats, including piracy, terrorism, illegal fishing, and maritime coercion. Through coordinated naval exercises, intelligence-sharing mechanisms, and capacity-building initiatives, the Quad seeks to enhance interoperability among their respective naval forces and

[32] Lalit Kapur, "Tensions at the Shangri-La Dialogue," *Delhi Policy Group Policy Brief* 8, no. 20 (18 June 2023), https://www.delhipolicygroup.org/; Joseph Clark, "Austin Underscores Importance of Partnerships in Securing a Shared Vision for Indo-Pacific," *DOD News*, 2 June 2023, https://www.defense.gov/; and Hunter Marston, "Eyes on Asia: Shangri-La Security Dialogue's Role in Managing Great Power Rivalry," *9DASHLINE*, 7 June 2023, https://www.9dashline.com/.

strengthen maritime domain awareness to ensure the safety and security of sea lanes of communication.

In addition to maritime security, the Quad also places significant emphasis on infrastructure development to promote connectivity, economic growth, and resilience in the Indo-Pacific region. Recognizing the critical role of infrastructure in shaping geopolitical dynamics and fostering regional integration, the Quad members have pledged to collaborate on high-quality, transparent, and sustainable infrastructure projects that adhere to international standards and best practices. By investing in infrastructure development, the Quad aims to address infrastructure gaps, promote economic development, and enhance the resilience of Indo-Pacific nations against external pressures and coercion.

Overall, the Quad represents a strategic alignment of like-minded democracies committed to advancing a rules-based order and promoting peace, stability, and prosperity in the Indo-Pacific region. Through their collective efforts in maritime security cooperation and infrastructure development, the Quad members seek to shape the regional security architecture and contribute to the long-term peace and prosperity of the Indo-Pacific.[33]

Bilateral and Multilateral Agreements

Repeatedly, many Indo-Pacific nations have engaged in bilateral agreements to strengthen maritime security. For example, the US has security alliances with South Korea, Australia, the Philippines, and Japan for the sake of regional stability. Aside from that, trilateral agreements between countries like Japan, the US, and India have also emerged to address shared security concerns.

Maritime Domain Awareness Initiatives

In the Indo-Pacific region, many nations have recognized the importance of bilateral agreements to strengthen maritime security and promote regional stability. These agreements serve as frameworks for cooperation, intelligence-sharing, joint exercises, and capacity-building initiatives aimed at addressing common security challenges and threats in the maritime domain.

One prominent example of such bilateral agreements is the network of security alliances established by the United States with key partners in the region. These

[33] Jagannath P. Panda and Ernest Gunasekara-Rockwell, eds., *Quad Plus and Indo-Pacific: The Changing Profile of International Relations* (New York: Routledge, 2022); Kyoko Hatakeyama et al., "The Quad's Growing Focus on Maritime Security," *Domino Theory*, 29 February 2024, https://dominotheory.com/; and Yui Nishimura and Atsushi Tago, "Are Shared Values Valuable?: Liberal Democracy and Human Rights among AUKUS and its Future Membership," *International Journal* 78, no. 3 (September 2023): 394–416, https://doi.org/.

alliances, forged through bilateral treaties and agreements, play a crucial role in enhancing maritime security and deterring potential threats. For instance, the United States maintains security alliances with countries such as South Korea, Australia, the Philippines, and Japan, which serve as linchpins for regional stability. Through these alliances, the US provides security assurances to its partners, conducts joint military exercises, and coordinates efforts to address shared security concerns, including maritime threats, territorial disputes, and regional instability.

In addition to bilateral alliances, trilateral agreements have also emerged as a mechanism for enhancing maritime security cooperation in the Indo-Pacific. These agreements involve three countries coming together to address shared security challenges and promote regional stability. For example, trilateral agreements between Japan, the United States, and India have gained prominence in recent years, reflecting the growing strategic convergence among these countries. These trilateral partnerships aim to deepen defense cooperation, enhance interoperability among their respective armed forces, and address common security concerns, including maritime security, counterterrorism, and regional stability.

Furthermore, bilateral and trilateral agreements often complement multilateral frameworks and initiatives aimed at promoting maritime security in the Indo-Pacific. By leveraging existing partnerships and networks of cooperation, countries in the region can pool their resources, expertise, and capabilities to effectively address complex security challenges and uphold the rules-based order in the maritime domain.

Overall, bilateral and trilateral agreements play a vital role in strengthening maritime security cooperation and promoting regional stability in the Indo-Pacific. By fostering closer ties and collaboration among key stakeholders, these agreements contribute to the maintenance of peace and security in one of the world's most strategically significant regions.

Despite the importance of these initiatives, challenges persist in their effective implementation. Historical disputes, geopolitical tensions, and differing strategic interests present complexities that hinder seamless cooperation among participating nations.[34]

While regional collaboration platforms have facilitated dialogue and confidence-building measures among key actors, challenges remain due to varying threat perceptions, divergent strategic interests, and historical disputes among member states. These factors continue to impede efforts toward achieving seamless cooperation in addressing maritime security challenges.[35]

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[34] Jasmin Alsaied, "How to Make the Indo-Pacific Partnership for Maritime Domain Awareness Work," *The Diplomat*, 12 October 2022, https://thediplomat.com/.

[35] Alsaied, "How to Make the Indo-Pacific Partnership."

Evolution of Regional Maritime Security Concerns

The regional maritime security concerns in the Indo-Pacific have undergone significant transformations, reflecting emerging challenges and a changing geopolitical landscape. Initially, the focus was on protecting merchant vessels from raiders and piracy, as well as safeguarding trade routes. However, over time, the scope expanded to encompass broader security issues, including geopolitical rivalries, the proliferation of nonstate actors engaged in maritime criminal activities, the impact of climate change, and territorial disputes.[36]

One ongoing challenge in the Indo-Pacific is territorial disputes over maritime boundaries, EEZs, and islands. For example, the South China Sea has been a focal point of contention involving regional countries like China, the Philippines, Vietnam, and others, along with the involvement of the United States. These disputes have led to heightened tensions and conflicting claims, posing implications for regional stability and security.

The comprehensive US *Indo-Pacific Strategy* aims to address various challenges and promote US interests in the region. Under the Biden administration, efforts have been made to assert US leadership in the region and adapt its role for the twenty-first century.[37] Consequently, since 2022, the United States has strengthened emerging partnerships, forged innovative links, and modernized its longstanding alliances to address urgent challenges, including competition with China, the COVID-19 pandemic, and climate change. Notably, the United States has undertaken these endeavors at a time when its partners and allies throughout the world are increasingly engaging in the region.

Beijing contends that the US *Indo-Pacific Strategy* aims to constrain China's rise geopolitically while safeguarding US leadership and interests in the region. Moreover, China asserts that its expanding influence through initiatives like the BRI, ostensibly aimed at infrastructure development and connectivity across Asia, Europe, and Africa, is intended to promote shared prosperity through peaceful means. However, China's growing military presence in the region, particularly in the South China Sea, has led to tensions with other regional countries.[38]

Against the backdrop of the Indo-Pacific's evolving geopolitics, the contemporary relationship between the United States and China is undergoing a critical juncture. The two countries are engaged in a new great-power competition, leading to uncertainties surrounding various geopolitical flashpoints across the region,

[36] Alsaied, "How to Make the Indo-Pacific Partnership."

[37] "Indo-Pacific Strategy of the United States" (fact sheet, The White House).

[38] Dingding Chen, "What China Thinks of the Indo-Pacific Strategy," *The Diplomat*, 27 April 2018, https://thediplomat.com/.

including the Taiwan Strait. Despite efforts by both sides' political leadership to de-escalate tensions and prevent inadvertent crises, there is a heightened risk of potential kinetic exchanges between the United States and China.[39]

Moreover, nontraditional security threats such as maritime piracy, illegal fishing, human trafficking, and the smuggling of drugs and arms have emerged as significant challenges to maritime security.[40] These activities not only undermine the stability of coastal communities and regional economies but also pose risks to the safety of vessels and crew. Additionally, the rise of asymmetric threats, such as insurgency and terrorism, further complicates the security landscape as extremist groups exploit the maritime domain for illegal activities and target maritime infrastructure.[41]

Furthermore, the rapid advancement of technology has introduced new dimensions to maritime security concerns, particularly in the form of cyberthreats targeting maritime infrastructure, communication networks, and navigation systems. These cyberthreats pose substantial risks to the security and safety of maritime operations, adding to the complexity of maritime security challenges in the Indo-Pacific region.[42]

Regional Environmental Maritime Security

In addition to traditional threats, climate change has emerged as one of the most significant nontraditional challenges globally.[43] The Indo-Pacific region has also experienced alterations in average weather patterns due to climate change, including changes in precipitation, temperature, and other atmospheric conditions. Carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4) are the primary

[39] Chen, "What China Thinks of the Indo-Pacific Strategy."

[40] Erin Zimmerman, "Security Cooperation in the Indo-Pacific: Non-Traditional Security as a Catalyst," *Journal of the Indian Ocean Region* 10, no. 2 (2014): 150–65, https://doi.org/; and Brandon Prins et al., "Tackling Maritime Security Requires a Revised Indo-Pacific Strategy," *War on the Rocks*, 22 June 2023, https://warontherocks.com/.

[41] Sreeparna Banerjee and Pratnashree Basu, "Countering Nontraditional Security Threats," *Indo-Pacific Defense Forum*, 16 December 2022, https://ipdefenseforum.com/.

[42] Chan Yan Jau, "Cyber-Attacks as an Evolving Threat to Southeast Asia's Maritime Security," *Asia Maritime Transparency Initiative*, 7 December 2022, https://amti.csis.org/.

[43] "Climate Change 'Biggest Threat Modern Humans Have Ever Faced', World-Renowned Naturalist Tells Security Council, Calls for Greater Global Cooperation" (press release, UN Security Council, 23 February 2021), https://press.un.org/.

drivers of contemporary climate change, influenced by various natural and human-induced factors.[44]

Climate change affects both marine and terrestrial ecosystems in the Indo-Pacific region, making it a significant factor in contemporary global security with specific implications for regional maritime security. The intersection of environmental changes, such as rising sea levels and extreme weather events, with geopolitical complexities has resulted in numerous challenges.[45]

The Indo-Pacific region is particularly vulnerable to the impacts of climate change. The rise in sea levels threatens coastal regions, including critical maritime infrastructure and naval installations. Littoral states such as Myanmar, Indonesia, the Philippines, Vietnam, Sri Lanka, Pacific island nations, and Bangladesh face displacement, while critical infrastructure may encounter logistical obstacles due to encroaching waters.

Moreover, the region is susceptible to severe cyclones, storms, and unpredictable weather patterns, which can disrupt maritime operations, endanger shipping and ports, and affect vital coastal facilities. This disruption poses a threat to maritime trade and rescue operations, ultimately impacting regional stability.[46]

Touching briefly on environmental challenges in each Indo-Pacific country, Bangladesh faces riverbank erosion exacerbated by climate change, which impacts agriculture and displaces communities. Water pollution and deforestation further threaten the country's ecosystems.

The Maldives confronts an existential threat from rising sea levels, critically impacting the nation. As coral reefs degrade due to climate change, fisheries and tourism suffer significant setbacks.[47]

Indonesia grapples with environmental security issues, including deforestation driven by agricultural expansion and illegal logging, leading to biodiversity decline

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[44] Melanie Pill, "Understanding 'lost and damage' from climate change across the Indo-Pacific," *The Interpreter*, 24 July 2023, https://www.lowyinstitute.org/; and Piers Forster et al.,"Changes in Atmospheric Constituents and in Radiative Forcing," in *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the 4th Assessment Report of the Intergovernmental Panel on Climate Change*, ed. Susan Solomon et al. (New York: Cambridge University Press, 2017): 131–234, https://www.ipcc.ch/.

[45] Robert Glasser, Cathy Johnstone, and Anastasia Kapetas, eds., *The geopolitics of climate and security in the Indo-Pacific* (Barton: Australian Strategic Policy Institute, 24 February 2022), https://www.aspi.org.au/.

[46] Glasser, Johnstone, and Kapetas, eds., *The geopolitics of climate and security*.

[47] Amit Ranjan, "Rising Sea Levels: Threat for the Maldives," *ISAS Briefs*, 8 December 2021, https://www.isas.nus.edu.sg/.

and habitat loss. Additionally, forest fires, exacerbated by climate change, worsen air quality concerns.[48]

Similarly, Vietnam, Myanmar, Sri Lanka, and Thailand face challenges from climate change–induced rising sea levels in the Mekong Delta, posing significant risks to livelihoods and agriculture.[49] Industrial pollution and deforestation also threaten environmental sustainability in these countries, while Myanmar additionally contends with water pollution and climate-change effects.

The Philippines faces environmental challenges, including frequent typhoons and storms resulting in landslides, flooding, and coral reef degradation. Overfishing and improper waste disposal further impact marine ecosystems.

Sri Lanka and Thailand also grapple with issues such as illegal fishing, coral reef degradation, and water pollution. East Timor or Timor Leste struggles with sustainable economic development and natural resource management challenges.

Pacific island nations like Kiribati, Tuvalu, and the Marshall Islands are particularly vulnerable to climate change, experiencing rising sea levels, extreme weather events, and ocean acidification. Preservation of freshwater resources is crucial for their sustainability.

India, China, Japan, South Korea, Singapore, Malaysia, Brunei, and Cambodia are other regional stakeholders facing significant maritime environmental challenges. Coastal pollution, habitat degradation, and unsustainable resource exploitation affect marine ecosystems. Rising sea levels and extreme weather events, exacerbated by climate change, pose substantial threats, increasing the vulnerability of coastal regions and impacting infrastructure, communities, and fisheries.

Deforestation and urbanization contribute to soil erosion and sedimentation, further impacting water quality. Additionally, maritime traffic and industrial activities can lead to oil spills and chemical pollution, jeopardizing marine ecosystems' health. The Indo-Pacific's heavy reliance on maritime trade heightens the risk of accidental spills and introduces invasive species.

Collaborative efforts are essential to address these challenges, emphasizing sustainable resource management, climate adaptation, and pollution control. Such

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[48] Kathryn Hansen, "Indonesian Fires Return in 2023," Earth Observatory, 2 October 2023, https://earthobservatory.nasa.gov/.

[49] To Quang Toan, "Climate Change and Sea Level Rise in the Mekong Delta: Flood, Tidal Inundation, Salinity Intrusion, and Irrigation Adaptation Methods," in *Coastal Disasters and Climate Change in Vietnam*, ed., Nguyen Danh Thao, Hiroshi Takagi, and Miguel Esteban (New York: Elsevier, 2014): 199 – 218, https://doi.org/; and Anamitra Anurag Danda, "Climate Change and Sea-Level Rise in the BIMSTEC Region: Towards a Suitable Response," *ORF Issue Brief*, October 2022, https://www.orfonline.org/.

measures are crucial for ensuring the long-term security and health of maritime environments across the region.[50]

Evolving Maritime Technologies

Analyzing technological advancements in the Indo-Pacific region through the lens of Mahan's theory of sea power entails examining several key aspects.[51] The development and deployment of autonomous vessels, equipped with advanced sensors and artificial intelligence (AI) to perform tasks independently, are revolutionizing maritime operations by enhancing patrolling, surveillance, and data collection capabilities. Similarly, the utilization of underwater drones or unmanned underwater vehicles (UUV) for reconnaissance, monitoring undersea activities, and mapping ocean floors is increasingly common, thereby improving underwater surveillance and data gathering capabilities.[52]

The integration of such advanced technologies is reshaping naval strategies, with a growing emphasis on leveraging autonomous vessels and UUVs expected to further transform traditional maritime tactics.[53] Currently, rapid advancements in maritime technologies have significantly enhanced situational awareness by providing real-time data on maritime activities, aligning with Mahan's emphasis on understanding and controlling critical maritime spaces to exert influence.

However, this reliance on corresponding systems and digitized platforms in the maritime domain has also increased cybersecurity risks in the region, particularly through cyberattacks targeting communication networks, navigation systems, and data breaches. Therefore, safeguarding essential maritime infrastructure from cyberthreats through robust cybersecurity mechanisms is imperative.[54]

The incorporation of evolving maritime technologies not only enhances domain awareness and reshapes naval strategies but also underscores the importance of securing technological infrastructure for sustained sea power, in line with Mahan's theory. Addressing future cybersecurity challenges is essential to leverage these advancements while ensuring a resilient and secure maritime domain in the Indo-Pacific.

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[50] *ASEAN Maritime Outlook* (Jakarta: ASEAN Secretariat, August 2023), https://asean.org/.

[51] Daniel F. Runde, Conor M. Savoy, and Owen Murphy "Post-Pandemic Infrastructure and Digital Connectivity in the Indo-Pacific," *CSIS Briefs*, November 2020, https://csis-website-prod.s3.amazonaws.com/.

[52] Tate Nurkin, *The Five Revolutions: Examining Defense Innovation in the Indo-Pacific Region* (Washington, DC: Atlantic Council, December 2020), https://www.atlanticcouncil.org/.

[53] Nurkin, *The Five Revolutions*.

[54] Ash Rossiter and Brendon J. Cannon, *Conflict and Cooperation in the Indo-Pacific: New Geopolitical Realities* (New York: Routledge, 2020).

Implications for Maritime Security in 2040

Anticipating the implications for regional maritime security by 2040 through the lens of Mahan's theory of sea power provides a framework to forecast potential scenarios and their ramifications.[55] If territorial disputes persist, it is foreseeable that intensified naval competition among major actors such as the United States and China, vying for maritime supremacy through increased military build-ups and enhanced naval capabilities, will escalate the regional power struggle, in accordance with Mahan's emphasis on the significance of naval might in securing sea routes and controlling strategic points.

The prevalence of unresolved disputes may pose challenges related to the freedom of navigation, a central tenet in Mahan's theory. Additionally, tensions in vital maritime chokepoints could lead to heightened disruption of maritime trade and economic activities, underscoring the importance of controlling crucial sea lanes.

Mahan also advocated for harnessing emerging technologies for naval supremacy. However, looking ahead, the maritime domain may face increased cyberthreats due to AI-driven cyberwarfare and vulnerabilities in maritime technology.

Considering the naval strategist's emphasis on the primacy of diplomacy in securing sea power, concerted diplomatic efforts and adherence to international law could potentially pave the way for peaceful resolutions. Consequently, confidence-building measures and cooperative initiatives may aid in fostering alliances to bolster maritime security and mitigate tensions.

In this context, the significance of alliances cannot be overstated, and persistent disputes may prompt realignments in partnerships among regional powers to uphold maritime influence and counterbalance rising powers.

Environmental Challenges Seen through the Lens of Mahan's Theory

Against the backdrop of the complex regional maritime landscape, environmental challenges emerge as pivotal factors shaping the region's trajectory. Assessing these challenges through the lens of Mahan's theory unveils the significance and ramifications of rising sea levels, resource competitions, and climate adaptation strategies. It is crucial to recognize that the mounting threats posed by rising sea levels in climate-vulnerable coastal areas, coupled with intensified competition for maritime resources, compound the complexities encountered in ensuring naval dominance. Additionally, echoing Mahan's advocacy for adaptable maritime strat-

[55] Jamison. "Alfred Thayer Mahan."

egies, the imperative for climate adaptation strategies underscores the need to safeguard naval assets and infrastructure amid evolving environmental conditions.[56]

Hence, understanding and mitigating environmental challenges are imperative for fostering resilient maritime forces and safeguarding the region's strategic interests effectively. In this regard, evaluating environmental challenges in the Indo-Pacific entails considering several key aspects:

- Rising sea levels resulting from climate change present a significant threat to low-lying coastal regions across the Indo-Pacific. These areas encompass the small island nations of Tuvalu, Kiribati, Tokelau, and the Marshall Islands, as well as the coastal zones of China and Indonesia. It is crucial to recognize that densely populated and highly productive agricultural river deltas, such as the Mekong, Irrawaddy, and Ganges-Brahmaputra, confront increased risks of flooding, erosion, and salinity intrusion. Consequently, coastal erosion, land inundation, and the loss of critical infrastructure emerge as urgent concerns.
- Similarly, coastal communities, vital maritime infrastructure, and naval installations face heightened vulnerabilities due to greater exposure to extreme weather events and rising sea levels. It is essential to acknowledge that such susceptibility undermines Mahan's emphasis on securing strategic coastal regions for maritime dominance.
- Moreover, the Indo-Pacific region has a history of competition for maritime resources, including fisheries, energy reserves, and minerals. The potential overexploitation and competition for limited resources may lead to conflicts among states, thereby affecting regional stability.
- In this context, climate adaptation strategies are indispensable for naval and maritime forces to mitigate the impacts of climate change. Therefore, the implementation of coastal defenses, the advancement of climate-resilient technologies, and infrastructure enhancements are imperative measures.[57]

Furthermore, Mahan's theory underscores the importance of developing strategies to adapt to changing environmental conditions to maintain maritime supremacy. Climate adaptation measures are in accordance with this principle to secure control over maritime domains and naval assets.

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[56] Jamison. "Alfred Thayer Mahan."

[57] *Ocean Climate Action Plan: A Report by the Ocean Policy Committee* (Washington, DC: The White House, March 2023), https://www.whitehouse.gov/; and "Building Resilience: Indo-Pacific Militaries Adapt, Fortify against Climate Impacts," *Indo-Pacific Defense Forum*, 18 December 2023, https://ipdefenseforum.com/.

Addressing rising sea levels, resource competition, and implementing climate adaptation strategies are imperative for the Indo-Pacific region. To uphold maritime superiority amid evolving environmental challenges, aligning Mahan's emphasis on coastal control, resource management, and adaptive strategies with these endeavors is essential.[58]

Environmental Degradation's Impact on Maritime Security in the Indo-Pacific

The environmental challenges facing countries in the Indo-Pacific region significantly impact both conventional security and maritime security.[59] These impacts are multifaceted and affect various aspects of regional security.

Extreme weather events, rising sea levels, and coastal erosion have the potential to hinder the operational capability of naval forces. Damage to naval bases, ports, and vital infrastructure can hamper the readiness and deployment of maritime assets.

Climate change–induced frequent and severe natural disasters necessitate an increase in humanitarian assistance and disaster response missions for naval forces. Consequently, this affects the ability to respond to traditional security threats, diverting resources from conventional security activities.

Rivalry over maritime resources, such as oil reserves and fisheries, due to environmental degradation, can potentially escalate into security challenges. Disputes over these resources may cause tensions and conflicts between neighboring countries.

Extreme weather events and changes in sea currents can disrupt established maritime trade routes. Securing these routes is crucial for maintaining economic stability and national security, as well as addressing navigational challenges and potential disruptions in the flow of goods.

Environmental challenges can exacerbate socio-economic issues, leading to social unrest and instability, fostering piracy, smuggling, and other illicit maritime activities.

Disputes over environmental resources can heighten geopolitical tensions, as competing claims over EEZs and strategic sea lanes may threaten regional security and overall stability in the Indo-Pacific.

Climate-induced migration and displacement can result in demographic shifts and increased competition over limited resources due to environmental changes. This may lead to border disputes and security challenges.

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[58] "Warming of the Indo-Pacific Ocean Is Changing Global Rainfall Patterns," Climate Program Office, 27 November 2019, https://cpo.noaa.gov/.

[59] Conor M. Savoy and Thomas Bryja, "Challenges and Opportunities in the Indo-Pacific Water Sector," CSIS, April 2023, https://csis-website-prod.s3.amazonaws.com/.

Furthermore, regional environmental degradation can facilitate illegal activities such as poaching, trafficking, and illegal fishing, escalating security threats.[60]

Security Challenges in the Indo-Pacific Region in 2040

Projecting the regional security challenges by 2040 necessitates a comprehensive assessment of various factors. The current issues confronting the Indo-Pacific region are poised to exacerbate by 2040 if not addressed through mutual consensus among all stakeholders, potentially leading to heightened tensions between the United States and China if their aggressive behaviors persist.[61] However, the predominant challenges for the region's prosperity and security will revolve around regulating the proliferation of digitized and technology-driven systems amid pervasive geopolitical tensions, combating climate change and its resultant rising sea levels and intensified natural disasters, and managing resources alongside economic development while ensuring security.

Traditionally, the ongoing escalation of naval capabilities by key stakeholders, including China, India, Japan, the United States, and others, may escalate conventional security threats, resulting in the proliferation of advanced naval technologies such as aircraft carriers, submarines, and long-range (hypersonic) missiles, along with sophisticated weaponry including cyberwarfare capabilities and unmanned systems. Additionally, the adoption of innovative military strategies such as anti-access/area-denial (A2/AD) measures could exacerbate strategic competition among prominent naval powers.[62] Submarine-based activities, particularly in contested regions like the South China Sea, are likely to increase the risk of inadvertent incidents or miscalculations, amplifying security challenges with global implications.[63]

Furthermore, due to the vast expanse of maritime routes, maritime crimes are expected to persist despite concerted efforts to combat piracy. Contemporary tactics employed by evolving criminal networks could pose significant challenges to maritime security, particularly in vulnerable areas. These tactics may include piracy and armed robbery, involving cargo theft, vessel hijackings, and crew kidnappings

[60] Savoy and Bryja, "Challenges and Opportunities in the Indo-Pacific Water Sector."

[61] Julian Ryall, "Can US and Japan Push Back against China in Indo-Pacific?," *Deutsche Welle*, 16 March 2021, https://www.dw.com/.

[62] Hassan M. Kamara, "Countering A2/AD in the Indo-Pacific: A Potential Change for the Army and Joint Force," *Joint Forces Quarterly* 97, no. 2 (April 2020): 97–102, https://ndupress.ndu.edu/.

[63] Seth Robson, "More undersea activity in South China Sea increases risks, experts say after submarine crash," Stars and Stripes, 8 October 2021, https://www.stripes.com/.

for ransom. The South China Sea and the Malacca Strait are particularly susceptible to such activities.[64]

Illegal, unreported, and unregulated (IUU) fishing activities by criminal networks using technologically advanced fishing vessels to evade detection through the exploitation of weak enforcement and governance in certain maritime zones will continue to pose a threat in the future. Criminal networks have expanded their operations to include cyberattacks targeting maritime infrastructure, including port facilities, vessels, and shipping companies. Cyberthreats are a significant concern as they can compromise sensitive data, pose safety risks, and disrupt operations.

Furthermore, other crimes such as contraband smuggling and the use of unmanned systems like drones and UUVs for smuggling operations, surveillance, or even deploying explosives or other illicit payloads, as well as collusion between criminal elements and officials or corrupt practices within local maritime authorities, will remain persistent threats in the future.

In the realm of cybersecurity, the growing reliance on interconnected systems in maritime security may expose vulnerabilities to widespread cyberattacks, including state-sponsored cyberattacks aimed at disrupting critical infrastructure or military networks, navigation systems, data breaches, and disinformation campaigns, posing significant challenges to both national and regional security by undermining maritime operations and communications.

Similarly, the increased integration of AI into naval technologies and warfare systems has the potential to revolutionize maritime operations. AI-enabled decision-making, autonomous vessels, and UUVs may introduce uncertainties and complexities in naval strategies, revolutionizing the dynamics of surveillance and conflicts in the maritime domain.

Prospects for Enhanced Cooperation by 2040

Potential enhanced cooperation by 2040 hinges on bolstered collaboration among regional players to strengthen existing mechanisms and establish new frameworks that foster greater trust and dialogue. In this regard, the inclusion of nontraditional global entities, such as European nations, along with expanded participation from emerging maritime powers, could deepen collaboration to promote collective responses to evolving security challenges.

Given the convoluted security dynamics of the Indo-Pacific, addressing challenges to cooperation, fostering inclusive engagement, and leveraging existing

[64] Claire Gute, "South China Sea: Where Piracy Impedes Smooth Sailing," *Asia Media*, 6 August 2021, https://asiamedia.lmu.edu/.

mechanisms are pivotal to enhancing regional partnerships for fostering a long-lasting maritime environment and addressing emerging security threats by 2040.[65]

Historical crises, like the Taiwan Strait confrontations between China and Taiwan, highlight the risk of military escalation and underscore the importance of diplomatic de-escalation strategies.[66] Similarly, historical maritime conflicts like piracy in the Malacca Strait and naval battles such as the First Sino-Japanese War (1894-1895), the Second Sino-Japanese War (1937–1945), and the World War II Pacific Theater, including battles like Midway, the Coral Sea, and naval clashes around Guadalcanal, emphasize the need for collaboration between stakeholders for regional peace. Moreover, post–World War II, sporadic maritime altercations and disputes involving many countries in the Indo-Pacific region have occurred.[67]

The highly intricate maritime security landscape of the Indo-Pacific calls for collaborative endeavors and innovative approaches. Military strategists, policy makers, and international actors, including China and the United States, must prioritize cooperative frameworks and technological advancements while acknowledging historical lessons.

Synthesizing the extensive evaluation of maritime security in the Indo-Pacific yields vital results and implications. Based on Mahan's theoretical framework of sea power, it efficiently demonstrates multi-dimensional challenges in the region. Traditional threats like naval capabilities will persist alongside evolving nontraditional threats, environmental vulnerabilities, and technological advancements. Fostering cooperation mechanisms that transcend geopolitical tensions is imperative, particularly in policy making, by emphasizing dialogue, leveraging technological advancements, and building trust.

Future research should deeply analyze technological innovations like AI-driven warfare for enhanced cybersecurity resilience. Understanding the implications of regional conflicts on maritime security is crucial for fortifying cooperation initiatives.

Looking toward 2040, there are encouraging possibilities for improved collaboration in the realm of environmental security within the Indo-Pacific. Countries in the region are increasingly inclined to collaborate for sustainable solutions, acknowledging the shared challenges and susceptibilities imposed by climate change, ecosystem degradation, and rising sea levels. Cooperation can encompass joint

[65] Cleo Paskal, "Indo-Pacific Strategies, Perceptions and Partnerships," Chatham House, 23 March 2021, https://www.chathamhouse.org/.

[66] Scott L. Kastner, "Is the Taiwan Strait Still a Flash Point?: Rethinking the Prospects for Armed Conflict between China and Taiwan," *International Security* 40, no. 3 (2016): 54 – 92, https://doi.org/.

[67] Paul Hardman, "Maritime Trade Is Essential to the Indo-Pacific," *Proceedings* 149, no. 5 (May 2023): https://www.usni.org/.

efforts in climate resilience, resource management, and the mitigation of environmental risks affecting security. This collaborative approach may foster a collective commitment to protecting maritime environments and coastal areas, with a shared understanding that environmental issues transcend national boundaries. Moreover, nations in the region may build a resilient and ecologically sustainable future through joint research initiatives, technology exchange, and coordinated policy frameworks, safeguarding both regional security and environmental integrity. This approach not only addresses pressing environmental challenges through collaborative efforts but also lays the foundation for strengthened regional ties and a shared commitment to the well-being of Indo-Pacific nations. ✪

Zubeda Anjum Niazi

Ms. Niazi is the managing editor of *The Diplomatic Insight*, a Pakistani magazine dedicated to public diplomacy. Her academic background includes an MSc in strategic studies from the National Defense University (Pakistan). Her areas of interest encompass the intricate landscape of maritime security and geopolitics of Asia with a focus on traditional and nontraditional security challenges. Over the past four years, she has acquired substantial publication experience in esteemed platforms, which has contributed to her experience in research and writing.

VIEW

Blue Economy in the Indo-Pacific

The Need to Create a Cooperative Framework

Dr. Shushant VC Parashar

Abstract

Contemporary environmental challenges stress ocean, coastal, and marine ecosystems, impacting billions. Coastal regions, vulnerable to climate change, face rising sea levels and intense storms. To address these complexities, innovative solutions offering economic growth are crucial. The ocean economy contributes USD 2.5 trillion globally, supporting 3 billion livelihoods. Beyond traditional sectors, nations explore ocean-based renewable energy and marine biotechnology. Embracing the blue economy concept promotes sustainable use of ocean resources for social, economic, and environmental progress. It recognizes threats like plastic pollution and emphasizes interconnected ecosystems. As the Indo-Pacific adapts, redefining the blue economy becomes vital to align with sustainable development goals. This entails inclusivity, value creation, and sustainability, fostering regional collaboration for prosperity and sustainable development.

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Nearly every country considers the Indo-Pacific region pivotal geopolitically, strategically, and economically. With nearly two-thirds of the global population, it is also exceptionally culturally diverse. Encompassing the convergence of the Indian Ocean, deemed the most crucial ocean in the twenty-first century, and the Western Pacific, home to numerous dominant and burgeoning economies, the region boasts maritime choke-points, extensive uncharted waters, and diverse economic and geopolitical dimensions, nurturing rapidly advancing global economies and promoting small island developing states.[1] Consequently, competition for influence, if not outright control, over the region's resources has intensified.

Coastal and marine ecosystems are vital for the economic, environmental, and sociocultural well-being of Indo-Pacific countries.[2] However, debasement due to marine pollution has led to increased salinization, adversely affecting land quality, drinking water, and fish populations, resulting in coastal encroachment and inland salinization, and declining ecosystem health.

[1] Robert D. Kaplan, "Center Stage for the Twenty-First Century: Power Plays in the Indian Ocean," *Foreign Affairs* 88, no. 2 (March–April 2009), 16–32, http://www.jstor.org/.

[2] Cristina Román et al., "Surfing the waves: Environmental and socio-economic aspects of surf tourism and recreation," *Science of the Total Environment* 826 (20 June 2022), 154122, https://doi.org/.

Improper unsustainable methods have significantly reduced ocean reserves in certain regions, harming marine species and ecosystem integrity. Coastal habitat degradation has displaced species supporting artisanal and commercial fisheries, causing biodiversity loss and impacting millions reliant on these ecosystems.[3] Urgent action is needed to protect marine and coastal ecosystems by implementing sustainable fishing practices, reducing marine pollution, and restoring habitats, critical for species preservation and community well-being.

Collaboration among countries is essential to counter climate change impacts. Clean energy sources and innovative technologies are needed to meet decarbonization targets, requiring aid for regional nations.[4] A blue economy framework promotes sustainable use of oceans and inland water resources for social, economic, and environmental progress. Achieving economic growth while preserving the environment demands international collaboration. The region presents vast potential for economic advancement through the blue economy and partnerships to address shared threats, making collaboration within the Indo-Pacific context paramount for addressing these challenges collectively.

Understanding Blue Economy

The term *blue economy* has a disputed origin, with some attributing its creation to Gunter Pauli in 1994, while others trace it back to discussions during the 1992 Rio Earth Summit.[5] It symbolizes the convergence of economic growth and environmental concerns, aiming to achieve a balance by emphasizing sustainable utilization of natural resources within various ocean-related economic activities.[6] However, conflicting perspectives exist regarding the blue economy, with some prioritizing economic growth and others advocating for ocean conservation and protection.[7] Despite garnering significant attention in policy and academia over the past decade, there remains ambiguity regarding its scope, as different institu-

[3] Daniel F. Runde, Conor M. Savoy, and Janina Staguhn, "Post-pandemic natural resource management in the Indo-Pacific," *Centre for Strategic and International Studies*, 9 October 2020, https://www.csis.org/.

[4] Lin Chen et al., "Strategies to achieve a carbon neutral society: a review," *Environ Chem Lett* 20 (2022): 2277–310, https://doi.org/.

[5] Timothy Cadman et al., "Sustainable Ocean Development and the Blue Economy," in *De Gruyter Handbook of Sustainable Development and Finance*, ed. Timothy Cadman and Tapan Sarker (Boston: De Gruyter, 2022), 497–510, https://doi.org/.

[6] Philippa Louey, "The Pacific Blue Economy: An Instrument of Political Maneuver," *Marine Policy* 135 (January 2022), 104880, https://doi.org/.

[7] Rosa María Martínez-Vázquez, Juan Milán-García, and Jaime de Pablo Valenciano, "Challenges of the Blue Economy: Evidence and Research Trends," *Environmental Sciences Europe* 33 (2021): 61, https://doi.org/.

tions offer varying interpretations. Clarification is necessary to navigate these differing perspectives effectively.[8]

Blue Economy in the Indo-Pacific

The Indo-Pacific, spanning approximately one-fifth of the Earth's total ocean area, extends from the southern tip of Africa to the Americas, encompassing various bays, seas, and straits. This region hosts a diverse array of nations, ranging from small island countries to continents, including dependencies and overseas territories of the United Kingdom and France.

Ocean-based economies within the Indo-Pacific are among the world's fastest-growing sectors, boasting significant advantages in trade, port infrastructure, transportation, energy generation, fisheries, and tourism.[9] However, escalating greenhouse gas emissions, rising sea levels, and extreme weather events pose substantial threats to these activities. Governments and international organizations are increasingly urging shipping companies to adopt energy-efficient practices and transition from conventional fuels to alternative sources.

Collaborative efforts among governments can facilitate the development of efficient blue corridors, albeit with potentially costly shifts for industries investing in alternative fuels and emission-reducing technologies to align with emission-free objectives.[10] The Indo-Pacific represents a critical economic frontier, with the blue economy playing a pivotal role in global trade and fostering connections among people, countries, and cultures.[11]

While nations have leveraged oceanic resources to bolster gross domestic product (GDP) and economic growth, concerns are mounting regarding rising sea levels and unsustainable practices. Developing nations are urged to provide solutions to these challenges rather than solely relying on developed countries, which contribute significantly to climate change.[12]

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[8] Guillermo Auad and Brian D. Fath, "Towards a Flourishing Blue Economy: Identifying Obstacles and Pathways for its Sustainable Development," *Current Research in Environmental Sustainability* 4 (2022), 100193, https://doi.org/.

[9] Lu Wenhai et al., "Successful Blue Economy examples with an emphasis on International Perspectives," *Frontiers in Marine Science* 6 (2019), https://doi.org/.

[10] John Virdin et al., "The Ocean 100: Transnational Corporation in the Ocean Economy," *Science Advances* 7, no. 3 (13 January 2021), https://www.science.org/.

[11] Philippa Louey, "The Blue Economy's Retreat from Equity: A Decade under Global Negotiation," *Frontiers in Political Science* 4 (2022), https://doi.org/.

[12] Rahul Tongia, "It is unfair to push poor countries to reach zero carbon emissions too early," *Brookings*, 26 October 2022, https://www.brookings.edu/.

Energy security, typically a domestic concern, is increasingly intertwined with foreign policy. Reliance on limited resources, particularly fossil fuels such as coal-based energy, poses challenges for countries heavily dependent on them, exacerbating concerns about greenhouse gas emissions.

Anthropogenic activities pose severe and undeniable threats to marine and coastal ecosystems. Despite the increase in marine protected areas (MPA) over the past two decades, which currently cover only a fraction of the world's oceans, global and local stressors persist, causing destruction to critical marine habitats.[13] Major infrastructure projects significantly contribute to the exploitation of maritime resources, pollution, and disruptions to terrestrial biodiversity, with devastating consequences for marine and coastal ecosystems.[14] Frequent extreme weather events further compound these challenges, leading to population displacement and the emergence of climate refugees.

Small-scale fisheries are integral to the Indo-Pacific region's economy, providing employment to an estimated 120 million people, with an additional 20 million in aquaculture. These fisheries support approximately 177 million individuals and sustain the livelihoods of roughly 600 to 820 million people.[15] However, overfishing and exploitation have depleted fish stocks, significantly impacting fishing communities and fisheries, leading to reduced catches, economic hardships, and jeopardizing sector sustainability.[16]

The term *blue economy* denotes an economic framework aiming to sustainably utilize and conserve freshwater and marine environments while driving economic growth and resource production, including food and energy. Globally, the blue economy's importance is underscored by the fact that around 90 percent of internationally traded goods are transported by sea.[17] The estimated annual market value of marine and coastal industries and resources stands at USD 3 trillion, approximately 5 percent of the global GDP.[18]

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[13] Michael Kriegl et al., "Marine Protected Areas: At Crossroads of Nature Conservation and Fisheries Management," *Frontiers in Marine Science* 8 (8 June 2021), https://doi.org/.

[14] Qiang He and Brian R. Silliman, "Climate Change, Human Impacts, and Coastal Ecosystems in the Anthropocene," *Current Biology* 29, no. 19 (7 October 2019): R1021–35, https://doi.org/.

[15] Robert I. Arthur et al., "Small-Scale Fisheries and Local Food Systems: Transformations, Threats and Opportunities," *Fish and Fisheries*, 23, no. 1 (2021): 109–24, https://doi.org/.

[16] Ca-Van Pham et al., "The Threshold Effect of Overfishing on Global Fishery Outputs: International Evidence from a Sustainable Fishery Perspective," *Fishes*, 8, no. 2 (2023), 71, https://doi.org/.

[17] Mark J. Spalding, "The New Blue Economy: The Future of Sustainability. *Journal of Ocean and Coastal Economics* 2, no. 2 (2016), Art. 8, https://doi.org/.

[18] Sinan Küfeoğlu, SDG-14: Life Below Water," in *Emerging Technologies* (Cham: Springer, 2022), 453–68, https://doi.org/.

Coastal regions in the Indo-Pacific benefit from favorable climate conditions conducive to various economic activities, including fisheries, aquaculture, and forestry, with mangroves playing a pivotal role.[19] Coastal agriculture and forestry offer carbon sequestration benefits and significant contributions to coastal economies.[20] However, the region faces challenges such as flooding, erosion, salinity intrusion, and rising temperatures. Chemicals used in agriculture negatively impact marine life and ecosystems. Additionally, coastal areas are vulnerable to ocean pollution, ship accidents, and oil spills. Forest ecosystems confront similar challenges, with inadequate inventories and conservation measures potentially sacrificing long-term benefits for short-term gains. Pollution and increased sedimentation from shoreline structures pose further threats, while ocean acidification resulting from greenhouse gas emissions presents a grave danger to marine life.

Climate-induced migration, also known as *environmental refuge migration*, refers to people relocating due to the adverse effects of climate change. Such migration can render individuals ecological or climate change refugees when crossing international borders, though their legal status remains uncertain. Moreover, climate change can trigger internal displacement within countries.

Displacement caused by climate change impacts social, economic, and political facets, disrupting regional economies and raising concerns regarding foreign security and diplomatic matters such as visas and residency status.[21] Policy frameworks addressing climate-induced migration should be integrated into disaster management plans. Real-time data collection on displacement is essential for understanding its population impact and formulating effective regional policies.

In the Indo-Pacific, increased natural disasters due to climate change have significant geopolitical ramifications, affecting maritime boundaries and necessitating the identification of new shipping routes.[22] Consequently, regional nations must establish cooperative frameworks, address legal ambiguities, and share information and technology to enhance maritime domain awareness (MDA) and expedite responses to emerging humanitarian assistance and disaster relief (HADR) situations.

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[19] Lavanya Ravikanth Anneboina and K.S. Kavi Kumar, "Economic Analysis of Mangrove and Marine Fishery Linkages in India," *Ecosystem Services* 24 (April 2017): 114–23, https://doi.org/.

[20] Valerie Hagger, Nathan J. Waltham, and Catherine E. Lovelock, "Opportunities for coastal wetland restoration for blue carbon with co-benefits for biodiversity, coastal fisheries and water quality," *Ecosystem Services* 55 (June 2022), 101423, https://doi.org/.

[21] Michael Berlemann and Max Friedrich Steinhardt, "Climate Change, Natural Disasters, and Migration—A Survey of the Empirical Evidence," *CESifo Economic Studies* 63, no. 4 (December 2017), 353–85, https://doi.org/.

[22] Darshana M. Baruah, Nitya Labh, and Jessica Greely, "Mapping the Indian Ocean Region," *Carnegie Endowment for International Peace*, 15 June 2023, https://carnegieendowment.org/.

The blue economy objectives of the Indian Ocean region have sparked intense debates among politicians, academics, economists, and conservationists due to the region's reliance on maritime resources. Coastal states grapple with environmental degradation, climate change effects, and marginalized coastal communities, posing a significant policy dilemma for leaders. Balancing conservation efforts with economic growth proves particularly challenging for small island developing states (SIDS) and local authorities in coastal communities.[23] While some leaders prioritize climate action due to severe regional impacts, political pressure persists to exploit coastal positions for economic gains, potentially leading to long-term environmental damage.

The Need for a Cooperative Framework: The Indo-Pacific Oceans Initiative

Achieving blue economy objectives in the Indo-Pacific encounters challenges from both traditional and nontraditional threats. Cooperation among littoral states is paramount to advancing these goals, with the Indo-Pacific Oceans Initiative (IPOI) serving as a foundational platform for joint action.[24] Ideally, subregional cooperation drives progress, complemented by extraregional assistance to bolster coastal states' capabilities in combating illegal fishing, piracy, and prioritizing marine conservation efforts. However, geopolitical tensions, particularly between the United States and China and India and China, can impede collaborative efforts toward blue economy goals in the Indo-Pacific.

Nations in the Indo-Pacific must concentrate on establishing a unified framework for the blue economy by harmonizing various national initiatives. This collaborative platform would facilitate discussions and deliberations on the blue economy within the region, ensuring alignment with overarching regional interests. Given the presence of diverse regional organizations pursuing their agendas in this domain, the IPOI must prioritize the collective interests of the region concerning the blue economy.

The Indo-Pacific region, spanning the Indian and Pacific oceans, significantly influences global security and prosperity. While stakeholders strive for peace and stability, competition among powerful nations often results in alliance formations. The IPOI, spearheaded by the Government of India, builds upon New Delhi's Security and Growth for All in the Region (SAGAR) initiative, fostering col-

[23] Rosanne Martyr-Koller et al., "Loss and Damage Implications of Sea-Level Rise on Small Island Developing States," *Current Opinion in Environmental Sustainability* 50 (June 2021): 245–59, https://doi.org/.

[24] Premesha Saha and Abhishek Mishra, "The Indo-Pacific Oceans Initiative: Towards a Coherent Indo-Pacific Policy for India," *Observer Research Foundation*, 23 December 2020, https://www.orfonline.org/.

laboration among states to safeguard a secure and stable maritime domain while advocating for the conservation and sustainable use of marine resources.[25]

The IPOI represents a global endeavor to tackle challenges within the maritime domain through pragmatic cooperation, aiming to establish new partnerships with like-minded nations through mutually beneficial collaboration. India's prime minister, Narendra Modi, unveiled the initiative during the East Asia Summit in Bangkok in 2019, underscoring India's commitment to upholding the existing global order and fortifying its relations with countries across Africa, Asia, and the Americas.[26] India has actively engaged with potential partners to lead specific sectors within its seven pillars, all centered around the maritime domain. These identified pillars, each led by an Indo-Pacific country, encompass (1) maritime security; (2) maritime ecology; (3) resources; (4)capacity building and resource sharing; (5) disaster risk reduction and management; (6) science, technology, and academic cooperation; as well as (7) trade, connectivity, and maritime transport. While the vastness of the blue economy inherently integrates the seven pillars of IPOI, a road map is essential to align the IPOI with the overarching concept of the blue economy.

The concept of the blue economy underscores our economy's significant reliance on the oceans and rests on three core principles. Firstly, recognizing the seas' pivotal role in global economic activities.[27] Secondly, acknowledging that environmental degradation is an unavoidable consequence of the Anthropocene era and undertaking measures to minimize its impact.[28] Lastly, ensuring the sustainable extraction of resources from the oceans to prevent adverse environmental effects.[29]

For the IPOI to effectively implement a policy for the blue economy in the Indo-Pacific, several key considerations must be considered:

First and foremost, ensuring the sustainable management of the marine environment and resources is imperative. Member countries of the IPOI must grasp the significance of oceans and their subsets, striving to manage resources and the environment sustainably. A comprehensive understanding of the oceans and their

[25] Pankaj Vashisht, "Indo-Pacific Strategies: What Do They Entail for India?," *Journal of Indo-Pacific Affairs* 6, no. 3 (March–April 2023): 110 – 29, https://media.defense.gov/.

[26] Dipanjan Roy Chaudhury, "PM Modi proposes Indo-Pacific Oceans Initiative," *Economic Times*, 5 November 2019, https://economictimes.indiatimes.com/.

[27] Jesse M. Lane and Michael Pretes, "Maritime dependency and economic prosperity: Why access to oceanic trade matters," *Marine Policy* 121 (November 2020), 104180, https://doi.org/.

[28] Yadvinder Malhi, "The Concept of the Anthropocene," *Annual Review of Environment and Resources* 42, no. 1 (2017): 77–104, https://doi.org/.

[29] Roland Cormier, Michael Elliott, Ángel Borja, "Managing Marine Resources Sustainably—The 'Management Response-Footprint Pyramid' Covering Policy, Plans and Technical Measures," *Frontiers in Marine Science* 9 (24 May 2022), https://doi.org/.

subsets will empower IPOI member countries to assess their potential accurately and manage them appropriately through concrete actions:

- Building the capacity and capability of Indo-Pacific countries, facilitated by the IPOI, to adhere to international norms and standards, and enhancing the collection and sharing of fisheries data.
- Strengthening regional research and data-sharing partnerships to enhance observations in the Indian and Pacific oceans and coastlines.
- Gaining a better understanding of the marine sector's market and nonmarket value, enabling stakeholders and decision makers to achieve sustainable, integrated marine management.
- Promoting sustainable management of activities in the marine environment within the Indo-Pacific to enhance the condition and productivity of marine and coastal ecosystems. Establishing an agreed-upon set of factors applicable to marine ecosystems and establishing a vital collection of variables to monitor and assess ecosystem changes in the region are crucial for ensuring the sustainability of the blue economy in the Indo-Pacific.
- Implementing the United Nations Environment Programme's Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, which will encourage relevant Indo-Pacific economies to reduce land-based sources of marine pollution.
- Recognizing that the blue economy heavily relies on oceans and that the marine environment is delicate. A rise in marine invasive species threatens the livelihoods of coastal communities and the larger economy. Therefore, the IPOI must promote the ratification or adherence to various conventions and treaties (such as the Ballast Water Convention) by countries within the organization to prevent the introduction of marine invasive species in the Indo-Pacific.

Secondly, the blue economy relies heavily on marine resources. Thus, ensuring the sustainable management of these resources is essential for fostering a healthy and productive environment. To achieve this goal, the following points should be considered by the IPOI:

- Facilitating the adherence of Indo-Pacific economies to UNCLOS, UNFSA, FAO Compliance Agreement, FAO Code of Conduct for Responsible Fisheries, and effectively implement their provisions domestically and regionally.

- Enhancing the capacity of Indo-Pacific economies to develop and implement domestic conservation and resource management plans.
- Fostering a deeper understanding of the interaction between climate and fisheries in the Indo-Pacific region.

Thirdly, member economies of the IPOI must devise effective and practical measures to unlock the full economic potential of the ocean resources in the Indo-Pacific region. This entails fostering increased trade and liberalization across the region while simultaneously prioritizing conservation and sustainable management of living marine resources. To achieve this, institutional capacity building and technical assistance are essential, and can be pursued through the following avenues:

- Establishing an IPOI Aquaculture Network for the Indo-Pacific to enhance the traceability of marine products.
- Facilitating market access for industries, particularly small and medium enterprises (SME), across various product lines.
- Implementing international laws to promote the trade of fish and fish products while eliminating discriminatory practices.

Lastly, the vitality of the blue economy hinges on the health and productivity of oceans and coasts. Given the impact of anthropogenic climate activities and the escalation of natural disasters, it is imperative for IPOI members to acknowledge the necessity of prompt rehabilitation and reconstruction efforts to restore sustainable coastal economies across the Indo-Pacific. To mitigate the effects of future hazards and climate extremes on society, it is imperative to ensure that all future coastal development adheres to principles of sustainable management, disaster risk management, and integrated coastal zone management.

It is noteworthy that due to the vast size and diverse requirements of the Indo-Pacific, the implementation of the blue economy policy and its various components through the seven spokes of the IPOI will need to be tailored to accommodate the unique needs of different subregions within the Indo-Pacific. Failure to do so risks relegating the IPOI to just another among the many regional organizations in the area.

The Way Ahead

The Indo-Pacific region encompasses vast maritime interests that attract numerous stakeholders. It serves as a crucial economic powerhouse, contributing 62 percent to the global GDP and facilitating nearly half the world's trade through

its waters. While the region's cultural diversity and growing population drive economic growth, it also grapples with geopolitical and geoeconomic challenges. Climate change poses a significant risk to the region's stability, while rapid technological advancements bring both promise and peril. The adoption of a blue economy strategy is imperative for the area, albeit presenting challenges due to varying geographical pressures. Investment in fisheries and other sectors, improved access to basic amenities, and the effective implementation of sustainable ocean governance policies are pivotal for further regional growth.

Despite the presence of regional organizations, achieving consensus among them is crucial when implementing a regional blue economy strategy. The IPOI holds potential to enact the concept of a blue economy by leveraging resources, enhancing understanding of ocean governance, and carefully navigating decision-making processes to execute such a program accurately and efficiently. Fostering cooperation among countries in the region and identifying common ground is essential to bridging gaps in understanding and balancing the interests of member states within the IPOI. ✪

Dr. Shushant VC Parashar

Dr. Parashar is a research fellow at the Centre for Land Warfare Studies (CLAWS). Previously, he worked as an associate fellow at the National Maritime Foundation (NMF). He has completed his PhD in political science at Amity University (thesis titled "Environmental Security Policy in South Asia: A Case Study of India and Bhutan"). His research interests at CLAWS range from national security, nuclear deterrence, internal security, nontraditional threats, statecraft–nonmilitary, Pakistan, and the history of relations with India's neighbors. Apart from his doctorate, Dr. Parashar holds an MPhil degree in South and Southeast Asian studies from the University of Madras, an MA degree in South Asian studies from Pondicherry University, and a bachelor's degree in journalism and mass communication from Amity University along with a PG Diploma in English journalism from Indian Institute of Mass Communication, Delhi.

Securing the Seas

Fishery Security Is Maritime Security in the Indo-Pacific Command Area of Responsibility

CDR Arthur M. Dehnz, US Coast Guard

Abstract

Illegal, unreported and unregulated (IUU) fishing has emerged as a leading threat to global maritime security, with China operating the world's largest fleet engaging in predatory practices. This article argues that combatting IUU fishing should be a strategic priority for the US Indo-Pacific Command to promote a free and open region and counter negative Chinese influence. It advocates for a robust, multinational law enforcement approach consisting of an expanded mission for Joint Interagency Task Force West, an intelligence fusion center in the Philippines, additional bilateral shiprider agreements, more US Coast Guard cutters based in Oceania, and an enlarged tactical law enforcement program. Implementing these recommendations will strengthen ties with regional partners, reinforce territorial claims, and protect vital marine resources and US national interests.

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The INDOPACOM area of responsibility holds the distinction of being the largest among all geographic combatant commands. Of the 36 nations within this region, nearly all are maritime nations, with over one-third being "smaller, island nations."[1] These countries heavily rely on the oceans for sustenance and economic prosperity, with fisheries serving as a primary source of protein for their populations. As the significance of fishery resources continues to rise in the area, so does the imperative to address instances of illegal, unreported, and unregulated (IUU) fishing as a national security threat. A recent strategic report from the US Coast Guard asserts that "IUU fishing has replaced piracy as the leading global maritime security threat."[2] Additionally, the Biden administration's national security memorandum identifies IUU fishing as one of the "greatest threats to ocean health."[3]

[1] "Area of Responsibility," U.S. Indo-Pacific Command, n.d., https://www.pacom.mil/.

[2] *Illegal, Unreported, and Unregulated Fishing Strategic Outlook* (Washington DC, US Coast Guard, 2020), 2, https://www.uscg.mil/.

[3] National Security Memorandum/NSM-11 2022, *Memorandum on Combatting Illegal, Unreported, and Unregulated Fishing and Associated Labor Abuses* (Washington, DC, 27 June 2022), https://www.whitehouse.gov/.

China's extensive distant water global fishing fleet, estimated to range from 2,500 to potentially 17,000 vessels, poses a particular cause for concern.[4] Chinese vessels frequently engage in illegal activities such as targeting endangered species, falsifying documents, disabling required transponder equipment, and perpetrating human rights violations. It is evident that China either lacks the will or the capability to adequately address these issues within its fishing fleet. According to a 2019 global index report by the Global Fishing Watch, China ranked as the poorest-performing country concerning IUU fishing practices.[5]

Addressing illegal Chinese fishing necessitates a comprehensive strategy spanning three distinct regions: the US exclusive economic zone (EEZ), the EEZs of partner nations, and the high seas. Enforcement within the US EEZ primarily falls under the purview of state resource conservation officers or federal agencies such as the National Oceanic and Atmospheric Administration (NOAA) and the Coast Guard. Enforcement operations within the EEZ of foreign nations can only occur within the legal framework of bilateral agreements. In the Pacific region, several treaty-based international organizations, known as regional fisheries management organizations (RFMO), aim to ensure the sustainability of migratory resources through international collaboration. Agreements within these RFMOs afford the United States limited authority to conduct law enforcement on the high seas against foreign-flagged vessels.

The escalating prevalence of IUU fishing presents an opportunity for INDOPACOM to leverage in pursuit of US national security strategic objectives for a free and open Indo-Pacific. To counteract adverse Chinese influence and excessive maritime claims, INDOPACOM's naval services should prioritize efforts to combat IUU fishing. This can be achieved through the establishment of a multinational coalition comprising a Joint Interagency Task Force, an Intelligence Fusion Center, and a robust bilateral shiprider program. Additionally, enhancing maritime law enforcement capabilities entails deploying additional USCG cutters, expanding the Tactical Law Enforcement Program, and repurposing littoral combat ships.

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[4] Sean Mantesso, "China's 'dark' fishing fleets are plundering the world's oceans," *ABC* (Australia), 18 December 2020, https://www.abc.net.au/.

[5] Dan Collyns, "It's terrifying: can anyone stop China's vast armada of fishing boats?," *The Guardian*, 25 August 2020, https://www.theguardian.com/.

An INDOPACOM-led Multinational Coalition

Joint Interagency Task Force (JIATF) West—A New Role

The INDOPACOM commander should collaborate with Congress and the administration to broaden the mandate of JIATF West to encompass the fight against IUU fishing in Oceania and the South China Sea. Since its inception in 1994, JIATF West has operated as a component of INDOPACOM that "brings military and law enforcement capabilities together to combat drug-related transnational crime in the Asia-Pacific Region."[6] VADM Scott Buschman, who recently served as the Coast Guard's Deputy Commandant for Operations, has commended the efficacy of the JIATF model in combating crime. He lauds its effectiveness in "bringing together a wide variety of agencies, experts, and foreign partners to analyze and share intelligence, and coordinate detection and monitoring."[7] The partnerships and resources that JIATF West can provide make it a natural fit for this newly expanded mission set.

On a daily basis, JIATF West collaborates with various intelligence, military, customs, and law enforcement entities of the U.S. and regional partners to disrupt the flow of illicit substances. These same groups are engaged in the fight against IUU fishing, albeit in a fragmented manner. JIATF West is well-suited to lead by serving as the central authority for coordination, ensuring efficient resource utilization across the expansive oceanic domain. Currently, there lacks a unified entity to coordinate the myriad military and law enforcement assets throughout the vast Indo-Pacific region. JIATF West could assume this leadership role, coordinating surveillance overflights and surface patrols among participating nations to optimize resource allocation. Similar coordination has been successfully executed by both JIATF West and JIATF South in counternarcotics efforts, making it a natural extension to combat IUU fishing.

Additionally, JIATF West can broaden its existing services of capacity-building and security cooperation. With a proven track record in small-scale construction projects enhancing law enforcement infrastructure, such as training centers, firing ranges, and command centers, JIATF West can extend its focus to countries threatened by IUU fishing. Moreover, it can enhance security cooperation by expanding training programs in maritime skills, mission planning, and boarding techniques for partner countries. The US Coast Guard and various RFMOs offer training

[6] "Joint Interagency Task Force West," U.S. Indo-Pacific Command, n.d., https://www.pacom.mil/.

[7] Craig Collins, "IUU Fishing: The Leading Global Maritime Threat," *Defense Media Network*, 15 February 2021, https://www.defensemedianetwork.com/.

programs to enhance law enforcement officers' proficiency in international fishery laws. JIATF West is well-positioned to support and facilitate these training events, along with exchange programs among partner nations.

IUU Intelligence Fusion Center

To ensure the effectiveness of JIATF West in combating IUU fishing, CDRINDOPACOM should spearhead the establishment of an IUU intelligence fusion center within one of our regional partner nations. In a recent interview, CDR James Binniker, chief of Fisheries Enforcement for the US Coast Guard's Office of Law Enforcement, emphasized that "there's a growing understanding that to combat IUU fishing is not simply more ships at sea doing more boardings, but illuminating the predatory behavior and irresponsible flag states and identifying the bad actors and sharing information about them."[8] Currently, no single entity is responsible for synthesizing the vast amount of information available from regional governments and nongovernmental organizations (NGO). There is a significant opportunity to enhance engagement and facilitate information sharing and exploitation.[9]

One of the primary challenges associated with IUU fishing is the sheer scale of the problem. With tens of thousands of fishing vessels operating globally each day, INDOPACOM and its partners must allocate resources judiciously for optimal impact. Actionable intelligence on potentially illegal fishing activities, including vessel identification, satellite imagery, automated identification system (AIS) data, catch reports, and criminal history, is essential for targeted law enforcement efforts. LT Holden Takahashi, in a recent article for Proceedings, proposes the development of a simple application to allow honest fishermen to discreetly report instances of illegal activity.[10] An IUU fusion center would be well-placed to lead the development of such an application and integrate valuable tips with other intelligence sources to enhance law enforcement efforts.

The Philippines emerges as an ideal candidate for hosting the fusion center due to its strategic geography and geopolitical significance as a U.S. treaty ally. Geographically, the Philippines is strategically positioned adjacent to both the South China Sea and Oceania, areas susceptible to exploitation by Chinese IUU fishing

[8] Lee Willett, "International agencies co-operate to tackle illegal fishing," *Jane's Intelligence Review*, 13 August 2020, https://www.uscg.mil/.

[9] Lee Willett, "Rear Admiral Scott Clendenin, Assistant Commandant for Response Policy, US Coast Guard," *Jane's Navy International*, 1 December 2020, https://www.uscg.mil/.

[10] Holden Takahashi, "The World's Fishermen as a Maritime Sensor Network," *Proceedings* 148, no. 8 (August 2022), 28, https://www.usni.org/.

fleets. Additionally, many countries in these regions lack the resources to effectively patrol their waters and enforce their EEZs. Proximity to these locations and mainland China would facilitate the deployment of ground-based sensors and network equipment to bolster maritime domain awareness and aid in tracking suspected IUU fishing or transport vessels.

From a geopolitical standpoint, the Philippines offers several advantages as the fusion center's location. As a key US treaty ally, the Philippines has occasionally leaned towards warmer relations with China due to economic ties. Situating the fusion center in the Philippines provides an opportunity for the United States to strengthen its ties with the nation and counter any adverse Chinese influence in the region. Moreover, it enables the Philippines to demonstrate leadership and promote regional cooperation. Smaller nations in the region, seeking to balance relations between the United States and China, may be more inclined to participate in the multinational effort if the fusion center is based in the Philippines rather than the United States itself.

Expanded Bilateral Shiprider Agreements

In addition to intelligence, another critical tool in combating IUU fishing is the utilization of bilateral agreements with other countries. These agreements empower the United States to directly bolster the law enforcement efforts of partner nations. Currently, there are 11 agreements in place for the Indo-Pacific region, encompassing nations such as "Cook Islands, Fiji, Kiribati, Marshall Islands, Micronesia, Palau, Nauru, Samoa, Tonga, Tuvalu, and Vanuatu."[11] Shiprider programs are particularly beneficial to promoting a free and open Indo-Pacific because they allow the United States and partners expanded access to protect lucrative fishing grounds and establish "positive relationships with smaller Pacific Island nations for whom traditional military to military relationships are less possible because of their limited military capability."[12]

The overarching objective of INDOPACOM should be to collaborate with the Department of State and Coast Guard to establish these agreements with all friendly and like-minded nations interested in participating in the coalition against IUU fishing. Having these agreements in place does not necessarily obligate the United States to allocate resources or expend funds in these countries immediately. However, they serve as a valuable law enforcement tool ready for utilization should

[11] Warren Wright, "Shiprider Program," *Indo-Pacific Defense Forum*, 27 January 2020. https://ipdefenseforum.com/.

[12] Joseph Espino, "Niue Should be a Shiprider Partner," *Proceedings* 148, no. 8 (August 2022), 14, https://www.usni.org/.

the need arise in the future. These agreements are most advantageous in regions where the host nation lacks the resources to enforce its own EEZ. Developing island nations with limited maritime patrol capabilities, such as Niue, the Solomon Islands, and Papua New Guinea, are prime candidates for the next round of shiprider agreements.

As the United States seeks to expand the number of shiprider agreements throughout the Indo-Pacific region, it should also aim to enhance existing partnerships by modernizing shiprider agreements already in force. The recently inked shiprider agreement with the Federated States of Micronesia (FSM) serves as an exemplary template for future agreements. In this groundbreaking agreement, the United States and FSM will coordinate law enforcement efforts through command centers, enabling U.S. law enforcement officers to combat illegal activities without requiring the physical presence of an FSM law enforcement officer.[13] This streamlined approach facilitates quicker responses to intelligence on illicit activities and enhances the efficient utilization of patrol boats and other resources by eliminating the need for travel to specific ports for embarking or disembarking host nation law enforcement officers. While some nations may hesitate to adopt a similar approach due to sovereignty concerns, it is imperative for the United States to foster trust and confidence with these nations as it endeavors to deepen partnerships with this innovative model.

Thus, expanded shiprider programs offer a formidable means to counter the escalating influence of China in the region and provide partner countries with additional capabilities to safeguard their vital natural resources. INDOPACOM should advocate for other developed nations with interests in the region, such as Japan, France, and Australia, to initiate their own shiprider programs and contribute resources to assist less affluent nations in protecting their EEZs.

Building Maritime Law Enforcement Capability

Additional USCG Cutters Needed

To bolster domestic capacity for safeguarding the US EEZ and countering illegal fishing in the South China Sea and Oceania, the INDOPACOM commander should advocate for additional national security cutters (NSC) in Guam and fast response cutters (FRC) in American Samoa. It is widely acknowledged that "an enhancement of patrols is a fundamental component" of an effective strategy to

[13] "U.S., Federated States of Micronesia Sign Expanded Shiprider Agreement," U.S. Indo-Pacific Command, 14 October 2022, https://www.pacom.mil/.

reduce illegal fishing.[14] The Coast Guard currently lacks adequate forces to protect maritime interests in the region, and "despite the United States' sizable territorial interests . . . Oceania has become the United States' strategic blind-spot."[15] To illustrate, figure 1 depicts the extent of the US EEZ in the region.

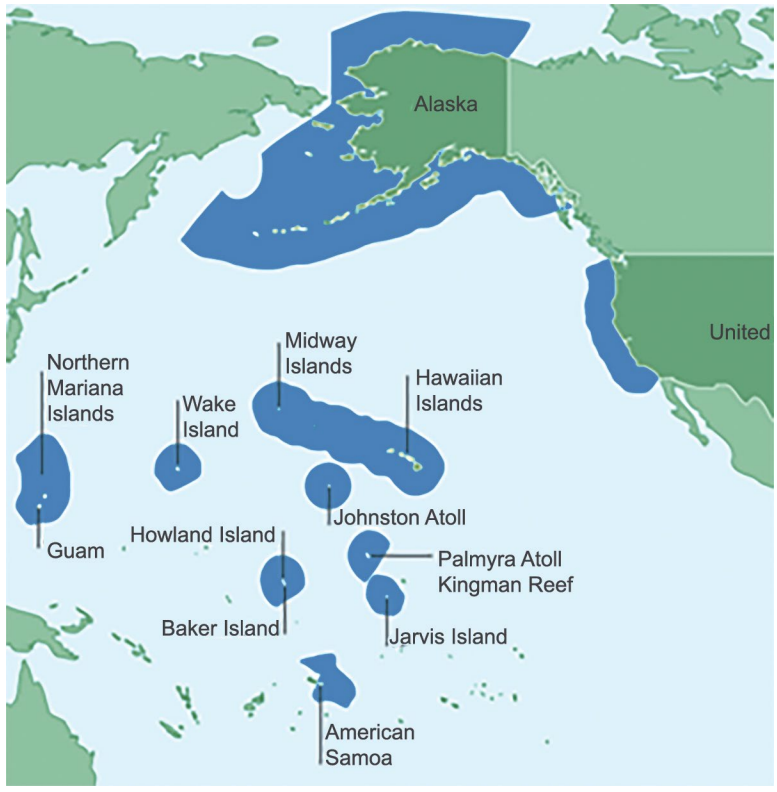

Figure 1. Map of the US exclusive economic zone in the Pacific. (Source: "The United States is an Ocean Nation Graphic," NOAA, 2011, https://www.gc.noaa.gov/.)

The Coast Guard maintains a mix of FRCs, buoy tenders, and NSCs stationed across the West Coast, Alaska, and Hawai'i, providing fairly adequate coverage of the EEZs in those regions. However, in Guam, the Coast Guard's presence is limited to just three FRCs and one buoy tender. There are no cutters stationed in American Samoa or any of the US minor outlying islands. By establishing home-

[14] Iwao Fujii, Hajime Kawamura, and Yumi Okochi, "Promoting Cooperation of Monitoring, Control and Surveillance of IUU Fishing in the Asia-Pacific," *Sustainability*, 13 no. 18 (September 2021): 10231, https://doi.org/.

[15] Mike Moyseowicz, "Rebalance U.S. Coast Guard Cutters to Advance a 'Free and Open' Indo-Pacific," *Security Nexus* 22 (May 2021), https://apcss.org/.

ports for at least two NSCs in Guam, the INDOPACOM commander would have access to the Coast Guard's largest and most capable assets, enabling persistent presence in the South China Sea and Oceania, where the threat of Chinese IUU fishing is most acute. Similarly, homeporting two or three FRCs in American Samoa would extend coverage to this section of the US EEZ and provide a platform for deployment into the high seas and neighboring partner nations in the South Pacific.

The Indo-Pacific region is marked by vast distances, necessitating efforts to maximize the effectiveness of these new patrol vessels. To achieve this, CDRINDOPACOM should ensure that the necessary logistics and supplies infrastructure are in place to keep ships on station for as long as possible. A recent analysis by the Coast Guard revealed that in the JIATF South region, ships spent more than half of their time in transit or port for logistics, indicating that cutter sustainment and overextended supply lines are critical weaknesses in mission accomplishment for vessels deployed on distant assignments.[16]

To bolster logistics in this remote region, the J4 directorate should collaborate with the Defense Logistics Agency, the Navy, and USCG to establish a robust network of port call agreements and husbanding contracts. Additionally, logistics vessels such as oilers and expeditionary sea base ships should be tasked with supporting patrol ships engaged in the region's bustling theater of operations. Furthermore, to facilitate operations near the US minor outlying islands, the J4 should establish forward operating bases at Midway, Johnston, Palmyra, and Wake islands. These islands, once extensively used during World War II and the Cold War, now offer various seaports and airports, albeit in different states of use or disrepair. With minimal investment, this infrastructure could be rehabilitated to provide replenishment for ships in this remote, uninhabited region. Leveraging military teams such as USN Seabees for infrastructure reconstruction would not only minimize construction costs but also maintain their proficiency for similar tasks in the South China Sea or elsewhere. Establishing forward operating bases at these strategic locations would enable the United States to safeguard these otherwise vulnerable sites from the encroachment of Chinese IUU fishing activities.

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[16] Michael Cilenti and Matthew Rooney, "SOUTHCOM Needs an Oiler," *Proceedings* 148 no. 10 (October 2022), 14 https://www.usni.org/; and Craig Allen Jr., "Expeditionary Cutter Deployments Should Not Be a Mission to Mars," *Proceedings* 148, no. 8 (August 2022), 23–24, https://www.usni.org/.

Expand the USCG TACLET Program

INDOPACOM should expand the USCG Tactical Law Enforcement Team (TACLET) program in the Pacific as a cost-effective measure to combat IUU fishing. Since 1982, these small teams of USCG law enforcement officers have operated by riding on US Navy and partner nation vessels to interdict illegal drugs. Federal law mandates "that there be assigned on board every appropriate surface naval vessel at sea in a drug-interdiction area members of the Coast Guard who are trained in law enforcement and have powers of the Coast Guard under title 14, including the power to make arrests and to carry out searches and seizures."[17]

In a recent blog post, CAPT Mike Sinclair suggests developing the legal authorities for TACLET deployments on NOAA vessels that routinely survey sensitive fish stocks and whose mission includes the protection of our ocean's natural resources.[18] INDOPACOM should expand the TACLET program by mirroring the requirements of 10 U.S.C. §279 for any surface naval vessel that will be transiting in or near areas of concern for IUU fishing. When transiting through or near the EEZ of a partner nation, they should also offer to embark shipriders from that country whenever possible. Every Navy or NOAA vessel transit without a USCG or foreign partner shiprider represents a missed opportunity to increase law enforcement presence and show our commitment to the cause.

US Navy and partner vessels frequently operate in areas of concern for IUU fishing. By having TACLETs available on these deployments, the INDOPACOM commander will have a valuable tool to counter Chinese malign behavior that falls short of armed conflict on the competition continuum. New shiprider requirements for combating IUU fishing could easily be met by increasing the staffing at the Pacific Area TACLET in San Diego, California, and by adding small detachments at other US Navy fleet concentration centers such as Pearl Harbor, Hawai'i, or Yokosuka, Japan.

A Role for the Navy

The US Navy's LCS program has faced criticism for failing to meet its original vision as a fast, agile, and flexible combat ship capable of seamlessly transitioning between mission modules for surface warfare, anti-submarine warfare, and mine countermeasures. Despite the decision to decommission several ships early and reduce the program of record to reallocate resources to other ship classes, the

[17] Assignment of Coast Guard personnel to naval vessels for law enforcement purposes 10 U.S.C. §279.

[18] Michael Sinclair, "The national security imperative to tackle illegal, unreported, and unregulated fishing," *Order from Chaos* (blog), 25 January 2021, https://www.brookings.edu/.

LCS can still serve a crucial role in shaping the theater and advancing a free and open Indo-Pacific. Esteemed naval theorist Jim Holmes recounts instances of successful repurposing of Navy ships and advocates for utilizing the LCS for constabulary and diplomatic duties.[19] The current US maritime strategy underscores the strategic importance of allies and partners, making the LCS well-suited to collaborate with partner nations in low-intensity operations such as combating IUU fishing.

Many issues plaguing the LCS class revolve around their combining gear for achieving top speed and structural vulnerabilities during high-speed operations in rough seas. Fortunately, typical operations enforcing fishery laws do not necessitate high speeds for targeting or pursuit. Although the LCS has limited range, it could still be deployed strategically in areas like the South China Sea or within the Exclusive Economic Zone (EEZ) of a partner nation where fuel and logistical support are readily available. Such deployment could enable Coast Guard cutters with greater endurance than the LCS to patrol the high seas and remote areas far from shore. The Navy has employed the LCS in counter-narcotics patrols for several years, with the USS *Mobile* successfully enforcing tuna fishery laws in the Western Pacific last year.[20] Equipped with sensors, communications and command-and-control (C2) systems, small boats for boarding teams, and the ability to deploy helicopters and unmanned aerial vehicles, the LCS possesses all necessary tools for this mission set. Despite its combat limitations, the LCS retains significant potential and should be leveraged to collaborate with law enforcement agencies and partner nations in combating IUU fishing and maintaining a stable maritime environment.

Counterargument and Rebuttal

Some may argue that the most effective approach to combating IUU fishing involves non-law enforcement measures that target the underlying causes, such as economic subsidies and transparency initiatives. One proposed method is to address the economic incentives driving IUU fishing by collaborating with the World Trade Organization to "eliminate capacity-enhancing subsidies" as recent reports indicate that over half of high-seas fishing activities rely on government subsidies

[19] James Holmes, "The Littoral Combat Ships are Broken. Here's How to Fix Them," *The Reboot* (blog), 21 September 2021, https://nationalinterest.org/.

[20] "U.S. Navy Deploys an LCS to Enforce Fishing Rules in Western Pacific," *Maritime Executive*, 26 March 2023, https://maritime-executive.com/.

to remain financially viable.[21] Redirecting these public funds toward more sustainable practices, such as aquaculture, could promote long-term environmental and economic stability.

Another suggested approach is to bolster support for consumer education and supply chain transparency initiatives. Various organizations, such as the Monterey Bay Aquarium and Ocean Watch, produce educational materials to inform seafood consumers about sustainable choices. Additionally, efforts by major seafood retailers and other stakeholders to enhance transparency in the supply chain allow consumers to trace their seafood from source to table. Similar initiatives in industries like global apparel, extractive, and timber markets have demonstrated that increased transparency can lead to more sustainable practices.[22]

While aquaculture and educational initiatives hold promise, they are not without drawbacks and do not address the urgent nature of the global IUU fishing crisis. While aquaculture presents a potential solution, improper implementation can lead to unsustainable practices. For instance, China's promotion of fish farming since the 1980s, driven by depleted coastal fish stocks, has exacerbated environmental degradation and contributed to the decline of wild fish stocks worldwide due to inadequate environmental regulations.[23] Educational and transparency efforts, while valuable, are not foolproof solutions, as some consumers prioritize price over sustainability and environmental considerations.

Furthermore, these solutions require time to effect change in the industry and fail to address the immediate need to protect marine resources from collapse. Raul Pedrozo recently argued that only immediate and robust law enforcement efforts can deter illegal Chinese fishing, advocating for measures such as confiscating illegal catch, impounding or destroying vessels, and treating offenders who disable or tamper with transponders as stateless vessels.[24] Urgent action is required from the international community to safeguard fishery stocks from the ravages of IUU fishing, necessitating a vigorous law enforcement approach.

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[21] Deon K. Canyon et al., "Policy Recommendations for Combatting Overfishing and Fisheries Crime," *Security Nexus*, 22 (October 2021), https://dkiapcss.edu/.

[22] John Virdin et al., "Combatting Illegal Fishing through Transparency Initiatives: Lessons Learned from Comparative Analysis of Transparency Initiatives in Seafood, Apparel, Extractive, and Timber Supply Chains," *Marine Policy* 138 (April 2022): 104984, https://doi.org/.

[23] Hongzhou Zhang, "Fisheries cooperation in the South China Sea: Evaluating the options," *Marine Policy* 89 (February 2018), 73, https://doi.org/.

[24] Raul Pedrozo, "China's IUU Fishing Fleet: Pariah of the World's Oceans," *International Law Studies* 99 (2022), 352, https://digital-commons.usnwc.edu/.

Conclusion

Over the past decade, China has demonstrated increasingly aggressive behavior in its pursuit of challenging the existing world order and asserting itself as a global superpower. Of particular concern is its expanding distant water fishing fleet, which frequently engages in IUU fishing practices, posing a significant threat to global fishing stocks. With IUU fishing now acknowledged as the foremost maritime security threat and China identified as the primary perpetrator, it is imperative for INDOPACOM to address this multifaceted maritime challenge promptly and effectively.

Failure to mount a unified response from INDOPACOM and its allies could precipitate global food shortages, maritime instability, and undermine the vision of a free and open Indo-Pacific. Just as INDOPACOM has taken the lead in combating narcotics trafficking at sea, it must also spearhead efforts to combat IUU fishing. This requires the formation of a robust multinational coalition and the enhancement of maritime law enforcement capabilities.

By coordinating with partner nations and bolstering enforcement measures, INDOPACOM can mitigate the threat posed by Chinese IUU fishing activities, safeguarding marine resources and upholding the principles of a free and open Indo-Pacific. ✪

CDR Arthur M. Dehnz, US Coast Guard

Commander Dehnz is a 21-year commissioned officer in the US Coast Guard, with experience serving aboard a ship, responding to oil spills and natural disasters, and performing engineering and logistics for the service. His educational credentials include a BS in civil engineering from the US Coast Guard Academy, MS in civil engineering and MBA from the University of Illinois, and a MA in national security and strategic studies from the US Naval War College.

The Rise of Great Mineral Powers

Gregory Wischer
Dr. Morgan Bazilian

Abstract

Minerals play a crucial role in bolstering a state's military capabilities, defining its "mineral power." This study assesses a state's mineral power by evaluating its access to secure mineral supplies from four key sources: domestic production, government stockpiles, overseas production by domestic companies, and imports from aligned states. Analyzing the mineral power of two emerging great powers, the United States and China, across different historical periods, the research reveals the correlation between mineral power and military strength. Amid escalating US–China competition, the US government could enhance its mineral power by supporting domestic production, increasing stockpiles, facilitating overseas acquisitions, and fostering supply agreements with aligned states. Leveraging trade negotiations, particularly in advanced technology, the United States could ensure continued access to crucial minerals from China, discouraging restrictive export policies through strategic warnings.

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Minerals drive the production of defense platforms and munitions, thus shaping military power.[1] They are essential for manufacturing various defense goods, including submarines, bombers, torpedoes, and missiles. A state's access to secure mineral supplies thus significantly influences—and can serve as a proxy for—its military capabilities. This access is termed *mineral power*,[2] and a state possessing substantial secure mineral supplies wields considerable mineral power. When a state's mineral power and resulting military might reach significant levels, it can attain great-power status in the international system, exerting substantial influence on security-related matters.[3]

Historians, geologists, and government officials have long acknowledged the nexus between a state's mineral resources and its power. In 1902, historian Brooks

[1] C. K. Leith, "The Struggle for Mineral Resources," *The Annals of the American Academy of Political and Social Science* 204, no. 1 (1939), 42, https://doi.org/.

[2] We use the term *power* in the international relations context, as defined by John J. Mearsheimer: "[P]ower is based on the particular material capabilities that a state possesses," which include "tangible assets" like attack submarines and nuclear weapons. *See* John J. Mearsheimer, *The Tragedy of Great Power Politics* (New York: W. W. Norton & Company, 2001), 55.

[3] Jack S. Levy, *War in the Modern Great Power System, 1495–1975* (Lexington, KY: University Press of Kentucky, 1983) 16, https://core.ac.uk/. In pages 9–19, Levy provides other definitions of *great power*, most of which link military capabilities to great power. Similarly, Mearsheimer asserts that great power is largely determined by military capabilities. *See* Mearsheimer, *The Tragedy of Great Power Politics*, 5.

Adams asserted that "all experience has demonstrated that the centre of mineral production is likely, also, to be the seat of empire."[4] In 1916, US Secretary of the Interior Franklin K. Lane prioritized minerals as the foremost "foundations of power," a sentiment echoed by US Geological Survey Director George Otis Smith, who affirmed "that mineral wealth is the foundation of power."[5] More recently, in 2023, David Humphreys observed, "Countries with power have always depended on a healthy supply of mineral resources."[6] These commentators agree that mineral supplies influence state power.

Mineral experts have emphasized the intricate connection between a state's mineral resources and its military capabilities. In 1939, geologist C. K. Leith highlighted, "Military power used to be measured principally by man power, but is coming more and more to be measured in terms of guns, ships, automobiles, and airplanes, and the fuel to drive them. These mean minerals."[7] In 1949, James Boyd, director of the US Bureau of Mines, asserted that "minerals potential is an index of military strength,"[8] while John D. Morgan, Jr., later a minerals expert in the Office of Defense Mobilization, stated, "The activity of the mineral industry of any nation is a major guide to that nation's ability to wage war."[9] These quotes succinctly underscore the influence of a state's mineral supplies on its overall power and, particularly, its military strength.

Building on the established relationship between mineral power and military strength, this article posits that mineral power contributes to military prowess, suggesting that great powers should possess considerable mineral power. To examine this proposition, the article analyzes the mineral power of two ascending great powers: the United States in the early twentieth century and China in the early twenty-first century. If mineral power indeed bolsters military might, both the United States and China during these periods should exhibit significant mineral power. The subsequent sections of this article are structured as follows: Section 2 delves into the components constituting mineral power; Section 3 explores the mineral power of the United States in the early twentieth century,

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[4] Brooks Adams, *The New Empire* (New York: MacMillan Company, 1902), 175–176.

[5] George Otis Smith, "The Public Interest in Mineral Resources," in *Mineral Resources of the United States 1915* (Washington: Government Printing Office, 1917), 1a, https://www.forgottenbooks.com/.

[6] David Humphreys, "Mining and Might: Reflections on the History of Metals and Power," *Mineral Economics*, 3 May 2023, 2, https://doi.org/.

[7] Leith, "The Struggle for Mineral Resources," 42.

[8] James Boyd, "Strategic Mineral Resources for National Security," *Military Engineer* 41, no. 282 (1949), 261, http://www.jstor.org/.

[9] John D. Morgan, Jr., "The Domestic Mining Industry of the United States in World War II: A Critical Study of the Economic Mobilization of the Mineral Base of National Power" (PhD dissertation, Pennsylvania State College, 1949), 358, https://scholarsphere.psu.edu/.

while Section 4 evaluates China's mineral power in the early twenty-first century. Section 5 presents the findings of these case studies, followed by Section 6, which examines the contemporary mineral power of the United States. Section 7 outlines policy options for enhancing the US government's mineral power, concluding with Section 8.

Variables of Mineral Power

The state can secure mineral supplies from diverse sources, with this article identifying four main sources: (1) domestic production, (2) government stockpiles, (3) overseas production by domestic companies, and (4) aligned imports, which are imports from states aligned geopolitically or commercially with the importing state (e.g., the cobalt trade relationship between the Democratic Republic of the Congo and China). These sources—domestic production, government stockpiles, overseas production, and aligned imports—constitute the variables defining a state's mineral power.

In the computation of mineral power, greater emphasis is placed on domestic production and government stockpiles compared to overseas production and aligned imports. This weighting is attributed to the heightened security of mineral supplies from domestic production and government stockpiles, particularly during periods of conflict. For example, submarine warfare disrupted mineral imports to the United States during World War II,[10] while recent Houthi attacks on Red Sea shipping lanes led to extensive rerouting of container vessels in late 2023 and early 2024.[11] As noted by John D. Morgan, Jr., "Imports in war are rendered much more difficult; consequently, it is the domestic mineral industry that is of primary importance."[12] Thus, domestic mineral production and government stockpiles offer more secure mineral supplies and are accorded greater weight in the calculation of mineral power as well.

Mineral imports from states not aligned geopolitically or commercially also contribute to a state's mineral power. However, these imports are excluded from the calculation due to their vulnerability to supply disruptions such as export controls. For instance, China, responsible for 98 percent of global gallium production,[13]

[10] E. W. Pehrson, "Review of the Mineral Industries in 1942," in *Minerals Yearbook 1942* (Washington, DC: US Government Printing Office, 1943) 19, https://digital.library.wisc.edu/.

[11] Paul Wiseman and Mae Anderson, "Attacks on Ships in the Red Sea Are Disrupting Global Trade. Here's How It Could Affect What You Buy," *Associated Press*, 28 January 2024, https://apnews.com/; and Stefan Nicola, "Over 100 Container Ships Reroute As US Weighs Red Sea Response," *Bloomberg*, 20 December 2023, https://www.bloomberg.com/.

[12] Morgan, "The Domestic Mining Industry," 4.

[13] Brian W. Jaskula, "Gallium," *US Geological Survey*, January 2023, https://pubs.usgs.gov/.

imposed export controls on gallium in August 2023, leading to a significant reduction in exports.[14] Similarly, other mineral-rich states like Indonesia are implementing export controls on mined minerals to promote domestic downstream processing.[15] Consequently, mineral imports from non-aligned states are deemed insecure and are not factored into the calculation of a state's mineral power.

A state's mineral resources, encompassing reserves, serve as a reservoir of secure mineral supplies and thereby contribute to mineral power. However, mineral production better reflects a state's actual mineral power, as it enables the swift conversion of extracted minerals into refined forms suitable for military production, in contrast to the lengthier process of converting mineral resources into extracted ore and then refining them. Illustrating the impact of mineral production versus mineral resources on military power, China in the early twentieth century possessed "the raw materials of a world power," yet its resources remained "almost wholly undeveloped." Consequently, China found itself "unprepared for a struggle with even a third-rate power."[16] Hence, mineral resources are excluded from the calculation of a state's mineral power.

While domestic production, government stockpiles, overseas production, and aligned imports influence mineral power, they are not the sole determinants. Other factors affecting a state's mineral power include other mineral imports, mineral resources, a state's influence on mineral demand, international exchanges, market transparency, mineral companies, and various other considerations. Nonetheless, domestic production, government stockpiles, overseas production, and aligned imports serve as valuable variables of mineral power, and the subsequent sections explore these variables concerning the United States in the early twentieth century and China in the early twenty-first century.

[14] "China Export Curbs Choke Off Shipments of Gallium, Germanium for Second Month," *Reuters*, 19 October 2023, https://www.reuters.com/.

[15] International Energy Agency, "Prohibition of the Export of Nickel Ore," 12 December 2023, https://www.iea.org/.

[16] Joseph E. Pogue, "Mineral Resources in War and Their Bearing on Preparedness," *Scientific Monthly* 5, no. 2 (1917), 123, http://www.jstor.org/.

Case Study 1: US Mineral Power in the Early Twentieth Century

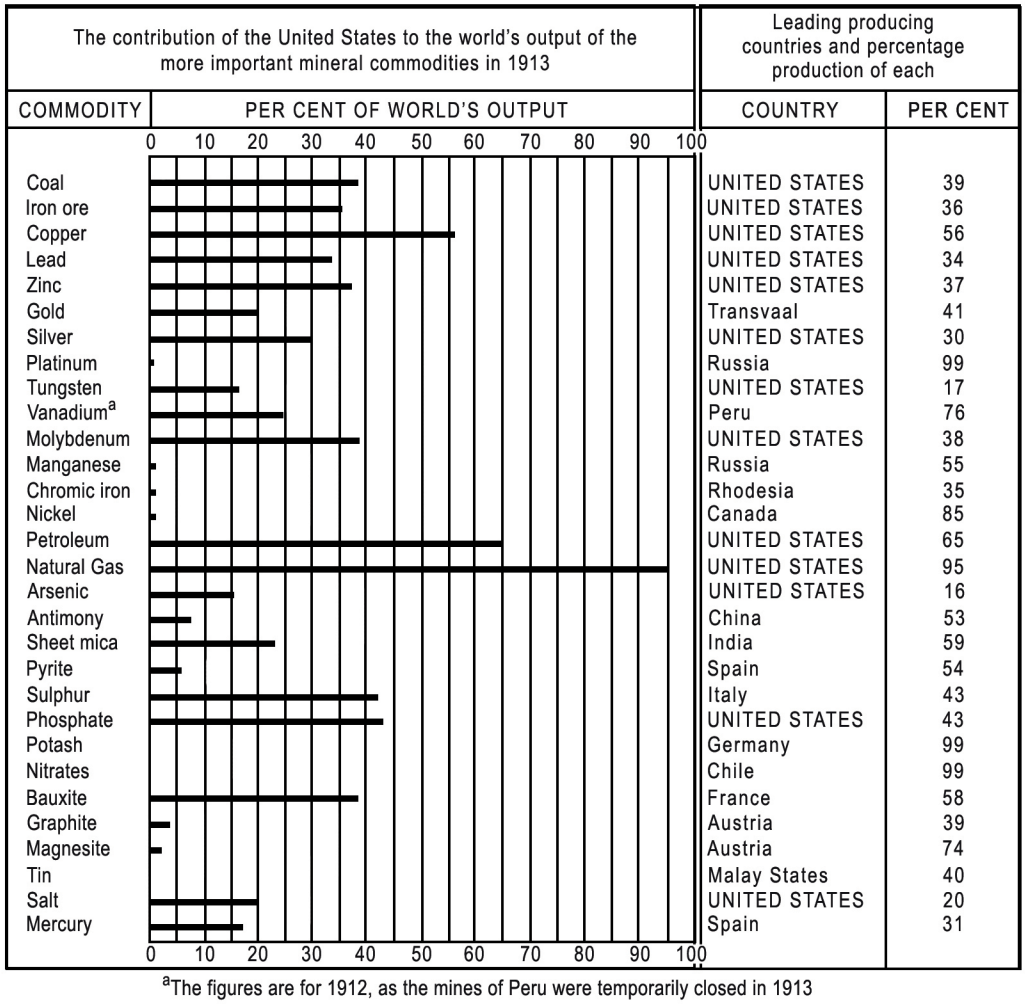

Figure 1. US mineral production as a percentage of global mineral production for various minerals in 1913. (Source: Joseph B. Umpleby, "The Position of the US among the Nations," in *The Strategy of Minerals: A Study of the Mineral Factor in the World Position of America in War and in Peace*, ed. George Otis Smith (New York: D. Appleton and Company, 1919), 288, https://books.google.com/.)

Early in the twentieth century, the United States ascended to great-power status and emerged as the world's foremost mineral producer.[17] By 1913, the United States led in the production of 13 out of 30 key minerals, and ranked second in the production of an additional four minerals (fig.1).[18] For instance, in 1915, the United States accounted for 60 percent of global copper production and 32 percent of lead and zinc production. US Secretary of the Interior Franklin K. Lane remarked, "With the exception of one or two minor minerals, the United States produces every mineral that is needed in industry, and this can be said of no other country."[19] By 1917, the United States had solidified its position as "the world's greatest producer of mineral wealth."[20] Throughout the 1920s, US mineral power continued to burgeon as it assumed the mantle of the world's largest producer of fluorspar, a mineral with applications in steel and chemical production.[21] Consequently, the United States boasted robust domestic mineral production in the early twentieth century (fig. 2).

However, for much of the first half of the twentieth century, the US government lacked a mineral stockpile. Prior to and during World War I, there was no comprehensive stockpiling strategy in place.[22] Following the war in 1922, the US government established the Army and Navy Munitions Board,[23] which aimed to

[17] Many historians attribute the United States' emergence as a great power to the year 1898, following its victory over Spain in the Spanish-American War. This period also marked the United States' rise as a mineral power. In 1899, the United States set a record for the greatest amount of iron ore produced by a single state up to that point in history. Iron ore is the primary mineral used to produce virgin steel, a crucial material for manufacturing military goods. By 1900, the United States accounted for nearly 30 percent of global mining production. *See* Walter Lafeber, "The 'Lion in the Path': The US Emergence as a World Power," *Political Science Quarterly* 101, no. 5 (1986), 705. https://doi.org/; David T. Day, "Summary," in *Twenty-First Annual Report of the United States Geological Survey to the Secretary of the Interior 1899–1900* (Washington: Government Printing Office, 1901), 7, https://pubs.usgs.gov/; Magnus Ericsson and Frida Löf, "Overview of State Ownership in the Global Minerals Industry," Raw Materials Group, commissioned by the World Bank, 2008, 3, https://documents1.worldbank.org/; and Leith, "The Struggle for Mineral Resources," 48.

[18] Joseph B. Umpleby, "The Position of the US among the Nations," in *The Strategy of Minerals: A Study of the Mineral Factor in the World Position of America in War and in Peace*, ed. George Otis Smith (New York: D. Appleton and Company, 1919), 288.

[19] Franklin K. Lane, "Report of the Secretary of the Interior," in *Reports of the Department of the Interior: For the Fiscal Year Ended June 30, 1915* (Washington: Government Printing Office, 1916), 5–6, https://babel.hathitrust.org/.

[20] Pogue, "Mineral Resources in War," 130.

[21] Herbert K. Russell, "State Mineral Helped End World War II," *Illinois Heritage*, 24 September, 2018, 24, https://www.historyillinois.org/.

[22] National Research Council, *Managing Materials for a Twenty-first Century Military* (Washington, DC: National Academies Press, 2008), 23, https://doi.org/; and Robert A. Batchelor and James E. Kirby, "The National Defense Stockpile: An Organizational Perspective" (master's thesis, Air University, March 1985), 10, https://apps.dtic.mil/.

[23] National Research Council, *Managing Materials for a Twenty-first Century Military*, 23.

coordinate military procurement and industrial mobilization in preparation for war.[24] Then, in 1939, the Strategic and Critical Materials Stock Piling Act formally established and funded a stockpiling plan.[25] However, after the United States entered World War II, the US government focused on supplying wartime mineral demands rather than stockpiling.[26] Consequently, the United States lacked a mineral stockpile for nearly the entire first half of the twentieth century.[27]

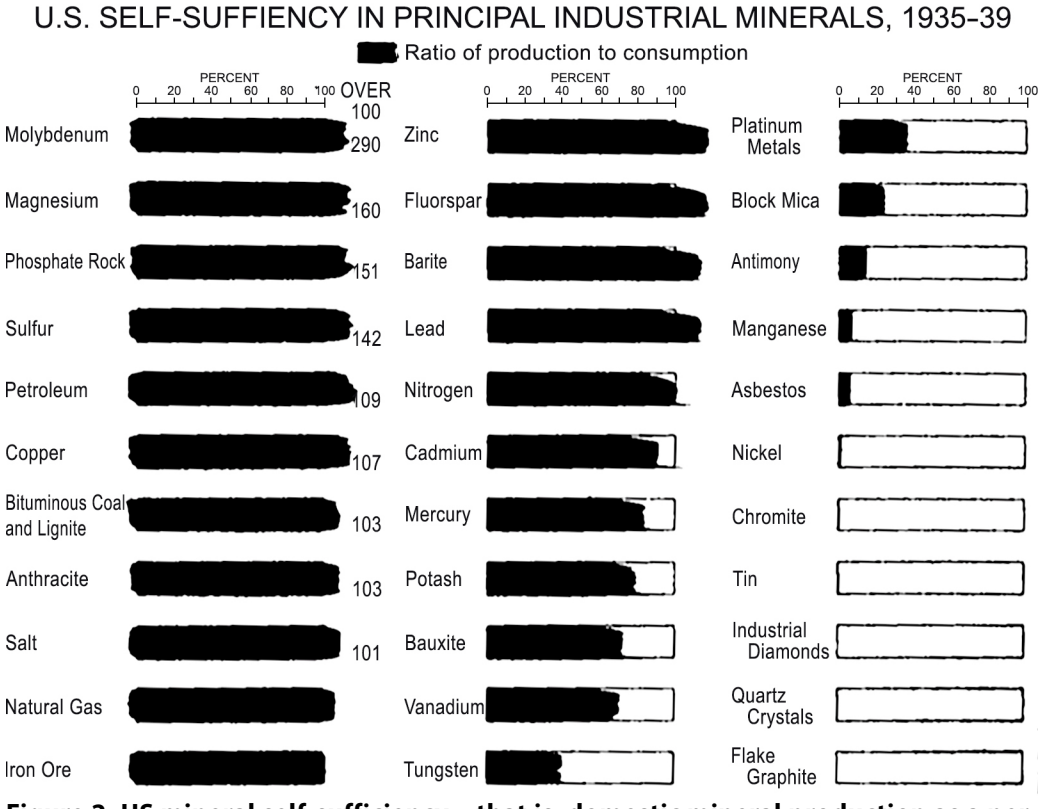

Figure 2. US mineral self-sufficiency—that is, domestic mineral production as a percentage of domestic mineral consumption—for various minerals from 1935 to 1939. (Source: E. W. Pehrson, "Our Mineral Resources and Security," Foreign Affairs 23, no. 4 [1945], 653, https://doi.org/.)

[24] H. W. T. Eglin, "Army and Navy Munitions Board: The Peace-Time Coordination of War Requirements," *Army Ordnance* 17, no. 101 (1937): 275–77, http://www.jstor.org/.

[25] National Research Council, *Managing Materials for a Twenty-first Century Military*, 23.

[26] James S. Thomason et al., "Strategic and Critical Non-Fuel Materials and the National Defense Stockpile," Institute for Defense Analyses, September 1996, 12, https://apps.dtic.mil/; and Robert A. Batchelor and James E. Kirby, "The National Defense Stockpile: An Organizational Perspective" (master's thesis, Air University, March 1985), 11, https://apps.dtic.mil/.

[27] Thomason et al., "Strategic and Critical Non-Fuel Materials," 12.

Nevertheless, US companies boasted substantial overseas mineral production during this period. American companies held significant control over major mineral resources throughout the Western Hemisphere.[28] For instance, the largest copper mines in Canada, Chile, and Mexico were predominantly owned or operated by US companies, collectively wielding considerable influence over the global copper market.[29] By the late 1920s, the four largest US copper firms alone commanded over half of the world's copper production,[30] with US financial interests extending their sway over approximately two-thirds of global output.[31] Additionally, US financial entities exercised significant control over overseas production of other minerals, including nickel in Canada and vanadium in Peru.[32] In essence, US companies wielded significant influence over overseas mineral production in the early twentieth century.

Furthermore, for certain minerals, the United States heavily relied on aligned imports, particularly from the British Empire, with whom it collectively controlled approximately 75 percent of global mineral supplies by 1938.[33] Tin, for instance, was sourced primarily from foreign mines,[34] particularly those within the British Empire's sphere of influence like Malaya.[35] Similarly, the majority of chromite imported into the United States between 1913 and 1933 originated from territories such as the British Empire's Rhodesia and the French colony of New Caledonia.[36] Likewise, US manganese consumption heavily depended on imports,

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[28] Leith, "The Struggle for Mineral Resources," 48.

[29] Adelaide Walters, "The International Copper Cartel," *Southern Economic Journal* 11, no. 2 (1944), 134, https://www.jstor.org/.

[30] Christopher Schmitz, "The Rise of Big Business in the World Copper Industry 1870-1930," *Economic History Review* 39, no. 3 (1986), 392, https://doi.org/.

[31] F. E. Richter, "The Copper Industry in 1928," *Review of Economics and Statistics* 11, no. 1 (1929), 41, https://doi.org/.

[32] G. A. Roush, "Strategic Mineral Supplies 3. Nickel (Continued)," *Military Engineer* 27, no. 151 (1935): 20–21, https://www.jstor.org/; and William S. Culbertson, "Raw Materials and Foodstuffs in the Commercial Policies of Nations," *Annals of the American Academy of Political and Social Science* 112 (March 1924), 18, https://www.jstor.org/. Regarding nickel, Roush wrote, "Although the deposits are under the political control of Canada primarily, and secondarily of the British Empire, the commercial control has from the beginning been largely in the hands of United States capital." US capital controlled this nickel production mainly through financial interests in the International Nickel Company. See G. A. Roush, "Strategic Mineral Supplies 3," 20–21.

[33] C. K. Leith, "Mineral Resources and Peace," *Foreign Affairs* 16, no. 3 (1938), 516, https://doi.org/.

[34] Charles White Merrill, "Tin," in *Minerals Yearbook 1932–33* (Washington: Government Printing Office, 1933), 281–82, https://search.library.wisc.edu/.

[35] G. A. Roush, "Strategic Mineral Supplies 6. Tin (Continued)," *Military Engineer* 28, no. 158 (1936), 133, https://www.jstor.org/.

[36] G. A. Roush, "Strategic Mineral Supplies 4. Chromium (Continued)," *Military Engineer* 27, no. 153 (1935), 214–15, https://www.jstor.org/.

sometimes accounting for more than 90 percent of total consumption. In 1913, major manganese import sources included British-controlled India, as well as Russia and Brazil.[37] Thus, aligned imports played a crucial role in meeting the United States' mineral demands during the early twentieth century.

Considering its substantial domestic production, overseas production, and aligned imports, the United States wielded significant mineral power in the early twentieth century. During this era, the US government primarily aimed to safeguard and bolster domestic mineral producers through tariff measures. In a comprehensive study of the US mining industry spanning from 1899 to 1939, Harold Barger and Sam Schurr observed, "The principal effect of fiscal policy upon mineral extraction is through the tariff." The US government implemented tariffs on various minerals, including lead, manganese, mercury, tungsten, and zinc.[38] Additionally, the government supported the domestic mineral industry through various other policies. For instance, following World War I, financial assistance was extended to domestic producers of certain minerals—such as chromite, pyrites, manganese, and tungsten—that had developed domestic mineral deposits at the government's behest but subsequently encountered financial losses.[39] These policies, among others, conferred upon the United States significant mineral power during the early twentieth century.

[37] G. A. Roush, "Strategic Mineral Supplies: 2. Manganese," *Military Engineer* 26, no. 148 (1934), 251–52, https://www.jstor.org/.

[38] Harold Barger and Sam H. Schurr, *The Mining Industries, 1899-1939: A Study of Output, Employment, and Productivity* (New York: National Bureau of Economic Research, 1944), 259–60, https://www.nber.org/.

[39] This governmental financial relief came from the War Minerals Relief Act." *See* "Relief in Cases of Contracts Connected with Prosecution of the War," report no. 2041, 69th Cong. 2nd sess. (11 February 1927), https://www.govinfo.gov/; Middleton Beaman et al., "Department of Current Legislation: Federal Legislation," *American Bar Association Journal* 15, no. 10 (1929), 620, https://www.jstor.org/; and Thomas Walker Page et al., *Fourth Annual Report of the United States Tariff Commission* (Washington: Government Printing Office, 1921), 17, https://www.usitc.gov/.

Case Study 2: China's Mineral Power in the Early Twenty-first Century

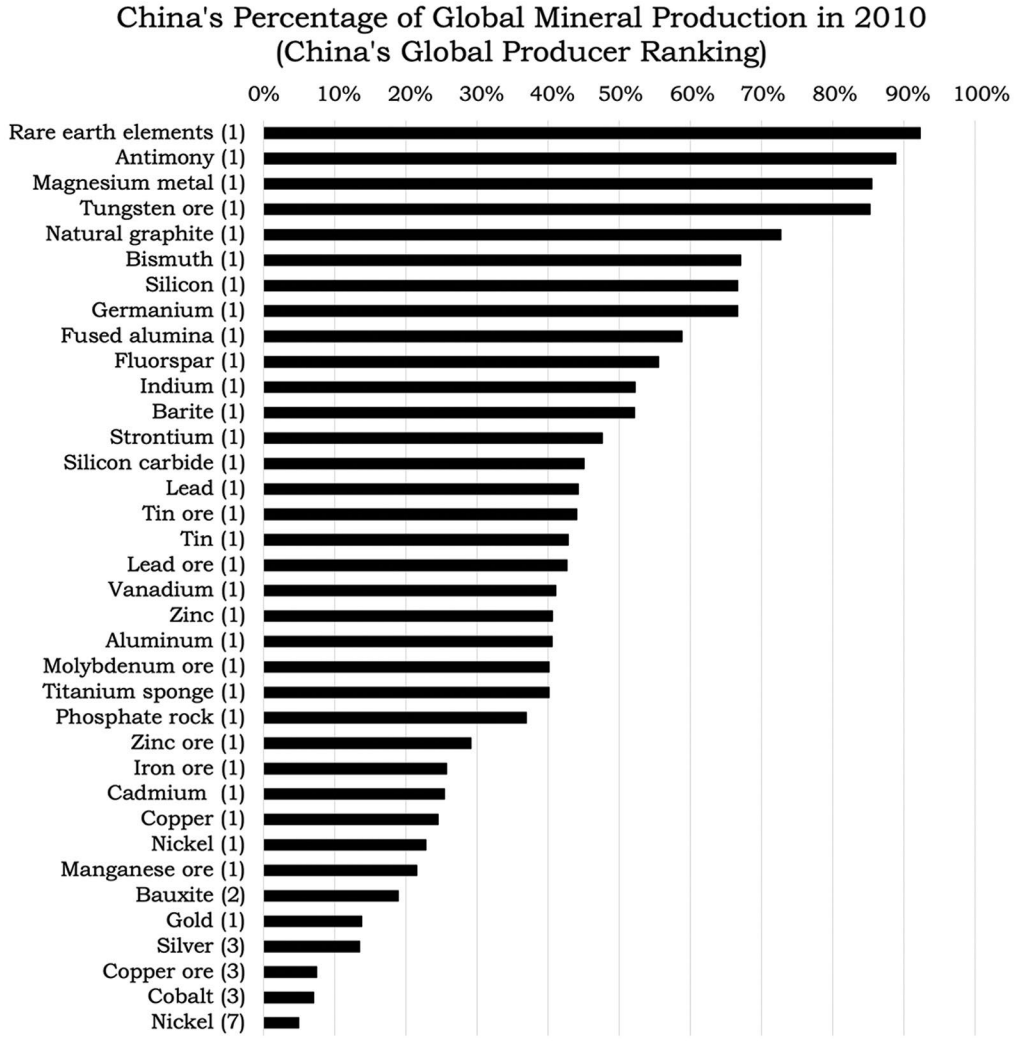

Figure 3. China's mineral production as a percentage of global mineral production for various minerals, including China's global producer ranking. (Source: Hearing on China's Global Quest for Resources and Implications for the United States, before the US–China Economic and Security Review Commission [26 January 2012], testimony of W. David Menzie, chief, Global Minerals Analysis Section, National Minerals Information Center, US Geological Survey, https://www.doi.gov/.)

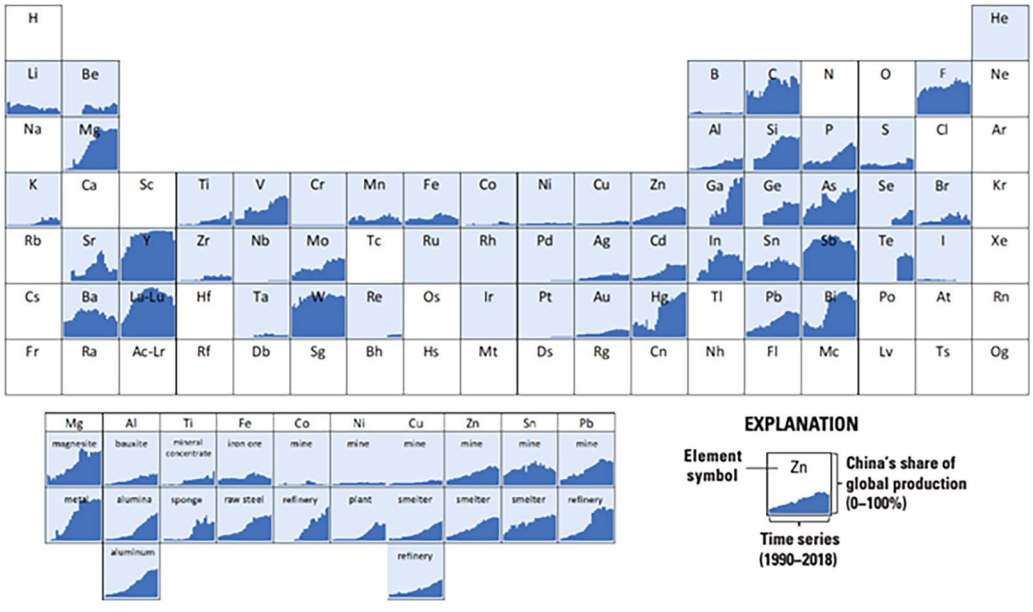

Figure 4. China's percentage of global mineral production from 1990 to 2018 for various minerals. (Source: Nedal T. Nassar, Elisa Alonso, and Jamie L. Brainard, "Investigation of US Foreign Reliance on Critical Minerals: US Geological Survey Technical Input Document in Response to Executive Order No. 13953 Signed September 30, 2020," US Geological Survey, December 7, 2020, 4, https://pubs.usgs.gov/.)

In the early twenty-first century, China emerged as a formidable global power and the predominant mineral producer worldwide (fig. 4).[40] According to the US Geological Survey, the most noteworthy transformation in global mineral production from 1990 to 2018 was the exponential increase in China's mineral output, coinciding with its ascent as a major power, arguably even a superpower.[41] By 2022, China had assumed the top position in the production of 30 out of the 50 minerals listed as critical by the US, solidifying its status as the primary source of many

[40] Jim Garamone, "White House Report Recommends Multi-Pronged Approach to Counter China," *DOD News*, 5 June 2020, https://www.defense.gov/; and US Geological Survey, *Mineral Commodities Summary 2024* (Reston, VA: US Geological Survey, 2024), 5, 8, 19, 23, https://doi.org/.

[41] Nedal T. Nassar, Elisa Alonso, and Jamie L. Brainard, "Investigation of US Foreign Reliance on Critical Minerals: US Geological Survey Technical Input Document in Response to Executive Order No. 13953 Signed September 30, 2020," *US Geological Survey*, 7 December 2020, 2, https://pubs.usgs.gov/. By 2020, "China had become the world's leading producer and consumer of numerous mineral commodities." *See* Sean Xun, "2019 Minerals Yearbook: China [Advanced Release]," *US Geological Survey*, July 2022, 9.1, https://pubs.usgs.gov/; and Jim Garamone, "China Military Power Report Examines Changes in Beijing's Strategy," *DOD News*, 29 November 2022, https://www.defense.gov/.

minerals imported by the United States.[42] Furthermore, in November 2023, China's natural resources minister announced plans to intensify efforts in mineral research, exploration, and extraction.[43] Consequently, China boasts significant domestic mineral production in the early twenty-first century.

China also maintains substantial mineral stockpiles. Through its National Food and Strategic Reserves Administration, China stockpiles critical minerals, including aluminum, cobalt, copper, rare earth elements, and zinc.[44] While the specific quantities of stockpiled minerals remain undisclosed, they are presumed to be considerable—and increasing.[45] China stockpiles minerals to safeguard against external supply disruptions, procuring these minerals from domestic producers and providing them with financial support.[46] Given that global trade volumes for many of the stockpiled minerals are relatively modest, China's stockpiling—or speculation thereof—can increase global mineral prices,[47] with the release of minerals—or rumors thereof—having the opposite effect.[48] Therefore, China possesses substantial mineral stockpiles in the early twenty-first century.

Chinese companies also wield significant control over overseas mineral production. For instance, through direct and indirect ownership, Chinese companies controlled between 40 percent and 50 percent of all cobalt produced in the Dem-

[42] US Geological Survey, *Mineral Commodities Summary 2023* (Reston, VA: US Geological Survey, 2023), 20, https://doi.org/. In 2023, China was the leading producer for 29 of 43 critical minerals for which reliable information was available. Mark Burton also notes in *Bloomberg*, "Today, China is the leading producer of twenty critical raw materials, as measured by its share of global mined or refined production." *See* US Geological Survey, *Mineral Commodities Summary 2024* (Reston, VA: US Geological Survey, 2024), 21, https://doi.org/; Mark Burton, "Why the Fight for 'Critical Minerals' Is Heating Up," *Bloomberg*, 20 November 2023, https://www.bloomberg.com/; and US Geological Survey, *Mineral Commodities Summary 2024* (Reston, VA: US Geological Survey, 2024), 5–6, 23, https://doi.org/.

[43] Kinling Lo, "China's Strategic Mineral Supply Push 'a Very Urgent Mission', Says Resources Minister, amid Self-Reliance Push," *South China Morning Post*, 10 November 2023, https://www.scmp.com/.

[44] "China's State Reserve Expected to Buy 3,100 T of Cobalt—Sources," *Reuters*, 20 October 2023, https://www.reuters.com/; and James T. Areddy, "China Moves to Strengthen Grip Over Supply of Rare-Earth Metals," *Wall Street Journal*, 7 February 2011, https://www.wsj.com/.

[45] In June 2021, Andy Home estimated the amounts for some minerals in China's stockpile, such as 800,000–900,000 metric tons of aluminum. *See* Andy Home, "Home: Learning to Live with (Talk of) Chinese State Metal Sales," *Reuters*, 17 June 2021, https://www.mining.com/; and "China's State Reserve Expected to Buy 3,100 T of Cobalt – Sources," *Reuters*, 20 October 2023, https://www.reuters.com/.

[46] Tracy Hu, "Analysts Expect Long-Term Cobalt Price Support in China amid Stockpiling Reports," *S&P Global*, 5 October 2020, https://www.spglobal.com/.

[47] "China Plans to Stockpile Cobalt after Price Rout," *Benchmark Source*, 25 October 2023, https://source.benchmarkminerals.com/; and Alexander Cook, "China Plans State Reserve Tender to Increase Cobalt Stockpile," *Fastmarkets*, 7 July 2023, https://www.fastmarkets.com/.

[48] "Copper Sinks to Two-Month Low on China's Plan to Release Reserves," *Mining.com*, 17 June 2021, https://www.mining.com/; and Min Zhang and Tom Daly, "Explainer: What We Know about China's Metals Reserves Release," *Reuters*, 17 June 2021, https://www.reuters.com/.

ocratic Republic of the Congo in 2020.[49] Additionally, Chinese companies hold ownership interests in the majority of large nickel projects in Indonesia, with companies predominantly owned by Chinese entities accounting for an estimated 84 percent of Indonesia's output of nickel suitable for batteries in 2023.[50] Chinese companies are also actively investing in and acquiring overseas lithium projects.[51] Notably, for certain minerals, individual Chinese companies hold significant shares of global production. Despite China's share of global cobalt mine production being only 1 percent in 2022, Chinese company CMOC, through its ownership stakes in overseas mines, is projected to control approximately 30 percent of global cobalt mine production by 2025.[52] Hence, China boasts exceptional overseas mineral production in the early twenty-first century.

Moreover, China imports substantial quantities of minerals from states with aligned commercial interests. Approximately 40 percent of its heavy rare earths are sourced from Myanmar,[53] while it heavily relies on imported lithium, including from Australian lithium producers with whom Chinese companies often share aligned commercial interests.[54] For example, in January 2024, the Chinese company Ganfeng expanded its agreement to purchase lithium from the Australian company Pilbara Minerals.[55] Concerning cobalt, China imports cobalt produced not only by Chinese companies in the Democratic Republic but also by Congolese "artisanal" miners, consisting of men, women, and children from the informal sector who

[49] Luiza Ch. Savage, "How America Got Outmaneuvered in a Critical Mining Race," *Politico*, 2 December 2020, https://www.politico.com/.

[50] Andrea Hotter, "FEOC Definition Leaves Most Indonesian Nickel outside IRA Tax Credits | Hotter Commodities," *Fastmarkets*, 5 December 2023, https://www.fastmarkets.com/. In November 2022, an Indonesian lawmaker claimed that Chinese companies control 90 percent of Indonesia's nickel industry. *See* Gusty da Costa, "China Controls Indonesia's Nickel Industry," *Indonesia Business Post*, 30 November 2022, https://indonesiabusinesspost.com/; and Benchmark Mineral Intelligence (@benchmarkmin), "Majority Chinese-owned companies will produce a large but declining share of nickel suitable for #batteries made in Indonesia out to 2030…." *X*, 10:10AM EST, 25 January 2024, https://x.com/.

[51] Charles Chang et al., "China's Global Reach Grows behind Critical Minerals," *S&P Global*, August 2023, 3–4, 6, 9, 12–13, https://www.spglobal.com/.

[52] Kim B. Shedd, "Cobalt," *US Geological Survey*, January 2023, https://pubs.usgs.gov/; and Eric Onstad, "China Turbo-charges Cobalt Mine Output despite Price Crash," *Reuters*, 6 December 2023, https://www.reuters.com/.

[53] "China's Rare Earth Imports from Myanmar Surge in First Half of 2023," *Reuters*, 20 July 2023, https://www.reuters.com/; Tom Daly, "Chian Rare Earths Extend Surge on Worries over Myanmar Supply, Inspection Threat," *Reuters*, 26 March 2021, https://www.reuters.com/; and Xun, "2019 Minerals Yearbook,", 9.6.

[54] "China's Lithium Vulnerability: Reliance on Imports Set to Rise This Decade," *Benchmark Source*, 29 June 2023, https://source.benchmarkminerals.com/; and Natasha Frost, "Australia Tries to Break Its Dependence on China for Lithium Mining," N*ew York Times*, 23 May 2023, https://www.nytimes.com/.

[55] "Pilbara Minerals Expands Ganfeng Offtake Agreement" (press release, Pilbara Minerals, 15 January 2024), https://company-announcements.afr.com/.

frequently toil in hazardous conditions.[56] Consequently, China commands notable volumes of aligned mineral imports in the early twenty-first century.

Given its significant domestic production, government stockpiles, overseas production, and aligned imports, China possesses great mineral power in the early twenty-first century. China's mineral policies primarily aim to secure ample mineral supplies for both the Chinese economy and military.[57] Consequently, China subsidizes domestic production of strategic minerals,[58] including mineral research, exploration, and extraction, as well as the acquisition of overseas mineral supplies.[59] In its 10th Five-Year Plan in 2001, China emphasized the "effective use of overseas resources,"[60] prompting heavy Chinese outward investment targeting the mineral sector.[61] Following the 2017 reforms on outward investments, the Chinese government further incentivized Chinese companies to invest in overseas mining.[62] The Chinese government, through state-led development banks and commercial banks,

[56] Andrew L. Gulley, "China, the Democratic Republic of the Congo, and Artisanal Cobalt Mining from 2000 through 2020," *Proceedings of the National Academy of Sciences* 120, no. 26 (June 27, 2023), 7, https://doi.org/.

[57] Lu Yutong et al., "China's Hunt for Strategic New Energy Minerals," *Caixin*, 14 February 2023, https://asia.nikkei.com/; Christina Lu, "Beijing Tightens Its Grip on the Critical Minerals Sector," *Foreign Policy*, 7 November 2023, https://foreignpolicy.com/; Edward A. Burrier and Thomas P. Sheehy, "Challenging China's Grip on Critical Minerals Can Be a Boon for Africa's Future," *US Institute of Peace*, 7 June 2023, https://www.usip.org/; Chang et al., "China's Global Reach Grows," 3; and Zeyi Yang, "How China Hopes to Secure Its Supply Chain for Critical Minerals," *MIT Technology Review*, 13 September 2023, https://www.technologyreview.com/.

[58] Weihuan Zhou, Victor Crochet, and Haoxue Wang, "Demystifying China's Critical Minerals Strategies: Rethinking 'De-risking' Supply Chains," University of New South Wales Law Research Paper No. 23-23, 1 September 2023, 12–13, http://dx.doi.org/; Bruce Shen, "China's Dominance over Critical Minerals Faces New Challengers," *The Diplomat*, 10 November 2022, https://thediplomat.com/; Daniel F. Runde and Austin Hardman, "Elevating the Role of Critical Minerals for Development and Security," *CSIS*, September 2023, 3, https://csis-website-prod.s3.amazonaws.com/; and Nabeel A. Mancheri, "Effect of Chinese Policies on Rare Earth Supply Chain Resilience," *Resources, Conservation and Recycling* 142 (March 2019), 108, https://doi.org/.

[59] Lo, "China's Strategic Mineral Supply Push."

[60] National People's Congress of the People's Republic of China, "Report on the Outline of the Tenth Five-Year Plan for National Economic and Social Development (2001)," delivered at the Fourth Session of the Ninth National People's Congress on March 5, 2001, http://www.npc.gov.cn/.

[61] Organisation for Economic Co-operation and Development, "OECD Investment Policy Reviews: China 2008," 5 December 2008, 75–76, https://www.oecd.org/; and Charles Wolf, Jr., Xiao Wang, and Eric Warner, *China's Foreign Aid and Government-Sponsored Investment Activities: Scale, Content, Destinations, and Implications* (Santa Monica, CA: RAND Corporation, 2013), xi; https://www.rand.org/.

[62] Hernan Cristerna et al., "2018 Global M&A Outlook: Navigating Consolidation and Disruption," J. P. Morgan, January 2018, 19, https://www.jpmorgan.com/.

coordinates financing for such projects with Chinese companies.[63] These policies have endowed China with great mineral power in the early twenty-first century.

Results

The case studies reveal that both the United States and China, as ascending great powers, enjoyed secure access to substantial mineral supplies. Specifically, the United States possessed significant mineral power during the early twentieth century, while China exhibits great mineral power in the early twenty-first century. Both nations required access to ample secure mineral supplies to sustain their heightened defense production and sizable military forces. These findings suggest that mineral power plays a crucial role in enabling military prowess and that enhancing mineral power may be a prerequisite for a state to augment its military capabilities.

The Modern Mineral Power of the United States

Currently, the United States exhibits limited domestic mineral production—evident in its heavy reliance on imports—and a constrained government mineral stockpile.[64] In terms of overseas mineral production, US companies hold stakes in mineral production ventures in Peru, Indonesia, and Chile, but the United States heavily relies on mineral imports controlled by Chinese companies, rather than those aligned with American interests.[65] Despite America's restricted access to secure mineral supplies, it has maintained significant mineral power owing to its diplomatic, economic, and military prowess, ensuring continued access to mineral imports and international sea lanes. As noted by C. K. Leith in 1939, although the United States and the British Empire controlled nearly 75 percent of global mineral production, equally crucial was their control over the seas through which these products traversed.[66] Even with limited domestic mineral production, the United States can still tap into overseas mineral production, thus securing the requisite mineral supplies to sustain its great-power military.

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[63] Gregory T. Chin and Kevin P. Gallagher term China's state financing model as a "coordinated credit space model." *See* Gregory T. Chin and Kevin P. Gallagher, "Coordinated Credit Spaces: The Globalization of Chinese Development Finance," *Development and Change* 50, no. 1 (13 January 2019): https://onlinelibrary.wiley.com/.

[64] US Geological Survey, *Mineral Commodities Summary 2023* (Reston, VA: US Geological Survey, 2023), 6–8, 21, https://doi.org/; and Bryant Harris, "Congress and Pentagon Seek to Shore Up Strategic Mineral Stockpile Dominated by China," *DOD News*, 23 May 2022, https://www.defensenews.com/.

[65] Polly Bindman, "The Countries Controlling the Critical Minerals Supply Chain: In Four Charts," *Energy Monitor*, 30 October 2023, https://www.energymonitor.ai/; and US Geological Survey, *Mineral Commodities Summary 2024* (Reston, VA: US Geological Survey, 2024), 5–6, 23, https://doi.org/.

[66] Leith, "The Struggle for Mineral Resources," 42; and Leith, "Mineral Resources and Peace," 516.

Nevertheless, risks to US mineral imports are mounting.[67] China has already imposed export controls on gallium, germanium, graphite, rare earths, and rare earths processing technology.[68] If US–China competition escalates further, China—upon which the United States heavily relies for minerals—could curtail other mineral exports to the United States. Moreover, in the event of a US–China conflict, mineral exports from China and possibly other mineral-producing Asian states could face disruption.[69] The substantial US dependence on imported minerals, coupled with vulnerabilities to import disruptions, poses serious risks to US mineral power and, consequently, its military power.[70] As E. W. Pherson warned in 1945, "Dependence on supplies of raw materials from overseas poses a serious problem of national defense."[71]

Given the risks associated with imported minerals, US officials have frequently advocated for US mineral independence and self-sufficiency, particularly during periods of great-power competition. In 1919, following World War I, US Secretary of the Interior Franklin Lane emphasized, "The war taught us the need for mineral independence, and now that peace has come we should not forget it and be lured into the sweet illusion that all is forever to be well."[72] Similarly, in 1935, US Geological Survey Director Walter Mendenhall stressed, "There is great unrest in the world, and all that it is possible to do should be done to make this country self-sufficient in the mineral field."[73] Despite these warnings, the United States' dependence on imported minerals has persisted, as evidenced by the number of

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[67] Nassar, Alonso, and Brainard, "Investigation of US Foreign Reliance."

[68] "China to Restrict Exports of Chipmaking Materials As US Mulls New Curbs," *Reuters*, 3 July 2023, https://www.reuters.com/; Siyi Liu and Dominique Patton, "China, World's Top Graphite Producer, Tightens Exports of Key Battery Material," *Reuters*, 20 October 2023, https://www.reuters.com/; Shunsuke Tabeta, "China Tightens Rare-Earth Export Curbs amid Tension with US," *Nikkei Asia*, 7 November, 2023, https://asia.nikkei.com/; and Siyi Liu and Dominique Patton, "China Bans Export of Rare Earths Processing Tech over National Security," *Reuters*, 22 December 2023, https://www.reuters.com/.

[69] "Conflict over Taiwan: Assessing Exposure in Asia," *Economist Intelligence Unit*, 2023, 1–7, https://www.eiu.com/. The Economist Intelligence Unit report asserts that a conflict between the United States and China could disrupt supply chain networks in Southeast and Northeast Asia, impacting countries such as the Philippines and South Korea. Importantly, both nations are significant suppliers of minerals to the United States: the Philippines serves as a major import source for scandium, tellurium, and selenium, while South Korea is a key import source for indium, yttrium, bismuth, and lead.

[70] Leith, "The Struggle for Mineral Resources," 42.

[71] E. W. Pehrson, "Our Mineral Resources and Security," *Foreign Affairs* 23, no. 4 (1945), 655, https://doi.org/.

[72] Franklin K. Lane, "Introduction," in *The Strategy of Minerals: A Study of the Mineral Factor in the World Position of America in War and in Peace*, ed. George Otis Smith (New York: D. Appleton and Company, 1919), xx.

[73] Mary C. Rabbitt and Clifford M. Nelson, *Minerals, Lands, and Geology for the Common Defence and General Welfare, Volume 4, 1939-1961: A History of Geology in Relation to the Development of Public-Land, Federal Science, and Mapping Policies and the Development of Mineral Resources in the United States from the 60th to the 82d Year of the US Geological Survey* (Reston, VA: US Geological Survey), 9, https://pubs.usgs.gov/.

minerals for which the United States is at least 25 percent net import reliant, increasing from 21 percent in 1954 to 58 percent in 2019.[74]

Policy Options for the US Government

Several policies could help increase US access to secure mineral supplies and thus enhance US mineral power. First, to boost domestic mineral production, the US government could expand financial support for domestic exploration, mining, and processing. Presently, the Department of Defense provides financial backing for cobalt and nickel exploration;[75] antimony, graphite, and lithium mining;[76] and aluminum, graphite, and titanium refining.[77] Expanding such financial support for domestic mineral production is crucial, as underscored by America's great-power rival, China. In November 2023, China's natural resources minister emphasized, "The exploration and mining of mineral resources and being at the top of the supply chain is the key to protecting our supply chain."[78]

Additionally, the US government could ramp up support for secondary production, such as metal recovery from recycled scrap. Historically, secondary production has yielded significant mineral volumes compared to mining, which is known as primary production. For instance, prior to US entry into World War II, secondary copper production accounted for 61 to 76 percent of US primary copper production.[79] However, as with other minerals, America's secondary copper industry has witnessed a decline. While the United States had five secondary copper smelters

[74] Nassar, Alonso, and Brainard, "Investigation of US Foreign Reliance," 2.

[75] "DOD Enters Agreement to Expand Domestic Manufacturing and Strengthen US Cobalt Supply Chains" (press release, US Department of Defense, 15 June 2023), https://www.defense.gov/; and "Department of Defense Enters an Agreement to Strengthen the US Supply Chain for Nickel Production" (press release, US Department of Defense, 12 September 2023, https://www.defense.gov/.

[76] "DoD Issues $24.8M Critical Minerals Award to Perpetua Resources" (press release, US Department of Defense, 19 December 2022), https://www.defense.gov/; "DOD Enters Agreement to Expand Capabilities for Domestic Graphite Mining and Processing for Large-Capacity Batteries" (press release, US Department of Defense, 17 July 2023, https://www.defense.gov/; and "DoD Enters Agreement to Expand Domestic Lithium Mining for US Battery Supply Chains" (press release, US Department of Defense, 12 September 2023, https://www.defense.gov/.

[77] "DoD Enters Agreement to Expand Domestic Manufacturing to Strengthen U.S. Missiles and Munitions Supply Chains" (press release, US Department of Defense, 16 June 2023, https://www.defense.gov/; "DOD Enters Agreement to Expand Domestic Graphite Supply Chain" (press release, US Department of Defense, 29 November 2023), https://www.defense.gov/; and "DOD Awards $12.7 Million to Increase Titanium Powder Production for Defense Supply Chains" (press release, US Department of Defense, 30 October 2023, https://www.defense.gov/.

[78] Lo, "China's Strategic Mineral Supply Push."

[79] T. H. Miller and H. M. Meyer, "Copper," in *Minerals Yearbook Review of 1941* (Washington, DC: US Government Printing Office, 1943), 105, https://digital.library.wisc.edu/.

in 1995, all were shuttered by 2002.[80] Nonetheless, one new US secondary smelter commenced operations in 2022, and two other secondary smelter projects have since been announced.[81] For copper and other minerals, the US government could provide financial support for existing secondary production facilities, their expansions, and the establishment of new facilities.

The US government could explore other policy options to bolster domestic mineral production, such as government procurement and tariffs. For example, during the Korean War, the US government—under the Defense Production Act—guaranteed the purchase of tungsten for its stockpile at a predetermined price from domestic producers for five years, leading to a surge in domestic tungsten production.[82] Similarly, imposing tariffs on foreign minerals could deter cheap imports from undermining domestic producers. Foreign competitors often offer lower mineral prices due to state support and adherence to lower labor and environmental standards.[83] Tariffs could mitigate this foreign cost advantage and safeguard domestic mineral production. As noted by E. W. Pehrson toward the end of World War II, "[A] large measure of [mineral] self-sufficiency has been maintained for many years with moderate tariff protection."[84]

Secondly, the US government could bolster its mineral stockpiles, focusing on minerals heavily utilized by the military. Notably, aluminum and copper rank as the most utilized elements by weight in the US military. In the 1960s, the US government stockpiled nearly 920,000 short tons of aluminum and over one mil-

[80] Daniel L. Edelstein, "Copper," *US Geological Survey*, 1994, 1, https://d9-wret.s3.us-west-2.amazonaws.com/; and Daniel L. Edelstein, "Copper," 2003, 21.1, https://d9-wret.s3.us-west-2.amazonaws.com/.

[81] DeAnne Toto, "ISRI2023: Critical Copper," *Recycling Today*, 22 April 2023, https://www.recyclingtoday.com/.

[82] John D. Morgan, Jr., "National Stockpile and United States Strategy," Industrial College of the Armed Forces, 6 December 1955, 10–12, https://www.hsdl.org/.

[83] According to Jorge Uzcategui of Benchmark Mineral Intelligence, Chinese mineral companies, even when not state-owned, can access inexpensive government financing, allowing them to operate at lower mineral prices than their international competitors. *See* Eric Onstad, "China Turbo-charges Cobalt Mine Output despite Price Crash," *Reuters*, 6 December 2023, https://www.reuters.com/. For example, companies producing nickel in Indonesia adhere to lower labor and environmental standards (e.g., tailings management) than companies operating in Western jurisdictions, giving Indonesian nickel producers a cost advantage. *See* Ken Moriyasu, "US Senators Oppose Indonesia FTA That Paves Way for Nickel Subsidies," *Nikkei Asia*, 2 November 2023, https://asia.nikkei.com/.

[84] Pehrson, "Our Mineral Resources and Security," 656–57.

lion short tons of copper.[85] However, presently, the US government does not stockpile aluminum or copper.[86] Additionally, the military's third and fourth most used elements, lead and fluorspar, are also absent from the stockpile.[87] This decline in stockpile levels is further highlighted by the fact that while the US government stored materials at 213 locations in 1961;[88] today, it does so at only six locations.[89] To address this issue, recommendations from the White House, Department of Defense, and Department of Energy advocate for increased stockpiling efforts.[90] Given China's dominance in the mineral realm, the US government may need to consider sourcing minerals from China to swiftly augment its stockpile. For many minerals, such as rare earth elements, China stands as the sole provider with the necessary production volume to rapidly expand the US mineral stockpile.

Thirdly, although the United States lacks major domestic mineral companies, it could enhance overseas mineral production by providing capital to US companies to acquire ownership stakes in foreign mineral production. Currently, the US government is allocating funds to foreign entities for this purpose; for instance, the US Development Finance Corporation has invested USD 105 million in TechMet, a Dublin-based private investment vehicle, to support a nickel-cobalt mine in

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[85] Institute for Defense Analyses, "Key Materials for High-Priority Weapon Systems, and Assessing Risks to Their Supply: A Report for the US Defense National Stockpile Center," July 31, 2008, in US Department of Defense, "Reconfiguration of the National Defense Stockpile Report to Congress," April 2009, B-2, https://www.scribd.com/; Bureau of Industry and Security, "The Effect of Imports of Aluminum on the National Security: An Investigation Conducted under Section 232 of the Trade Expansion Act of 1962, as Amended," US Department of Commerce, 17 January 2018, 34, https://www.bis.doc.gov/; and "Copper Sale Set to Ease Supplies," *New York Times*, 17 December 1964, https://www.nytimes.com/.

[86] Adam M. Merrill, "Aluminum," *US Geological Survey*, January 2023, https://pubs.usgs.gov/; and Daniel M. Flanagan, "Copper," *US Geological Survey*, January 2023, https://pubs.usgs.gov/.

[87] Amy C. Tolcin, "Lead," *US Geological Survey*, January 2023, https://pubs.usgs.gov/; Michele E. McRae, "Fluorspar," *US Geological Survey*, January 2023, https://pubs.usgs.gov/; and Institute for Defense Analyses, "Key Materials for High-Priority Weapon Systems, and Assessing Risks to Their Supply: A Report for the US Defense National Stockpile Center," 31 July 2008, in US Department of Defense, "Reconfiguration of the National Defense Stockpile Report to Congress," April 2009, B-2, https://www.scribd.com/.

[88] Office of Emergency Planning, *Stockpile Report to Congress* (Washington: Executive Office of the President, June–January 1961), 5.

[89] "About Strategic Materials," Defense Logistics Agency, 2024, https://www.dla.mil/.

[90] *Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-Based Growth: 100-Day Reviews under Executive Order 14017* (Washington: The White House, June 2021), 16, 200–201, https://www.whitehouse.gov/; *Securing Defense-Critical Supply Chains: An Action Plan Developed in Response to President Biden's Executive Order 14017* (Washington: DOD, February 2022), 43–45, https://media.defense.gov/; and Tsisilile Igogo, *America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition: US Department of Energy Response to Executive Order 14017, "America's Supply Chains"* (Washington: US Department of Energy, February 2022), 25, 46, https://www.energy.gov/.

Brazil and a rare earths project in South Africa.[91] Prioritizing such funding for US companies would enable them to secure control over overseas mineral production. Moreover, as domestic mineral companies boost production and revenue domestically, they would have more capital to invest in overseas mineral projects, reminiscent of practices observed in the early twentieth century.

Fourthly, the US government could augment its aligned imports by facilitating offtake agreements between US companies and overseas mines in states and owned by companies aligned geopolitically with the United States. To prevent undermining mineral production within the United States, the government should only finance offtake agreements for minerals lacking reserves domestically. For instance, since the United States lacks manganese reserves while Australia possesses them; thus, the government could offer financing to US manufacturers, particularly those in the defense supply chain, to secure long-term offtake agreements with Australian manganese producers.

Importantly, offtake agreements not only secure overseas mineral supplies for US companies but also stimulate mineral production in the supplier states, as mining companies often utilize capital from offtake agreements to develop or expand their mineral production.[92] Additionally, signed offtake agreements can attract greater capital for the mining project, as other investors and lenders perceive the project as partially de-risked. The US government could coordinate such financing under the Mineral Security Partnership—an international consortium of 14 states aimed at establishing secure mineral supply chains. Many US partners, including Australia, have expressed their interest in attracting US investment in their mining sectors.[93]

Fifthly, as the US government endeavors to enhance its mineral security, it could utilize its trade leverage in advanced technology to ensure continued access to minerals produced in China. For various minerals, China currently serves as an indispensable supplier to the United States. For instance, China mines 90 percent of the world's gallium, 88 percent of the world's magnesium, 81 percent of the world's tungsten, 80 percent of the world's bismuth, and 77 percent of the world's

[91] Yvonne Yue Li, "US Gives $50 Million Boost to Critical Minerals Investor TechMet," *Bloomberg*, 1 December 2023, https://www.bloomberg.com/.

[92] Clyde Russell, "Supply Anxiety Is the New Hope for Developing Energy Transition Mines," *Reuters*, 25 May 2023, https://www.reuters.com/.

[93] Phil Mercer, "Australia Unveils $1.25 Billion Critical Minerals Plan," *Voice of America*, 26 October 2023, https://www.voanews.com/.

natural graphite.[94] To maintain access to these minerals, the US government, through diplomatic channels, could convey to the Chinese government that any export controls on minerals—and mineral processing technology—from China will result in retaliatory US export controls on technology to China.[95] Moreover, the US government should consider the risks associated with imposing export controls on technology, as the Chinese government can and has retaliated with export controls on minerals.[96]

Challenges to implementing the aforementioned US government policies include concerns regarding labor practices and market intervention, but the primary challenge revolves around environmental considerations. Mining, like all major industrial activities, entails tradeoffs with the environment. For instance, mining currently accounts for 4 percent to 7 percent of global greenhouse gas emissions.[97] However, when evaluating mining's economic impact, its footprint is relatively small: the mining industry exhibits a higher economic impact per metric ton of carbon dioxide emissions compared to the agricultural, construction, and energy industries.[98] Moreover, minerals are essential for various new energy technologies, such as electric vehicle batteries, which can mitigate carbon emissions when paired with low-carbon electricity sources.

On a local scale, mining also affects the environment to varying degrees depending on factors such as mine type (e.g., open pit or underground), mine size, and mine tailings management. For example, mine tailings—waste material, usually in

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[94] US Geological Survey, *Mineral Commodities Summary 2024* (Reston, VA: US Geological Survey, 2024), 23, https://pubs.usgs.gov/. China is also the dominant processor for many minerals. For example, China processes 98 percent of the world's natural graphite, 93 percent of the world's manganese, and 77 percent of the world's cobalt. *See* Eric Onstad, "Auto Firms Race to Secure Non-Chinese Graphite for EVs As Shortages Loom," *Reuters*, 21 June 2023, https://www.reuters.com/; Organisation for Economic Co-operation and Development, "Strengthening Clean Energy Supply Chains for Decarbonisation and Economic Security: OECD Report for the G7 Finance Ministers and Central Bank Governors," May 2023, 5, https://www.oecd.org/; and Harry Dempsey and Leslie Hook, "China Set to Tighten Grip over Global Cobalt Supply As Price Hits 32-Month Low," *Financial Times*, 12 March 2023, https://www.ft.com/.

[95] Siyi Liu and Dominique Patton, "China Bans Export of Rare Earths Processing Tech over National Security," *Reuters*, 22 December 2023, https://www.reuters.com/.

[96] Potentially in response to US export controls on semiconductor technology, China retaliated with export controls on gallium and germanium. *See* James T. Areddy and Sha Hua, "China Restricts Exports of Two Minerals Used in High-Performance Chips," *Wall Street Journal*, 4 July 2023, https://www.wsj.com/; and Mia Nulimaimaiti, "China's Gallium and Germanium Exports Tumble As Controls on Shipments to the West Take Toll," *South China Morning Post*, 21 January 2024, https://www.scmp.com/.

[97] Lindsay Delevingne et al., "Climate Risk and Decarbonization: What Every Mining CEO Needs to Know," McKinsey & Company, January 2020, 2, https://www.mckinsey.com/.

[98] Benjamin Cox et al., "The Mining Industry as a Net Beneficiary of a Global Tax on Carbon Emissions," *Communications Earth & Environment* 3, no. 17 (2022), 2, https://doi.org/.

a slurry, produced during mining and processing—are typically disposed of in ponds or impoundment dams, which present seepage and breach risks. However, employing dry stacking tailings, which involve dewatering tailings, poses fewer pollution and safety risks. Therefore, for both domestic and overseas mineral projects to receive US government support, the US government should mandate that recipient projects adhere to best-in-industry standards, such as dry stacking tailings.

Conclusion

Minerals enable the production of defense platforms and munitions, which influence a state's military power. Thus, a state's domestic mineral production, government mineral stockpiles, overseas mineral production, and aligned mineral imports comprise—what we call—a state's mineral power. The case studies in this article find that the United States was a rising great power *and* had great mineral power in the early twentieth century and that China is a rising great power *and* has great mineral power in the early twenty-first century. These results indicate that a state's mineral power helps enable its military power.

Presently, the United States confronts a formidable mineral power in China. Unlike previous scenarios, where the United States faced minimal challenges to its mineral power, the escalating competition between the United States and China poses a significant threat to US mineral security. Potential mineral shortages could severely undermine US military capabilities amid the intensifying rivalry with China.[99] Therefore, it is imperative for the US government to take proactive measures to bolster domestic mineral production, enhance government mineral stockpiles, provide financial support and risk mitigation tools for US investments in overseas mineral production, and facilitate offtake agreements between US companies and mineral producers aligned with US interests. Additionally, the US government should utilize its trade leverage to ensure continued access to Chinese minerals by warning of potential export controls on certain technologies should China impose restrictions on mineral exports. ✪

Gregory Wischer

Mr. Wischer is the founder and principal at Dei Gratia Minerals, bringing a wealth of experience from his previous roles as executive vice president and vice president for government affairs at Westwin Elements. His background includes internships with the National Defense University, the US Senate Committee on Foreign Relations, and US Representative Russell Fulcher (R–ID), providing him with a solid foundation in both foreign and domestic policy. With an MA in security studies from Georgetown University and a bachelor's degree in international business from Boise State University, he possesses a unique blend of expertise that informs his expertise within the mineral industry.

[99] Leith, "Mineral Resources and Peace," 515–16; and Leith, "Mineral Resources in Their International Relations," *Proceedings of the American Philosophical Society* 91, no. 1 (1947), 85, http://www.jstor.org/.

Dr. Morgan Bazilian

Dr. Bazilian is the director of the Payne Institute and a professor of public policy at the Colorado School of Mines. Previously, he served as lead energy specialist at the World Bank and held key roles in international organizations including the United Nations. Dr. Bazilian holds multiple master's degrees and a PhD in energy systems, and has authored more than 200 articles in learned journals, as well as the book Analytical Methods for Energy Diversity and Security. He is a member of the Council on Foreign Relations and Ireland's Climate Change Council.

VIEW

Intersecting Tides

Climate Change and Maritime Trade in Indo-Pacific 2040

Anadi

Abstract

The article explores the profound impact of climate change on Indo-Pacific maritime trade routes by 2040. It anticipates rising global temperatures and sea levels altering critical maritime pathways, affecting major global powers. Using a forward-looking approach, it integrates future climate projections, geopolitical trends, and economic forecasts. Uniquely, it delves into the intricate interaction between climate-induced changes and geopolitical realities, emphasizing major global powers' strategic interests. The article offers a comprehensive analysis of the complex relationship between climate change and maritime trade, addressing sea-level rise, extreme weather events, and geopolitical shifts. It proposes sustainable solutions and adaptation measures for the maritime sector, highlighting the need for proactive measures, international cooperation, and sustainable solutions. Its significance lies in providing insights for policy makers and operational forces, emphasizing the urgency of addressing climate change in the maritime domain.

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As we cast our gaze into the not-so-distant future of 2040, the Indo-Pacific region stands out as a focal point of significant change, with climate dynamics leading the roster of global challenges. Amid shifting global economic and geopolitical landscapes, the term *Indo-Pacific* has gained prominence, encompassing both the Asia Pacific and the Indian Ocean Region.[1] As temperatures rise, precipitation patterns alter, and environmental uncertainties escalate, this article explores the potential impacts of climate change on maritime trade in the Indo-Pacific. In an era projected to witness intensified anthropogenic climate-change effects, the intricate relationship between environmental shifts and geopolitical realities assumes unprecedented importance. Already crucial for international trade and energy flows, the Indo-Pacific is poised for substantial changes over the next two decades. Maritime trade routes in this vast region serve not only as economic lifelines but also as strategic passages influencing the geopolitical strategies of major global players. With climate change accelerating, bringing new challenges like sea-level changes, ocean current shifts, and

[1] Sam Bateman, Rajni Gamage and Jane Chan, eds., "Introduction," in *ASEAN and the Indian Ocean: The Key Maritime Links* (Singapore: S. Rajaratnam School of International Studies, 2017), 7.

more frequent extreme weather events, the resilience and adaptability of these maritime routes become critically important.

The article delves into potential scenarios for 2040, examining how climate-induced changes might reshape the Indo-Pacific maritime domain. The implications for trade routes, traditionally seen as stable channels of global commerce, are amplified in a world where climate factors evolve rapidly. Additionally, as nations strategically position themselves in the Indo-Pacific, economic and geopolitical interests become intertwined with the need to adapt to and mitigate the effects of climate change. By contextualizing the analysis within the Indo-Pacific of 2040, this article aims to offer a forward-looking perspective that transcends current temporal boundaries. Through synthesizing future climate projections, geopolitical trends, and economic forecasts, this article seeks to enhance understanding of how the intricate interplay between climate change and maritime trade will shape the strategic interests of major global powers in a future marked by both uncertainty and opportunity.

Climate-Change Outlook in the Indo-Pacific Region by 2040

The climate-change scenarios projected for the Indo-Pacific region by 2040 are characterized by rising sea levels (SLR) primarily attributed to global warming. Global temperatures have already exceeded 1.0°C compared to pre-industrial levels and are expected to reach 1.5°C by the 2030s, posing significant risks to coastal developing nations.[2] Concerns loom over the possibility of a 2.0°C temperature increase, deemed a critical threshold for heightened climate-change risks, possibly occurring by the 2050s, depending on future greenhouse gas emissions.[3] Despite sporadic emission reductions during the COVID-19 pandemic and increased climate ambition in select countries, the UN Environment Programme (UNEP) *Emissions Gap Report 2020* indicates a trajectory toward a temperature rise surpassing 3.0°C this century, exceeding the objectives outlined in the Paris Agreement.[4]

The intricate dynamics of global warming contribute to substantial mean sea-level changes in the Indo-Pacific. This phenomenon primarily results from ocean water expansion due to alterations in land water storage, augmented mass from melting glaciers, caps, and continental ice sheets, alongside isostatic adjustment, higher

[2] Valérie Masson-Delmotte et al., eds., *Global Warming of 1.5°C* (Cambridge: Cambridge University Press, 2018), https://www.ipcc.ch/.

[3] Regina Asariotis, "Climate Change Impacts on Seaports: A Growing Threat to Sustainable Trade and Development," United Nations Conference on Trade and Development, 4 June 2021, https://unctad.org/.

[4] "Emissions Gap Report 2020: Key Messages," United Nations Environment Programme, n.d., https://wedocs.unep.org/.

ocean heat content, and human-induced coastal subsidence. Recent observations indicate a globally averaged mean SLR of approximately 4.0 cm per decade.[5]

Forecasts for sea-level rise are continuously revised, suggesting that a global temperature increase of 2.0°C above pre-industrial levels by 2100 could lead to a 30–93 cm elevation in global sea levels compared to the 1986–2005 average.[6] This heightened mean sea level, coupled with anticipated occurrences such as extreme storm surges, waves, and tides, poses significant risks to seaports in the Indo-Pacific region. The Intergovernmental Panel on Climate Change's (IPCC) 2019 report forecasts a rise in extreme sea levels (ESL) almost universally, with events like the 1-in-100 years ESL becoming more frequent across certain regions. Notable concerns are identified along the macrotidal western European, Northwest and Northeast American, and East Asian coasts, with projections indicating increased future ESLs for ports in all regions as global warming intensifies. In a 1.5°C warmer world, ESL events expected once a century may occur every decade in various ports by the 2030s, escalating to several times a year in a 3°C warmer world.[7] These projections carry significant implications for port adaptation strategies in the Indo-Pacific, impacting decisions regarding infrastructure planning and climate-change adaptation measures.

The urgency for climate action is underscored by the accelerated melting of polar and mountainous glaciers, heightening the potential for future ESLs and elevating the threat of coastal flooding in the Indo-Pacific region by 2040. Research indicates a potential reduction in ice mass ranging from 18 percent to 36 percent by the end of the twenty-first century in mountainous and polar glaciers.[8] The expedited melting of ice sheets in Greenland and Antarctica contributes to additional sea-level rise. The IPCC 2019 report highlights ongoing ice loss in the Greenland Ice Sheet, with projections suggesting a potential significant increase in ice loss after 2060, contributing approximately 0.5 cm/yr to global SLR by 2100.[9] The report also highlights increased melting of the Antarctic Ice Sheet, projecting a potential sudden surge in ice loss after 2060, which could contribute

[5] Asariotis, "Climate Change Impacts on Seaports."

[6] Ove Hoegh-Guldberg, et al., "Impacts of 1.5°C Global Warming on Natural and Human Systems," in *Global Warming of 1.5°C*, ed. Valérie Masson-Delmotte et al. (Cambridge: Cambridge University Press, 2018), 175–312, https://www.ipcc.ch/.

[7] Michael Oppenheimer et al., "Sea Level Rise and Implications for Low-Lying Islands, Coasts, and Communities," in *Special Report on the Ocean and Cryosphere in a Changing Climate*, ed. Hans-Otto Pörtner et al. (Cambridge: Cambridge University Press, 2022), https://www.ipcc.ch/.

[8] Joydeep Gupta and Soumya Sarkar, "As Glaciers disappear, Can We Be Far Behind?," *The Third Pole*, 25 September 2019, https://www.thethirdpole.net/.

[9] Michael Meredith et al., "Polar Regions," in *Special Report on the Ocean and Cryosphere in a Changing Climate*, ed. Hans-Otto Pörtner et al. (Cambridge: Cambridge University Press, 2022), https://www.ipcc.ch/.

approximately 0.5 cm/yr to global sea-level rise by 2100. This acceleration presents a significant risk of coastal flooding, underscoring the critical imperative for immediate climate action.

The World Bank projects that failure to implement measures addressing climate change will compel approximately 49 million people in East Asia and the Pacific to evacuate their homes by 2050 due to climate-related impacts.[10] Among the first regions witnessing these effects are the Pacific Islands, especially low-lying islands, many of which are atolls or just a few feet above sea level. The current unprecedented rate of sea-level rise (SLR) over 5,000 years poses threats of flooding, coastal erosion, and storm surges to these vulnerable island systems. Predictions indicate an average SLR of 25 cm to 58 cm by the mid-twenty–first century, a disastrous scenario for islands positioned at or slightly above sea level.[11] With a 2-degree Celsius increase in global temperatures from preindustrial levels becoming more probable, it is anticipated that 90 percent of coral reefs in much of the Pacific Island region could suffer severe degradation, negatively impacting marine species reliant on these ecosystems.[12] Researchers have found that, under various climate-change scenarios, all studied island systems face threats throughout the twenty-first century. In the most likely scenario, the rate of SLR would triple, resulting in the permanent loss of groundwater sources in the coming decades, rendering islands unstable in the latter half of this century. In a more pessimistic climate-change scenario, a one-meter SLR would destabilize the islands within the next 20 to 40 years, exposing many communities to intolerable levels of risk by 2060.[13] Furthermore, according to the ASEAN State of Climate Change Report, the Association of Southeast Asian Nations (ASEAN) region is expected to experience detrimental effects on priority sectors such as agriculture, water resources, coastal zones, and human health.[14] For instance, projected SLR by 2050 shows an average increase ranging significantly across nations: from as little as 7 cm for Brunei Darussalam to a striking 378 cm for Vietnam. Concurrently, heat stress projections under Representative

[10] "Climate Change could force 216 million people to migrate within their own countries by 2050," World Bank, 13 September 2021, https://www.worldbank.org/.

[11] "Pacific Climate Change" (fact sheet, Secretariat of the Pacific Regional Environment Programme, August 2008), https://www.sprep.org/.

[12] "Climate Change increasing threats in southwest Pacific: WMO report," *UN News*, 10 November 2021, https://news.un.org/.

[13] Chris Parsons, "The Pacific Islands: The front line in the battle against climate change," *Science Matters* (blog), 23 May 2022, https://new.nsf.gov/.

[14] *ASEAN State of Climate Change Report: Current status and outlook of the ASEAN region Toward the ASEAN climate vision 2050* (Jakarta: ASEAN Secretariat, October 2021), https://asean.org/.

Concentration Pathways (RCP)[15] scenarios indicate that ASEAN countries will face an increase in average heat mortality (number of deaths per 1,000 km2), with the Philippines expecting an average of 5.50 to 5.67 and Vietnam expecting an average of 7.82 to 7.85 under RCP 4.5 and RCP 8.5 scenarios by 2050.[16]

Moreover, in the Indo-Pacific region, the El Niño–Southern Oscillation (ENSO) continues to exert significant influence, notably affecting the natural variability of tropical cyclones (TC). Projections for the region suggest an increased frequency of TCs, estimated to be approximately 20 to 40 percent more frequent in the entire central Pacific during future El Niño periods compared to the present.[17] Climate model experiments indicate a heightened likelihood of more severe TCs and increased global rainfall as the climate warms, with the Pacific anticipating elevated TCs-induced extreme wind gusts and rainfall. The region is expected to experience ongoing warming, with temperatures projected to rise by around 0.7°C by 2030 and further increases of approximately 0.8°C by 2050 for a low emission scenario and up to 1.5°C for a high emission scenario. SLR is foreseen, with estimates ranging from 0.09 to 0.18 meters by 2030 and further increases up to 0.63 meters by 2070, depending on emission scenarios. Despite a projected decrease in the number of TCs, their average intensity may change by -5 to +10 percent for a 2°C global warming scenario.[18] This anticipated rise in average cyclone intensity, combined with SLR and increased heavy rainfall, underscores the heightened risk of intensified cyclone impacts in the Indo-Pacific region in 2040.

These climate-change projections for the Indo-Pacific region carry significant implications for maritime trade. The more frequent and intense occurrence of TCs, coupled with SLR and extreme weather events, poses notable challenges for coastal infrastructure and navigation in the area. Climate change can disrupt global trade by altering trade costs, shifting comparative advantages, and disturbing global value chains. Research indicates that a temperature rise of 1°C is associated with a reduction in the yearly export growth rate of developing nations by approximately 2.0

[15] A Representative Concentration Pathway (RCP) is a trajectory of greenhouse gas concentrations (not emissions) adopted by the IPCC. Four pathways were utilized for climate modeling and research for the IPCC Fifth Assessment Report (AR5) in 2014. These pathways delineate various climate change scenarios, all of which are deemed possible depending on the quantity of greenhouse gases (GHG) emitted in the future. Rajendra K. Pachauri et al., Fifth Assessment Report (Cambridge: Cambridge University Press, 2015), https://unfccc.int/.

[16] *ASEAN State of Climate Change Report*.

[17] Kate Morioka, "Tropical cyclones and climate change: implications for the Western Tropical Pacific," Regional Climate Consortium for Asia and the Pacific, 2022, https://www.rccap.org/.

[18] "Climate Change Update for the Pacific," Regional Climate Consortium for Asia and the Pacific, n.d., https://www.rccap.org/

to 5.7 percentage points.[19] The IPCC warns that if current practices persist, we could reach the critical warming threshold of 1.5˚C to 2.0˚C within the next decade, by 2030.[20] Our planet, already experiencing heightened temperatures, could witness a staggering global average temperature increase of up to 5.5˚C. Even with immediate intervention, it is anticipated to take 20 to 30 years, equivalent to a full generation, to stabilize the current negative trends. Consequently, the outlook for the Indo-Pacific region by 2040 appears bleak, with further adverse impacts on maritime trade due to the changing climate. As maritime trade heavily relies on stable and accessible ports, the heightened risk of cyclone impacts and SLR necessitates strategic adaptations and resilience measures in the maritime sector. Furthermore, the potential disruption of global value chains due to climate-induced events underscores the need for a comprehensive understanding of how these climatic shifts may impact the future landscape of maritime trade in the Indo-Pacific.

Maritime Trade Dynamics Amid Indo-Pacific Climate Challenges

The Indo-Pacific region holds strategic importance for three primary reasons. Firstly, it hosts three of the world's largest economies—the United States, China, and Japan—collectively contributing to 60 percent of global gross domestic product (GDP). Secondly, a significant portion of global maritime trade, totaling 60 percent, flows through the waters of this region.[21] Additionally, the Indo-Pacific hosts the fastest-growing emerging economies, such as Cambodia, India, and the Philippines. Key economies in the area, such as China, India, and Japan, heavily rely on sea routes in the Indo-Pacific for their trade and energy supply, solidifying the region as a pivotal nexus in global trade and energy networks. Notably, 80 percent by volume and 70 percent by value of global trade is conducted via maritime routes, and 60 percent of this maritime trade traverses the Indo-Pacific.[22] The economic significance underscores the strategic value of the Indo-Pacific region. Stability in the Indo-Pacific is essential for global trade prosperity, given the presence of critical maritime chokepoints like the Bab al Mandeb and the Malacca Strait. Moreover, the economic importance of the Indo-Pacific region is highlighted by the presence of ten of the busiest container ports worldwide along the Pacific

[19] Marc Bacchetta et al., "The Role of Trade in Adapting to Climate Change," in *World Trade Report 2022: Climate Change and International Trade* (Geneva: WTO, 2022), 33, https://www.wto.org/.

[20] Kim Atkinson and Suki Dixon, eds., *Asia-Pacific Futures in 2040: Raising Ambitions for a Healthy Environment* (Bangkok: United Nations, 2021), https://www.unescap.org/.

[21] Françoise Nicolas, "The Regional Economic Order: Four Scenarios," *National Security College Futures Hub*, May 28, 2021, https://futureshub.anu.edu.au/.

[22] Deniz Barki and John Rogers, eds., *Review of Maritime Transport 2015* (Geneva: UN Conference on Trade and Development, 2015), https://unctad.org/.

and Indian Ocean coasts. Additionally, more than half of the global maritime trade in petroleum passes through the Indian Ocean alone.[23] As the region continues to play a pivotal role in global trade and economic growth, addressing the impacts of climate change on maritime trade becomes imperative for sustaining the prosperity and stability of the Indo-Pacific.

Maritime transport, encompassing the conveyance of goods and passengers by seafaring vessels on journeys conducted wholly or partially at sea, stands as a cornerstone of the global economy. Despite its pivotal role, the maritime sector is implicated in contributing to global warming through its carbon emissions, accounting for approximately 3 percent of the world's CO_2-equivalent emissions.[24] Nonetheless, when juxtaposed with land and air transport, maritime transport emerges as the most economically efficient method for the global distribution of goods. More than 90 percent of globally traded goods are transported by sea, and maritime trade volumes are projected to triple by 2050, as reported by the Organisation for Economic Co-operation and Development.[25] However, this vital trade sector faces increasing challenges due to the escalating impacts of extreme weather events, exacerbated by climate change. The frequency of Category 3 to 5 cyclones has risen by approximately 5 percent per decade since 1979, with storms causing significant disruptions, such as the loss of 80 ships out of 400 between 2015 and 2019.[26] In 2019, bad weather accounted for one in five ship losses, indicating the severity of the problem.[27] The consequences of extreme weather are far-reaching, causing missed port calls, delayed arrivals, and financial losses, with an estimated USD 54.5 million lost in the first four months of 2021 alone due to containers falling overboard.[28]

Seaports are susceptible to significant disruptions from extreme weather, facing vulnerabilities such as flooding, waves, and winds due to their geographical locations. The occurrence of storm surges and "flood" tides can adversely affect the loading and unloading of cargo, causing delays and longer journey times. Extensive

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[23] Michael J. Green, "China's Maritime Silk Road: Strategic and Economic Implications for the Indo-Pacific Region," *CSIS*, 2 April 2018, https://www.csis.org/.

[24] George Zittis et al., "Maritime Transport and Regional Climate Change Impacts in Large EU Islands and Archipelagos," *Euro-Mediterranean Journal for Environmental Integration* 8 (May 2023): 441–54, https://doi.org/.

[25] "Ocean Shipping and Shipbuilding," *The Ocean* (blog), n.d., https://www.oecd.org/.

[26] Hans Vermij, "Is Climate Change Altering Trade Routes around the World?," *International Trade Magazine*, 19 January 2023, https://intrademagazine.com/.

[27] "Shipping Losses at Record Low, but Covid-19 Impact and Political Tensions Cloud the Horizon," *Allianz*, 15 July 2020, https://commercial.allianz.com/.

[28] Natalie Marchant, "How Climate Change is Impacting Shipping and Maritime Trade," *Wärtsilä*, 16 March 2022, https://www.wartsila.com/.

economic harm arises from direct damage to infrastructure and disruptions in interconnected global supply chains, particularly in regions affected by TCs and associated storm surges and waves. An illustrative case is Hurricane Sandy in 2012, where losses exceeded USD 62 billion in New Jersey, New York, and Connecticut.[29] This event led to significant damage and a week-long closure of the container port in and around New York and New Jersey. Additionally, these conditions contribute to heightened bunker consumption, adding further strain to the maritime sector. Heightened vulnerability to coastal flooding will assess the robustness of port infrastructure and operations, potentially disrupting the loading, unloading, and movement of goods. This impact extends to transportation and communication networks, industrial areas, housing, and sanitation systems. Alexander Eslava Sarmiento outlines the risks associated with climate change on infrastructures and details the resulting side effects. These include the degradation of materials, foundations, and structures due to shifts in groundwater, increased temperatures, or intensified rains and winds. Heatwaves may necessitate increased energy use to cool cargo stored in ports. He also emphasizes limitations in vessel maneuverability, docking, loading, and unloading operations during strong winds, challenges for port personnel working outdoors on hot days, reduced visibility due to rainfall (especially during storms), leading to delays in berthing and cargo handling operations. Additionally, limitations in approach maneuvers due to wave height and constraints on port operations due to flooding are highlighted. Sarmiento underscores that since seaports operate as part of intricate transportation, logistics, and supply-chain systems, any weather-related disruptions to them have broader implications for the resilience of the global economy.[30] Furthermore, as the Paris Agreement's 1.5^0C ceiling appears challenging to achieve, the maritime sector faces potential disruptions and the need to adapt to new trade routes. Ports, numbering over 3,700 globally, must grapple with the dual challenge of SLR and storm threats, necessitating resilient designs and reinforced weather monitoring systems. The interconnected nature of these challenges was evident in the 2003 Typhoon Maemi's impact on Busan, South Korea, illustrating the cascading effects of climate change on both ports and inland infrastructure.[31]

Climate-related risks present increased vulnerability for maritime transport, particularly as rising sea levels directly jeopardize port operations. Moreover, alterations in precipitation patterns affect the sustainability of vital shipping hubs

[29] Asariotis, "Climate Change Impacts on Seaports."

[30] Alexander Eslava Sarmiento, "El Cambio Climático Global y Su Impacto en los Puertos Marítimos," *Pórticolive*, August 2022, https://www.puertocartagena.com/.

[31] Vermij, "Is Climate Change Altering Trade."

and passages. A noteworthy instance is the Panama Canal, facilitating about 6 percent of worldwide maritime trade.[32] Its reliance on freshwater availability for operational purposes makes it highly prone to fluctuations in precipitation and periods of drought. Approximately 1,000 vessels navigate through the Panama Canal every month, transporting more than 40 million tons of goods, constituting roughly 5 percent of the total global maritime trade volumes.[33] However, due to the most severe drought in the canal's 143-year history, water levels in this crucial link between the Atlantic and Pacific oceans have declined to precarious lows. Furthermore, rising sea levels, a consequential outcome of climate change, can have multifaceted impacts on trade. Elevated sea levels may render certain ports inaccessible, necessitating substantial investments in infrastructure for adaptation. Conversely, it could unveil new routes previously too shallow for sizable cargo ships, potentially reshaping global trade networks and carrying significant economic implications.[34]

The interconnectivity of global value chains shaping the current international trade system amplifies the impact of disruptions in key locations on the global economy. This poses a particular challenge when disasters impact regions that manufacture unique and difficult-to-replace goods, as exemplified by the disruption of electronics parts production during the Thailand floods in 2011.[35] These factors significantly affect the trade of food products and manufacturing sectors, especially those relying on climate-sensitive agricultural inputs. Moreover, economies in sub-Saharan Africa and South Asia, heavily dependent on agricultural exports with a substantial workforce in this sector, face a disproportionate level of vulnerability. Concerns about food insecurity, intensified by climate change, might prompt countries to limit crop exports during stressful periods, as demonstrated by India's decision to ban wheat exports in May 2022 to secure national food security during a heatwave.[36] Furthermore, the impact of climate change, leading to acidification and ocean warming, is negatively affecting fisheries. This has consequences for the trade of ocean-related products and food security, particularly impacting the lives

[32] Danae Kyriakopoulou, Georgina Kyriacou, and Natalie Pearson "How Does Climate Change Impact on International Trade?," Grantham Research Institute on Climate Change and the Environment, 12 June 2023, https://www.lse.ac.uk/.

[33] Serkan Arslanalp et al., "Climate Change is Disrupting Global Trade," *IMF Blog*, 15 November 2023, https://www.imf.org/.

[34] George Zittis et al., "Maritime Transport and Regional Climate Change Impacts."

[35] Shamika Sirimanne and Jerry Velasquez, eds., *Reducing Vulnerability and Exposure to Disasters: The Asia-Pacific Disaster Report 2012* (Bangkok: UN Economic and Social Commission for Asia and the Pacific, 19 October 2012), https://www.unisdr.org/.

[36] Santosh K. Singh, "India Bans Wheat Exports Due to Domestic Supply Concerns" (attaché report, US Department of Agriculture, 19 May 2022), https://apps.fas.usda.gov/.

of rural, small-scale fishermen and individuals engaged in food supply chains. Moreover, rising temperatures contribute to increased trade costs by elevating cooling expenses in storage facilities.

The heightened frequency of flood tides is anticipated to have a substantial impact on the processes of loading and unloading cargo. This phenomenon is expected to bring about challenges attributed to both elevated tide levels and increased instances of flooding. As these occurrences become more frequent, the difficulties in cargo handling are likely to escalate, introducing notable impediments in maritime operations. In certain instances, adjustments to port infrastructure may be necessary to accommodate higher water levels. On the other side, the diminishing sea ice is opening fresh opportunities for trade routes in certain regions and seasons that were previously impassable. The feasibility of the Northern Sea Route is growing, significantly cutting down the time and fuel needed for transportation from the Canadian Maritimes and/or northern Europe to the Far East, thereby influencing conventional maritime routes.[37] Additionally, with the evolution of weather patterns, ice melting, and temperature increases, these alterations have consequences for ocean currents. Although local winds mainly propel most surface ocean currents, the strengthening and more frequent occurrence of storms lead to more robust yet potentially more unpredictable surface ocean currents. The deep-water currents, guided by variations in density, are similarly impacted as the influx of melted ice introduces more fresh water into the ocean, inducing density shifts that influence worldwide current patterns. These alterations in ocean currents can subsequently induce further changes in weather patterns, which adversely affect maritime trade. While it may not be the primary concern for those navigating the seas, shifts in marine life induced by climate change could eventually influence decisions on maritime routes. This is because certain regions might be identified and designated as restricted areas to safeguard delicate ecosystems. As climate-driven alterations in marine ecosystems continue, considerations about preserving biodiversity and mitigating environmental impact may increasingly factor into the planning and selection of optimal sea routes. The evolving dynamics of marine life due to climate change could introduce a new layer of complexity in route planning, prompting a balance between economic interests and environmental conservation efforts. Additionally, the gradual rise in drought and desertification may contribute to an upsurge in sand and dust storms, posing challenges for navigation. Further, by 2050, extreme heat events reaching 45°C are projected to double, and by 2100,

[37] Keith Wagner, "Climate Change and Shipping," *Maritime Executive*, 15 March 2021, https://maritime-executive.com/.

they could increase sevenfold.[38] The repercussions of high temperatures encompass alterations in sea salinity and density, impacting engine cooling on ships. Simultaneously, drier soil conditions may heighten the likelihood of sandstorms, posing a potential threat to visibility.

Beyond the physical repercussions of weather and climate hazards, anticipated socioeconomic effects are expected to ensue. These effects may include heightened risk perceptions among users, leading to reduced rates of moorings and turnover, elevated costs for the maintenance of nautical installations and equipment, increased expenses for new investments and insurance, the influence of carbon taxes on fossil fuel prices, diminished turnover from maritime transport activities, and escalated disruption costs.[39] A recent report underscores the vulnerability of the global shipping and port industry to substantial infrastructure damage and trade disruptions from climate-change impacts. RTI International crafted the report *Act Now or Pay Later: The Costs of Climate Inaction for Ports and Shipping* for the Environmental Defense Fund, analyzing climate-related disasters and forecasting potential industry damages and its financial impact. Absent ambitious emissions reduction measures, climate-change impacts could impose annual costs of up to USD 25 billion on the shipping industry by the century's end. Based on historical consequences and predicted climate-change scenarios, the report projects that extra annual costs to port infrastructure could reach almost USD 18 billion by 2100.[40] Additionally, storm-related disturbances may contribute an extra USD 7.5 billion annually. These numbers represent the financial setbacks encountered by shippers, shipping clients' carriers, and ports due to closures.

Furthermore, climate change has the capacity to shape the dynamics of great-power competition in the Indo-Pacific. Major players like China, the United States, and others are engaged in a struggle for regional influence, focusing on trade, military prowess, and political sway. The competition becomes more intricate with the impact of climate change, introducing an additional dimension as nations vie to control resources and exert influence over vulnerable communities, some of which may be exploited. This competitive environment also hampers collective efforts to tackle climate change, as certain countries prioritize economic development over environmental conservation. Recognizing this, all countries in the region and

[38] "Key Shipping Routes at Risk from Climate Change Disruption, Report Finds," *Maritime Gateway*, 16 November 2022, https://www.maritimegateway.com/.

[39] Carmelo J. Léon et al., *Downscaling climate change impacts, socio-economic implications and alternative adaptation pathways for islands and outermost regions* (Madrid: McGrawHill, 2021).

[40] George Van Houtven et al., *Act Now or Pay Later: The Costs of Climate Inaction for Ports and Shipping* (Research Triangle Park, NC: RTI international, March 2022) https://www.edf.org/.

beyond have a role to play in ensuring the stability and sanctity of the region. Additionally, climate change is expected to compel approximately 45 percent of fish stocks traversing multiple exclusive economic zones to significantly shift their historical habitats and migration paths by 2100, potentially escalating into international conflicts.[41] This displacement of fish due to climate change may drive fishers, who traditionally relied on these stocks, toward engaging in illegal, unreported, and unregulated (IUU) activities for sustenance and income, potentially leading to an uptick in the scale and sophistication of organized crime related to fishing.[42] Alterations in ocean temperatures, currents, and sea levels from climate change affect fish distribution and abundance, intensifying resource competition and fostering illegal fishing practices, ultimately contributing to overfishing. Vulnerable communities displaced by climate change become more susceptible to exploitation by transnational criminal organizations (TCO) engaged in IUU fishing. Both TCOs and China play significant roles in IUU fishing, leading to the depletion of fish stocks, environmental harm, and economic impacts across the Indo-Pacific and globally.[43] China's involvement in the global fishing industry, including IUU fishing through its domestic and distant water fleets, further underscores the importance of addressing IUU fishing to mitigate the broader impacts of climate change in the Indo-Pacific region.

Sustainable Solutions for Indo-Pacific Maritime Trade

Given the current climate-change scenario, a less optimistic outlook emerges for the Indo-Pacific region by 2040. As previously discussed, the repercussions of climate change on maritime trade are poised to indiscriminately impact the strategic and economic interests of both developed and developing nations. Considering the significant relevance of the Indo-Pacific region for the economic stability and prosperity of countries within and beyond, it becomes imperative to proactively implement measures to mitigate the adverse effects of climate change. This proactive approach is crucial for shaping a more favorable future for international trade in the Indo-Pacific by 2040.

To address the challenges posed by climate change on maritime trade, a multifaceted approach is essential. Firstly, governments should play a pivotal role by

[41] "Nearly half of countries' shared fish stocks are on the move due to climate change, prompting dispute concerns," *ScienceDaily*, 18 January 2022, https://www.sciencedaily.com/.

[42] Kevin He and Gina Fiore, "New report predicts how climate change and illegal fishing could threaten global ocean," *Pew*, 10 April 2023, https://www.pewtrusts.org/.

[43] Joseph Green et al., *Indo-Pacific 2050 climate change impact analysis: anticipating climate change impacts to enhance climate security across the region* (Kihei, HI: Pacific Disaster Center, 2023), https://www.cfe-dmha.org/.

setting regulatory standards and offering financial incentives to encourage the adoption of greener technologies in shipping, such as cleaner fuels, electric or hybrid engines, and energy-efficient measures. The development and deployment of new technologies aiming to enhance fuel efficiency, explore alternative, less carbon-intensive fuels, integrate renewable energy sources such as wind or solar power, and implement operational procedures to minimize fuel consumption and carbon emissions is highly significant.

Further, investing in climate-resilient maritime infrastructure is equally crucial to mitigate disruptions caused by extreme weather events. This includes modifying port infrastructure to manage rising sea levels, altering routes to avoid adverse weather conditions, and enhancing equipment resilience to withstand extreme weather events. Emission reduction strategies, such as enforcing caps on emissions and supporting research into cleaner propulsion technologies, are imperative. Additionally, policies should facilitate the shipping industry's transition to low-carbon alternative fuels, such as hydrogen or ammonia. Encouraging "green ports" through policies promoting renewable energy use and waste recycling further contributes to sustainability.

Moreover, financing and investment play a pivotal role in realizing these changes, particularly in resource-constrained developing countries. This entails a global commitment to investment through mechanisms like public sector funding, private investment, and financial instruments such as carbon pricing or green bonds to incentivize capital flows toward low-carbon maritime solutions.

Further, in addressing the evolving challenges in the Indo-Pacific region by 2040 due to climate change, the military plays a pivotal role. A critical aspect of this role involves providing essential support during natural disasters, encompassing the evacuation of affected populations, delivery of emergency supplies, and the reconstruction of vital infrastructure. Given that climate-induced resource scarcity may escalate tensions, military engagement extends to peacekeeping and stability operations aimed at preserving or restoring peace in vulnerable areas.[44]

Additionally, militaries contribute to infrastructure adaptation initiatives, safeguarding crucial services and assets against climate-related damages, such as fortifying structures against extreme weather events. Beyond reactive measures, the military plays a proactive role in building the resilience of local communities and strengthening institutions, thereby enhancing their capacity to withstand environmental disruptions. Furthermore, military involvement in environmental peace-

[44] Shirley V. Scott and Shahedul Khan, "The implications of climate change for the military and for conflict prevention, including through peace missions," *ASPJ Africa & Francophonie* 7, no. 3 (2016): 82–94, https://www.airuniversity.af.edu/.

building endeavors helps mitigate conflicts over resources, fostering sustainable management and cooperative utilization of natural assets.

Moreover, given the global nature of the issue, collaborative international efforts, facilitated through organizations like the United Nations, are essential to enact policies at an international level. Cross-sector collaboration and cooperation emerge as essential components in this collective effort. Engaging stakeholders from the maritime industry, governments, research institutes, and international communities fosters the identification and implementation of effective climate-change adaptation and mitigation measures. This collaborative approach ensures a holistic and impactful response to the challenges posed by climate change in the maritime sector. It is crucial to develop parallel strategies, focusing on emission reduction and adaptation measures in coastal territories and port areas, involving substantial investments in technology and infrastructure to navigate the challenges posed by climate change.

Conclusion

In conclusion, the envisioned landscape of the Indo-Pacific region in 2040 presents a complex tapestry of challenges and opportunities shaped by the intricate interplay of climate change and maritime trade dynamics. As global temperatures rise and sea levels follow suit, the ramifications for the critical maritime arteries threading through this vast region are profound. The climate-induced transformations forecasted for 2040 carry significant implications for the strategic interests of major global powers, echoing the urgent need for comprehensive analysis and proactive measures. The projections for SLR, extreme weather events, and the shifting patterns of ocean currents in the Indo-Pacific portend a future where the resilience and adaptability of maritime trade routes become paramount.

The anticipated increase in the frequency and intensity of TCs, coupled with rising sea levels, poses substantial challenges to coastal infrastructure and navigation. These challenges, in turn, reverberate through the global trade network, impacting the stability and efficiency of maritime trade, which constitutes a lifeline for economies across the globe.

The economic significance of the Indo-Pacific region, hosting major players like the United States, China, and Japan, further amplifies the need for strategic foresight and proactive adaptation. As the maritime sector faces heightened exposure to climate-related risks, it is imperative to prioritize sustainable practices, green technologies, and climate-resilient infrastructure. Governments, in collaboration with international organizations, must spearhead efforts to enforce regulatory standards, incentivize the adoption of eco-friendly technologies, and invest in the resilience of maritime infrastructure.

Moreover, the interconnected nature of global value chains emphasizes the cascading effects of disruptions, underscoring the importance of a comprehensive understanding of how climate-induced shifts may impact the future landscape of maritime trade. The projected socioeconomic effects, ranging from increased costs to reduced turnover and heightened risk perceptions, necessitate a multifaceted approach that spans regulatory, technological, and international cooperation fronts.

In the face of this climatic uncertainty, the imperative for immediate and sustained climate action cannot be overstated. The envisioned challenges are formidable, and their repercussions extend far beyond the confines of the Indo-Pacific. The window of opportunity to mitigate these challenges and adapt to the evolving climate reality is narrowing. The choices made today will resonate through the maritime trade routes of tomorrow, shaping the trajectory of global economic interdependence.

The call to action is clear—a collaborative and forward-looking approach is essential to navigate the stormy seas of climate change and secure a sustainable and resilient future for maritime trade in the Indo-Pacific and beyond. ✪

Anadi

Ms. Anadi is a research associate at Centre for Air Power Studies (CAPS), New Delhi, India. She is working on a book project tentatively titled *Non-Traditional Security Threats in South Asia: Challenges for India*. Her areas of interests are traditional and nontraditional security threats, peace and conflict studies, arms control and disarmament, Indian foreign policy, climate policy, and fragile states. She has completed her MPhil from Diplomacy and Disarmament division, Centre for International Politics, Organization and Disarmament (CIPOD), School of International Studies, Jawaharlal Nehru University, New Delhi. She completed her master's in politics with specialization in international studies from the School of International Studies, Jawaharlal Nehru University, New Delhi. She was also a recipient of a junior research fellowship for completing her MPhil dissertation. Contact at anadichoudhari@gmail.com.

VIEW

Climate Change and Food Security in the Indo-Pacific

Challenges and Opportunities

Ameya Kelkar

Abstract

The Indo-Pacific region hosts approximately one-quarter of the world's population, predominantly comprised of developing nations. Despite developmental strides, all nations in the region grapple with fundamental challenges concerning public health and well-being. This predicament is further exacerbated by the adverse impacts of climate change. This article examines the ramifications of climate change on the escalating issue of food insecurity in the Indo-Pacific. Additionally, it proposes solutions aimed at fostering a cooperative framework among Indo-Pacific nations to address this challenge collectively. The central thesis underscores the national security imperatives of implementing mitigation measures in food security, emphasizing the manifold advantages such a collaborative framework can offer to individual national security architectures.

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The twenty-first century world is intricately interconnected, where events in one region exert both direct and indirect influences on others. These interconnections pervade all aspects of society, spanning social, cultural, economic, and military domains. While this interconnectivity has fostered heightened levels of prosperity, it has also exacerbated existing societal challenges and given rise to new ones. Terrorism, piracy, supply chain disruptions, and the impacts of contemporary warfare, though predominantly local or regional, reverberate globally. Among these challenges, climate change stands out, affecting all facets of human society. Also referred to as global warming, it is a pervasive global phenomenon transcending borders, regions, and ecosystems, irrespective of nations' economic and military prowess.

The severity of this challenge is amplified by the profound economic interdependence characterizing today's world. Regions rely on each other for essentials like food, utilities, labor, and human capital, driving development across all metrics. Whether supplying vital food grains to nations grappling with poverty, furnishing critical electronics to technologically advanced nations, or delivering weaponry to maintain military efficiency, global development owes much to these economic networks. Any disruption, whether natural or man-made, threatens to destabilize

millions. The impact of the Russian invasion of Ukraine on oil and wheat prices serves as a stark illustration of this reality.

The Indo-Pacific, crucial for global development, warrants particular attention due to its diverse factors complicating both problems and solutions. Home to over a quarter of the world's population and spanning vital trade routes between two oceans, the region holds significant importance for all societies. Climate change poses an outsized threat to the Indo-Pacific, with sea-level rise, extreme weather events, and associated challenges disproportionately affecting economically and geographically vulnerable nations in the region.[1] Moreover, its relatively non-industrialized status, coupled with food and energy insecurity, low interconnectivity, and developmental disparities, magnifies the impact of climate change and exacerbates existing dilemmas. Addressing these challenges should be a primary consideration in the strategic calculus of nations, recognizing that the region's development is intertwined with global progress.

This article aims to analyze the impact of climate change on food security in the Indo-Pacific. Its objective is to underscore the national security imperatives of establishing resilient networks to address food insecurity, outlining fundamental measures nations can adopt. Given that food is essential for national sustenance and development, it is imperative for nations to fortify networks and measures to combat food insecurity, particularly in light of climate change and its enduring repercussions.

Food Security as a National Security Imperative

The availability of food is integral to a nation's development. Uninterrupted access to clean, nutritious food enables society members to pursue various socioeconomic advancements. Food security correlates with numerous positive outcomes for the general populace, including heightened standards of living and enhanced economic contributions.[2]

A nation's power is contingent upon the happiness of its populace and its capacity to positively impact its economy and security. Indicators such as food availability, levels of malnutrition and hunger, and food accessibility gauge the health of a population. Moreover, food security influences education levels, yielding a

[1] "Climate change in Asia and the Pacific. What's at stake?," *UN Development Programme*, 28 November 2019, https://www.undp.org/.

[2] Cristian Timmermann, "Food Security As a Global Public Good," in *Routledge Handbook of Food as a Commons*, ed., Jose Lius Vivero Pol et al. (New York: Routledge, 2019), 85–99.

greater pool of skilled laborers essential for a nation's security objectives.[3] This direct benefit extends to households, where access to food enhances saving potential for future needs, thereby increasing disposable income.[4] Consequently, families can contribute positively to the nation during their lifetime and potentially pass on these benefits to future generations.

Food security significantly impacts the readiness of a nation's Armed Forces. Effective military operations rely on the availability of adequate food supplies for personnel.[5] A balanced diet, rich in essential nutrients, also promotes soldiers' mental well-being, enhancing their operational effectiveness both on and off the battlefield.[6] Given that prepared service members form the cornerstone of a proficient military, ensuring a secure food supply is essential for developing and sustaining a nation's military infrastructure.

Consequently, it is imperative for nations to prioritize food security as a national security imperative. Regardless of a nation's power, effective functioning across all domains necessitates a steady and uninterrupted food supply to its citizens. Governments worldwide are addressing these concerns at the highest levels, with India exemplifying this approach by acknowledging and addressing issues of malnutrition and food insecurity.[7] Treating food security as a core national security concern ensures resilience against the indirect impacts of climate change on military infrastructure while fostering a productive and content populace capable of contributing meaningfully to national development.

Furthermore, ensuring food security is not only essential for maintaining citizen satisfaction and productivity but also for quelling discontent within a nation. Food insecurity has been linked to increased discontent and loss of trust in government.[8] When a nation fails to guarantee food security, its population becomes vulnerable

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[3] Michele McNabb, "The Impact of Education Across Sectors: Food Security. Policy Brief. Educational Quality Improvement Program" (policy brief, USAID, 2011), 6, https://www.epdc.org/.

[4] Andrée-Anne Fafard St-Germain and Valerie Tarasuk, "Prioritization of The Essentials In The Spending Patterns of Canadian Households Experiencing Food Insecurity", *Public Health Nutrition* 21, no. 11 (2018), 2070, https://doi.org/.

[5] Neil Hill et al., "Military Nutrition: Maintaining Health and Rebuilding Injured Tissue," *Philosophical Transactions of the Royal Society B: Biological Sciences* 366, no. 1562 (2011): 231–40, https://doi.org/.

[6] Kelly L. Forys-Donahue et al., "The Association Between Nutrition And Behavioural Health in A US Army Population," *Public Health Nutrition* 23, no. 17 (2020), 3063, https://doi.org/.

[7] Joseph R. Biden, "National Security Memorandum on Strengthening the Security and Resilience of United States Food and Agriculture," NSM-16 (memorandum, The White House, 10 November 2022), https://www.whitehouse.gov/; and Sunil Madan and Badri Narayanan Gopalakrishnan, "Food Security And National Security Of India," *Financial Express*, 27 March 2023, https://www.financialexpress.com/.

[8] Tilman Brück et al., *The Relationship Between Food Security and Violent Conflict* (Berlin: International Security and Development Center, 22 December 2016), 15, https://isdc.org/.

to recruitment or support of armed groups, often out of necessity to secure food sources from anti-government factions. This not only complicates efforts to combat rebel and insurgent elements but also burdens authorities with addressing internal dissent and distrust.

A food-secure nation can mitigate sources of discontent, fostering economic and societal development with greater security. Dissatisfaction with the government's ability to address food security challenges can manifest in various ways within the populace. Declining productivity in agricultural sectors due to climate events prompts those reliant on these industries to seek alternative livelihoods, often leading to rural-to-urban migration. This influx strains urban areas and exacerbates resource demands, intensifying competition and widening inequities.

Hence, nations, particularly those in the Indo-Pacific, must urgently address food security challenges. Given the multifaceted threats of the twenty-first century, particularly climate change, it is imperative to prevent food insecurity from compounding existing issues. Allowing food insecurity to persist will result in far-reaching and detrimental impacts on societal functioning.

Food Security in the Indo-Pacific—A Problem of Climate Change

The Indo-Pacific encompasses numerous developing nations, ranging from major powers like the Republic of India to smaller island nations such as the Maldives and Mauritius. Despite the diversity in economic, military, and geographic dimensions, these nations share fundamental challenges, particularly in the agricultural sector.

Several factors contribute to the underdevelopment of the agricultural sector in the region, including outdated infrastructure, limited public awareness of modern farming practices, and inadequate investment in agricultural development. For instance, India, despite its economic strength, still heavily relies on monsoon rains for agricultural water needs, a scenario common across many Indo-Pacific nations.[9] This reliance leads to underutilization of natural water resources like rivers and lakes. Moreover, persistent economic challenges have hindered investment in research and development of modern agricultural techniques, exacerbating issues of food scarcity, malnutrition, and hunger.

These challenges are poised to worsen in the face of climate change.[10] The region's reliance on traditional agricultural methods leaves it particularly vulnerable to the

[9] Nachiketa Acharya and Elva Bennett, "Characteristic of the Regional Rainy Season Onset over Vietnam: Tailoring to Agricultural Application," *Atmosphere* 12, no. 2 (2021): 198, https://doi.org/.

[10] Vincent Gitz et al., *Climate Change and Food Security: Risks And Responses* (Rome: Food and Agricultural Organization, 2015), 8, https://www.fao.org/.

impacts of climate change, including shifting rainfall patterns, increased frequency of droughts and floods, and extreme weather events affecting crop and livestock productivity.[11] Additionally, forests face declining productivity and soil degradation due to erosion caused by severe weather events.

The negative impacts of climate change extend beyond land-based agriculture to include fishing and aquaculture activities, which are significant components of agricultural output in the Indo-Pacific nations.[12] Climate change-induced phenomena such as extreme weather events and rising ocean temperatures adversely affect the reproductive patterns and quality of aquatic life in the Indian and Pacific oceans. These impacts are already evident in regions adjacent to the Indian Ocean, exemplified by the Sundarbans area in India. The Sundarbans, renowned for its ecological richness, faces challenges such as increased salinity due to saltwater intrusion, soil erosion, and heightened occurrences of cyclones, adversely affecting local livelihoods.[13]

The repercussions of climate change on the Sundarbans and its inhabitants' livelihoods reflect broader global trends. As agricultural workers predominantly hail from economically disadvantaged backgrounds, they bear the brunt of climate change impacts, exacerbating food insecurity and risking hunger and malnutrition. This vicious cycle perpetuates declining agricultural productivity, exacerbating food insecurity, diminishing human capacity for labor, and impeding regional development. This underscores the multifaceted threat of climate change, impacting biodiversity, crop production, and overall human health and productivity in the region.

Therefore, climate change demands serious attention to mitigate its most adverse effects, safeguarding vulnerable segments of society and economic sectors from its harshest impacts. Prioritizing the protection of these vulnerable groups enables the nation to address the diverse needs of its populace simultaneously. It ensures that any initiatives or programs aimed at benefiting the agricultural sector consider the wide array of segments that stand to gain from such endeavors.

Mitigation Measures—National Strategy

However, it is evident that in recent years, nations in the Indo-Pacific, particularly larger ones like India, have acknowledged this reality and taken proactive measures to prevent their countries from succumbing to the dangers of unprepared-

[11] Gitz et al., *Climate Change and Food Security*, 12–13.

[12] Gitz et al., *Climate Change and Food Security*, 12–13.

[13] Bimal Mohanty et al., "The Impact of Climate Change on Marine and Inland Fisheries and Aquaculture in India," in *Climate Change Impacts on Fisheries and Aquaculture: A Global Analysis*, vols. 1 and 2, ed., Bruce F. Philips and Mónica Pérez-Ramírez (Chichester, UK: Wiley Blackwell, 2018), 583–585.

ness in addressing food insecurity, regardless of its causes. India, in particular, has made significant strides in modernizing its agricultural sector through various government initiatives. These include programs aimed at enhancing crop and fisheries yields, as well as funding research and development of innovative agricultural techniques.[14]

Moreover, India's investments in social welfare programs and farmers' initiatives ensure the viability of those reliant on the agricultural sector, thereby ensuring food security for the nation. The government is also focused on improving auxiliary agricultural infrastructure by enhancing transportation facilities, irrigation systems, and integrating agricultural markets across the country for efficient food distribution.[15]

India is also fostering the adoption of current and emerging technologies in agriculture, facilitating the entry of the private sector and startups into the industry. This support extends to improved logistics, education, and research facilities.[16] While building necessary infrastructure poses challenges, consistent and well-planned investment remains a key driver for sectoral development. Consequently, India's agricultural exports have surged to record highs, enabling its products to reach global markets.

India serves as a notable example in demonstrating how nations are advancing the modernization of their agricultural sectors. Throughout the Indo-Pacific region, countries are implementing initiatives to enhance agricultural productivity within their borders. Even smaller nations like Vietnam have embarked on significant reforms, expanding cultivable land for both land-based agriculture and aquaculture activities. Measures such as crop diversification and the optimization of small farms have contributed to an overall increase in productivity.[17] Similarly, the Philippines, despite having less arable land compared to India, has facilitated private sector involvement in agricultural modernization efforts, enabling direct capital investment.[18]

These measures, aimed at enhancing the agricultural sector, will also directly contribute to its resilience to climate change. Given that the sector and its workforce

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[14] "10 Important Government Schemes in Agriculture Sector," *India Today*, 30 August 2019, https://www.indiatoday.in/.

[15] Press Information Bureau, "Achieving Aatmanirbharta in Agriculture," Ministry of Agriculture and Farmers Welfare–Government of India, 11 November 2022, https://pib.gov.in/.

[16] *Gearing up to Solve Food Security Challenges: Building Agritech Ecosystem for the Global South UNCDF and Atal Innovation Mission* (New Delhi: UNCDF and Atal Innovation Mission, NITI Aayog, April 2023), https://niti.gov.in/.

[17] *Transforming Vietnamese Agriculture: Gaining More for Less*, Report No. AUS15856 (Washington, DC: World Bank Group, 29 April 2016), https://documents1.worldbank.org/.

[18] "FROM PHILSTAR: DA Sets Massive P2.5 Trillion Plan To Modernize Philippine Agriculture" (press release, Department of Agriculture, Government of The Philippines, 5 May 2022), https://www.da.gov.ph/.

are particularly vulnerable to the adverse effects of climate change, investment in programs to support those dependent on agriculture for their livelihoods is essential for fostering a robust agricultural labor force both now and in the future. Moreover, by investing in the modernization and efficiency improvement of the agricultural sector, the nation can achieve a level of food security that is resilient to climate change, both presently and in the future, by establishing and maintaining climate-resilient agricultural infrastructure.

These localized efforts will not only boost revenue across various sectors within the nations but also stimulate economic growth beyond agriculture. The modernization of the agricultural sector necessitates inputs in terms of materials, labor, and innovation, while also laying the groundwork for robust infrastructure and economic foundations that can support broader regional initiatives.

Mitigation Measures—Multilateralism

Investment and collaboration between the public and private sectors are crucial not only at the national level but also internationally. Recognizing climate change as a common threat to humanity necessitates the adoption of a similar spirit of cooperation at the international level, fostering multilateral networks to facilitate resource and knowledge sharing among nations. Such initiatives not only provide access to a wealth of resources and expertise but also cultivate a spirit of cooperation and solidarity within a diverse and disparate region.

To this end, multilateral institutions in the Indo-Pacific region have acknowledged this imperative and launched numerous programs, both bilaterally and multilaterally, to establish networks aimed at improving food security. These initiatives range from efforts to enhance cereal food production efficiency to the establishment of food banks and reserves for all SAARC-affiliated nations to draw upon during periods of declining productivity. Some of these initiatives have been in place for decades.[19] Other multilateral platforms, such as the G20, have also emphasized the importance of enhancing food security in the region and have taken steps to address it.[20]

The Quadrilateral Security Dialogue, or Quad, is another multilateral grouping actively engaged in mitigating the adverse effects of climate change and assisting communities in adapting to these changes. While member nations have demon-

[19] Md Saidul Islam and Edson Kieu, *Climate Change and Food Security in Asia Pacific: Response and Resilience* (Cham: Springer Nature, 2021), 81–90.

[20] Shoba Suri, "G20 Agenda For Improved Food Security Under India's Presidency," *Observer Research Foundation*, 24 April 2023, https://www.orfonline.org/.

strated their commitment through declarations, the organization has yet to see any agreements ratified by its members.[21]

One of the primary challenges faced by multilateral initiatives is the issue of uneven implementation.[22] Despite their well-designed nature, these initiatives often fail to address the challenge of implementation by all participating parties. Initiatives proposed by institutions such as the SAARC, for instance, require ratification by each individual nation, necessitating political will within each nation to incorporate these initiatives into actionable policies. Additionally, due to the lack of enforcement mechanisms and legal obligations, many nations merely agree to these initiatives on paper, seldom translating them into practice. Consequently, the potential benefits of these initiatives remain untapped, resulting in a dearth of resolutions and solutions for nations to adopt and utilize.

Moreover, countries within the Indo-Pacific region have a history of conflict and deep-seated divides, fostering a fundamental distrust among them. This lack of trust hampers diplomatic channels necessary for fostering an environment of knowledge sharing and cooperation in climate change resilience building.[23] The SAARC is particularly affected by this lack of trust, as member nations like India and Pakistan harbor longstanding suspicions and animosities due to their turbulent histories marked by ethnic and religious violence.

This erosion of trust has also contributed to the gradual decline of multilateral institutions in the region, as these organizations have become increasingly irrelevant. The failure of most agreements to transition from paper to practice is a significant reason why the common citizen sees little value in these organizations. In an environment of low trust, the Quad has emerged as a player in multilateral cooperation. However, the Quad faces its own set of challenges, stemming from the prevailing environment and the manner in which the organization was established. Initially formed as an economic partnership to counter China's influence, the Quad struggles with issues of commitment and a lack of focus among its members regarding their strategic priorities.[24] This lack of focus undermines efforts to create actionable agreements and frameworks for addressing food insecurity in the region.

Thus, while initiatives and measures exist on paper, their lack of implementation has prevented many of their potential benefits from being realized. A combination

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[21] "Quad Leaders' Joint Statement" (press release, Ministry of External Affairs, Government of India, 20 May 2023, https://www.mea.gov.in/.

[22] Islam and Kieu, *Climate Change and Food Security in Asia Pacific*, 90–94.

[23] Joyeeta Bhattacharjee, "SAARC vs BIMSTEC: The Search for the Ideal Platform for Regional Cooperation," Issue Brief No. 226, *Observer Research Foundation*, 17 August 2023, https://www.orfonline.org/.

[24] Anshita Shukla and Arun Sahgal, "Assessment of Quad's Effectiveness: An Indian Perspective", *AsiaLink* (blog), 17 May 2023, https://asialink.unimelb.edu.au/.

of factors, including a lack of political will, vague organizational objectives, inadequate international enforcement mechanisms, and histories marked by mutual animosity, hinders the development of the Indo-Pacific into a region where bilateral discord and distrust do not dictate potentially irreversible outcomes. This consequently leads to nations outside the region, such as the United States, often intervening to assist during crises when regional powers fail to do so.[25] This lack of interconnectedness among nations, stemming from various factors, disproportionately impacts the people of the region, subjecting them to the harshest consequences of such decisions.

Climate change, as a devastating phenomenon, disregards borders and societies in its impact on human activity. To effectively mitigate this multinational and multisectoral threat in the years ahead, Indo-Pacific nations must set aside short-term geopolitical grievances and collaborate in a spirit of cooperation. Cooperation between nations, when dealing with problems of global proportions, is not entirely unprecedented. One of the prime examples of multilateral efforts yielding undoubtedly positive results is the eradication of diseases such as smallpox. Smallpox, one of the world's deadliest diseases, ravaged communities, sparing no one, regardless of socio-economic standing or authority within the nation, with many world leaders having contracted the disease over the span of human history.[26] The formation of the World Health Organization (WHO) following the end of World War II saw the global eradication of the disease taking center stage in multilateral efforts. Despite challenges such as funding and commitment from nations in enforcing the Smallpox Eradication Programme of 1959, the Intensified Eradication Programme of 1967 saw member states wholly committing to solving this global health problem.[27] This resulted in many developed nations, primarily the US and the former Union of Soviet Socialist Republics (USSR), delivering large stockpiles of vaccines to the developing and decolonizing world, while also encouraging localized outbreak reporting through crowdsourcing information.[28] Thus, it is evident that multilateral efforts aimed at a single, enforceable purpose have had major success in making the world a better place for all to live. Other examples of such multilateral cooperation to solve problems affecting humanity include the Montreal

[25] Associated Press, "Donors Offer Over $9 Billion For Pakistan After Devastating Floods," *The Hindu*, 10 January 2023, https://www.thehindu.com/.

[26] Frank Fenner et al., "The History of Smallpox and Its Spread around the World," in *Smallpox and Its Eradication* (Geneva: WHO, 1988), 209–43, https://biotech.law.lsu.edu/.

[27] "History of Smallpox," Centers for Disease Control and Prevention, 20 February 2021, https://www.cdc.gov/.

[28] James Haynes and Cheng Li, "The US cooperated with the Soviets on smallpox – it should do the same with China on COVID-19 vaccine distribution," *Brookings*, 27 August 2020, https://www.brookings.edu/.

Protocol, which saw nations collaborating and enforcing agreed-upon protocols to work towards reducing air pollution globally.[29] The enforcement of this protocol led to the reduction of the hole in the ozone layer, further highlighting the successes such multilateral initiatives can achieve.

It is thus important that the world takes note of such success stories in their ideation of multilateral efforts to mitigate the problem of climate change.[30] Climate change, being a phenomenon that does not adhere to borders when affecting populations, will require efforts on a similar scale, as domestic solutions undertaken unilaterally will be wholly incomplete in addressing this problem. As humans across borders will have to bear the brunt of climate change as a civilization, it is imperative that world leaders realize that short-term geopolitical concerns and domestic politics are unimportant when facing an existential threat such as climate change.

Working on mitigating climate change through multilateral frameworks offers several advantages. First, it ensures that no single nation bears the entire economic burden of climate change mitigation. By sharing resources and knowledge transparently and accountably, with each party having access to the same knowledge base and funding streams, all nations can address the challenge of mitigating this existential threat without concerns about financial constraints or technical expertise. As demonstrated by the smallpox eradication efforts, larger nations must collaborate with smaller ones and freely disseminate necessary knowledge and resources, providing assistance when needed. This sharing of resources can also provide governments with more resources to enhance their capacities in other sectors of the economy, furthering efforts to develop resilient and adaptable infrastructure for the benefit of their domestic economies.

Moreover, multilateral initiatives require continuous public support and consensus among various stakeholders in mitigating the civilizational threat of climate change.[31] These initiatives have the dual advantage of engaging stakeholders from around the world while fostering consensus among the general public regarding the benefits of multilateralism in their daily lives. Establishing such frameworks not only promotes a more positive perception of the importance of multilateral

[29] "Thirty years on, what is the Montreal Protocol doing to protect the ozone?," UN Environmental Programme, n.d., https://www.unep.org/.

[30] Signe Krogstrup and Maurice Obstfeld, "A Planet at Risk Requires Multilateral Action," *IMF Blog*, 3 December 2018, https://www.imf.org/.

[31] Omar O. Dumdum, "The Public's Role in Politicizing International Issues: Why Multilateralism Needs to Take Public Opinion More Seriously," *Global Perspectives* 3, no. 1 (2022): 57706, https://doi.org/.

institutions and frameworks but also ensures that solutions to issues affecting humanity as a whole emerge from the diverse populations invested in mitigation efforts.

Conclusion

In conclusion, the multifaceted impact of climate change underscores its significance as a pressing concern for nations worldwide, both presently and in the future. Among the myriad issues requiring attention in climate change mitigation efforts, the agricultural sector stands out as a pivotal area of focus, particularly for nations in the Indo-Pacific region. Given the region's heavy reliance on agriculture as an economic driver and a primary source of sustenance for its populace, safeguarding this sector against the adverse effects of climate change is of paramount importance.

Nations in the Indo-Pacific are actively engaged in efforts to modernize their agricultural sectors, implementing comprehensive reforms aimed at enhancing productivity and resilience. Through a combination of domestic, bilateral, and multilateral initiatives, positive strides are being made to mitigate the impact of climate change on food availability. However, progress on bilateral and multilateral fronts is often hindered by diplomatic challenges and shortcomings in legal enforcement mechanisms.

These obstacles, rooted in institutional complexities and intergovernmental dynamics, underscore the critical need for trust-building among nations to foster effective collaboration towards common objectives. While addressing these issues will undoubtedly require time and concerted effort, they must not impede the Indo-Pacific's journey towards becoming a region capable of withstanding the worst effects of climate change and serving as a model of cooperative development for the world.

It is imperative for nations in the region to recognize that individual efforts to mitigate climate change's impact on their agricultural sectors will yield limited results unless accompanied by coordinated action from neighboring countries. This necessitates the cultivation of a spirit of trust and shared commitment to multilateralism and cooperation in addressing food security challenges. Pursuing these objectives represents the path towards realizing unrestrained prosperity and collective well-being for the people of the Indo-Pacific and beyond. ✪

Ameya Kelkar

Mr. Kelkar is a research assistant with the Centre for Land Warfare Studies, New Delhi, India. He previously served as a research assistant with the Observer Research Foundation. He holds master's degrees in global peace, security, and strategic studies (Savitribai Phule Pune University) and a postgraduate degree in history (SOAS University of London).

China's Weaponization of Water in Tibet

A Lesson for the Lower Riparian States

Neeraj Singh Manhas
Dr. Rahul M. Lad

Abstract

Tibet, dubbed "Asia's water tower," boasts eight major transboundary river systems, including the Brahmaputra, Indus, and Mekong rivers, vital to three billion people in South and Southeast Asia. As an upper riparian state, China has contemplated dam construction and river diversion since 1989. Driven by internal economic motives and aspirations for regional dominance, China seeks to control water flow, impacting lower riparian states such as India, Bangladesh, Nepal, Bhutan, Myanmar, Thailand, Cambodia, Laos, and Vietnam. With approximately 87,000 dams built, China poses a historic threat, having already dammed most internal rivers. This article examines China's potential weaponization of Tibetan water, offering insights for lower riparian states to prepare for contingencies and devise long-term strategies.

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Water, an essential resource sustaining life, plays a crucial role in the economic development of nations. The management and control of water resources have often sparked contention among riparian states, fueling diplomatic tensions and conflicts. In recent years, China's strategic maneuvers in Tibet, particularly its weaponization of water resources, have heightened concerns among lower riparian states in South Asia and Southeast Asia. China's Tibet Autonomous Region harbors the largest reserve of fresh water outside the North and South Polar Regions, supplying water for approximately 20 percent of the world's population. Because of this, it is often referred to as the Third Pole of the planet.[1]

The most critical river basins, formed by rivers originating from the Tibetan plateau and the Himalayas, include the Ganges–Brahmaputra–Meghna basin, the Indus basin, and the Mekong basin. Almost all these basins, including the Brahmaputra, the Indus, and the Mekong, are transboundary in nature. The exceptions are the Yangtze and the Yellow Rivers, which flow entirely within the borders of China itself.

[1] "The Earth Is on Fire: Tibet Is Melting," *Tibet 3rd Pole*, 29 November 2019, https://tibet3rdpole.org/.

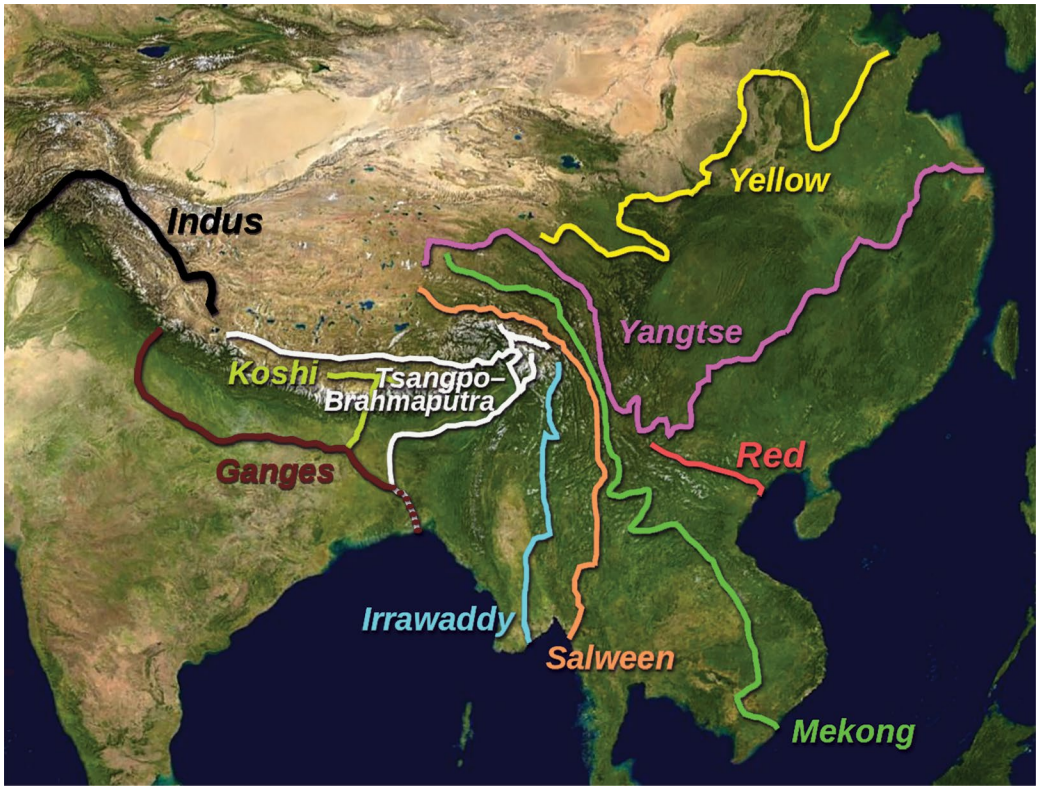

Figure 1. Map of rivers flowing out of Tibet. (Source: Thincat, Creative Commons, 20 August 2014, https://commons.wikimedia.org/.)

Tibet fell under the direct control of the Chinese Communist Party following the region's invasion in 1950. It was forcibly incorporated into the People's Republic the following year through the signing of the Seventeen-Point Agreement between the Beijing-based Central People's Government and the Lhasa-based Tibetan Government.[2] It is estimated that more than 700 billion cubic meters of water flow out of Tibet, Xinjiang, and Inner Mongolia to neighboring countries each year, with about 48 percent of that water flowing into India.[3] More than 50 transboundary rivers feed into Bangladesh, constituting the second largest river basin in the world. According to Brahma Chellaney, in his 2012 book *Water: Asia's New Battleground*, China may assume the role of "Asia's water hegemon" in the

[2] Tsewang Gyalpo Arya, "The 17-Point Agreement—What China Promised, What It Really Delivered and the Future?," Central Tibetan Administration, 23 May 2019. https://tibet.net/.

[3] Ameya Pratap Singh and Urvi Tembey, "India-China Relations and the Geopolitics of Water," *The Interpreter*, 29 October 2019, https://www.lowyinstitute.org/.

near future, driven largely by its favorable geopolitical position.[4] Economic imperatives and Beijing's global and regional hegemonistic ambitions would largely shape China's foreign policy calculations in this century.

The transboundary river systems originating in Tibet play a crucial role in the countries they traverse. These rivers provide irrigation, potable, and industrial water, as well as contribute to climate regulation and flood prevention. They are vital to the economies and ways of life of the inhabitants of the countries they pass through, and essential for the preservation of ecosystems and biological diversity. As the demand for water increases and the effects of climate change become more pronounced, the significance of these transboundary river systems is likely to grow even further in the future.[5]

China boasts a rich history of dam construction and river diversion projects, which have significantly influenced the country's water resource management, flood control, and hydroelectric power generation. One of the oldest and most remarkable examples is the Dujiangyan Irrigation System, constructed over 2,000 years ago during the Qin dynasty.[6] In the twentieth century, China's dam-building program accelerated. The Three Gorges Dam, completed in 2006, stands as the largest dam in the world. It serves as a hydroelectric power plant, aids in flood control, and enhances navigation on the Yangtze River. In a 1952 speech, Mao Zedong also declared, "Dams are the key to the development of our country. They will help us to control floods, generate electricity, and irrigate our fields. They will also help us to improve transportation and communication. We must build dams on all of our major rivers."[7]

China's control over water flow presents a substantial concern for lower riparian states, as it holds the potential to affect water security, economic development, environmental stability, and geopolitical relations. Such control could adversely impact the water security of these states. This article endeavors to illuminate China's weaponization of water in Tibet by examining its motivations and actions, identifying potential threats to lower riparian states, elucidating lessons that can be gleaned by these states, and proposing long-term strategies to safeguard their water security. It concludes with a summary of findings.

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[4] Medha Bisht, "Water: Asia's New Battleground by Brahma Chellaney," *Strategic Analysis* 36, no. 4 (July 2012): 690–92. https://doi.org/.

[5] Bisht, "Water."

[6] "Go West, Young Han," *The Economist*, 21 December 2000, https://www.economist.com/.

[7] Narendra Sisodia et al., *Water Security for India: The External Dynamics*, IDSA Task Force Report, MP-IDSA, 2010 (New Delhi: Institute for Defense Studies and Analyses, September 2010), http://www.indiaenvironmentportal.org.in/.

China's Motivations and Actions

The motives and drivers behind Chinese-linked hydropower investments abroad are varied and complex. Economic, political, geopolitical, and reputational considerations all contribute to these investments. Chinese companies and banks pursue overseas hydropower investments to further their economic interests, access new markets, or secure advantageous trade agreements. Such investments may also align with broader political strategies, such as the "going-out strategy," which encourages Chinese businesses to expand their global presence and influence.[8] From a geopolitical perspective, numerous factors, particularly in Southeast Asia, contribute to Chinese-linked hydropower investments. Factors such as geographic proximity, political ties, and cultural affinities between China and host countries significantly influence Chinese investment decisions in the hydropower sector.[9]

China's ambition for a dominant position over lower riparian states, especially concerning water resources, has sparked concern and debate in international relations. This geographical advantage has granted China perceived leverage and influence over water resources, eliciting apprehension among lower riparian states. Jayantha Dhanapala, a former UN undersecretary-general, contends that China's "water diplomacy" is often viewed as coercive and raises suspicions about China's intentions.[10] Such concerns have been voiced by lower riparian states like Vietnam and India, which accuse China of leveraging its water resources to exert political pressure. Vietnam, for instance, alleges that China's construction of dams on the Mekong River aims to divert water away from Vietnam, while India accuses China of building dams on the Brahmaputra River to diminish water flow into India.[11]

China refutes these allegations, asserting that it employs its water resources solely for legitimate economic and environmental purposes. However, the arguments of experts and the concerns voiced by lower riparian states have raised concerns about the potential for water conflicts in the future.[12]

China's concept of hydro-hegemony extends to its administration and control of rivers within its borders, notably the Mekong River and the Yarlung Tsangpo

[8] Audrye Wong, "China's Economic Statecraft under Xi Jinping." *Brookings*, 22 January 2019, https://www.brookings.edu/.

[9] Wong, "China's Economic Statecraft under Xi Jinping."

[10] Mathieu Duchâtel et.al., "Protecting China's Overseas Interests: The Slow Shift away from Non-interference," *SIPRI*, June, 2014, https://core.ac.uk/.

[11] Manash Pratim Gohain, "Fearing 'water war' by China, government puts Arunachal dams on Fast Track," *Times of India*, 19 January 2023, https://timesofindia.indiatimes.com/.

[12] PK Khup Hangzo, *Implications of China's Hydro-Hegemony on River Yarlung Tsangpo: Another Lever of China's Expansionist Tactics into India's East*, VIF Paper (New Delhi: Vivekananda International Foundation, October 2021, https://www.vifindia.org/.

River. Due to its management policies and approaches concerning transboundary rivers, China has been labeled a "negative hydro-hegemon" by several scholars. These strategies may involve coercion, pressure, and exploitation of power imbalances. From this perspective, China is seen as exerting control over rivers originating within its borders to gain an advantage in water resources and associated geopolitical interests over other countries.[13]

However, an alternative viewpoint, proposed by other scholars, suggests that China can be viewed as a positive hydro-hegemon regarding the Mekong River. They argue that China has taken proactive steps to foster collaboration among mainland Southeast Asian countries, leading to the expansion and development of the Mekong region. This perspective emphasizes China's efforts to promote regional cooperation and mutual benefit through various cooperative mechanisms, countering the negative portrayal of China as a hydro-hegemon.[14]

The construction of dams on the Yarlung Tsangpo River, particularly in the lower reaches including the Great Bend section, serves as part of an infrastructure-driven program aimed at consolidating China's claims over disputed territories such as Arunachal Pradesh. This policy seeks to enhance China's influence in these contested regions. Scholars suggest that these dam projects could have strategic implications, strengthening China's position along the border with India.[15]

China regards transboundary rivers as sovereign resources within its jurisdiction, to be utilized as it sees fit. Consequently, China perceives international water conventions and legally binding treaties concerning transboundary rivers as contrary to its national interests and sovereignty. This stance is exemplified by China's refusal to sign the United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses in 1997, which aims to establish norms for cooperation and management of transboundary rivers among riparian countries based on principles of mutual benefit and cooperation. China's rejection of this convention underscores its position.[16]

China's hydrological dominance over these rivers prompts debate over whether its actions are detrimental or beneficial, particularly regarding the Mekong River and the Yarlung Tsangpo River. It highlights China's reluctance to engage in in-

[13] Hangzo, *Implications of China's Hydro-Hegemony*.

[14] Stephen Chen, "Chinese Engineers Plan 1,000km Tunnel from Tibet to Xinjiang," *South China Morning Post*, 30 October 2017, https://www.scmp.com/.

[15] Chen, "Chinese Engineers Plan 1,000km Tunnel."

[16] Eleanor Albert, "Water Clouds on the Tibetan Plateau," *The New Politics of China, India, and Pakistan* (blog), 9 May 2016, https://www.cfr.org/.

ternationally recognized conventions and treaties related to transboundary rivers, signaling a preference for maintaining control over these resources.[17]

Potential Threats to Lower Riparian States

China's idiom 得天独厚 (dé tiān dú hòu, translated as "benefiting from the gifts of nature") underscores China's advantageous position as a riparian state in the vast Himalayan watershed. This position enables China to reap the benefits of the natural endowments bestowed upon it. It highlights China's control over the headwaters of rivers traversing its territory and the resulting power asymmetry it holds in the region, both economically and militarily. This power dynamic poses a significant challenge for efforts aimed at achieving fair water distribution in the region.[18]

The construction of dams by China on the Mekong River commenced in 1986, and since then, these dams have had numerous adverse effects on downstream countries, including Myanmar, Thailand, Laos, Cambodia, and Vietnam. Among these unintended consequences is the reduction of water levels, disrupting the natural flow of water and sediment. This disruption has negatively impacted fisheries' health, significantly affecting populations reliant on fishing along the Mekong River, particularly in Thailand.[19]

In 2019, China's dams in the upper Mekong River basin retained a record amount of water, setting a new record despite experiencing above-average rainfall in the region during the wet season. Consequently, countries downstream faced an unprecedented drought during this typically wet season.

This isn't the first instance of China's dams causing unintended repercussions downstream on the Mekong River. Over the past two decades, drought conditions have worsened and become more frequent in the lower Mekong basin, likely due to a combination of factors, including climate change and dam construction in China.

Since 2019, Thailand, Cambodia, and Vietnam have endured the most severe and prolonged drought on record. This has severely harmed the region's economy and ability to ensure food security. Farmers have lost crops, fish populations have dwindled, and reservoir levels have dangerously decreased.

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[17] Department of Water Resources, River Development & Ganga Rejuvenation, "India-China Cooperation," 12 February 2024, https://jalshakti-dowr.gov.in/.

[18] Ananth Krishnan, "Study on China Dams Brings the Brahmaputra into Focus," *The Hindu*, 29 April 2020, https://www.thehindu.com/.

[19] Brahma Chellaney, "China Is Weaponizing Water and Worsening Droughts in Asia," *Nikkei Asia*, 28 October 2019, https://asia.nikkei.com/.

Figure 2. Mainstream Mekong River dams. (Source: Brian Eyler and Courtney Weatherby, "Mekong Mainstream Dams," Stimson Center, 23 June 2020, https://www.stimson.org/.)

The debate surrounding the construction of dams on the Mekong River remains contentious. Many argue that dams are vital for clean energy production and ir-

rigation purposes, while others assert that they have detrimental effects on the river's ecosystem and the communities relying on it.

The situation is complex, with no clear-cut solution. However, it is undeniable that dams constructed in China contribute to downstream droughts. China must increase transparency regarding its dam operations and collaborate with affected countries to mitigate their negative impacts.[20]

Moreover, agriculture downstream has been severely affected by the dams. For example, the Mekong River Delta in Vietnam heavily relies on river water for irrigating crops, particularly rice, which contributes 16 percent to the country's annual gross domestic product (GDP).[21] Leaders from several Southeast Asian countries have criticized China for disregarding the downstream impacts of its dam projects.

In 1995, Cambodia, Laos, Thailand, and Vietnam established the Mekong River Commission (MRC) as an intergovernmental organization to collaboratively develop and manage shared water resources. This initiative aimed to address water security concerns. Southeast Asian states have consistently urged China to fully engage with the MRC. Currently, China is obligated to provide water-level data from its Jinghong and Manwan dams under a 2010 agreement with the MRC. Nevertheless, China continues to withhold crucial information regarding water quality, pollution, and irrigation water usage.

Full membership of China in the MRC would foster improved transparency and cooperation, leading to better understanding of the impacts of dam construction and supporting equitable water resource management in the region.[22]

In South Asia, China's proposal to construct seven dams along the main course of the Brahmaputra River has sparked concern in both India and Bangladesh. This apprehension stems from the river's vital role as a lifeline for farmers in both nations. China's current Fourteenth Five-Year Plan (2021–2025) prioritizes the rapid development of hydropower bases along the middle reaches of the Brahmaputra River. China asserts that these dams will operate as "run-of-the-river," meaning they will align with the natural flow of the river and avoid significant alterations to water storage upstream.[23]

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[20] Brian Eyler, Regan Kwan, and Courtney Weatherby, "New Evidence: How China Turned Off the Tap on the Mekong River," Stimson Center, 13 April 2020, https://www.stimson.org/.

[21] *Mekong Delta Plan: Long-Term Vision and Strategy for a Safe, Prosperous and Sustainable Delta* (Hanoi: Government of Vietnam, December 2013), https://www.wur.nl/.

[22] Eyler, Kwan, and Weatherby, "New Evidence."

[23] Ananth Krishnan, "China Gives Green Light for First Downstream Dams on Brahmaputra," *The Hindu*, 8 March 2021. https://www.thehindu.com/.

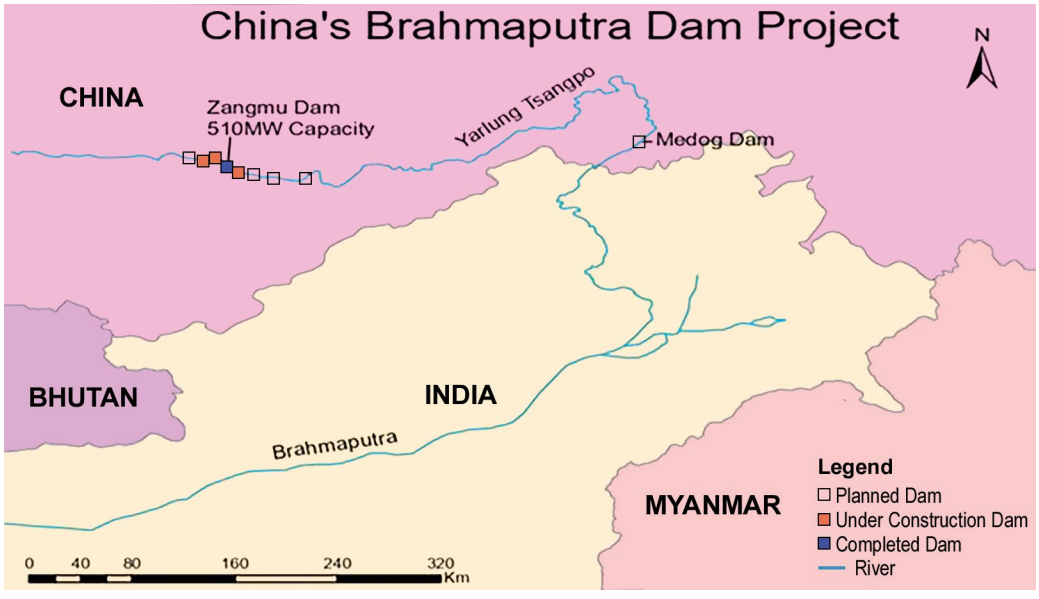

Figure 3. China's dam projects on River Yarlung Tsangpo (Brahmaputra). (Source: Generated by Arc GIS using data found at "China's Brahmaputra Dam Project," Graphic News, 1 November 2021, https://www.graphicnews.com/.)

However, India has expressed concern that China might redirect additional water from transboundary rivers to its arid northern regions to meet the water demands of China's coal and grain production centers. Compared to China's other main rivers, the Brahmaputra River has the lowest rate of hydropower utilization. Consequently, China has been actively constructing dams on the Brahmaputra River to generate hydroelectricity and enhance irrigation.

The Zangmu Dam in Tibet became China's inaugural hydropower project to commence operation in 2015, situated on the Brahmaputra River. Additionally, the Dagu Dam, Jiexu Dam, and Jiacha Dam are three other dams currently under construction. The Medog Dam, the latest addition to this region's dam infrastructure, commenced operation in 2023 and lies only 30 kilometers from the Indian border.[24]

The construction of dams on the Brahmaputra River has faced opposition from various environmental specialists concerned about the potential impact on the surrounding ecosystem. Nonetheless, China has defended its dam-building program, emphasizing its significance in meeting the country's growing energy demands.

[24] Mohd. Hussain Naik, "Transboundary Implications of Damming River Brahmaputra and Response of Indian Government" (dissertation, Central University of Punjab, June 2014), http://kr.cup.edu.in/.

While research continues to elucidate the potential effects of China's dam construction on the Brahmaputra River, it's highly probable that these dams will significantly impact both the river's environment and the livelihoods of those dependent on it. Alterations to water flow timing and distribution caused by the dams may disrupt fish migration patterns, leading to decreased water accessibility for drinking and agricultural purposes.

The issue of dam construction on the Brahmaputra River is complex, lacking straightforward solutions. However, to make informed decisions regarding the dams' future, a comprehensive understanding of their potential impacts is imperative.[25]

The series of dams erected on the Yarlung Tsangpo River poses a significant threat to various water-dependent activities in downstream countries, with India expressing valid concerns about their repercussions. The Yarlung Tsangpo River, known as the Brahmaputra in India, plays a critical role in supplying water to India's northeastern region, with estimates of India's dependence ranging from 7 percent to as much as 40 percent.[26]

The Government of India staunchly opposes China's proposed Medog project, asserting that it encroaches upon its rights as a lower riparian state and raises serious concerns about adverse impacts on water availability, especially during the lean season. These concerns are warranted, as the Brahmaputra serves as a lifeline for millions in India's northeastern states, supporting agriculture, industry, and daily livelihoods.

Bangladesh, another lower riparian country, shares India's concerns. About 70 percent of Bangladesh's population resides in the Brahmaputra River basin. Any alteration in the river's flow due to upstream dam construction could lead to severe consequences for Bangladesh, including potential water shortages, disruptions to agriculture, and adverse effects on citizens' livelihoods. India, in particular, perceives this as a violation of its rights as a lower riparian state, underscoring the necessity for diplomatic dialogue and international cooperation to address these urgent issues.[27]

According to certain reports, the proposed western route of the South-North Water Transfer Project aims to transfer water from the Yangtze River in southern China to the Gobi Desert in the north. Construction of the project's east and central canals has already commenced, with the completion of all three channels

[25] Krishnan, "China Gives Green Light for First Downstream Dams."

[26] Nilanjan Ghosh, "Chinese Dam on Yarlung Tsangpo/Brahmaputra: Should India Be Concerned?," *Observer Research Foundation*, 1 December 2020, https://www.orfonline.org/.

[27] Nilanthi Samaranayake, Satu Limaye, Joel Wuthnow, *Water Resource Competition in the Brahmaputra River Basin: China, India, and Bangladesh* (Arlington, VA: Center for Naval Analyses, May 2016), https://www.cna.org/.

anticipated by 2050.[28] The potential involvement of the Brahmaputra River in this project raises concerns about its impact on downstream water availability in India and Bangladesh. Despite sharing the major transboundary river, the Brahmaputra, India and China lack a formal water-sharing agreement, exacerbating worries and uncertainties surrounding China's dam construction activities.[29]

The deteriorating water quality of rivers within Chinese territory has the potential to become a contentious issue between China and downstream countries in the near future. There is growing apprehension that China might deliberately degrade the water quality of transboundary rivers, rendering them unsuitable for various uses. An indicative incident occurred in 2017 when the Siang River, known as the Brahmaputra between the Indian states of Arunachal Pradesh and Assam, exhibited sudden signs of contamination, turning muddy and black. This event raised suspicions regarding upstream activities in Chinese territory.[30] Subsequent water quality testing revealed elevated turbidity levels, indicating an increased presence of suspended particles. This surge in turbidity had detrimental consequences, including a significant decline in fish populations due to the clogging of their gills by these suspended particles, severely impacting the local fishing community and agricultural production in the Siang Valley.

This instance highlights the vulnerability of the Brahmaputra basin to potential conflicts over water resources. The region faces significant risks to water security, further compounded by the lack of established institutional mechanisms to address the challenges of transboundary water security. Consequently, there is an urgent requirement for diplomatic initiatives and cooperative agreements to tackle these issues and ensure the sustainable management of shared water resources.

China's Attempt to "Isolate" India in South Asia

India, due to its strategic geographical location, occupies a central role in the management of transboundary rivers in South Asia. As a regional power, India's involvement in river management is regarded with suspicion by neighboring countries, many of which share river systems with India.[31] This dynamic has prompted China, an influential player and extended neighbor in South Asia, to undertake

[28] Nivedita Khandekar, "Why India Must Push for a Water-Sharing Agreement with China," *dailyO*, 31 October 2017, https://www.dailyo.in/.

[29] Khandekar, "Why India Must Push for a Water-Sharing Agreement."

[30] Neeraj Singh Manhas and Hari Yadav G, "Relooking India-China Water Relations: A Major Concern?," *Financial Express*, 2 October 2022, https://www.financialexpress.com/.

[31] Richa Singh, *Trans-Boundary Water Politics and Conflicts in South Asia: Towards "Water for Peace"* (New Delhi: Heinrich Boll Foundation, December 2008,) http://www.indiaenvironmentportal.org.in/.

actions that seem to challenge India's leadership in the region. These activities by China, aimed at offsetting India's influence, are evident in various instances.[32]

In 2016, China announced that it had obstructed the flow of the Xiabuqu River, a Brahmaputra tributary located in Tibet near the Sino-Indian border. This obstruction was executed to facilitate the operation of the Lalho hydropower project.[33] Notably, this action occurred while India was contemplating a review of the Indus Waters Treaty with Pakistan following the Uri attack. It suggests a collaborative effort between upper and lower riparian states to undermine India's water-related interests. This trend signifies the potential "weaponization" of transboundary water resources, posing a significant threat to regional stability in South Asia.[34]

Moreover, China has exhibited a discriminatory approach in sharing hydrological data between India and Bangladesh. Following the Doklam military standoff, China abruptly ceased sharing hydrological data for the Brahmaputra River with India, despite previous agreements. In contrast, Bangladesh continued to receive uninterrupted data from China. This behavior by China reflects its intent to utilize water resources as a political tool against India within the South Asian context.[35]

China's indirect efforts to exert pressure on India within its own sphere of influence, particularly regarding water resources, present a significant risk and are profoundly concerning for the long-term security of the region. Such actions have the potential to escalate tensions not only between India and China but also with other neighboring nations that depend on shared rivers for their water requirements.[36]

Preparing for the Worst-Case Scenario

Extracting vital lessons from China is crucial for lower riparian states in effectively managing shared water resources. When dealing with China's water resources and transboundary river systems, lower riparian states can adopt several key strategies.

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[32] Antara Ghosal Singh, "China's Evolving Strategic Discourse on India from Doklam to Galwan and Beyond," Stimson Center, May 2022. https://www.stimson.org/.

[33] Neeraj Singh Manhas, "A Comparative Analysis of Water Management Issues and Challenges for India and China," Centre for Joint Warfare Studies, December 2022. https://cenjows.in/.

[34] Wini Fred Gurung and Amit Ranjan, eds., *Emerging Security Challenges and Water Politics in the Himalayas* (Singapore: Institute of South Asian Studies, NUS, March 2023. https://www.isas.nus.edu.sg/.

[35] Neeraj Singh Manhas, "A Fragile Lifeline: India and China Must Collaborate on Water," *The Interpreter*, 21 November 2023, https://www.lowyinstitute.org/.

[36] Brahma Chellaney, "China's Escalating Water War: On Top of Other Asymmetric Tactics, Brahmaputra Mega-Project Is a New Threat India Faces," *Times of India*, 16 March 2021. https://timesofindia.indiatimes.com/.

First and foremost, recognizing the importance of bilateral and multilateral cooperation is paramount. Establishing transparent channels of communication and nurturing diplomatic relationships can foster trust and facilitate negotiations over shared water resources.

Second, a thorough understanding of international water law and related agreements is essential. Embracing principles such as equitable and reasonable utilization, prior notification, and consultation can provide a robust legal framework for resolving water-related disputes.

Third, investing in sustainable water management practices is imperative.[37] Lower riparian states can prioritize efficient water resource utilization, advocate for conservation measures, and implement eco-friendly approaches to mitigate potential conflicts.

Additionally, participating in knowledge-sharing and capacity-building initiatives can enhance technical expertise and decision-making processes related to water governance.[38]

Long-Term Strategies for Lower Riparian States

China underscores the necessity to reassess its dam-development policies and improve the transparency and thoroughness of environmental and social impact assessments. Other Asian nations should put aside their bilateral disputes and strive for a unified stance concerning Chinese upstream dam development. The impacts of climate change on the Himalayan watershed highlight the importance of establishing frameworks for water sharing and enhancing the effectiveness of water and energy management.[39]

Chinese policy makers ought to enforce existing water management objectives and laws and enhance effectiveness by fostering a deeper understanding of the water-energy-food nexus. This could entail implementing regulations, conducting public awareness campaigns, and enforcing stricter enforcement measures. It is urged to transition into a full-fledged member of the MRC rather than remaining a dialogue partner.[40]

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[37] Department of Water Resources, River Development & Ganga Rejuvenation, "India-China Cooperation."

[38] Department of Water Resources, River Development & Ganga Rejuvenation, "India-China Cooperation."

[39] Aaron T. Wolf, "Conflict and cooperation along international waterways," *Water Policy* 1, no. 2 (1998): 251–65, http://cawater-info.net/.

[40] Yumiko Yasuda et al., *Transboundary Water Cooperation over the Brahmaputra River: Legal Political Economy Analysis of Current and Future Potential Cooperation* (The Hague: Hague Institute for Global Justice, 2017), https://siwi.org/.

Figure 4. Map of the Mekong Basin (Source: Shannon1, Creative Commons, 5 January 2015, https://commons.wikimedia.org/.)

In the South Asian context, it is imperative that China commits to a water agreement with India to build trust. This entails increased transparency in data sharing and informing downstream neighbors of dam construction plans. It is

advisable for China to broaden regional dialogues on water security to encompass renewable energy sources like solar and wind.[41]

Centering on topics such as dam construction, environmental impact assessments, water management, regional collaboration, transparency, and sustainable energy, China will stress the importance of proactive measures to tackle these issues, fostering regional harmony and sustainable development.[42]

Institutional Approaches to deal with China

In South Asia, there are two potential institutional approaches to engage with China regarding transboundary river management. Firstly, inspired by the MRC, South Asian nations could unite as lower riparian countries to negotiate collectively with upper riparian China concerning shared water resources. In this initiative, a regional organization, primarily South Asian Association for Regional Cooperation (SAARC), should take an active role in convening all lower riparian countries under a common platform. This unified stance would amplify their collective voice in discussions with China.

Moreover, to ensure that China's engagement in regional institutions aligns with the interests of South Asian countries, it is essential to consider China's participation in organizations where it holds representation. The Shanghai Cooperation Organization (SCO), initiated by China, includes South Asian nations sharing transboundary rivers facing various challenges. China's influence over the management practices of such organizations could indirectly impact shared water resources.

China's inclination to lead negotiations on shared water resources might be framed within contemporary concepts like climate change rather than direct reference to water sharing. If the SCO delves into climate change issues, it would inevitably address transboundary water concerns, given that many key rivers, such as the Indus and the Brahmaputra, originate in Chinese-controlled territory. This geographical advantage grants China significant influence. With SAARC encountering challenges and no other regional institution adequately equipped to manage transboundary water issues, this power vacuum could lead to an expanded role for China in hydro diplomacy within South Asia.

Consequently, incorporating China into the management of cross-border rivers within institutions led by South Asian countries could signify a positive stride toward achieving a peaceful and lasting resolution to transboundary river water

[41] Aditya Gowdara Shivamurthy, ed., *India-China Competition: Perspectives from the Neighbourhood*, ORF Special Report No. 197 (New Delhi: Observer Research Foundation, August 2022), https://www.orfonline.org/.

[42] Santosh Chaubey, "Water Imperialism and Future Water Wars—Why China Has Colonised Tibet," Central Tibetan Administration, 3 March 2021, https://tibet.net/.

management issues in South Asia. This approach would underscore collaboration and collective decision-making, thereby addressing the concerns of all parties involved.

Conclusion

The imperative to address the threat of China weaponizing water in Tibet cannot be overstated. Immediate action is essential to safeguard the water resources of lower riparian states. Proactive measures are crucial for anticipating future disturbances and implementing enduring policies to protect these vital resources. Drawing lessons from other regions, fostering regional cooperation, diversifying water sources, engaging in diplomatic dialogue, and garnering international support are paramount strategies for mitigating the risks posed by China's actions.[43] Leveraging open-source satellite data can further enhance these efforts.

Should existing bilateral or regional mechanisms prove ineffective or nonexistent, lower riparian countries must advocate for multilateral solutions to counter any single country's dominance over transboundary rivers. With only about one percent of Tibet's hydropower potential currently exploited, the potential for further dam-building and hydropower development on Tibetan rivers looms large.[44] China's ability to manipulate the flow of water from Tibet's rivers for geopolitical leverage poses a significant concern for lower riparian states, potentially shaping future conflicts.

The future of continental Asia's hydro-politics hinges on institutionalized cooperation, transparency, the establishment of new regional frameworks for water sharing, and robust mechanisms for dispute resolution. Such measures are imperative for ensuring the sustainable management of transboundary river systems, benefiting millions of people in South Asia and Southeast Asia alike. ✪

Neeraj Singh Manhas

Mr. Singh Manhas is the PhD candidate in the Department of Political Science at The Maharaja Sayajiarao University of Baroda, Gujarat, India. In addition to his academic endeavors, he holds the position of Special Advisor for South Asia at the Parley Policy Initiative, Republic of Korea. He has previously worked as the Director of Research in the Indo-Pacific Consortium at Raisina House, New Delhi. He can be reached at neeraj.m-polsciphd@msubaroda.ac.in.

Dr. Rahul M. Lad

Dr. Lad is a visiting fellow in the Department of Geography at the Savitribai Phule Pune University, India. He can be reached at ladrahul93@gmail.com.

[43] Chaubey, "Water Imperialism and Future Water Wars."

[44] Uttam Kumar Sinha, *Riverine Neighbourhood: Hydro-politics in South Asia* (New Delhi: Pentagon Press, 2016), https://idsa.in/.

COMMENTARY

Safeguarding the Indo-Pacific

Navigating the Nonkinetic Battlefield of Environmental Security

Shreya Das Barman

Abstract

The environment has evolved into a nonkinetic domain of warfare, with chemical, biological, radiological, and nuclear (CBRN) threats posing significant risks. Historical events like the Spanish flu, anthrax poisoning, and the COVID-19 pandemic underscore the devastation caused by CBRN elements. Technological advancements have increased the risk of nonkinetic warfare, exemplified by the 2001 anthrax poisoning in the United States. To address this, countries must bolster their capabilities and invest in research and development for prevention, preparedness, and response strategies. This article focuses on bioterrorism within environmental security, emphasizing the need for countries to utilize limited resources effectively while considering potential animal-based threats. Collaboration among Indo-Pacific nations is essential, transcending bilateral issues to collectively safeguard the environment. The article examines each country's strengths and proposes cooperative strategies. Challenges include assessing stakeholder willingness to cooperate while maintaining territorial integrity and developing population training modules. Measures to address these challenges are imperative for effective preparedness and execution.

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But man is a part of nature, and his war against nature is inevitably a war against himself.
—Rachel Carson

In today's world, the chaos wrought by the non-kinetic domain of warfare is undeniably alarming and demands prompt attention. Furthermore, the ascendance of the environment as a novel arena of warfare has significantly compounded humanity's challenges. Events such as the Spanish flu and COVID-19 could readily be weaponized to inflict substantial harm on adversaries, exploiting the element of plausible deniability. This underscores the stark reality of chemical, biological, radiological, and nuclear (CBRN) warfare.

An Overview

The environment, often described as "the most transnational of transnational issues," harbors readily available resources susceptible to misuse under the guise of

research.[1] The COVID-19 virus purportedly leaked from a lab in Wuhan, China, engaged in bat research. Similarly, the world witnessed the devastating consequences of the Bhopal Gas Tragedy in India, where the leakage of methyl isocyanate (MIC) from the Union Carbide chemical plant claimed thousands of lives and inflicted hereditary abnormalities on survivors who continue to suffer.[2] Apart from all this, the anthrax attack on the United States, famously known as Amerithrax, demonstrated the potential for biological attacks from any direction.[3]

This underscores the pressing need to address environmental security and the emerging threat of bioterrorism. Animals such as rodents and bats could serve as vectors for spreading diseases over long distances and short periods, potentially triggering epidemics and pandemics that strain economies and undermine defense systems. The 2021 India–China confrontation in Galwan, Ladakh, during the peak of the COVID-19 pandemic serves as a stark reminder of the vulnerabilities faced.

Climate change exacerbates the risk of bioterrorism by facilitating the growth and spread of pathogens. For example, melting permafrost in Siberia has unearthed infected bodies and biological agents, leading to anthrax outbreaks after decades of dormancy.[4] Climate change also makes the world vulnerable to economic losses at a large scale. Moreover, climate conditions favorable to diseases like Lumpy Skin Disease pose significant economic risks, particularly to countries reliant on industries such as dairy production. Ethiopia, for instance, incurred substantial financial losses due to lumpy skin disease (LSD) in local Zebu cattle, while in India, such a disease outbreak could severely impact agriculture, where cattle are still used for plowing.[5] This illustrates the potential for adversaries to exploit vulnerabilities in both environmental and economic domains for strategic gain.

Using the environment as a tool for warfare is not a recent concept. For instance, during the Trojan War, Scythian archers reportedly utilized clostridium-infested (poisoned) arrows to assail their adversaries, causing gangrene and tetanus, resulting in fatalities.[6] Similarly, during the First World War (1914-1918), Germany

[1] Sanjay Kumar and Neelam Kumari, "Environmental Security of India and its Implications," *International Journal of Science and Research* 9, no.4 (April 2020): 467–74, https://www.ijsr.net/.

[2] Judah Passow and Tim Edwards, "The long, dark shadow of Bhopal: still waiting for justice, four decades on," *The Guardian*, 14 June 2023, https://www.theguardian.com/.

[3] Federal Bureau of Investigation, "Amerithrax or Anthrax Investigation," n.d., https://www.fbi.gov/.

[4] Vladan Radosavljevic, "Environmental Health and Bioterrorism," *Encyclopedia of Environmental Health* (12 September 2019): 450–57, https://doi.org/.

[5] Fatemeh Namazi and Azizollah Khodakaram Tafti, "Lumpy skin disease, an emerging transboundary viral disease: A Review," *Veterinary Medicine and Science* 7, no. 3 (May 2021): 888–96, https://doi.org/.

[6] Friedrich Frischknecht, "The History of Biological Warfare," in *Decontamination of Warfare Agents*, ed. André Richardt and Marc-Michael Blum (Chichester: Wiley-VCH, 2008), 1–10, https://application.wiley-vch.de/.

covertly plotted to infect allied forces' horses with Glanders, aiming to diminish their combat effectiveness.[7] Thus, bioterrorism has long served as an effective method for inflicting casualties on enemies covertly.

Furthermore, the ease with which non-state actors can employ biological weapons, even with just a single syringe, underscores the critical need for comprehensive study and preparedness. Historical accounts detail instances of medieval warriors hurling cattle heads infested with microbes into enemy territory to maximize harm.[8] The objectives of biological warfare are twofold: to cause maximum casualties and to wage psychological warfare with lasting effects on future generations. Advances in genetic engineering have facilitated the tailored design and deployment of specific organisms to suit strategic objectives.

The challenge remains: how can nations defend themselves against such invisible threats? Strengthening domestic defenses and border security concurrently is imperative. Domestically, nations must fortify healthcare infrastructure to ensure an ample supply of necessary medicines, thereby avoiding scenarios like the hoarding of Hydroxychloroquine and Chloroquine during the COVID-19 pandemic.

Waging warfare through the environment is not only cost-effective but also grants nonstate actors the opportunity to delay subsequent attacks. For instance, releasing virus-infected medicine into a water body creates a gradual spread throughout the population, allowing adversaries to prepare for further assaults, ensnaring the target in a cyclically evolving threat landscape with no immediate resolution in sight.

Furthermore, employing biological agents as tools of warfare carries consequences that reverberate for generations. Consider the COVID-19 pandemic as a case in point. The aftermath of the pandemic has been marked by a complex recovery phase, with many individuals succumbing during this period. Those who survived continue to grapple with various health complications, effectively achieving the intended goal of nonstate actors: disrupting societal harmony.

Indo-Pacific Region: Dedication, Cooperation, and Collectiveness

To prevent the environment from becoming an active theater of warfare, it is crucial to closely monitor environmental developments and changes. Nations must prioritize investment in research and development (R&D), particularly in specialized labs dedicated to identifying solutions for emerging and "unmanned" diseases.

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[7] Barry R. Schneider, "Biological Weapons in History," *Britannica*, n.d., https://www.britannica.com/.

[8] David P. Clark and Nanette J. Pazdernik, "Biological Warfare: Infectious Disease and Bioterrorism," in *Biotechnology: Applying the Genetic Revolution* (Burlington, VT: Elsevier Science, 2016), 687–719, https://doi.org/.

However, caution must be exercised during research to prevent accidental leaks from labs, which could disrupt normal functioning. To mitigate this risk, labs should enforce strict standard operating procedures (SOP), such as wearing safety gear and thorough sanitization protocols for individuals exiting the lab. In the event of an infection, infected individuals must be promptly isolated and provided with appropriate medical care. Furthermore, blood samples should be collected for further research into the virus' protein structure, facilitating the development of effective countermeasures.

In an interconnected world, close cooperation is imperative to prevent the complete collapse of any single economy, as exemplified by the Sri Lankan economy.[9] The Indo-Pacific region, home to the world's most populous and economically dynamic countries, faces significant risks from pandemics.[10] Establishing a centralized database of disease-related information, including past occurrences and treatments, can facilitate rapid response efforts. This database, managed by an international organization like the World Health Organization (WHO), would enable swift analysis and the establishment of standard medical protocols to contain the spread of emerging diseases. Mandatory auditing of labs involved in biological weapons research by state authorities can ensure ethical conduct and accountability in their operations.

The region should prioritize hosting an annual Joint Conference on Doctors with the objective of discussing environmental health and devising strategies to address unknown diseases. Additionally, stakeholders in the region should collaboratively organize workshops to raise awareness among their populations.

The assessment of the COVID-19 pandemic revealed the significant role of fear in exacerbating the crisis. Due to widespread unawareness and fear, many individuals avoided testing for the virus, inadvertently accelerating its spread. It is imperative to educate people on proper conduct in the event of a disease outbreak, emphasizing the importance of regular drills to familiarize them with necessary actions.

Outbreaks of novel diseases often induce panic, complicating response efforts and leading to erroneous actions. During the COVID-19 pandemic, fear-driven behaviors hindered effective containment measures, contributing to the virus's rapid spread. To mitigate such challenges, countries in the Indo-Pacific Region should establish rapid response teams (RRT) comprising local law enforcement,

[9] Associated Press, "Explained: Why Sri Lanka's economy collapsed, and what's next for the island nation?," *Indian Express*, 10 July 2022, https://indianexpress.com/.

[10] Daniel F. Runde, Conor M. Savoy, and Owen Murphy, "Post-pandemic Infrastructure and Digital Connectivity in the Indo-Pacific," *CSIS Brief*, 2 November 2020, https://www.csis.org/.

medical professionals, and trained nurses. These teams should undergo rigorous training to effectively manage disease outbreaks at the epidemic level. Furthermore, integrating pandemic management into higher education curricula for doctors and nurses would ensure that training begins at the foundational level. RRT members should be equipped with skills to maintain calm and provide guidance to the public during such crises.

Researchers studying potential biological agents could subject viruses to varying weather conditions to acclimate them, ensuring their vulnerability to temperatures higher or lower than the set threshold, thereby weakening or rendering them inactive. Additionally, exploring quorum sensing techniques with the aim of attenuating virus virulence could be beneficial. The Indo-Pacific region could collectively investigate and integrate quorum sensing concepts into their R&D protocols.

In this era of technological advancement, Artificial intelligence (AI) integrated with robotics offers promising solutions for combating unknown viruses. For instance, biosensitive labs could employ remotely controlled robots to conduct experiments. These robots, equipped with sensors, can promptly detect and alert humans to any potential leaks, enabling swift response measures. Research into virovore bacteria, which purportedly consume viruses, holds promise for curbing disease spread and exploring vaccine applications through quorum sensing methods.[11] Additionally, regular vaccination campaigns should be conducted, with efforts to integrate COVID-19 vaccines into routine immunization schedules, akin to vaccines such as the diptheria, tetanus, and whooping cough (DTaP) vaccine Collaboratively, the region's nations can establish a vaccine experts group to uphold health security and create a dedicated relief fund for researching future diseases and responding to epidemic or pandemic crises.[12]

The Indo-Pacific Region must unite and invest in technology to proactively address emerging threats, particularly in their nascent stages. Furthermore, on a global scale, greater emphasis should be placed on the effective implementation of the Biological Weapons Convention (BWC) of 1975. Adhering to Article V of the BWC, stakeholders in the Indo-Pacific region should engage in bilateral and multilateral consultations to devise a comprehensive roadmap for pandemic response.[13] All stakeholders should share this road map and strictly adhere to it.

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[11] Oceane Duboust, "An organism that eats viruses has been discovered. What is a 'virovore'?," *Euronews*, 2 January 2023, https://www.euronews.com/.

[12] "Joint Statement from Quad Leaders" (press release, The White House, 24 September 2021), https://www.whitehouse.gov/.

[13] Office of Disarmament Affairs, United Nations, "History of the Biological Weapons Convention," n.d., https://disarmament.unoda.org/.

To uphold the environmental integrity, the principle of "no first use" should evolve into a commitment of not using biological weapons under any circumstances. Establishing hotlines among stakeholders in the Indo-Pacific region can facilitate timely communication and information sharing, particularly regarding national emergencies.

Additionally, the region should establish a dedicated "Pandemic Fund" by reallocating resources, ensuring preparedness for future outbreaks. This fund could support research and development, procurement of medical equipment, infrastructure development, and personnel training, bolstering the region's readiness to combat pandemics effectively.

Conclusion

With the evolving nature of warfare, the environment has emerged as a potent, yet unpredictable, avenue of attack capable of crippling a nation's economy or causing widespread devastation. It is essential for every nation to fortify its healthcare systems and bolster national security defenses against potential adversaries. The Indo-Pacific region, given its strategic significance, must collaborate to uphold peace and stability in the area while exercising caution to prevent accidental release of viruses into the environment. Additionally, countries within the region should explore the efficacy of traditional medicines in combating such diseases. Through efficient cooperation, the Indo-Pacific region can serve as a model of dedication, cooperation, and collective action for the global community. ✪

Shreya Das Barman

Ms. Das Barman holds postgraduate degree in East Asian studies. Her areas of interest include India–Taiwan–China relations and defense & strategic studies.

COMMENTARY

Transforming Defense and Community Climate Action and Resilience

Dr. Adam Smith

Abstract

Climate change poses an existential threat to global security. However, defense forces, as major greenhouse gas emitters, lack emissions reporting requirements and climate adaptation plans. This article analyzes current deficiencies and advocates for improved climate risk assessment, measurement, transparency, target setting, and mitigation by defense forces. It introduces tools to build climate awareness and catalyze action across military and civilian spheres. Specifically, a C4 model (command, control, climate, and community) integrates top-down and bottom-up approaches. Meanwhile, the CLARA framework (communicate, leadership, awareness, risk and resources, and action) provides guidance for defense forces to assess and reduce risks. Establishing a methodology for comparability and accountability, as NATO has done, is advised. With unprecedented climate impacts already occurring, urgent collaborative action is imperative. Defense forces must show leadership in understanding, communicating and reducing their own emissions, while supporting societal resilience.

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The climate crisis poses the single greatest threat to the livelihoods, security, and well-being of people worldwide, including defense forces and their families. Human activities, primarily through the emission of greenhouse gases, unequivocally caused global warming, with the global surface temperature reaching 1.1°C (3.6°F) above 1850–1900 in 2011–2020. Global greenhouse gas emissions continue to rise, with unequal historical and ongoing contributions stemming from unsustainable energy use, land use changes, lifestyles, and consumption and production patterns across regions, countries, and individuals (high confidence).[1]

US Secretary of Defense Lloyd J. Austin III spoke at the Leaders Summit on Climate, stating, "Today, no nation can find lasting security without addressing the climate crisis. We face all kinds of threats in our line of work, but few of them truly deserve to be called existential. The climate crisis does. . . . climate change is mak-

[1] H. Lee and J. Romero, eds., *Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (Geneva: Intergovernmental Panel on Climate Change, 2023), 1–34, https://www.ipcc.ch/.

ing the world more unsafe and we need to act."[2] While these are powerful words, what is missing is the implementation of SMART (specific, measurable, achievable, realistic, and timely) actions.

Military operations, including those involving planes, tanks, and ships, require vast amounts of energy derived from fossil fuel sources. Among the world's largest fuel consumers, militaries account for 5.5 percent of global greenhouse gas emissions.[3] To illustrate in dollars rather than percentages, during missions in Afghanistan and Iraq, the US military spent over USD 20 billion annually on air-conditioning for troops.[4]

Surprisingly, defense forces are not obligated by international climate agreements to report or reduce their carbon emissions, and the data published by some militaries is unreliable or incomplete. This is because military emissions abroad, from flying jets to sailing ships to training exercises, were excluded from the 1997 Kyoto Protocol on reducing greenhouse gases and were again exempted from the 2015 Paris Accords. The rationale behind this exemption is that data on energy use by armies could undermine national security.

Defense plays a crucial role in supporting the community and government's climate and disaster resilience agenda by incorporating climate risk into the planning and execution of its activities and operations.

Impact

Obtaining accurate, comparable data on impacts such as fuel use and carbon footprint for defense forces worldwide is challenging. However, a valuable resource, The Military Emissions Gap database, provides useful information for measuring and comparing some emissions.[5] This reveals limited data from the United States, Canada, United Kingdom, and stationary emissions from China at 108.35 and Russia at 40.72 metric tons of carbon dioxide equivalent ($MTCO_2e$).

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[2] David Vergun, "Defense Secretary Calls Climate Change an Existential Threat," DOD News, 22 April 2021, https://www.defense.gov/.

[3] Sarah Mcfarlane and Valerie Volcovici, "Insight: World's war on greenhouse gas emissions has a military blind spot, *Reuters*, 10 July 2023, https://www.reuters.com/.

[4] Shirley V. Scott and Shahedul Khan, "The Implications of Climate Change for the Military and for Conflict Prevention, Including through Peace Missions," *ASPJ Africa & Francophonie* 7, no. 3 (2016) : 82 – 94, https://www.airuniversity.af.edu/.

[5] "The Military Emission Gap," *Conflict and Environment Observatory* and *Concrete Impacts*, 2021, https://militaryemissions.org/.

Additional sources from government and media suggest US emissions of 51 $MTCO_2e$ and UK emissions of 3.34 $MTCO_2e$.[6] A noteworthy comparison highlights that the UK armed forces contribute to 50 percent of the UK government's emissions, while the US military similarly accounts for 56 percent of US government emissions. It stands as the world's largest institutional petroleum user and carbon emitter, ranking as the 55th largest CO_2 emitter if considered a separate country, underscoring its substantial impact.[7]

Why?

While we commonly perceive human-induced climate change as a future event, it is an ongoing process. Presently, ecosystems, communities, and people in 195 countries worldwide are experiencing its impact.

Critical Thresholds

To avoid surpassing the 1.5-degree Celsius global warming threshold established in the Paris Climate Agreement, numerous countries have set a long-term objective to attain net-zero emissions by 2050.[8]

Huge Gaps in Targets, Commitments, and Leadership

In November 2023, the Earth's temperature briefly exceeded the 2-degree Celsius threshold, a limit scientists have long warned could lead to catastrophic and irreversible impacts on the planet and its ecosystems. Warming to 2 degrees places a larger portion of the population at risk of deadly extreme weather and raises the likelihood of the planet reaching irreversible tipping points, such as the collapse of polar ice sheets and the mass death of coral reefs.[9]

A significant disparity, calculated from the UN's Intergovernmental Panel on Climate Change's 2018 report, reveals that CO_2 emissions need to be reduced by

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[6] Defence Committee, UK House of Commons, *Defence and Climate Change. Eighth Report of Session 2022-23* (London: House of Commons, 18 August 2023), https://committees.parliament.uk/.

[7] Louise van Schaik et al., *The World Climate and Security Report 2022: Decarbonized Defense—Combating Climate Change and Increasing Operational Effectiveness with Clean Military Power, The Need for Clean Military Power in the Age of Climate Change*, ed. Erin Sikorsky and Francesco Femia (Washington, DC: Center for Climate and Security, June 2022), https://imccs.org/wp-content/.

[8] van Schaik et al., *The World Climate and Security Report 2022*.

[9] United Nations, *Nationally determined contributions under the Paris Agreement: Synthesis report by the secretariat* (Sharm el-Sheikh, Egypt: United Nations, 6–18 November 2022), https://unfccc.int/.

45 percent by 2030, compared to 2010 levels. Current commitments, however, are on track to increase emissions by 10.6 percent by 2030, compared to 2010 levels.[10]

Contrary to accelerating efforts to address rising emissions, progress on climate adaptation is slowing globally.[11] Defense, much like the rest of the world, is underprepared, underinvested, and lacks the necessary planning, leaving everyone exposed.

Assuming the role of a global leader is no easy task. Rear Admiral Paul Beattie, Director Naval Staff, Royal Navy, recently characterized the measures required for climate change adaptation in the military as the ". . . biggest change programme in defence." He noted that, unusually for technology, countries "can't look to the US "for global leadership and that some were therefore looking to the UK."[12]

However, perhaps attention should be directed to the community advocating solutions. They propose that "states should put military emissions on the table at COP28. They must also commit to improving the standard, scope, frequency and transparency of their reporting. This commitment must be backed by pledges for meaningful, credible and verifiable cuts to their emissions."[13]

Starting with a Simple Tool

A fundamental distinction between traditional top-down approaches of government and defense and the bottom-up approach of the community lies in the level of detail and granularity of the data. The bottom-up approach furnishes detailed information on individual sources, while the top-down approach offers more general information on overall emissions.

Is it possible to identify a middle ground or tool that could be comprehended and acted upon by the government, defense, and communities? We propose a simple tool based on an acronym as a potential starting point to assist defense personnel in sharing knowledge, understanding, and implementing climate actions. Acronyms, which utilize the first letters of words or phrases in a list or sequence of events to create a new word, prove effective in aiding memory. Acronyms are widely employed, especially within defense forces. Examples include AAAV (Ad-

[10] United Nations Environment Programme, *Adaptation Gap Report 2023: Underfinanced. Underprepared. Inadequate investment and planning on climate adaptation leaves world exposed* (Nairobi: United Nations, November 2023), https://doi.org/.

[11] Seamus Hoyne, "Climate leadership—what does it really mean?," *European Sustainable Energy Week* (blog), 28 February 2023, https://sustainable-energy-week.ec.europa.eu/.

[12] William Leben and Ulas Yildiri, "Aggressive action required to meet Defence's ambitious emissions-reduction target," *The Strategist*, 27 September 2022, https://www.aspistrategist.org.au/.

[13] Pierre Barthélemy, "The CBDR principle in the climate negotiations: deadend or new start?," *IDDRI* (blog), 10 December 2015, https://www.iddri.org/.

vanced Amphibious Assault Vehicle), ADF (Australian Defence Forces), ANZAC (Australian and New Zealand Army Corps), DOD (Department of Defense), JCS (Joint Chiefs of Staff), NCO (noncommissioned officer), XO (executive officer), FOB (forward operating base), and USINDOPACOM (US Indo-Pacific Command).

Similarly, numerous specific acronyms are known for nonmilitary processes, such as first aid (DRSABCD: danger, response, send, airway, breathing, CPR, defibrillation), diving (SCUBA: self-contained underwater breathing apparatus), management (SWOT: strengths, weaknesses, opportunities, and threats; SMART: specific, measurable, achievable, relevant, and time-bound; PESTEL: political, economic, social, technological, legal, and environment), and the environment (EIS: environmental impact statement; GHG: compressed hydrogen gas; C02 carbon dioxide).

This article proposes that the acronym CLARA is straightforward and may serve as a tool to facilitate the sharing of knowledge, inspire action, and translate intentions into climate action for both defense and the millions of individuals seeking a starting point:

C – Communicate

L – Leadership

A – Awareness

R – Risk and Resources

A – Action

There have been other acronyms proposed as potential saviors of the world. Have you ever come across CBDRILONCWRC? Probably not, and neither have I. It is a cumbersome 12-letter term that is challenging to pronounce, standing for "Common but Differentiated Responsibility in Light of National Circumstances with Respective Capability."14

Let us opt for something simpler, easier to remember, and pronounce. CLARA (named after the Impossible Girl, Clara Oswald, from the fictional TV series "Dr. Who") assists you in identifying key factors for climate, communication, capacity, leadership, and awareness for both individuals and organizations. It guides you to capitalize on strengths, address shortcomings, minimize risks, communicate actions, and contribute to creating a sustainable future.

Providing Solutions That Are Easy to Understand and Actualize

Saving the world or changing behavior is undoubtedly a challenging task, but nothing worthwhile ever comes easy. We present two models, C4 and CLARA, offering a straightforward solution for both defense and the community.

In the military context, defense recognizes that command and control (C2) is a critical enabler for all military organizations. C2 encompasses tactical, operational, and strategic levels, applicable in both operations and peacetime, and spanning the entire spectrum of conflict. However, a community approach is equally crucial, supporting or opposing military endeavors and contributing to reshaping public thought, shifting cultural tendencies, and instigating lasting changes in behaviors.[14] Perhaps it is time to transition from the old model to a new model, C4 (command, control, climate, and community)?

For all defense-based approaches aiming to plan, bridge gaps, and reduce risks, the implementation of the CLARA tool (capacity, leadership, awareness, risk, and action) could prove beneficial:

1. **Capacity**—Initiate the first step by designing and implementing capacity-building programs to enhance knowledge of climate change issues and solutions. Numerous online courses, such as the WorkforClimate Academy, provide valuable resources.[15]

2. **Leadership**—Define leadership as "the process of influencing others to gain their willing consent in the ethical pursuit of missions." While command grants the authority to direct tasks, leadership is the human dimension of being a commander, inspiring subordinates to perform tasks. Climate leaders ensure that climate action and the necessary resources are integrated into all decision-making processes, emphasizing that leadership is a responsibility for everyone.

3. **Awareness**—Recognize that it is impossible to manage what one does not measure. Defense needs measurements to heighten awareness of climate issues and risks. Publish a standalone annual footprint of climate and sustainability performance (at base, service, and country levels), including individual ecological footprints, with independent verification of emissions.[16] The NATO methodology outlined below is a recommended approach.

[14] Edith Brown Weis and Vicki Arroyo, "Addressing Climate Change from the Bottom-Up in a Kaleidoscopic World," *Revue Européenne du Droit*, 2 (Spring 2021), https://geopolitique.eu/.

[15] "WorkforClimate Academy," WorkforClimate, 2022, https://www.workforclimate.org/.

[16] "Footprint Calculator," Global Footprint Network, 2023, https://www.footprintnetwork.org/.

4. **Risk and Resources**— Develop a straightforward climate risk assessment for individuals, units, bases, and communities. Projecting out to 2025 or 2030, allocate between 1 and 10 percent of your human, financial, and infrastructure resources to climate actions.
5. **Action**— Based on your risk assessment, focus on three actions: one for yourself now, one for your unit in the next 12 months, and one for the national defense force over the next five years. These actions should be positive and aimed at reducing risk.

Interestingly, the CLARA model aligns with NATO's Climate Change and Security Action Plan, encompassing awareness, adaptation, mitigation, and outreach.[17] This article recommends adopting the NATO (2023) Compendium of Best Practices and the NATO (2023) Greenhouse Gases Emission Mapping and Analytical Methodology as globally useful guidance and methodology for all defense forces to address the global problem of climate change.[18]

Influencing the Future

The global climate crisis can no longer afford the business-as-usual omission of the military from national accounts. Fortunately, cities, the private sector, and individuals are taking leadership measures to reduce emissions, advocate for low-carbon solutions, and exert pressure on governments at all levels to take action.[19] Some are even pursuing legal action against governments and fossil fuel companies. All these endeavors can be seen as bottom-up initiatives.

The envisioned future impacted by climate change is not inevitable. Many of the problems and solutions are currently known to us, and ongoing research continues to uncover new ones. Experts assert that there is still time to avert the most negative outcomes by limiting warming and swiftly reducing emissions to zero. Achieving a reduction in greenhouse gas emissions will necessitate investments in new technology and infrastructure, ultimately fostering job growth.

A sustainable planet, where citizens comprehend global climate impacts and actions, businesses take initiative, and decisive government regulations are implemented at the local level through communities, is crucial for our survival. Unfortunately, we have a long way to go for this dream to become a reality. Nevertheless,

[17] NATO "NATO Climate Change and Security Action Plan,"14 June 2021, https://www.nato.int/.

[18] NATO Climate Change and Security Action Plan, *Compendium of Best Practice* (Brussels: NATO, 2023), https://www.nato.int/; and Emerging Security Challenges Division, NATO, *The NATO Greenhouse Gases Emission Mapping and Analytical Methodology* (Brussels: NATO 2023), https://www.nato.int/.

[19] Hoyne, "Climate leadership."

every journey starts with the first step, every conversation starts with the first word, and every change in behavior commences with the first action.

Conclusion

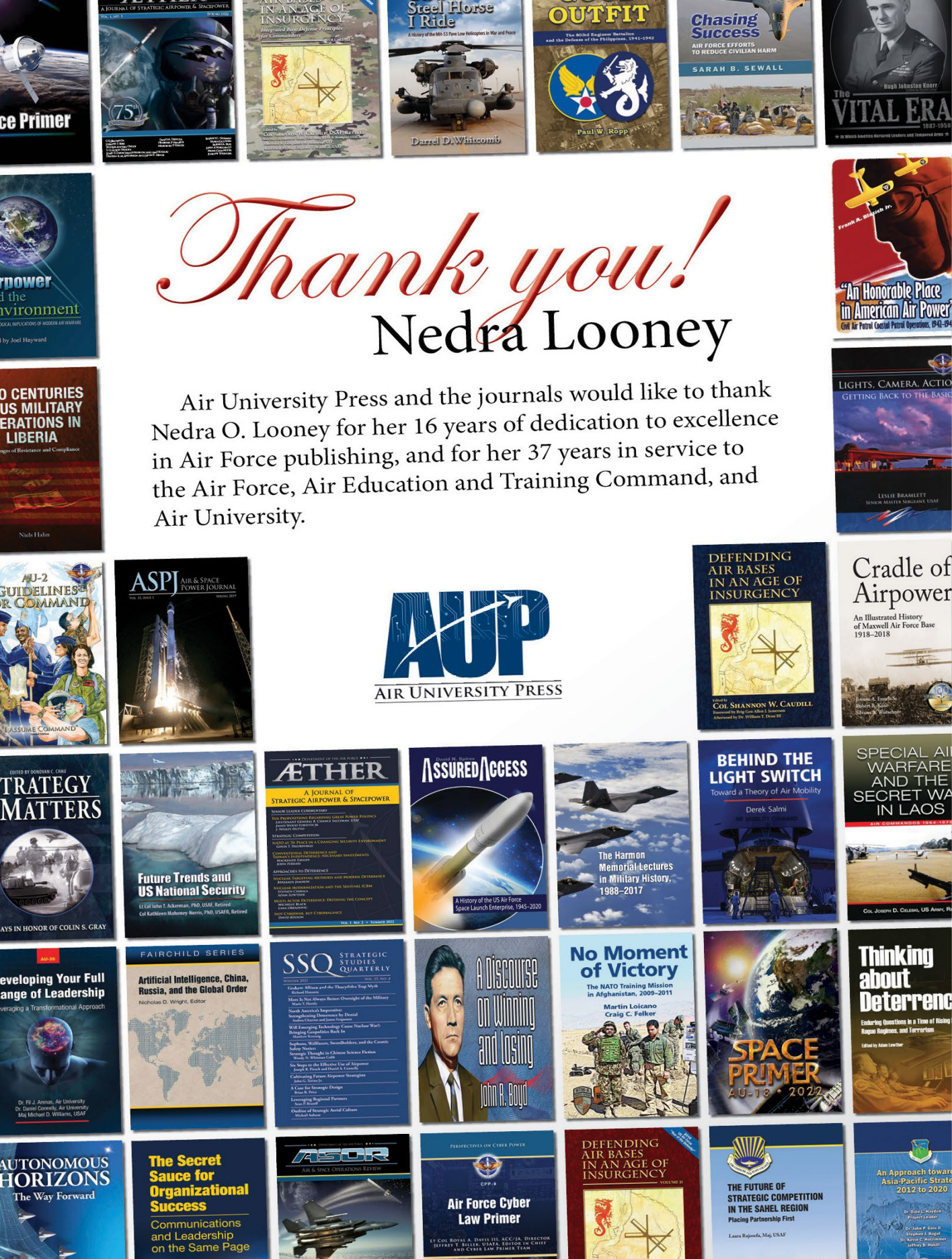
Despite our best efforts to engage and collaborate with leaders in defense over a two-year period associated with the 2022 and 2023 Indo-Pacific Environment Security Forums, we encountered limited success due to a lack of information, competing priorities, insufficient resources, and a sense of urgency. Consequently, this thought piece did not benefit from insights into the latest global thinking. However, it was not constrained by business-as-usual, political considerations or greenwashing.

The objective of this article is to inform (and perhaps also to prompt introspection), inspire, and influence defense leaders to review, recognize, and measure their climate impacts at various scales and take swift measures to reduce them. Leveraging new technologies and clean energy approaches can provide operational benefits to militaries, enhancing their resilience and adaptability to twenty-first–century threats.[20] ✪

Dr. Adam Smith

Adjunct Associate Professor Smith has postgraduate degrees in science and management and serves on the faculty of James Cook University. He is the chief executive officer of Reef Ecologic Pty Ltd, an environmental consultancy based in Queensland, Australia, and provides strategic advice, research and monitoring, and capacity building. The ecological footprint of his company is measured annually and offset to achieve carbon neutral. He is a regular attendee as a speaker, facilitator, and scientist at defense conferences and workshops in the Indo-Pacific region. In 2023, he was awarded an Australia Day Award for Environment Excellence and Sustainability Award.

[20] Leben and Yildiri, "Aggressive action required to meet Defence's ambitious emissions-reduction target"; and Michael Brzoska, "Climate change and the military in China, Russia, the United Kingdom, and the United States," *Bulletin of the Atomic Scientists* 68, no. 2 (2012) 43–54, https://doi.org/.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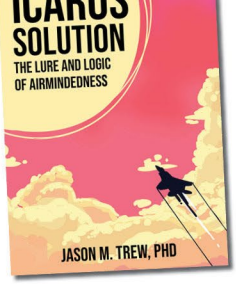
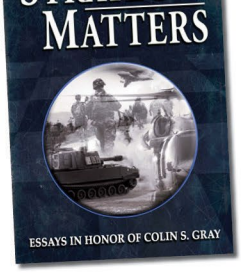
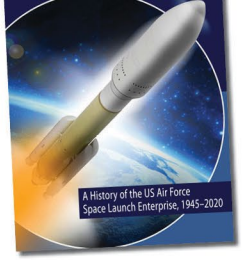
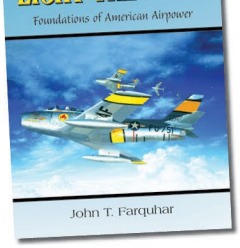
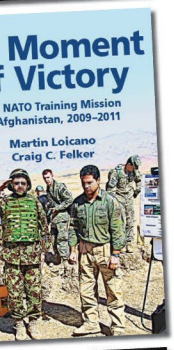
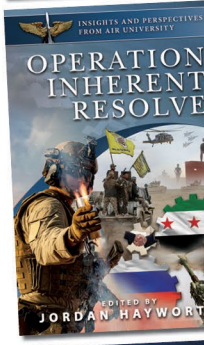








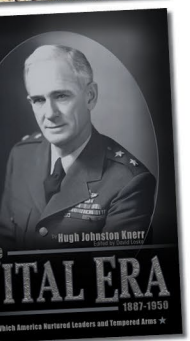


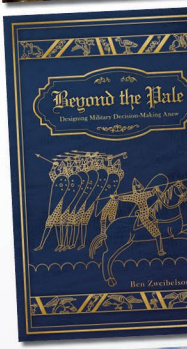


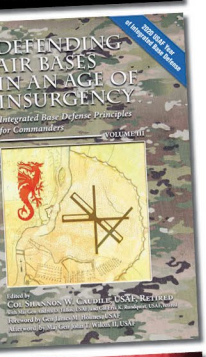
Thank you!

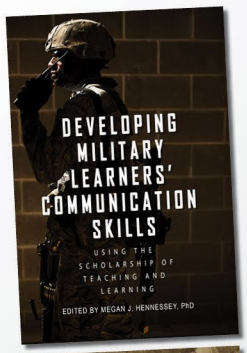
Dr. Chris Rein

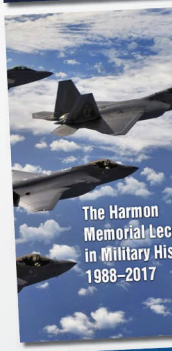
The journals would like to recognize and thank Dr. Chris Rein for his years of service as managing editor at Air University Press. Dr. Rein oversaw the successful publication of numerous books and papers, from May 2019 through January 2024. He has been a steady, thoughtful, and wise colleague, and he will be missed. We wish him well in his future endeavors!

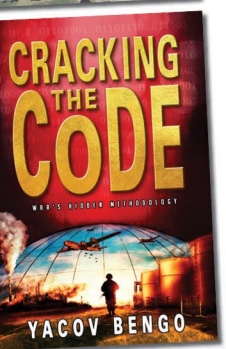


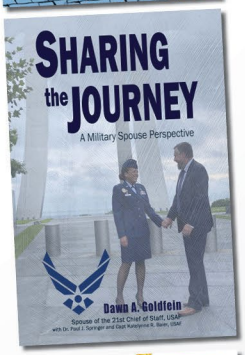


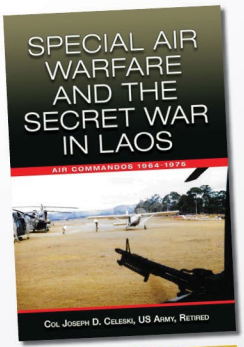


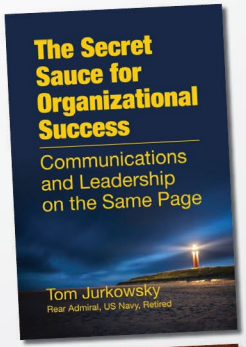


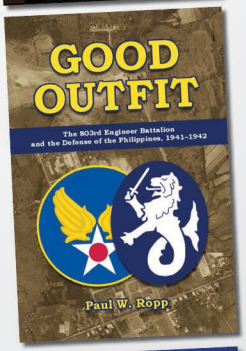


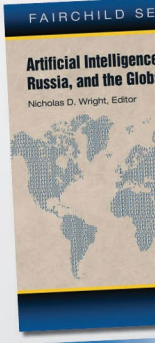


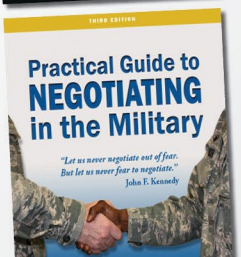


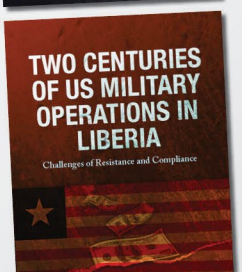


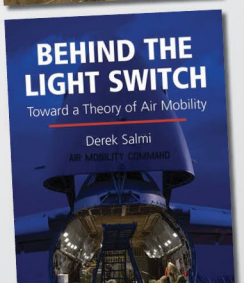












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