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Climate Insecurities: Exploring the Strategic Implications for Asia-Pacific Armed Forces

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Abstract

This paper seeks to explore and assess the implications of climate insecurities for the armed forces of the Asia-Pacific region, and in particular Southeast Asia. It identifies key issues and trends related to climate insecurities – in the areas of mass migration, diseases, natural disasters and the scarcity of water, food and other resources. It then details the implications for armed forces in the region with reference to the strategic, institutional and operational realms, and contends that climate change will become both a burden multiplier and a threat multiplier in the decades to come.

This Policy Series presents papers in a preliminary form and serves to stimulate comment and discussion. The views expressed are entirely the author's own and not that of the RSIS Centre for Non-Traditional Security (NTS) Studies. The paper is the result of research conducted under the Asia Security Initiative programme on internal challenges supported by the MacArthur Foundation. Visit www.asicluster3.com to find out more about this initiative. More information on the work of the RSIS Centre for NTS Studies can be found at www.rsis.edu.sg/nts.

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Biography

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His writings have appeared in *Foreign Policy*, *The Diplomat*, *World Politics Review*, *Asia Pacific Bulletin*, *Asia-Pacific Defence Reporter*, *The Jakarta Post*, *The Straits Times* and *The China Times*. He has written papers for the Brookings Institution, the Singapore Armed Forces, the Korean National Defense University, the University of Manchester, the Complutense University of Madrid, and others. His current research projects and interests deal with defence transformation, civil-military relations, military education and regional security.

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Introduction

Should militaries pay more attention to the implications of climate change? If so, how should they explore and assess the strategic options available to address them? This paper seeks to address these questions, which are pertinent ones in the international security field today. The literature has thus far looked at these questions in ways that are less than accessible to many armed forces. At the same time, the majority of works highlighting the security implications of climate change have tended to fall within the broader 'environmental security' school of thought, which focuses on the possible international security implications of changing weather patterns, rising sea levels, environmental degradation and resource scarcity. Only recently have some observers begun to call attention to what these security implications suggest for military organisations. As we shall discuss in the following section, most of these calls have, however, centred on the implications of climate change for developed Western militaries, with little attention being paid to the armed forces of Asia, a region considered one of the most vulnerable to climate change.

This paper seeks to address this gap by explicating the strategic implications of climate change for the armed forces of Asia, and in particular, Southeast Asia. It argues that from a security perspective, climate change will act both as a burden multiplier (for the natural resources and socio-political-economic infrastructure of countries in the region) and as a threat multiplier (to a country's strategic international and domestic environment). This paper also argues that climate change and natural security – defined as the sufficient, reliable, affordable and sustainable supply of, and access to, natural resources – will have significant ramifications for armed forces in the region, from strategic, institutional and operational perspectives. These impacts will be exacerbated by a nexus of traditional and non-traditional security challenges within the next few decades, including increasing social unrest and internal conflicts, growing regional tension, and the need to devote a larger portion of a military's operational duties to the fields of humanitarian assistance, disaster relief and peacekeeping operations.

This paper will be divided into several sections. First, it will outline why the study of climate change and the military is important. Second, the paper will discuss the security implications of climate change. Third, it will assess how these security ramifications will impact armed forces in the region at the strategic, institutional and operational levels. Finally, several conclusions will be drawn, along with an outline of future policy options as well as an agenda for research.

Why Study Climate Change and the Military

Although it may be very difficult today to attain absolute certainty when it comes to climate change predictions, the scientific evidence that the climate is changing, and that this will have significant effects, is increasingly well established. Policymakers around the world now seem to accept that there is sufficient scientific data to conclude that the speed and magnitude of climate change in the 21st century will be unprecedented and that this will pose daunting challenges to the planet.[1] The 2007 report of the Intergovernmental Panel on Climate Change (IPCC) further clarified the nearly unanimous global scientific opinion that climate change is real, it is already occurring and that these changes will continue for

[1] Alan Dupont, 'The Strategic Implications of Climate Change', *Survival* 50, no. 3 (2008): 30.

decades into the future.[2] While enormous energy and time have been spent on establishing the scientific basis of climate change, there has been less attention given to its security ramifications and how they would further impact armed forces in the region. Yet, there are at least three reasons why it is important to understand how climate change could have an impact on and influence military organisations.

First, military organisations are often expected to be at the forefront of various efforts to respond to the security implications of climate change, such as humanitarian crises, large-scale disasters, social unrest and even border protection. Yet, as will be shown below, very few studies outline specifically how defence planners should think of climate change. Consequently, very little is done to prepare the military for a climate-influenced future.

Second, climate change is not a stand-alone environmental or ecological phenomenon. It also relates to, or has significant impacts on, other policy areas such as energy security and geopolitics. Energy security and geopolitical issues will in turn significantly influence the military's operating environment in ways that have yet been fully understood by defence planners. Also, certain preliminary studies have argued that climate change is altering the nature of international relations – by pitting new power blocks against each other over, for example, the issue of carbon emissions.[3] Thus, as one former US Army Chief of Staff has argued, 'climate change, national security, and energy dependence are all inter-related'.[4]

Finally, understanding and highlighting the ways in which climate change might have an impact on the military could lead to an unlikely suspect – the military – joining the cause, and thus improve the chances of the goals of mitigating and adapting to climate change becoming noticed. The involvement of the military could also be of significance to countries – the US, for example – where military organisations are among the highest carbon emitters. More importantly, military efforts in climate change mitigation and adaptation could serve as exemplars of good practices in environmental management for other government institutions.

Recently, two streams of academic and policy studies are beginning to note the crucial link between climate change and military organisations. The first stream highlights the implications of climate change for regional and international security.[5] These recent studies tend to follow the vast post-Cold War literature on environmental security, and are thus likely to highlight how the meteorological impacts of climate change (e.g., rising sea levels) can lead to domestic or international conflicts.[6] It is a line of argument that can be traced back to

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[2] See M.L. Parry et al., eds. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge: Cambridge University Press, 2007).

[3] See, for example, Paul G. Harris, ed. *Climate Change and Foreign Policy: Case Studies from East to West* (London: Routledge, 2009).

[4] Quoted in Stew Magnuson, 'Climate Change Fears Spill Over to the Defense Community', *National Defense Magazine*, August 2008.

[5] See, for example, Kurt M. Campbell, ed. *Climatic Cataclysm: The Foreign Policy and National Security Implications of Climate Change* (Washington, DC: Brookings Institution Press, 2008); Oli Brown and Robert McLeman, 'A Recurring Anarchy? The Emergence of Climate Change as a Threat to International Peace and Security', *Conflict, Security and Development* 9, no. 3 (2009): 289–305; Nigel Purvis and Joshua Busby, *The Security Implications of Climate Change for the UN System* (Princeton, NJ: Woodrow Wilson Center for International Scholars, 2004).

[6] See, for example, Alan Dupont, *The Environment and Security in Pacific Asia*, Adelphi Paper no. 319 (London: Oxford University Press for the International Institute for Strategic Studies, 1998); Richard A. Matthew et al., eds. *Global Environmental Change and Human Security* (Cambridge, MA: The MIT Press, 2009); Thomas F.

the 1980s, when scholars sought to widen the concept of security to encompass environmental concerns, human rights and development.[7] Another similarity between recent studies on climate insecurities and the environmental security literature is the focus on the link between environmental scarcity and conflict in developing countries.[8] Consequently, these recent works fail to assess why and how military organisations should pay attention to, or respond to, climate change.

Another recent stream of studies looks more specifically at the security implications of climate change for military organisations. However, these studies have tended to focus on major Western militaries, in particular the US and UK armed forces.[9] This is partly because the two countries have enacted laws and policies highlighting the implications of climate change for their national security.[10] As such, very few studies, if any, have explored the security implications of climate change for militaries in developing regions such as Asia and Southeast Asia. In sharp contrast, there is near consensus that developing countries in Asia and Africa will be among those most vulnerable to climate change, and that, as a consequence, their militaries will be at the forefront of many of the security impacts of climate change.

Clearly, the two streams of studies have their merit. However, to address this as a policy-relevant issue for military organisations in the region, there is a need to reformulate the existing scholarly and policy debate on climate insecurities into a clear and comprehensible synthesis. The following section will thus attempt to highlight the key issues and trends in the area of climate insecurities, by examining the complex nexus of climate change, energy security, foreign policy and military organisations that will shape the region in the coming decades.

Homer-Dixon, *Environment, Scarcity, and Violence* (Princeton, NJ: Princeton University Press, 2001). For a critical review, see Marc A. Levy, 'Is the Environment a National Security Issue?' International Security 20, no. 2 (1995): 35–62; Daniel Deudney, 'The Case against Linking Environmental Degradation and National Security', *Millennium: Journal of International Studies* 19, no. 3 (1990): 461–4; John McNeill, 'Diamond in the Rough: Is There a Genuine Environmental Threat to Security', *International Security* 30, no. 1 (2005): 178–95.

[7] See, for example: Lester Russel Brown, *Redefining National Security* (Washington, DC: Worldwatch Institute, 1977); Richard H. Ullman, 'Redefining Security', *International Security* 8, no. 1 (1983): 129–53; Ian Rowlands, 'The Security Challenges of Global Environmental Change', *The Washington Quarterly* 14, no. 1 (1991): 99–113.

[8] See Thomas F. Homer-Dixon, 'On the Threshold: Environmental Changes as Causes of Acute Conflict', *International Security* 16, no. 2 (1991): 76–116; Colin H. Kahl, *States, Scarcity, and Civil Strife in the Developing World* (Princeton, NJ: Princeton University Press, 2006); Jon Barnett and W. Neil Adger, 'Climate Change, Human Security and Violent Conflict', *Political Geography* 26 (2007): 639–55.

[9] For the UK, see J.J. Bailey, 'Is It Practical for Defence to Reduce Its Carbon Emissions without Affecting Its Effectiveness?', *Defence Studies* 9, no. 1 (2009): 47–84. For the US, see Joshua W. Busby, 'Who Cares about the Weather? Climate Change and U.S. National Security', *Security Studies* 17, no. 3 (2008): 468–504; Herbert Carmen, Christine Parthemore and Will Rogers, *Broadening Horizons: Climate Change and the U.S. Armed Forces* (Washington, DC: Center for a New American Security, 2010); Carolyn Pumphrey, ed. *Global Climate Change: National Security Implications* (Carlisle, PA: U.S. Strategic Studies Institute, 2008); Gordon D. Kuntz, 'Renewable Energy Systems: Viable Options for Contingency Operations', *Environmental Practice* 9, no. 3 (2007): 157–61.

[10] See Robert F. Durant, *The Greening of the U.S. Military: Environmental Policy, National Security and Organizational Change* (Washington, DC: Georgetown University Press, 2007); Elizabeth R. Deblois, *Translating Environmental Policy Objectives into Effective Military Installation Management* (PhD Thesis, University of Massachusetts, 2009); UK Ministry of Defence, *Adaptability and Partnership: Issues for the Strategic Defence Review* (Norwich: TSO, 2010).

Climate Insecurities: Issues and Trends

Climate change has numerous ecological and environmental impacts. Sea levels are projected to rise by between 0.18 and 0.59 metres in this century (it should be noted, however, that some studies suggest that, on an aggregate basis, this estimated level of increase is considered modest). The earth's surface temperature will almost certainly warm by more than 2 degrees Celsius.[11] Some societies are likely to see significant drops in food production, due to: shifts in rainfall patterns accelerating erosion and desertification, which render land infertile; sea level increase causing the inundation of farmlands and the disruption of fish populations; and extreme weather events which disturb agricultural processes. Box 1 details the physical effects of climate change identified by the IPCC in 2001, as well as the global and regional trends it identified in 2007.[12]

Box 1: Summary of the expected effects of climate change.

Physical Effects (IPCC, 2001)
- Higher average surface and ocean temperatures. - More rainfall globally from increased evaporation. - More variability in rainfall and temperature, with more frequent and severe floods and droughts. - Rising sea levels from warming water. - Increased frequency and intensity of extreme weather events. - Extended ranges and seasons for mosquitoes and other tropical disease carriers.
Trending Phenomena (IPCC, 2007)
- Over most land areas, warmer and fewer cold days and nights, warmer and more frequent hot days and nights. - Increased frequency of warm spells and heat waves over most land areas. - Increased heavy precipitation events over most areas. - Increase in areas affected by drought. - Increase in intense tropical cyclone activity. - Increase in incidents of extremely high sea levels (including tsunamis).
Regional Impacts in Asia (IPCC, 2007)
- By the 2050s, freshwater availability in Central, South, East and Southeast Asia, particularly in the large river basins, is projected to decrease. - Coastal areas, especially the heavily populated mega delta regions of South, East and Southeast Asia, will be at the greatest risk from increased flooding from the sea and, in some mega deltas, flooding from rivers. - Climate change is projected to compound the effect of pressures on natural resources and the environment associated with rapid urbanisation, industrialisation and economic development. - Endemic morbidity and mortality due to diarrheal disease, which is primarily associated with floods and droughts, are expected to rise in East, South and Southeast Asia due to projected changes in the hydrological cycle.

Note: IPCC – Intergovernmental Panel on Climate Change
Source: Adapted from M.L. Parry et al., eds. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge: Cambridge University Press, 2007): 7–22.

[11] See Robert J. Nicholls, 'Coastal Flooding and Wetland Loss in the 21st Century: Changes under the SREs Climate and Socio-economic Scenarios', *Global Environmental Change* 14, no. 1 (2004): 79.
[12] See Parry et al., *Climate Change 2007: Impacts, Adaptation and Vulnerability*, 7–22.

While the full and precise security implications of the physical effects outlined in Box 1 have not been fully assessed and properly understood, it is safe to argue that climate change will impact military organisations through at least two ways – as a burden multiplier and as a threat multiplier.

Climate change can act as a burden multiplier that will complicate and multiply pre-existing environmental tensions and pressures impacting regional and domestic natural security. It will affect the supply of, and access to, natural resources such as energy, minerals, water and arable land, and as a consequence, the availability of public goods such as food and electricity.[13] This in turn will have significant ramifications for the military's domestic and regional strategic environment. For example, as a result of unbearable food and electricity crises, the military might be called on to conduct riot controls and humanitarian operations.

Climate change can also act as a threat multiplier that will either exacerbate existing intra- and inter-state conflicts and tensions, or create new ones. Of course, the path from climate change to conflict will not be a direct one. There are at least three possible routes from climate change to armed conflict.[14] First, conflict can emerge after a sustained period of divergent climate patterns. For example, long-term climate change-induced mass migrations could create destabilising conditions within host countries. Second, climate change can, in concert with other factors, contribute to and shape conflict. For example, with sustained climate change, social wealth will decline and the social fabric will weaken, making a society more vulnerable to future challenges. Third, climate change can create the structural conditions for conflict. In this case, however, it would require a trigger to set off any strife. For example, as climate change increases competition over strategic resources, an accident at sea which takes place in a disputed area with high energy reserves (e.g., the South China Sea) might lead to open conflict.

To avoid 'securitising' every issue related to climate change, however, several basic criteria could be used to assess whether or not a particular issue has serious consequences for national security (see Box 2). After all, climate change is not a unified phenomenon that will affect every region and every country evenly – some regions or countries are more vulnerable than others. The Stern Review, for example, argues that developing countries are particularly vulnerable because of their tropical geography; their high population growth; their heavy dependence on agriculture and their rapid urbanisation; and their weak infrastructures and lack of resources.[15]

[13] The concept of 'natural security' is developed in Sharon E. Burke, *Natural Security* (Washington, DC: Center for a New American Security, 2009) and Christine Parthemore and Will Rogers, *Sustaining Security: How Natural Resources Influence National Security* (Washington, DC: Center for a New American Security, 2010).
[14] James R. Lee, *Climate Change and Armed Conflict: Hot and Cold Wars* (London: Routledge, 2009), 3–7.
[15] Nicholas Stern, *The Economics of Climate Change* (Cambridge: Cambridge University Press, 2007).

Box 2: Assessing climate change and national security threats.

Does Climate Change Pose a Serious National Security Threat?
Assessment Criteria

- Climate change threatens the existence of the country.
- Climate change could decapitate the seat of government.
- Climate change could threaten the country's monopoly over force.
- Climate change could disrupt or destroy critical infrastructure.
- Climate change could lead to such catastrophic short-run loss of life or general well-being that government legitimacy is undermined.
- Climate change could cause these effects on neighbours and spur a refugee crisis.
- Climate change could alter the territorial borders or waters of the country.
- Climate change could lead to catastrophic short-run loss of life among a country's armed forces, causing it to suddenly disintegrate (e.g., due to a tsunami or a disease outbreak).

Source: Modified from Joshua W. Busby, 'Who Cares about the Weather? Climate Change and U.S. National Security', *Security Studies* 17, no. 3 (2008).

The greenhouse gas (GHG) emissions scenario developed by the IPCC pictures a world in which people and nations will be threatened by significant food and water shortages, devastating natural disasters and deadly disease outbreaks.[16] The following outlines some of the key security issues that will likely arise as a result of climate change.

Mass migration

Climate change-induced migration of displaced persons on a short-term basis may not seem highly significant. However, as these migrants accumulate over an extended period of time, there will be substantial demographic, social, economic, cultural and political ramifications within the host nation-states. Indeed, studies have shown that refugee flows and unregulated movements can destabilise states internally, aggravate trans-border conflicts, create political tensions between states and jeopardise human security. One study, for example, suggests that countries experiencing an influx of refugees from neighbouring states are significantly more likely to experience civil wars.[17]

The impact of climate change-induced migration will be most pronounced in the developing world, as it will widen the wealth gap between and within these countries. Indeed, some already contend that climate or environmental refugees are now the fastest growing proportion of refugees globally, and that by 2050, some 150 million people could be displaced because of global warming.[18] This migration will also deprive countries in the region of sorely needed economic and intellectual capital, and in some cases, spark conflict

[16] See Parry et al., *Climate Change 2007: Impacts, Adaptation and Vulnerability*.
[17] Idean Salehyan and Kristian Skrede Gleditsch, 'Refugees and the Spread of Civil War', *International Organization* 60, no. 2 (2006): 335–66.
[18] Norman Myers, 'Environmental Refugees: A Growing Phenomenon of the 21st Century', *Philosophical Transactions of the Royal Society* 357, no. 1420 (2002): 609–13.

by heightening competition over scarce resources and upsetting the socio-cultural order in the region.[19]

In the short term, there could be an increasing number of population dislocations due to particular climate stimuli. In the long term, there could be larger scale population movements that build more slowly but gain momentum as adverse shifts in climate interact with other migration drivers such as political disturbances, ecological stress and socioeconomic changes. These conditions will likely be exacerbated by global demographic trends. It is projected that the global population will be 8.6 billion by 2025 (with the Asia-Pacific hosting 2.5 billion of this number) and 11.2 billion by 2050.[20] In certain regions – in Southeast Asia, for example – demographic and population shifts might also co-mingle or coincide with poverty and increased crime rates, especially where regional organised drug syndicates are active. This might in turn exacerbate regional drug, human or weapons trafficking problems – which could also have significant implications for regional relations in cases where state boundaries are less than clear and historical animosities run high.

Thus, climate change could lead to disruptive migration patterns which could in turn lead to numerous socio-political, economic and security impacts. It is therefore not surprising that states feel overwhelmed by what they perceive as uncontrolled migration, and that as a consequence, many will employ military forces to deal with the challenge.[21] Thus, the perspective that climate change-induced migration is a security matter requiring a military response stems from a number of causes, including the perception that migrants may be a socioeconomic or political burden, a threat to national identity or even an overt security threat to local populations.[22]

Water and food scarcity

Climate change will have significant ramifications for water and food security. For example, extreme weather events and greater fluctuations in rainfall and temperatures have the capacity to refashion the world's productive landscape. Rising sea levels will inundate and make unusable fertile coastal land, and any changes in the strength and seasonality of ocean currents will cause fish species to migrate and disrupt breeding grounds.[23] Also, variable rainfall could contribute to periodic water scarcity and crop failure. A recent study further notes that variable rainfall makes the onset of violent conflict more likely as economic conditions drive desperate men to take up arms.[24]

Additionally, in a world where over 2 billion people already suffer moderate to high water stress, relatively small shifts in rainfall patterns could push countries and whole regions into water deficit, and might even cause conflicts over water. In Asia, per capita availability of water has already declined by between 40 and 65 per cent since 1950, and by 2025 half a billion people could be suffering from serious water shortages due to climate change and its

[19] John Podesta and Peter Ogden, 'The Security Implications of Climate Change', *The Washington Quarterly* 31, no. 1 (2007–2008): 117.
[20] Dupont, *The Environment and Security in Pacific Asia*, 18.
[21] Paul J. Smith, 'Climate Change, Mass Migration, and the Military Response', *Orbis* 51, no. 4 (2007): 619.
[22] For a discussion, see Christopher Rudolph, 'Security and the Political Economy of International Migration', *American Political Science Review* 97, no. 4 (2003): 603–20.
[23] Dupont, 'The Strategic Implications of Climate Change', 32.
[24] Cullen S. Hendrix and Sarah M. Glaser, 'Trends and Triggers: Climate, Climate Change and Civil Conflict in Sub-Saharan Africa', *Political Geography* 26, no. 6 (2007): 695–715.

related effects.[25] The increase of climate change-induced droughts (possibly by as much as 30 per cent in the coming decade) will make matters worse.[26] Water scarcity and drought are also often compounded by an accompanying depletion of food resources. This combination has been cited as a potential recipe for conflicts. For example, some researchers have found that historically there is a link between temperature fluctuations, reduced agricultural production and the frequency of warfare in Europe, China and the rest of the northern hemisphere over the last millennium.[27]

Water scarcity also shapes the geopolitical order when states engage in direct competition with neighbours over shrinking water supplies. This is not to say that 'water wars' per se will emerge. If anything, it is likely that states located in regions already stretched past their water limits will pursue technological and political solutions to ensure their continued existence.[28] However, in certain geographical regions, water scarcity will add further resource and energy pressures to an already fragile society. This can be seen, for example, in the 'equatorial tension belt', the region comprising the northern half of South America, central Africa, the Persian Gulf, South and Southeast Asia, and the islands of the western Pacific. Countries along the belt experience climate patterns inherent to tropical and desert areas.[29] In these areas, population levels and demands have reached a point where environmental resources are under stress; and climate change will make significant portions of these areas hotter and drier. These conditions, when mixed with the socio-political diversity and historical animosities within and among states, could make conflict more likely in the future.

Resource scarcity

Climate change will exacerbate the various problems associated with resource scarcity in Asia, especially as it relates to energy and other strategic resources. It should be noted, however, that when and how resource scarcity could lead to conflict depends largely on the degree of a society's natural security vulnerability. This vulnerability can be further measured by looking at: (1) the extent to which societies are dependent on natural resources and ecosystem services; (2) the extent to which the resources and services that societies do rely on are sensitive to changes in climate; and (3) the capacity of societies to adapt to changes in these resources and services.[30]

Global warming, along with population increases, the rise in protein requirements and shore-based pollution of the seas, has been cited as among the possible drivers of marine resource scarcity. Consequently, experts have predicted that there will be increasing competition among maritime powers over fishing rights and territorial boundaries, especially in the South China Sea.[31] A study claims that the total catch in the South China Sea increased from

[25] Dupont, 'The Strategic Implications of Climate Change', 33.
[26] Quoted in Ben Vogel, 'Climate Change Creates Security Challenge "More Complex than Cold War"', *Jane's Defence Weekly*, 30 January 2007.
[27] Quoted in Jurgen Scheffran, 'Climate Change and Security', *Bulletin of the Atomic Scientists* 64, no. 2 (2008): 20.
[28] Podesta and Ogden, 'The Security Implications of Climate Change', 121.
[29] Michael T. Klare, *Resource Wars: The New Landscape of Global Conflict* (New York: Henry Holt and Company, 2001), 215.
[30] This assessment is based on International Crisis Group, 'Key Issues: Climate Change and Conflict', http://www.crisisgroup.org/en/key-issues/climate-change-and-conflict.aspx#two (accessed on 28 August 2010).
[31] Bernard D. Cole, *Sea Lanes and Pipelines: Energy Security in Asia* (Westport, CT: Praeger Security International, 2008), 8.

425,000 tons in 1955 to 3.34 million tons in 1999.[32] Correspondingly, the resource density has dropped to around one-quarter of what it was a quarter century ago.

Furthermore, with the new scramble to secure hydrocarbon resources, the geopolitics of energy and resource scarcity will shape Southeast Asia's strategic environment. Already, in the Asia-Pacific region, resource scarcity is aggravating tensions over unresolved maritime boundaries.[33] That being said, the linkage between energy security and climate change, although an important one, is by no means straightforward.

First, the burning of fossil fuels – oil, gas and coal – to produce energy is by far the main source of anthropogenic GHG emissions.[34] In fact, slightly more than half of the total effect is due to carbon dioxide (CO_2) and about two-thirds from energy conversion.[35] Mitigating and adapting to climate change therefore cannot be successful without changing the way we produce, transform and use energy. As such, policies designed to address energy security concerns linked to resource concentration are likely to have significant implications for climate change mitigation and adaptation, and vice versa.

Second, climate change is heightening concerns over future supplies of energy, complicating energy choices by adding to the costs of production and usage.[36] Two dimensions of energy security are particularly relevant here: (1) the physical disruption of supplies due to infrastructure breakdown, natural disasters, social unrest, political action or terrorism; and (2) the deleterious effects on economic activity and peoples due to energy shortages, widely fluctuating prices or price shocks.[37] These dimensions are further complicated by the uneven distribution of fossil fuel resources around the world. For instance, Middle Eastern countries account for 83 per cent of the oil imported by the Asia-Pacific region in 2005.[38] Such dependence on only a few countries often indicates that a country is vulnerable to energy insecurity. This is particularly so if those few suppliers are located in conflict-prone areas like the Middle East.

Third, the linkage between energy security and climate change can have near- and long-term implications for military mission effectiveness. Employing more fuel-efficient aircraft, for example, could give a country's air force longer endurance (e.g., through having to refuel less often) and reduce logistical constraints. In the long term, linking energy and climate change also offers an opportunity to strengthen mission effectiveness by limiting the amount of GHG emissions. That would contribute to climate change, which in turn could have

[32] Kuen-chen Fu, 'Regional Cooperation for Conservation and Management of Fishery Resources in the South China Sea', in *China-ASEAN Relations: Economic and Legal Dimensions*, ed. John Wong, Zou Keyuan and Zeng Huaqun (Hackensack, NJ: World Scientific, 2006), 220–1.
[33] Dupont, *The Environment and Security in Pacific Asia*, 26.
[34] Nicolas Lefevre, *Energy Security and Climate Policy: Assessing Interactions* (Paris: International Energy Agency, 2007), 28.
[35] Toufiq A. Siddiqi, 'The Environmental Context of Energy', in *Asia's Energy Future: Regional Dynamics and Global Implications*, ed. Kang Wu and Fereidun Fesharaki (Honolulu: East-West Center, 2007), 23.
[36] Dupont, 'The Strategic Implications of Climate Change', 34.
[37] In practice, of course, there are other dimensions of energy security, such as long-term physical availability of supplies and potential disruptions from acts of terrorism. For details, see Economic Commission for Europe, *Emerging Global Energy Security Risks*, ECE Energy Series no. 36 (New York: United Nations, 2007), 8.
[38] Widhyawan Prawiraatmadja et al., 'Oil', in Wu and Fesharaki, *Asia's Energy Future*, 45.

strategic and operational implications due to the changes in the physical, social and political environments.[39]

Finally, climate change has significant geopolitical impact on energy insecurity when we take into account the full ramifications of the submergence of small atolls, rocks and low-lying islands due to sea level rise. These will shift territorial boundaries and countries' exclusive economic zones (EEZ). When this occurs in disputed maritime domains such as the South China Sea which has huge deposits of gas and marine resources, tensions and incidents at sea become more likely. This problem is complicated by the fact that international law currently provides no specific answer to the question of what would happen to sovereignty and EEZ claims should an island, or even a country, be submerged.[40]

With these four inter-connections in mind, climate change might arguably add further pressure to existing scarcities of strategic resources (such as oil and gas) while increasing the complications of Asia's geopolitical maritime theatre. This is particularly salient when we consider that, in the region, resource scarcity is set to worsen because of accelerating domestic demand, high exploration and development costs, political uncertainties and a decline in recoverable oil reserves.[41]

Overall, the projected increase in world oil demand from 86 million barrels per day (mbd) today to over 119 mbd in 2025 would require in the next two decades an incremental increase in world production capability sufficient to supply the additional demand as well as replace the yearly drop (currently at 5 per cent) in production from known fields.[42] In the Asia-Pacific as a whole, primary commercial energy consumption increased sixfold between 1965 and 2005, largely due to economic growth.[43] In Southeast Asia too, where the economy grew by nearly 5 per cent annually, energy consumption rose by 7.5 per cent from 1980 to 1999.[44]

Under these conditions, the possible militarisation of resource management, especially energy, cannot be entirely dismissed – though certainly factors other than simply energy needs would have to come to play for an actual armed conflict to occur. Asia's maritime-dominated geopolitical theatre suggests that future rivalry over resources will be fought at sea – where boundaries are harder to delineate and the international strictures against aggression are less easily applied. It is plausible therefore that the region's security environment will be complicated by the confluence of terrorism, political instability and conflicting claims over access to energy (due to rise in demand).[45]

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[39] Will Rogers, *Promoting the Dialogue: Climate Change and America's Air Forces* (Washington, DC: Center for a New American Security, 2010), 6.
[40] Dupont, 'The Strategic Implications of Climate Change', 36.
[41] Kent E. Calder, *Asia's Deadly Triangle: How Arms, Energy and Growth Threaten to Destabilize Asia-Pacific* (London: Nicholas Brealey Publishing, 1996), 47–8.
[42] Gal Luft and Anne Korin, 'Energy Security: In the Eyes of the Beholder', in *Energy Security Challenges for the 21st Century: A Reference Handbook*, ed. Gal Luft and Anne Korin (Santa Barbara, CA: Praeger Security International, 2009), 1.
[43] Kang Wu, Jeffrey G. Brown and Toufiq A. Siddiqi, 'The Asia-Pacific Energy Dilemma', in Wu and Fesharaki, *Asia's Energy Future*, 1.
[44] Shankar K. Karki, Michael D. Mann and Hossein Salehfar, 'Energy and Environment in the ASEAN: Challenges and Opportunities', *Energy Policy* 33 (2005): 499.
[45] Donna J. Nincic, 'Troubled Waters: Energy Security as Maritime Security', in Luft and Korin, *Energy Security Challenges for the 21st Century*, 31.

In Southeast Asia, piracy, illegal fishing and choke point vulnerabilities co-mingle with the uncertainties of historical animosities and lingering unresolved maritime disputes.[46] These complexities are significant as the region contains nearly all the shipping routes for energy transportation from the Middle East, Africa and Latin America.[47] There are at least a dozen geostrategic straits including the Malacca Strait. As many as 50,000 transits by seagoing vessels are made through the Malacca Strait annually, representing almost 25 per cent of the world's maritime trade and carrying about 11.7 mbd of oil in 2004. This dependency is even more significant given that no other form of oil transportation is more efficient.[48] Climate change will complicate all the abovementioned geopolitical fault lines – not just in the form of rising sea levels that exacerbate pre-existing boundary disputes, but also through the added pressure on the capacity of many countries in the region to provide the resources to meet the growth in demand as their economies expand.

Disease

Climate change will have a number of serious health-related impacts, including illness and death directly attributable to temperature increases, extreme weather, air pollution, water diseases, vector and rodent-borne diseases, and food and water shortages.[49] Temperature is indeed a key factor in the spread of some infectious diseases. The World Health Organization (WHO) estimates that climate change was responsible in 2000 for 2.4 per cent of worldwide diarrheal diseases, 6 per cent of malaria cases in some middle-income countries and 7 per cent of dengue fever cases in some industrialised countries. In total, the attributable mortality was 154,000 deaths.[50]

Water-borne and vector-borne diseases, such as malaria, will be most prevalent in countries with significant additional climate change-induced rainfall. Specifically, Indonesia, Malaysia, Thailand and most of Southeast Asia will see increased dengue fever transmission and increased respiratory illness.[51] Moreover, the risk of a pandemic is heightened when deteriorating conditions prompt human migration. This increase in disease outbreaks will inevitably lead to disputes between nations, or between communal or ethnic groups within a country, over the movement of people. Also, if certain border protection measures underlying disease quarantine policies are perceived as discriminatory, bilateral relations could be damaged.[52]

Economically, the impact of disease outbreaks could also be severe as it could result in the restriction of the movement of goods, leading to political instability in countries where poverty and resource scarcity are already prevalent. The added cost related to health treatment and

[46] An estimated 39 per cent of maritime boundaries are only partially resolved. See Clive Schofield and Ian Storey, 'Energy Security and Southeast Asia: The Impact on Maritime Boundary and Territorial Disputes', *Harvard Asia Quarterly*, 3 February 2006. http://asiaquarterly.com/2006/02/03/ii-135/ (accessed on 24 March 2011).
[47] Zhang Xuegang, 'Southeast Asia and Energy: Gateway to Stability', *China Security* 3, no. 2 (2007): 19.
[48] The cost per barrel per 1,000 kilometres is USD0.163 by tanker, USD0.793 by pipeline, and USD7.19 by train. Quoted in Cole, *Sea Lanes and Pipelines*, 1.
[49] Dupont, 'The Strategic Implications of Climate Change', 37.
[50] World Health Organization, *The World Health Report 2002: Reducing Risks, Promoting Healthy Life* (Geneva: World Health Organization, 2002), 72.
[51] See Assaf Anyamba et al., 'Developing Global Climate Anomalies Suggest Potential Disease Risks for 2006–2007', *International Journal of Health Geographic* 5 (2006): 60–8.
[52] See Podesta and Ogden, 'The Security Implications of Climate Change', p. 123.

insurance would also add further pressure to a country's fragile economic fabric. In some cases, these conditions could lead to the possible rise of opposition or extremist groups that would challenge the government's legitimacy and lead to a protracted insurgency.[53]

Finally, it is also very likely that disease outbreaks could impact soldiers stationed in border areas where health infrastructure is scarce or those in major urban centres. Disease burdens may also erode the effectiveness of military security forces, while at the same time destabilising socioeconomic political systems and compounding, or intersecting with, other problems such as drug trafficking.[54] In certain cases, this might even change the regional balance of power.

Natural disasters

Natural disasters seem set to climb in line with the warming of the planet. Of course, the incidence of natural disasters may rise for reasons other than climate change. Yet, there seems to be a strong correlation between the steady rise in ocean temperatures attributable to anthropogenic GHG emissions and the demonstrable increase in storm frequency and intensity.[55] Large storms have been said to typically require ocean temperatures of 27 degrees Celsius, which are now occurring more regularly. Between 1990 and 1999, an estimated 188 million people per year were affected by natural disasters.[56] While this does not suggest that climate change is to blame for all the damage, it is plausible to argue that climatic changes are correlated with the occurrence of several types of natural disasters and extreme weather events, and that in areas where preparedness is low and vulnerability is high, could wreak havoc.

By their very nature, large-scale natural disasters are already a significant security threat if proper disaster relief and management mechanisms are not put in place. Inadequate response from governments could meanwhile further undermine their legitimacy, especially if they are seen to be unable to cope with or address the post-disaster phase adequately. Recent studies have also shown that disasters actually foster competition between groups for basic resources – food, water and shelter – thus enhancing the probability that conflict will occur.[57] Other studies found that disasters enhance the risk of violent civil conflict in countries with high levels of inequality, mixed regimes and slow economic growth.[58]

[53] See, for example, Susan Peterson, 'Epidemic Disease and National Security', *Security Studies* 12, no. 2 (2002/2003): 43–81.
[54] Christopher Jasparro and Jonathan Taylor, 'Climate Change and Regional Vulnerability to Transnational Security Threats in Southeast Asia', *Geopolitics* 13, no. 2 (2008): 248.
[55] Kerry Emanuel, 'Increasing Destructiveness of Tropical Cyclones over the Past 30 Years', *Nature* 436, no. 7051 (2005): 686–8; C.D. Hoyos et al., 'Deconvolution of the Factors Contributing to the Increase in Global Hurricane Intensity', *Science* 312, no. 5770 (2006): 94–7.
[56] Purvis and Busby, *The Security Implications of Climate Change*.
[57] See Dawn Brancati, 'Political Aftershocks: The Impact of Earthquakes on Intrastate Conflict', *Journal of Conflict Resolution* 51, no. 5 (2007): 715–43.
[58] Philip Nel and Marjolein Righarts, 'Natural Disasters and the Risk of Violent Civil Conflict', *International Studies Quarterly* 52, no. 1 (2008): 159–85.

Climate Insecurities: Implications for Military Organisations

The preceding analysis has shown that climate change has wide-ranging security implications. Indeed, as one scholar noted, 'security is affected by climate, energy is affected by climate, security is affected by energy, and climate is affected by energy'.[59] Furthermore, a rapidly warming planet presents palpable geopolitical risks for countries in the region, increasing national vulnerabilities, exacerbating inter- and intra-state tensions, and threatening the survival of some societies.[60] Defence planners should pay close attention to these developments, as their respective militaries will be called upon to address them.

Unlike traditional defence planning, which is geared towards preparing for relatively low probability, high consequence events such as war, planning for climate change is different in two ways.[61] First, climate change is more likely to result in a high consequence event and, unlike most threats that are singular in their timing and nature, climate change and its impacts will persist over a long period of time. Second, climate change is also more certain to occur than conventional military threats. Therefore, it is inevitable that there would be a need to do a little crystal ball gazing to discern the various implications of climate insecurities; defence planners can then take into account the physical effects that operating in a warmer climate will have on mission, doctrine, structure, operations and equipment.

The question of how climate change will impact military organisations can be viewed from two perspectives. First, the ways in which climate change affects the military directly could be examined. The review may include the following: infrastructure challenges; the need to adapt to changing conditions, such as longer and more pronounced heat waves or stronger storms at sea; changing undersea conditions; supply chain challenges in relation to food, fuel and water; and increases in climate-related missions, such as humanitarian operations and disaster relief.

Second, the issue of how militaries could contribute to mitigation and adaption efforts could be explored. This may include putting in place fuel efficiency policies aimed at reducing GHG emissions. After all, the Kyoto Protocol did stipulate that military emissions from domestic activities are to be included in national inventories – though impacts from air and sea operations are less clearly specified.[62]

It should be noted however that, with the exception of the US, the contribution of militaries to global carbon emissions is small.[63] The focus of this section, therefore, is not to highlight how militaries in general can mitigate climate change, but how they can contribute as a governmental arm in terms of providing examples of good practices in environmental management while simultaneously improving their overall effectiveness and efficiency. To this end, the section employs three levels of analysis – strategic, institutional and operational – noting the relevance of each to the armed forces of the Asia-Pacific region and Southeast Asia.

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[59] E. Thomas Morehouse, Jr., 'Climate, Energy, and Security – A Related Set of Challenges', in Pumphrey, *Global Climate Change: National Security Implications*, 284.
[60] Dupont, 'The Strategic Implications of Climate Change', p. 31.
[61] Morehouse, Jr., 'Climate, Energy, and Security', 283.
[62] For more details on military carbon emissions and the Kyoto Protocol, see Axel Michaelowa and Tobias Koch, 'Military Emissions, Armed Conflict, Border Changes, and the Kyoto Protocol', *Climatic Change* 50, no. 4 (2001): 383–94.
[63] Bailey, 'Is It Practical for Defence', 49.

Strategic-level analysis

Given the impacts of climate insecurities discussed in the previous section, it would be possible to envision the strategic scenarios that would likely unfold in Asia and Southeast Asia. The first involves the complicating effects of climate change on the region's strategic operating environment, especially as it relates to maritime boundary disputes and energy security. The second involves the changing mission and function of military organisations as a result of climate change-induced humanitarian crises and large-scale disasters.

At the global level, a world of rising powers – China, India, Japan and Russia, to name a few – and shrinking fossil fuel resources is 'destined to produce intense competition among an expanding group of energy-consuming nations' for control over the planet's remaining reserves of hydrocarbons and other key industrial materials.[64] To enhance their competitive stance vis-à-vis one another, these energy-hungry countries may forge strategic partnerships with energy-rich states, often cementing them with massive arms transfers, military alliances or troop deployments. As a result, geopolitical conflicts might be more likely as regional enmity collides with historical distrust and unfinished territorial disputes.

As Asian countries become more import dependent, emerging energy security issues include: (1) 'energy nationalism' versus regional and international market cooperation; (2) energy source diversification from fossil fuels to nuclear energy and coal; and (3) the intensification of both contingent and structural risks to energy security.[65] These issues will also be tied to force development in the region as the possibility of conflict over energy resources provides 'a much-needed rationale for preserving the heavy conventional forces that still consume the lion's share of defence spending'.[66]

Strategically, climate change will exacerbate all these brewing regional tensions. Greater hurricane and typhoon activity, for example, will endanger oil and gas drilling in exposed offshore areas, while diminished rainfall will reduce water flow into many hydroelectric dams. Extreme weather events could also destroy refineries and electrical grids, and warmer temperature will boost demand for air-conditioning. This means that energy demand will be harder to meet, leading to more intense competition for energy sources. In Southeast Asia, the region's primary energy demand will increase from 492.1 million tons of oil equivalent (Mtoe) in 2005 to 988.2 Mtoe in 2030, while net oil import dependency will increase from 29.6 per cent in 2005 to 71.9 per cent in 2030.[67]

Rising sea levels will also complicate maritime boundaries and escalate incidents at sea into a broader conflict. This scenario is most likely to play out in the South China Sea, where its undersea resources are subject to overlapping and contested claims. The Spratlys, for example, according to China's Ministry of Geology and Mineral Resources (arguably inconclusive) estimates of a decade ago, hold 17.7 billion tons of oil and natural gas

[64] Michael T. Klare, *Rising Powers, Shrinking Planet: The New Geopolitics of Energy* (New York: Henry Holt and Company, 2008), 7.
[65] William T. Tow, 'Strategic Dimensions of Energy Competition in Asia', in *Energy Security in Asia*, ed. Michael Wesley (London: Routledge, 2007), 161.
[66] Daniel Moran and James A. Russell, 'The Militarization of Energy Security', in *Energy Security and Global Politics: The Militarization of Resource Management*, ed. Daniel Moran and James A. Russell (London: Routledge, 2009), 2.
[67] Asian Development Bank, *Energy Outlook for Asia and the Pacific* (Manila: Asian Development Bank, 2009), 42.

reserves.[68] This has made the islands the subject of boundary disagreements, with the disputants in this instance (China, Vietnam, Malaysia, Brunei, the Philippines and Taiwan) appearing prepared to employ military force. Between 1974 and 2002, there were a total of 17 military clashes in the area.[69] Already a 'nightmare for the determination and adjudication of EEZ boundaries', the situation in the area is set to become more complicated as rising sea levels are likely to cause the submergence of the disputed atolls.[70] Indeed, some of the low-lying atolls are already partially submerged and the highest (Southwest Cay) is only 4 metres above sea level.[71]

As a consequence of this volatile mix, it is only natural that militaries in the region begin to focus more on their naval development. Malaysia took delivery of its first Scorpene submarine in early 2009, while Singapore has commissioned six new frigates. Thailand, already in possession of the region's first aircraft carrier, is also considering submarine procurements to go along with its next generation Gripen jet fighters. China has also systematically bolstered its naval capabilities, changing from a 'coastal-defence' navy to possibly a 'blue-water' navy.

At the domestic level, climate change and energy insecurity might further exacerbate political and economic vulnerabilities, as well as increase resource pressures. There is also the possibility of an increase in the number of large-scale disasters. Specifically, this will influence the nature of military missions as domestic insurgencies might arise at the same time as possible regional conflicts over access to natural resources.

In addition, as large-scale natural disasters are increasing in frequency, humanitarian assistance and disaster relief (HADR) as part of the military's operational mission may become more frequent. This is mainly because militaries are usually the only organisations with the resources and skilled personnel necessary to respond quickly and effectively to natural disasters (see Table 1). It should be noted, however, that studies have shown that in large-scale disasters, the military's role should be limited to a number of areas, such as logistics, and not encompass the entire spectrum of pre- and post-disaster management and relief efforts.[72]

[68] Quoted in Dupont, *The Environment and Security in Pacific Asia*, 31.
[69] See U.S. Energy Information Administration, 'Countries–Overview', *U.S. Energy Information Administration*, http://www.eia.doe.gov/cabs/Sou th_China_Sea/TablesMaps.html (accessed on 25 September 2010).
[70] Klare, *Resource Wars*, 119.
[71] Dupont, 'The Strategic Implications of Climate Change', 36.
[72] See, for example, Jay Levinson, 'Military Involvement in Disaster Response', in *Disaster Management Handbook*, ed. Jack Pinkowski (CRC Press, 2008).

Table 1: Military capabilities relevant for humanitarian assistance and disaster relief (HADR) operations.

Operational area	Relevant capabilities
Security	Establishment of safe havens. Protection of relief supplies. Maintenance of a credible armed presence to reduce the threat of violence.
Transport and logistics	Rapid transport of personnel and supplies. Provision of an ongoing supply of equipment and materials.
Construction and repair	Building or repairing of essential infrastructure: roads, bridges, storage facilities, emergency runways.
Command, control and communications	Sophisticated communications systems. Rapid and complex contingency planning. Central planning and direction capabilities. Basic organisation and communications framework for relief organisations.
Medical care	Rapidly deployable medical teams and evacuation systems. Disease prevention and control. Operation of field water purification units.
Specialised units	Personnel trained to interface between the military and civilian populations. Experts in transportation, communications, health, engineering.
Preparedness	Joint training of military and civilian personnel in preparation for disaster or mass casualty situations.

Source: Adapted from S.J. Pettit and K.C. Beresford, 'Emergency Relief Logistics: An Evaluation of Military, Non-Military and Composite Response Models', *International Journal of Logistics Research and Applications* 8, no. 4 (2005): 313–31.

Regional collaboration in military HADR will also become more significant, facilitating the multilateral responses that large-scale disasters demand and further supporting the growing security cooperation in the Asia-Pacific in this field. At the Shangri-La Dialogue in June 2010, the region's defence chiefs argued that disaster relief must be the core task of Asia-Pacific militaries.[73] Previously, in July 2008, the ASEAN Regional Forum announced that it would hold multilateral disaster relief exercises for armed forces in the region from 2009 onwards, and even initiated discussions on a potential standing HADR force. [74]

Institutional-level Analysis

The preceding analysis shows that climate change will influence the strategic environment in the Asia-Pacific. This will have implications at the institutional level for Asia-Pacific armed forces. Specifically, the projected rise of HADR and peacekeeping operations will have significant implications for force structure and its related institutional settings. This is mainly because the changing nature of military missions requires a different set of training, education, equipment and force level. For example, UN peacekeepers should be lightly armed for self-defence, while peace-enforcers should be capable of using force to induce

[73] 'Asian Armies' Main Enemy "Must Be Natural Disasters"', *Jakarta Globe*, 7 June 2010.
[74] 'The Military in Disaster Relief', *IISS Strategic Comments* 14, No. 6 (August 2008): 2.

and maintain consent, and hence equipped with a high level of firepower, protection and mobility.[75]

The same logic applies to disaster relief. To support humanitarian assistance for a medium-sized disaster, for example, the following is considered sufficient:

- **Air force**
  One or more of each of the following – airlift squadron, aeromedical evacuation squadron, aerial port squadron.

- **Navy**
  One or more of each of the following – amphibious ships or coast guard vessels, deep submergence craft, rescue and salvage ship.

- **Army**
  Elements drawn from various personnel categories – infantry, military police, signal, engineer, medical, preventive medicine, communications, logistics – as well as general purpose helicopters, tractors and trucks.[76]

These examples suggest that HADR-oriented missions have specific requirements. When these requirements are compared to the existing institutional structures and capabilities of many Asian militaries, several gaps are apparent. In Indonesia, for example, the military's overall orders of battle (ORBAT) still focus on domestic security, with around 60 per cent of its forces consisting of territorial and intelligence officers, and another 30 per cent consisting of infantry and strike forces, an arrangement which is not suitable for sustained HADR deployment and management.[77]

Of course, there are other variables that go into assessing the different force requirements for missions related to climate change-induced situations (see Table 2). However, the point that should not be lost is this: new and different missions, regardless of the driving force or rationale behind them, often require different institutional force structures. This refers not only to a military institution's basic ORBAT (the types of military equipment and hardware), but also its 'software' (the norms, training and ethos).

[75] James V. Arbuckle, *Military Forces in 21st Century Peace Operations: No Job for a Soldier?* (London: Routledge, 2006), 118.
[76] Bruce R. Pirnie and Corazon M. Francisco, *Assessing Requirements for Peacekeeping, Humanitarian Asssistance, and Disaster Relief* (Santa Monica, CA: RAND Corporation, 1998), 24.
[77] For a brief discussion on the Indonesian military's potential challenges with regard to sustained humanitarian assistance and disaster relief (HADR) operations, see Evan A. Laksmana, 'The Indonesian Defence Forces and Disaster Relief: Potential Pitfalls and Challenges', *RSIS Commentary* no. 160, 29 November 2010.

Table 2: Factors determining force requirements for humanitarian assistance (HA), peacekeeping operations (PKO) and disaster relief (DR).

Mission	Combat	Determinants of Force Requirements
Humanitarian assistance (traditional peacekeeping)	No	Area of operations. Extent of devastation Needs of the affected population
Disaster relief	No	
Peacekeeping (preventive deployment)	Yes	Area and activities to be observed. If there are violations, the potential opposition has to be considered.
Humanitarian intervention	Yes	Area of operations. Available infrastructure Needs of affected population. Potential opposition (to deter opposition, force should appear overwhelming).
Humanitarian intervention and peace accord enforcement	Yes	
Peace accord enforcement	Yes	Area of operations. Available infrastructure. Potential opposition (to deter opposition, force should appear overwhelming).

Source: Adapted from Bruce R. Pirnie and Corazon M. Francisco, *Assessing Requirements for Peacekeeping, Humanitarian Asssistance, and Disaster Relief* (Santa Monica, CA: RAND Corporation, 1998).

Despite the necessities outlined in Table 2, however, most militaries in the region are still primarily structured in two conventional ways. They are either designed for large-scale continental or naval war against a foreign aggressor, or geared to maintain domestic security and stability. The former requires a large standing military with ORBAT that rely heavily on infantry brigades and strike forces (army), frigates, submarines, destroyers and amphibious capabilities (navy), and tactical fighters and medium- to long-range bombers (air force). The latter structure meanwhile would generally require a large army that relies on the use of Special Forces, and the deployment of intelligence, police and 'territorial' officers, rather than the development of a navy and air force. Neither structure is suited to HADR and peacekeeping missions (which will be required more frequently in the decades to come due to climate change). HADR missions would require, for example, more soldiers, with different training, more airlift capability and different types of vehicles. Another challenge is that, traditionally, Asian militaries have a limited understanding of humanitarian principles and have an organisational culture and ethos not adjusted to tasks requiring patience, restraint and flexibility.[78] In addition, the civil-military interface (military forces working with a civilian-led chain of command) during disasters can quickly become contentious if the proper mechanisms and training are not in place.[79]

[78] Robert Egnell, 'Between Reluctance and Necessity: The Utility of Military Force in Humanitarian and Development Operations', *Small Wars and Insurgencies* 19, no. 3 (2008): 411.
[79] Damon P. Coppola, *Introduction to International Disaster Management* (Boston, MA: Elsevier, 2007), 342.

Box 3: Possible role conflicts from military involvement in humanitarian assistance disaster relief (HADR).

Medical care
Military medicine is not necessarily appropriate for humanitarian operations and disaster relief. The supplies readily available to military forces may be inappropriate for refugees and disaster victims, though at the beginning of the crisis, they may be the only resources available.

Conflict resolution
Military forces are not well suited to aid long-term redevelopment efforts. The imposition of security by outside military forces may also impede negotiations and conflict resolution.

Cross-sector interactions
Military commanders may be unfamiliar with the roles of major international organisations, and conversely, civilians will have little experience of military organisations. There will be differences in strategy, objectives and tactics.

Humanitarian agenda
Using military resources to achieve humanitarian goals creates tension and can undermine the appearance of neutrality of participating relief organisations.

Training
Few officers have received specialised training in disaster relief and humanitarian assistance. There is also likely to be ambiguity under international humanitarian law over the role of military physicians during emergencies.

Commitment to disaster response
The commitment of the military to disaster response may be limited, as the principal mission of the military is to resolve military conflicts, and generally, less effort and fewer resources are devoted to humanitarian aid except during the period HADR missions are being executed.

Source: Adapted from S.J. Pettit and K.C. Beresford, 'Emergency Relief Logistics: An Evaluation of Military, Non-Military and Composite Response Models', *International Journal of Logistics Research and Applications* 8, no. 4 (2005): 313–31.

The difference in the equipment, training and skills sets required means that the increasing deployment of militaries for HADR will have profound consequences. While the military is ideal for rapid mobilisation and response, their deployment in disaster-relief missions moves them away from their professional mooring as experts in the management of violence. It will therefore impact troop readiness, by depriving them of time to train for their war-fighting mission, by causing wear and tear of military equipment and through other spillover impacts.[80] These operations also require soldiers to undertake civilian tasks, which might put stress on civil-military relations. Finally, the 'militarisation' of civilian functions during disaster response operations might bring the military into tension with international donor agencies and non-governmental organisations.[81]

[80] W. Chris King, *Understanding International Environmental Security: A Strategic Military Perspective* (Atlanta, GA: Army Environmental Policy Institute, 2000), 19.
[81] Rosalie Arcala Hall, 'Civil-Military Cooperation in International Disaster Reponse: The Japanese Self-Defense Forces' Deployment in Aceh, Indonesia', *Korean Journal of Defense Analysis* 20, no. 4 (2008): 384–5.

Thus, there are several potential challenges that must be addressed when disaster response involves the armed forces over a longer period of time.[82] First, military resources (which are geared towards high-intensity, short-term assignments) may be unsuitable for continued post-disaster relief that could take months. Second, the military is likely to modify disaster responses and recovery needs such that they would form a closer fit with its own training, abilities and operations. This would not only be disadvantageous to communities but it could also undermine military effectiveness. Third, local emergency civilian commanders may be unable to maintain control over the situation if military commanders – who operate under their own chain of command – begin to guide their forces according to their own agenda. Finally, in countries where military personnel have a reputation for corruption or abuse of power, or lack adequate and sustained training in HADR, disaster victims may not be receptive to them.

Operational-level analysis

At the operational level, the full extent of the physical and ecological ramifications of climate change for the military as a whole has not been fully understood or assessed. It appears, though, that most of climate change-induced changes will be in the operating domain of the navy, rather than the air force or army. The changing conditions of the oceans as a result of climate change – in terms of sea level, temperature, thermocline depth, stratification, currents, acidity and salinity – may affect undersea and surface navigation and require more frequent mapping and sampling of the ocean.[83] These changes may also affect the maintenance of ships, engines and other equipment. Also, sea level rise combined with extreme weather events might threaten naval bases, shipbuilding facilities and other coastal installations such as radar systems.

Furthermore, the underwater impacts of climate change may have several direct and indirect effects on sub-surface naval operations.[84] Ice melt will change water densities, as an infusion of fresh water lowers the density of high-latitude northern waters, while increased evaporation from a warmer atmosphere increases the density of tropical waters. According to one report, a change in salinity of just one part per thousand causes a buoyancy shift of nearly 8,000 pounds in a Sturgeon-class submarine.[85]

At the sub-surface level, changing water density and seawater acidity may also affect sonar readings due to changes in underwater acoustical properties. A study found that, based on reasonable projections of future fossil fuel CO_2 emissions, there could be a decrease in low frequency sound absorption of almost 40 per cent by mid-century – increasing the overall ambient noise levels in the ocean to within the auditory range critical to military interests.[86] This is particularly true for Submarine Warfare Systems that depend on long-established prediction systems of underwater acoustic propagation pathways. Widespread changes in the density of ocean water would therefore have the potential to complicate sonar-based detection and thus underwater missions.

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[82] Coppola, *Introduction to International Disaster Management*, 342.
[83] Sharon Burke et al., *Uncharted Waters: The U.S. Navy and Navigating Climate Change* (Washington, DC: Center for a New American Security, 2008), 7.
[84] Ibid., 18–19.
[85] Gordon I. Peterson and Dave Werner, 'Undersea Science at the Top of the World', *Undersea Warfare* 1, no. 4 (1999), http://www.navy.mil/navydata/cno/n87/usw/issue_4/scicex_99.html (accessed on 24 February 2010)
[86] Keith C. Hester et al., 'Unanticipated Consequences of Ocean Acidification: A Noisier Ocean at Lower pH', *Geophysical Research Letters* 35 (2008): 5.

At the surface level, climate change may have effects on ocean currents and induce violent weather events. The increased frequency of severe storms will create adverse conditions, especially for air and sea operations, while rising sea levels will threaten the long-term viability of naval bases situated in low-lying coastal areas.[87] Extreme weather events may also impede naval mobility, operations and maintenance. Despite improvements in weather forecasting, this means that as intense tropical storms increase, for example, it will be difficult and expensive to avoid them, as it requires tremendous amounts of manpower, energy, resources and time to reposition naval assets out of harm's way.[88] This would also have implications for the military's overall readiness and training.

Climate change-induced extreme weather events can also have negative repercussions on a navy crew's ability to sustain high tempo operations. Where a tsunami has destroyed ports, it would be difficult for navy ships to dock and deliver humanitarian assistance. This was seen in the aftermath of the tsunami that struck Indonesia's Mentawai islands in late October 2010.[89] Also, frequent and intense weather events will compel ships to deal with greater fluctuations in sea states, which may affect naval mobility as ships may need to re-chart courses to avoid high waves.[90] This will have significant implications for both fuel consumption, and the response rate of the military when deployed for emergency operations.

In terms of resources to fuel operations, the military would also be highly affected by global fluctuations in energy prices and the country's energy security conditions. After all, nearly all of today's military operations are powered by fossil fuels. Thus, military readiness depends on the availability of an adequate natural resource base for a variety of logistic and training purposes.[91] This is not a novel insight. The value of petroleum as a fuel for military applications had become apparent to military strategists by the first decade of the 20th century. Oil also contributed significantly to the 'revolution in military affairs', before, during and after World War II, due to the arrival of 'mechanised warfare'.

Energy therefore is a key enabler of combat power. Militaries are huge consumers of imported fossil fuels, have C4ISR (command, control, communications, computers, intelligence, surveillance and reconnaissance) networks dependent on the civilian electricity grid, and consequently, are subject to rising energy costs. As such, in the future, with cost of fossil fuels continuing to increase, energy efficiency will be required in the operation of military equipment – which could have an adverse effect on current levels of military activity. Also, as climate change increases the pressure on resources and exacerbates pre-existing threats while necessitating an increase in the number of operations, the standardisation of fuels (ensuring that the military can operate a wide range of equipment on a single type of fuel) will become a strategic necessity.[92]

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[87] Podesta and Ogden, 'The Security Implications of Climate Change', 133.
[88] Burke et. al. *Uncharted Waters*, 20.
[89] Five Indonesian navy ships were forced to return home as they could not properly dock. 'Kapal TNI AL Untuk Bantu Mentawai Tak Bisa Mencapai Sasaran' [Navy Ships to Assist Mentawai Could Not Reach Target], *Tempo Interaktif*, 29 October 2010, http://www.tempointeraktif.com/hg/nusa_lainnya/2010/10/29/brk,20101029-288138,id.html (accessed on 29 October 2010).
[90] Burke et. al., *Uncharted Waters*, 20.
[91] Ronald A. Kreizenbeck, 'Environmental Aspects of Managing Natural Resource Assets within the Military Sector', in *Defense and the Environment: Effective Scientific Communication*, ed. Katarina Mahutova, John J. Barich III and Ronald A. Kreizenbeck (New York: Kluwer Academic, 2004), 15.
[92] See Carmen, Parthemore and Rogers, *Broadening Horizons*, 3.

In many cases, pursuing energy efficiency measures do not significantly impact the conduct of military life. Indeed, pursuing lower defence energy consumption and minimising petroleum dependency, as one study concludes, will ultimately increase the combat and sustainment capabilities of a military organisation.[93] Lower energy consumption and, in particular, reduced reliance on petroleum-based products will give a military organisation greater freedom of manoeuvre (due to, for example, no longer being dependent on vulnerable logistical lines) and reduce the length and vulnerability of operational lines of communication.

The quality of a military's future resource base is therefore dependent on effective environmental management during the period of operations. Preventive policies (including waste avoidance and minimisation, preference for renewable sources and second-use of first-use resources) which change current practices and thus enhance future conditions, compliance with accepted standards and norms, and restoration where past damage has occurred, all work together to assure the best possible future defence resource base.[94]

Conclusion: Future Options and Further Research

At the theoretical level, this paper finds merit in the emerging consensus among security studies scholars that the traditional interpretation of national security as the protection of national (state) territorial integrity and sovereignty from organised violence caused by armed foreigners or external enemies no longer applies. As this paper has shown, some natural phenomena, in their speed and level of intensity, could bring about results that resemble those wrought by armed external attack.[95] In this regard, climate change works as a burden multiplier for a country's energy, political, economic and resource bases, as well as a threat multiplier to a country's strategic environment.

This paper has further described and assessed how climate change could have security ramifications – in the areas of mass migration; scarcity of water, food and other resources; disease and natural disasters. In all of these areas of climate insecurities, however, the analysis suggests that climate change will not be the only causal factor as it will co-mingle or coincide with short- and long-term economic, social, political and security issues. Fully mapping out future climate (in)security scenarios with a sense of complete certainty and confidence would therefore be extremely difficult. Available evidence, however, allows this paper to infer the various strategic, institutional and operational implications of climate insecurities for armed forces in the region, and to begin to consider various policy options to adapt to and mitigate their effects.

First, in the long term, governments in the region (perhaps through their respective defence ministries) should inculcate and instil a 'green ethic' within the military. The service headquarters as well as the general headquarters should foster within the military a sense of responsibility, that is, a commitment to meshing environment- and natural-resource-related values with national security needs. Through such efforts, the military could serve as an

[93] Jerry Warner and P.W. Singer, *Fueling the 'Balance': A Defense Energy Strategy Primer*, Foreign Policy Paper no. 17 (Washington, DC: The Brookings Institution, 2009), 2.
[94] John J. Barich, 'Environmental Management Systems, Reliability Management, and Vulnerability Assessments: Potential within Contemporary Security Settings', in Mahutova, Barich III and Kreizenbeck, *Defense and the Environment: Effective Scientific Communication*, 105.
[95] Busby, 'Who Cares about the Weather', 475.

exemplar of organisational missions that are proactively improving while ensuring environmental sustainability.[96]

Second, energy security for defence purposes should be aimed at more than just ensuring adequate energy sources to meet operational demands. It should also rely on a state of operational resilience that ensures mission sustainability in the face of uncertain and changing energy resource availability.[97] The end goal of any defence energy strategy should therefore include: (1) reduced fossil fuel-based energy consumption; (2) increased energy efficiency across weapons systems and platforms as well as overall defence facilities; (3) increased use of renewable or alternative energy sources such as geothermal, electric fuel cell and solar energy; (4) assured access to sufficient energy supplies; and (5) reduced adverse impacts on the environment.

Third, a solid database is required as the basis for an environmental management system (EMS) for the defence sector. The EMS is a framework of procedures, processes and practices designed to help an organisation manage its environmental agenda, and document, evaluate and communicate its environmental performance.[98] Based on this framework, the government could then formulate further defence energy efficiency plans for the military's complex weapons systems as well as its defence facilities and estates. Targets could be set. For example, it could be specified that 7 to 15 per cent of the electricity for command offices should be powered by renewable energy sources in 20 years' time, through using solar panels, wind turbines, biomass-fuelled energy generation plants and solar thermal systems.

Fourth, technologically, there are energy efficiency techniques which can be employed to assist with emissions reductions of military hardware and weapons systems. For the navy, energy efficiency can be achieved through propulsion systems efficiency measures (balancing diesel and electric power, for instance) or modifying hull forms to gain significant fuel efficiency (e.g., adding transom flaps to warships to lengthen the water plane area, thus reducing shift power and fuel consumption by 9.5 per cent).[99] Traditional energy efficiency measures can also be applied in the workplace, that is, on board ships and submarines. These could include turning lights out when compartments are unmanned, installing energy-efficient light bulbs, being energy-conscious and so forth. Refitting existing weapons platforms with fuel cell-based power supplies (e.g., in auxiliary generators) and adaptation of existing commercial energy-saver technologies could also be useful.

For the air force, there are many practices already in place in the commercial aviation industry which can be directly transferred to military aviation operations, including initiatives such as single-engine taxiing, continuous descent approaches which lower fuel consumption over stepped descents and scrutiny of aircraft weight to ensure that minimum weight is achieved for as many missions as possible.[100] To this end, efforts such as partnerships with

[96] Durant, *The Greening of the U.S. Military*, 2.
[97] Scott Thomas and David Kerner, *Defense Energy Resilience: Lessons from Ecology* (Carlisle, PA: U.S. Army War College, 2010), 7.
[98] Michael Dawson, 'Environmental Management Systems in the Military Sector', in Mahutova, Barich III and Kreizenback, *Defense and the Environment: Effective Scientific Communication*, 75.
[99] Bailey, 'Is It Practical for Defence', 70.
[100] Ibid., 75.

the commercial aviation industry, flight simulation training for pilots, and investments in adaptive wing and alternative propulsion technologies could be considered.[101]

Also, the exploitation of unmanned vehicles could extend capabilities while saving airframe hours and reducing carbon emissions. Feasibility studies into re-engining some airframes, or updating airframes with new, lighter weight materials, are future investments worth considering. In the future, possible innovations include unmanned attack aircraft powered by the sun, missiles fuelled with hydrogen produced by feeding algae to microbes, tanks which are electrically powered or run on fuel produced from oil squeezed out of weeds, or ships run completely on electricity produced by generators powered with synthetic fuels made from grass.[102]

Despite the extensive assessments in this paper, it must be noted that it is not yet possible to provide a conclusive analysis of the full-range of climate change impacts for military organisations. This is partly because of the imperfect nature of various models used to project climate change and its ecological ramifications, and partly because there are very few studies of military organisations of various countries (studies have mainly focused on the US and the UK armed forces) which could provide us with a sound comparative perspective. Based on existing studies, however, this paper has provided an initial assessment of the various security implications of climate change – in terms of its role as a burden multiplier and a threat multiplier – that armed forces in the region should consider.

[101] Will Rogers, *Promoting the Dialogue*, 10.
[102] Michael Smith, 'Solar Power, Weeds and Algae to Fuel Armed Forces of Future', *The Sunday Times*, 27 April 2008.