

How Prioritizing Climate Change Could Weaken America’s Military

Rebecca Grant, PhD

At approximately 12:30 pm on October 10, 2018, Hurricane Michael struck Northwest Florida as a Category 5 storm with sustained winds of 160 miles per hour. Hurricane Michael had burgeoned into a massive storm in just two days. Trapped in a hangar at Tyndall Air Force Base were 17 U.S. Air Force F-22 stealth fighters. While 38 of the advanced-performance stealth jets had been flown out to safety at other bases, these 17 F-22 Raptors were undergoing repairs and could not be moved on short notice. Official reports found that Hurricane Michael was the third most intense storm to make landfall in the U.S. since 1900. A wind gust of over 130 mph was recorded at Tyndall before the sensor failed.¹

When Hurricane Michael passed, the pictures of smashed buildings and F-22s covered in roof debris seemed to deliver a final warning: Climate change could impact the Department of Defense (DOD). Rising global temperatures could fuel storms and floods and perhaps even spark international conflict. If so, shouldn’t the U.S. military move climate change to the heart of its planning priorities?

Fast forward three years, and the Department of Defense has taken on the most ambitious climate change policy agenda in its history. On January 27, 2021, President Joe Biden declared by executive order “that climate considerations shall be an essential element of United States foreign policy and national security” and directed that:

The Secretary of Defense and the Chairman of the Joint Chiefs of Staff shall consider the security implications of climate change, including any relevant information from the Climate Risk Analysis described in subsection (c) of this section, in developing the National Defense Strategy, Defense Planning Guidance, Chairman’s Risk Assessment, and other relevant strategy, planning, and programming documents and processes.²

“We know first-hand the risk that climate change poses to national security because it affects the work we do every day,” said Secretary of Defense Lloyd Austin in an official Pentagon statement that same day.³ “Climate change is a threat,” Chairman of the Joint Chiefs of Staff General Mark Milley similarly testified to Congress in June 2021. “Climate change has a significant impact on military operations, and we have to take that into consideration.”⁴

For activists, skeptics, and everyone in between, the climate change discussion had arrived—and with significant risks.

America’s military is facing China and Russia across multiple domains. Yet while the Defense Department strives to modernize nuclear deterrence forces, replace old aircraft and ships, guard access to space, and fend off cyberattacks, new directives mandate that the military must also focus on the effects of climate change. “Every dollar that we spend addressing the effects of climate change is a dollar that we are not

putting toward other priorities, like meeting the challenge posed by China and modernizing our forces,” as Deputy Secretary of Defense Kathleen Hicks pointed out in May 2021.⁵

Asking the military to split its attention between great-power competition and the wide-ranging impacts of climate change is a tough assignment. The potential consequences of the effects of climate change for the military include everything from seawalls to B-2 bomber flights over the Arctic. Imagine if the military were told to prepare for “risks from Russia” but did not differentiate between cyberattacks and harassment of U.S. Navy destroyers in the Black Sea.

On top of that, the risks are poorly understood, and that is not standard practice at the Pentagon. If natural hazards do not emerge as predicted, the U.S. military may find that building forces, bases, and plans for climate change was a waste of effort. At a minimum, the dollars for climate crisis programs will have to compete with dollars for the development and acquisition of technologies needed for the U.S. to dominate in all-domain operations.

Nevertheless, there are surprises in this discussion. For example, the Department of Defense is by no means neglecting climate change. To the contrary: It has decades of experience with environmental impact studies, improving base resilience, and investing in sustainability and green energy research. That said, however, prioritizing climate change risks weakening the Pentagon’s preparations to face near-term threats. Policymakers face a difficult task in trying to develop policies that address climate change concerns while also maintaining U.S. military dominance.

No definitive answers will be provided here. Rather, this essay sets out several areas to consider for a better grasp of how the quest for climate change policies may impact U.S. military capabilities.

Climate Change and Defense Planning Guidance

The rise of climate as a new policy direction for the Pentagon did not happen overnight.

Discussion and assessments of climate date back over 15 years. Most recent defense reviews from the Administrations of Presidents Donald Trump and Barack Obama added a section on climate concerns.

However, the Biden–Harris Administration’s 2021 executive order went much further than previous policy guidance. As noted, the DOD was directed to perform a Climate Risk Analysis and then to include climate risk findings in “the National Defense Strategy, Defense Planning Guidance, Chairman’s Risk Assessment, and other relevant strategy, planning, and programming documents and processes.” Every January, starting in 2022, the Secretary of Defense and Chairman of the Joint Chiefs of Staff must report to the National Security Council on how they have included climate matters in key planning processes.⁶

This was not just a heads up; it was a mandate to inject responses to climate change into the most crucial defense planning processes. “This means that climate considerations must become an integral element in resource allocation and our operational decision-making process,” confirmed Deputy Secretary Hicks.⁷

Bringing a rigorous discussion of climate change into defense planning will not be easy because the threat analysis that is so central to military planning is at an elementary stage in this area. Typically, the military has years of analysis of threats to back its decisions. Analysis centers on weapons systems capabilities and adversary tactics. Convene a discussion of missile defense or China’s Taiwan strategy and you will get tactical and technological detail along with informed analysis and contrasting opinion on the best options. The climate change discussion has not yet met the rigorous standards demanded for national security dialogue.

Contrast that with the state of play seen in the 2019 unclassified Worldwide Threat Assessment released by the Director of National Intelligence. It noted threats to low-lying military installations and remarked on the general risks in language not so different from that of past Administrations: “Climate hazards such

as extreme weather, higher temperatures, droughts, floods, wildfires, storms, sea level rise, soil degradation, and acidifying oceans are intensifying, threatening infrastructure, health, and water and food security.”⁸

Such an estimate, while startling, does not provide clear direction for defense programs. Nor does it help decision-makers balance climate initiatives with meeting challenges from nation-state adversaries, terrorism, and so forth. In short, the DOD has a tremendous analytic task ahead if leaders want to take on climate change and make their budget and policy recommendations stick after scrutiny by Congress.

Climate Change and Military Disaster Relief Missions

One of the easiest areas to evaluate should be requirements for disaster relief. U.S. military forces engage regularly in relief missions both small and large. Current climate change policy anticipates increased deployment of U.S. forces for international disaster relief and for support to civil authorities at home. However, it is not always the climate—atmospheric and temperature conditions—that drives disaster relief missions. Earthquakes are a big factor.

Consider recent experience. On January 12, 2010, a 7.0 magnitude earthquake in Haiti left 220,000 dead.⁹ The capital city of Port Au Prince was devastated. U.S. special forces set up air traffic control at the airport’s one working runway. Roads from the neighboring Dominican Republic were few because of problematic political relationships. Aid from the international community poured in, but 10 years later, Haiti was still rebuilding.

A 9.0 magnitude earthquake hit Japan on March 11, 2011, causing a tsunami with a wave height measured at 133 feet. The tsunami swamped the power supply to Japan’s Fukushima nuclear reactor and killed 20,000 Japanese.¹⁰ “At the peak,” according to the Congressional Research Service, “approximately 24,000 personnel, 189 aircraft, and 24 Navy vessels were involved in the humanitarian assistance and relief efforts. Major assets in

the region were redirected to the quake zone, including the USS *Ronald Reagan* Carrier Strike group.”¹¹

The U.S. military brings specialized assets including command and control, airlift, air traffic control, and others to international disaster relief. The services already have both doctrine on disaster relief and prudent planning to keep joint task force resources at the ready.

Put in context, climate change projections may not be the right framework for estimating military contributions to disaster relief missions. Even a cursory look at historic disasters from the Great Chinese Famine of 1958–1962 or the 1815 eruption of the volcano at Mount Tambora, Indonesia, shows that factors other than climate can drive disaster relief. By projecting climate change, especially on a global scale, the U.S. military could oversize its relief forces at the expense of combat capability. Natural and man-made disasters will occur, and the U.S. military may well respond, but the climate change set of disasters is not a good sizing tool.

Ultimately, the decision to deploy military forces for worldwide disaster relief comes down to politics. Key ally Japan merited and welcomed assistance after the 2011 tsunami. The situation might be very different in flood-prone China or if the victim country did not want much help from U.S. forces. The bottom line is that climate change alone is not the driver of intervention; in the end, the choice is a political one. Focusing on climate change may not improve the forecasting and related preparation for disaster relief missions.

Connecting Climate Change and Causes of Wars

Another very difficult area to evaluate is the connection between climate change and the causes of wars. It has become almost an article of faith that climate change stokes conflict, in the words of Deputy Secretary Hicks, by “actually increasing risks of conflict from terrorism and civil wars.”¹² “Already, significant conflicts are being fueled by high temperatures

contributing to water shortages and crop failures in Africa, the Middle East, and South Asia,” commented retired Admiral and former NATO Supreme Allied Commander James Stavridis. “Wars in Syria, Iraq, Mali and Afghanistan are all examples of that.”¹³

Climate change as an accelerant of conflict is not a new idea. The 2010 Quadrennial Defense Review stated that “[w]hile climate change alone does not cause conflict, it may act as an accelerant of instability or conflict” and increase the “burden...on civilian institutions and militaries around the world.”¹⁴ President Obama’s 2015 National Security Strategy sharpened the point and called climate change “an urgent and growing threat to our national security, contributing to increased natural disasters, refugee flows, and conflicts over basic resources like food and water.”¹⁵

But the evidence is much more complicated. One clear connection is the Arctic. Thawing ice has led to open sea-lanes and increased competition among Arctic powers. The B-2 flights of 2020 were part of a coordinated show-of-presence mission to deter Russian activity in the Arctic.¹⁶

Some have attempted to link worsening climate conditions with the outbreak of wars, but scholarly debate is still raging. Take Syria’s civil war, which began in 2011. In 2015, Secretary of State John Kerry told an audience in Norfolk, Virginia, that “it’s not a coincidence that immediately prior to the civil war in Syria, the country experienced its worst drought on record.”¹⁷ President Obama also suggested that “the droughts that happened in Syria contributed to the Syrian civil war.”¹⁸

The claims did not hold up. Scholars differed with respect to the impact of the drought and the complex causes of the civil war such as the actions of Bashar al-Assad’s regime. A paper published by the National Academy of Sciences linked a rise in global sea temperature in the Mediterranean to a period of drought from 2007–2010.¹⁹

However, a contrasting study showed that rainfall in Syria was at the drought level of 80 percent of average rainfall only for 2008.

Drought alone was not sustained and did not cause the civil war; bad agricultural policies, which induced more migration to cities, were found to be more likely contributors.²⁰ Another academic study was even more direct:

We find that there is no clear and reliable evidence that anthropogenic climate change was a factor in northeast Syria’s 2006/07–2008/09 drought; we find that, while the 2006/07–2008/09 drought in northeast Syria will have contributed to migration, this migration was not on the scale claimed in the existing literature, and was, in all probability, more caused by economic liberalisation than drought; and we find that there is no clear and reliable evidence that drought-related migration was a contributory factor in civil war onset.²¹

While the DOD seeks to improve its modelling of climate threats, presuming that a climate crisis will drive certain types of conflicts is a risky proposition. Part of the problem comes from scaling up data on smaller, isolated conflicts. For example, a 2016 U.S. intelligence community report found specific cases of small riots over water access in Mexico, Nigeria, and Mauritania.²² This suggests that there may be a direct relationship between climate change and small-scale internal conflict, but there are few, if any, data to suggest that the same relationship exists in much larger country or regional-level events. On the contrary, another study predicted increasing demands for water to 2040 but noted that “historically, water tensions have led to more water-sharing agreements than violent conflicts.”²³

It would therefore be prudent for future modelling to appreciate the limits of data relevance.

Policy Clashes with Military Allies

Putting so much emphasis on climate change could also strain military alliances if allies disagree on decarbonization goals. Take the case of Australia. At the April 2021 Climate

Summit,²⁴ Australia opted to stick with its goals of reducing carbon emissions by about 26 percent.²⁵ Its goals are in line with the Paris Climate Accords, and Australia leads the world in solar panel capacity at 591 watts per person—eight times the world average.²⁶ This would seem to be a good thing worthy of praise.

Australia was also the world's second-largest exporter of coal at 395 metric tons in 2019 compared to Indonesia at 455 metric tons. Interestingly, China and India were the biggest coal buyers that year. Trade coal accounts for only about one-fifth of global coal consumption, implying that coal-produced energy occurs mostly with domestically produced coal and further implying that China and India produce huge quantities of coal. Despite a ban from China that was implemented in late 2020, Australia's coal exports recovered by feeding the markets of India and other countries. China produces, purchases, and consumes more coal than any other nation per year.²⁷

However, senior Biden Administration officials chose to criticize Australia, saying that it was “insufficient for Australia to follow the existing trajectory and hope that they will be on a course to deep decarbonization and getting to net zero emissions by mid-century.” The U.S. made no reference to China and its prodigious consumption of coal and production of greenhouse gases. This prompted a rebuttal from Angus Taylor, Australia's Energy and Emissions Reduction Minister, who said that “emissions reductions across the globe are what's necessary here to achieve outcomes.”²⁸

Consider, however, that Australia is one of America's most crucial military allies in the Pacific and, indeed, the world. Australia hosts U.S. forces for training; maintains hypersonic missile test ranges; joined U.S.-led operations in Afghanistan, Iraq, and Syria; opposes China's 5G intrusions; and figures in every scenario for keeping peace in the Pacific. In short, the U.S.–Australia relationship is of paramount importance. Clouding defense cooperation with criticism because of climate change goals could put larger U.S. defense strategy goals at risk.

Vulnerable Bases

One slam-dunk area for analysis should be U.S. base vulnerability. In 2021, the DOD adopted an Army climate risk tool and put it to work evaluating the more than 5,000 U.S. military installations at home and abroad.

The fiscal impacts of climate change can be seen clearly in the recent repair bills. Together, Hurricane Michael and Hurricane Florence, which hit the Carolinas in September 2018, created a bill of almost \$9 billion, primarily for the Air Force (costs of approximately \$5 billion) and the Marine Corps (\$3.3 billion from damage to Camp Lejeune and other facilities).²⁹ While many military construction projects are chronically underfunded, the mechanism to identify and characterize them does provide transparent funding for base repair.

The problem arises when one tries to project how hurricanes may increase funding needs in the future. Hurricanes are very costly but notoriously difficult to predict, especially years into the future.

For one thing, the historical baseline for big storms is spotty. According to data from the National Oceanic and Atmospheric Administration (NOAA), just four Category 5 hurricanes have made landfall in the United States since 1851: the 1935 Labor Day storm, Hurricane Camille in 1969, Hurricane Andrew in 1992, and Hurricane Michael in 2018. The number of hurricanes making landfall in the continental United States did not increase in either frequency or intensity from 1900 through 2017. What did increase were the populations along U.S. coastlines and the overall damage costs.³⁰

Looking at the data another way, one study determined that warming temperatures affected the global spatial distribution of hurricanes from 1988 to 2018 but did not affect their frequency. Intriguingly, this same study projected that increasing greenhouse gas emissions would lead to fewer hurricanes in coming years.³¹

What defense official would want to explain a hurricane disaster budget line to Congress with data this disparate? Storm repair

even in a bad year remains a tiny percentage of the overall defense budget. The DOD has a workable method for major disaster repair appropriations and completes them in a single fiscal year.

Keep in mind that money to rebuild military bases is just one part of the federal response to weather disasters. In contrast, other government departments fall behind on their storm mitigation. The National Flood Insurance Program, for example, “was about \$21 billion in debt to the Department of the Treasury as of April 2019,” and “the Congressional Budget Office estimated in May 2019 that federal crop insurance would cost the federal government an average of about \$8 billion annually from 2019 through 2029.”³² By wider federal standards, the DOD has a more efficient mechanism for coping with damage from climate change. Why, then, this imperative for the DOD to start accounting for the potential consequences of severe weather as if it has been negligent or unaware?

Impact on Research and Development

Of course, the DOD does more than spend money on base repair. Laced throughout the defense budget are many programs that take on climate problems. For example, the Defense Advanced Research Projects Agency (DARPA) has a project called the Reefense program, “which aims to develop novel hybrid biological and engineered reef-mimicking structures to mitigate wave and storm damage and reduce the ecological impact of current coastal protection measures.”³³

Energy programs have often taken the lead. In 2015, the U.S. Navy used 78 million gallons of biofuel to help power the USS *John C. Stennis* Carrier Strike Group.³⁴ Ten years earlier, the U.S. Air Force flew a B-52H bomber using biofuels in all eight engines.³⁵

The Department of Defense operates about 170,000 non-tactical vehicles, a number second only to the number operated by the U.S. Postal Service. As a result, Deputy Secretary of Defense Kathleen Hicks has called for smart investment in electrification for that fleet.³⁶

Combat vehicles are another matter, but research is underway. The Army has been investing in research into electric vehicles for years. In early 2021, a defense contractor developed an electric vehicle prototype for Army officials in just 12 weeks. The Army will spend \$50 million in fiscal year 2022 on electric and mobility vehicle development, although with caution. “If you took the amount of batteries with current technology that you would need to move an Abrams tank purely electrically,” according to Brigadier General Glenn Dean, Program Executive Officer for Ground Combat Systems, “it’s bigger than the tank, so we have a packaging and storage problem when it comes to pure electric.”³⁷

There is no reason why the DOD should not leverage commercial development of electric vehicles as part of climate response, but taken as a whole, programs like these run the risk of depleting investment needed to face higher priorities such as great-power competition. Surely, the men and women of America’s military should not be asked to fight with equipment for which green energy and sustainability were dominant design factors. Carbon footprint reduction should not become a key performance parameter for major military systems. Such a course would inevitably put combat performance at risk.

Climate, War Games, and Modelling Uncertainty

Injecting climate concerns into formal modelling of conflict is a tall order. The DOD counts on highly refined analysis to back up its internal budget choices and justify them to Congress. For nearly a century, American military planning has employed scenarios as tools for the assessment of tactics and systems for future combat. The 1930s “color plans” like War Plan Orange set out detailed plot lines for war with Japan and even Great Britain.³⁸ The Army and Navy used these scenarios to game out moves in battle and learn from the results. Scenario-based planning dominated during the Cold War and has created the basis for analyzing China as a pacing threat.

The current state of climate analysis is nowhere near the level needed, as the DOD has recognized. “We will need to incorporate climate change into our threat assessments,” Deputy Secretary Hicks has noted. “We must update our modeling and simulations to reflect climate change. Warfighting concepts, regional and country engagement plans, and logistics planning also need to be updated.”³⁹

What would a climate scenario for the military look like? Recently, the Office of the Director of National Intelligence produced a set of five scenarios set in 2040, including one titled “Tragedy and Mobilization” that captured climate issues.⁴⁰ In the scenario, a global food catastrophe caused by climate change led to formation of a global coalition led by Europe and China working with non-governmental organizations. Stronger “green” parties won elections and the scenario culminated with the rise of a Human Security Council that distributed food and technology.

Granted, this future scenario was the product of the intelligence community and is designed to stimulate thought. However, it contains little insightful future forecasting for military operations. With climate change not a principal factor in great-power competition, asking the military to put in time on scenarios like this could soon add up to a net loss of analytic capability.

As the DOD proceeds, it is important to note that climate modelling is known for wide swings in uncertainty. A World Bank/United Nations report estimated that a rare, major hurricane might strike the U.S. every 38 to 480 years under 2010 weather conditions but that the probability would shift to every 18 to 89 years with warmer average temperatures.⁴¹ Clearly, such a wild analytic range is not helpful for the refined analysis that the DOD needs to justify more than \$700 billion in annual spending.

It is possible that models can be developed to bring greater fidelity to climate analysis for the DOD, but the process is tricky. Leading insurance firm Lloyds found windstorms easier to model than hurricanes.

Insurers have money on the line and invest heavily in models to control risk, but the models they use are a case study of the numerous difficulties involved in modeling for climate change. One analysis found that climate change could imply a 3 percent–5 percent decrease in the total number of potentially damaging storms but a 10 percent–20 percent increase in the number of larger storms in addition to a shift in storm tracks toward France and Germany.⁴² Insurers point out that even these sophisticated models cannot cover every peril in every region.

Conclusion: The DOD’s Long History with Climate Consequences

The new guidance for the Department of Defense sets out extremely ambitious targets for including climate change as a national security priority, but the evidence indicates clearly that building up a proper analytic foundation will not be easy. For too long, casual discussion of climate and conflict has led proponents to skim the surface but neglect the tough choices.

What is needed is spadework to bring the climate “threat analysis” up to the high standards necessary for decisions on national defense—if possible. Likewise, the DOD must acknowledge that every bit of attention given to climate change comes with a risk of distracting it from the pressing problems of China and Russia (among many others).

Yet the Department of Defense also deserves credit for its solid, quiet work on environmental protection, energy efficiency, and base resilience, all of which enhance its overall mission.

Sometimes the DOD does not get enough credit for activities already underway such as providing a “climate-ready force.”⁴³ The DOD defines this as a force that is ready to train and operate in extreme temperatures. In this case, the department is well ahead of climate policy prescriptions.

Not surprisingly, weather has figured in equipment development for a very long time. For example, the Air Force operates the world’s largest indoor weather facility at Eglin Air

Force Base.⁴⁴ The McKinley Climatic Laboratory creates sandstorms, blizzards, and any conditions needed to test aircraft and equipment—and has been doing so since 1947. The analytic rigor needed for analyzing a climate-ready force should start with getting to know what that force already has to offer.

The United States military has been measuring sea levels, tracking erosion, improving energy efficiency, rebuilding bases after hurricanes, and trying to anticipate conflict trends from the Arctic to the sub-Saharan region for years. For example, the work of the Army Corps of Engineers stretches back decades and even centuries. In 1892, officers of the Corps took a grand jury on a boat tour of Pittsburgh harbor and obtained indictments against 50 firms that were dumping debris into the rivers.⁴⁵ The

Corps, of course, got its start building coastal forts like the one underneath the Statue of Liberty and has measured sea-level rise as a matter of routine from the late 1790s.

As for the 17 F-22s trapped in the hangar at Tyndall, none were destroyed. All were back in the air within a month. Despite being caught by surprise, the Air Force had taken proper precautions to protect the irreplaceable jets. The F-22s rode out the storm. Four had damage to multiple areas including coatings, doors, canopies, leading edge, and engine inlet, but their stealth features were fully restored by the summer of 2019.⁴⁶

That was a tribute to something far beyond climate discussion: the resilience and ingenuity of the men and women who serve in America's military.

Endnotes

1. Data on Hurricane Michael from U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Hurricane Center and Central Pacific Hurricane Center, "Hurricane Michael: Bulletin: Hurricane Michael Intermediate Advisory Number 16A...Corrected, NWS National Hurricane Center Miami FL AL142018, 100 PM CDT Wed Oct 10 2018," https://www.nhc.noaa.gov/archive/2018/all4/all42018.public_a.016.shtml (accessed July 31, 2021), and news release, "Hurricane Michael Upgraded to Category 5 at Time of U.S. Landfall," U.S. Department of Commerce, National Oceanic and Atmospheric Administration, last updated April 19, 2019, <https://www.noaa.gov/media-release/hurricane-michael-upgraded-to-category-5-at-time-of-us-landfall> (accessed July 31, 2021).
2. Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad," January 27, 2021, *Federal Register*, Vol. 86, No. 19 (February 1, 2021), pp. 7619 and 7621, <https://www.govinfo.gov/content/pkg/FR-2021-02-01/pdf/2021-02177.pdf> (accessed August 1, 2021).
3. News release, "Statement by Secretary of Defense Lloyd J. Austin III on Tackling the Climate Crisis at Home and Abroad," U.S. Department of Defense, January 27, 2021, <https://www.defense.gov/Newsroom/Releases/Release/Article/2484504/statement-by-secretary-of-defense-loyd-j-austin-iii-on-tackling-the-climate-cr/> (accessed July 31, 2021).
4. Joseph Guzman, "Changing America: Trump Lashes out After Biden Says Joint Chiefs Told Him Greatest Threat to US Is Global Warming," *The Hill*, June 10, 2021, <https://thehill.com/changing-america/sustainability/climate-change/557867-trump-lashes-out-after-biden-says-joint-chiefs> (accessed July 31, 2021).
5. David Vergun, "Climate Change Resiliency a High DOD Priority, Deputy Defense Secretary Says," U.S. Department of Defense, May 24, 2021, <https://www.defense.gov/Explore/News/Article/Article/2630037/climate-change-resiliency-a-high-dod-priority-deputy-defense-secretary-says/> (accessed July 31, 2021).
6. Executive Order 14008, *Federal Register*, Vol. 86, No. 19 (February 1, 2021), p. 7621.
7. Kathleen Hicks, Deputy Secretary of Defense, Keynote Remarks at Department of Energy ARPA-E Energy Innovation Summit, May 24, 2021, <https://www.defense.gov/Newsroom/Speeches/Speech/Article/2630071/deputy-secretary-of-defense-dr-kathleen-hicks-delivers-keynote-remarks-at-the-d/> (accessed August 3, 2021).
8. Daniel E. Coats, Director of National Intelligence, "Worldwide Threat Assessment of the US Intelligence Community," statement before the Select Committee on Intelligence, U.S. Senate, January 29, 2019, p. 23, <https://www.dni.gov/files/ODNI/documents/2019-ATA-SFR---SSCI.pdf> (accessed July 31, 2021).
9. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Centers for Environmental Information, Significant Earthquake Database, "January 12, 2010 DART [Deep-Ocean Assessment and Reporting of Tsunami] Data," https://www.ngdc.noaa.gov/hazard/dart/2010haiti_dart.html (accessed July 31, 2021).
10. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Centers for Environmental Information, "On This Day: 2011 Tohoku Earthquake and Tsunami," March 11, 2021, <https://www.ncei.noaa.gov/news/day-2011-japan-earthquake-and-tsunami> (accessed July 30, 2021).
11. Andrew Feickert and Emma Chanlett-Avery, "Japan 2011 Earthquake: Department of Defense (DOD) Response," Congressional Research Service *Report for Congress* No. R41690, June 2, 2011, p. 1, <https://fas.org/sgp/crs/row/R41690.pdf> (accessed July 31, 2021).
12. Hicks, Keynote Remarks at Department of Energy ARPA-E Energy Innovation Summit.
13. Adm. James Stavridis, "The Climate and U.S. National Security: A Conversation Series," *The Cipher Brief*, January 21, 2021, <https://www.thecipherbrief.com/the-climate-and-u-s-national-security-a-conversation-series> (accessed July 31, 2021).
14. Pew Project on National Security, Energy and Climate, "Defense Department Says Climate Change Is a Significant Threat to National Security," March 31, 2010, <https://www.pewtrusts.org/-/media/assets/2010/03/31/pewqdfactsheet.pdf> (accessed July 31, 2021).
15. President Barack Obama, *National Security Strategy*, The White House, February 2015, p. 12, https://obamawhitehouse.archives.gov/sites/default/files/docs/2015_national_security_strategy_2.pdf (accessed August 2, 2021).
16. Press release, "B-2s Fly North of Arctic Circle, Integrate with Norwegian F-35s," U.S. Air Forces in Europe & Air Forces Africa, June 18, 2020, <https://www.usafe.af.mil/News/Press-Releases/Article/2224362/b-2s-fly-north-of-arctic-circle-integrate-with-norwegian-f-35s/> (accessed July 31, 2021).
17. John Kerry, Secretary of State, "Remarks on Climate Change and National Security," Old Dominion University, Norfolk, Virginia, November 10, 2015, <https://2009-2017.state.gov/secretary/remarks/2015/11/249393.htm> (accessed August 2, 2021).
18. Zane Razaq, "Framing the Syrian War in Terms of Climate Change Oversimplifies a Complex Tragedy, Warn Experts," *New England Climate Change Review*, November 21, 2016, <https://www.northeastern.edu/climatereview/?p=210v> (accessed July 31, 2021).
19. Colin P. Kelley, Shahrzad Mohtadi, Mark A. Cane, Richard Seager, and Yochanan Kushnir, "Climate Change in the Fertile Crescent and the Implications of the Syrian Drought," *Proceedings of the National Academy of Sciences*, Vol. 112, No. 11 (March 17, 2015), pp. 3241-3246, <https://www.pnas.org/content/pnas/112/11/3241.full.pdf> (accessed July 31, 2021).

20. Lina Eklund and Darcy Thompson, "Is Syria Really a 'Climate War'? We Examined the Links Between Drought, Migration and Conflict," *The Conversation*, July 21, 2017, <https://theconversation.com/is-syria-really-a-climate-war-we-examined-the-links-between-drought-migration-and-conflict-80110> (accessed July 31, 2021).
21. Jan Selby, Omar S. Dahi, Christiane Frölich, and Mike Hulme, "Climate Change and the Syrian Civil War Revisited," *Political Geography*, Vol. 60 (September 2017), p. 241, <http://sro.sussex.ac.uk/id/eprint/69311/4/Selby%20et%20al%202017%20Climate%20change%20and%20Syria.%20Published%20version.pdf> (accessed August 2, 2021).
22. National Intelligence Council, *Implications for US National Security of Anticipated Climate Change*, NIC WP 2016-01, September 21, 2016, p. 7, https://www.dni.gov/files/documents/Newsroom/Reports%20and%20Pubs/Implications_for_US_National_Security_of_Anticipated_Climate_Change.pdf (accessed July 31, 2021).
23. Office of the Director of National Intelligence, *Global Water Security*, Intelligence Community Assessment ICA 2012-08, February 2, 2012, <https://fas.org/irp/nic/water.pdf> (accessed August 1, 2021).
24. U.S. Department of State, "Leaders Summit on Climate," <https://www.state.gov/leaders-summit-on-climate/> (accessed August 1, 2021).
25. BBC News, "Australia Resists Calls for Tougher Climate Targets," April 23, 2021, <https://www.bbc.com/news/world-australia-56854558> (accessed August 1, 2021).
26. Clare Watson, "Australia Just Broke a Major Record for New Solar Panel Roof Installations," *ScienceAlert*, May 14, 2021, <https://www.sciencealert.com/australia-a-world-leader-in-rooftop-solar-breaks-new-record-for-installations> (accessed August 1, 2021).
27. Worldometer, "Coal Reserves by Country," 2016, <https://www.worldometers.info/coal/coal-reserves-by-country/> (accessed August 1, 2021).
28. Matthew Knott, "'Insufficient': Biden Administration Criticises Australia on Climate," *The Sydney Morning Herald*, April 22, 2021, <https://www.smh.com.au/world/north-america/insufficient-biden-administration-criticises-australia-on-climate-20210422-p571b9.html> (accessed August 1, 2021).
29. The Air Force had another \$350 million in expenses from flooding at Offut Air Force Base, located in Nebraska, that same year.
30. Phillip J. Klotzbach, Steven G. Bowen, Roger Pielke Jr., and Michael Bell, "Continental U.S. Hurricane Landfall Frequency and Associated Damage: Observations and Future Risks," *Bulletin of the American Meteorological Society*, Vol. 99, Issue 7 (July 2018), pp. 1359-1377, https://journals.ametsoc.org/view/journals/bams/99/7/bams-d-17-01841.xml?tab_body=pdf (accessed August 1, 2021).
31. Hiroyuki Murakami, Thomas L. Delworth, William F. Cooke, Ming Zhao, Baoqiang Xiang, and Pang-Chi Hsu, "Detected Climatic Change in Global Distribution of Tropical Cyclones," *Proceedings of the National Academy of Sciences*, Vol. 117, No. 20 (May 19, 2020), pp. 10706-10714, <https://www.pnas.org/content/pnas/117/20/10706.full.pdf> (accessed August 1, 2021).
32. U.S. Government Accountability Office, *Climate Change: Potential Economic Costs and Opportunities to Reduce Federal Fiscal Exposure*, GAO-20-338T, December 19, 2019, p. 8 <https://www.gao.gov/assets/gao-20-338t.pdf> (accessed August 2, 2021).
33. U.S. Department of Defense, Defense Advanced Research Projects Agency, "DARPA Launches Program to Mitigate Coastal Flooding, Erosion and Storm Damage," December 17, 2020, <https://www.darpa.mil/news-events/2020-12-17#> (accessed August 1, 2021).
34. Wyatt Olsen, "Navy Launching First Great Green Fleet," *Stars and Stripes*, January 15, 2016, https://www.stripes.com/theaters/asia_pacific/navy-launching-first-great-green-fleet-next-week-1.388769 (accessed August 1, 2021).
35. U.S. Air Force, "B-52 Flight Uses Synthetic Fuel in All Eight Engines," December 15, 2006, <https://www.af.mil/News/Article-Display/Article/128702/b-52-flight-uses-synthetic-fuel-in-all-eight-engines/> (accessed August 1, 2021).
36. Hicks, Keynote Remarks at Department of Energy ARPA-E Energy Innovation Summit.
37. Jen Judson, "Is the Army Warming up to Electric Vehicles in Its Fleet?" *Defense News*, July 12, 2021, <https://www.defensenews.com/land/2021/07/12/is-the-army-warming-up-to-electric-vehicles-in-its-fleet/> (accessed August 2, 2021).
38. Henry G. Cole, *The Road to Rainbow: Army Planning for Global War, 1934-1940* (Annapolis, MD: Naval Institute Press, 2003), pp. xviii and 22-23.
39. Hicks, Keynote Remarks at Department of Energy ARPA-E Energy Innovation Summit.
40. Office of the Director of National Intelligence, *Global Trends 2040: A More Contested World*, National Intelligence Council Publication NIC 2021-02339, March 2021, pp. 118-119, https://www.dni.gov/files/ODNI/documents/assessments/GlobalTrends_2040.pdf (accessed July 31, 2021).
41. World Bank and United Nations, *Natural Hazards, UnNatural Disasters: The Economics of Effective Prevention*, *The World Bank*, 2010, pp. 20-21, <https://documents1.worldbank.org/curated/en/620631468181478543/pdf/578600PUB0epi2101public10BOX353782B.pdf> (accessed July 31, 2021).

42. Ralf Toumi and Lauren Rostell, "Catastrophe Modeling and Climate Change," Lloyd's, 2014, p. 14, <https://www.lloyds.com/-/media/lloyds/reports/emerging-risk-reports/cc-and-modelling-template-v6.pdf> (accessed July 31, 2021).
43. David Vergun, "Climate Change Resiliency a High DOD Priority, Deputy Defense Secretary Says," U.S. Department of Defense, May 24, 2021, <https://www.defense.gov/Explore/News/Article/Article/2630037/climate-change-resiliency-a-high-dod-priority-deputy-defense-secretary-says/> (accessed July 31, 2021).
44. Kirk Velasco, "McKinley Climatic Laboratory Home to World's Largest Climatic Chamber," Arnold Air Force Base, September 8, 2020, <https://www.arnold.af.mil/News/Commentaries/Display/Article/2338681/mckinley-climatic-laboratory-home-to-worlds-largest-climatic-chamber/> (accessed July 31, 2021).
45. U.S. Army Corps of Engineers, *The U.S. Army Corps of Engineers: A Brief History*, <https://www.usace.army.mil/About/History/Brief-History-of-the-Corps/> (accessed July 31, 2021).
46. Lockheed Martin, "F-22s After the Storm: Tyndall's Raptors Ride Out Hurricane Michael," 2019, <https://www.lockheedmartin.com/en-us/news/features/2019-features/f-22-after-the-storm--tyndalls-raptors-ride-out-hurricane-michael.html> (accessed July 31, 2021).