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CONGRESSIONAL TESTIMONY

**Ensuring Resiliency of Military
Installations and Operations in
Response to Climate Changes**

**Subcommittee on Readiness
Committee on Armed Services
U.S. House of Representatives**

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My name is Nick Loris and I am the Herbert & Joyce Morgan Fellow in the Roe Institute for Economic Freedom at The Heritage Foundation. The views I express in this testimony are my own and should not be construed as representing any official position of The Heritage Foundation. Thank for this opportunity to appear before the subcommittee to discuss the resiliency of military installations and operations in response to climate changes.

For the Department of Defense (DOD) to successfully carry out its missions, military resilience and readiness is critical. Without question, extreme weather and long-term climate changes can adversely affect DOD infrastructure, training, and operations. Solutions to protect against such threats should achieve cost-effective, meaningful results. The DOD should address climate-related infrastructure vulnerabilities through site- and situation-specific analysis and spending. Furthermore, the DOD should continue to collaborate with the scientific community, states and local governments, the private sector, and other stakeholders to maximize resiliency and preparedness.

While the DOD is a large institutional energy consumer, its overall carbon-dioxide footprint is quite small. Congress should remove any costly, unnecessary mandates and spending on activities intended to reduce the DOD's climate footprint but divert resources away from DOD's core mission of protecting America's vital national interests. They have practically no effect on impacting the climate and do nothing to current and future climate-related vulnerabilities the DOD recognizes.

Instead, spending on alternative technologies must be mission- and proficiencies-driven first. Any positive commercial innovation and broad economic benefits resulting from DOD research and development must come second. Policymakers should open channels to government research, so that innovators can spin off research into economically viable products. Government R&D for national security objectives can have tremendous economic value. Pathways for innovation can co-exist with protecting classified and sensitive information.

Policymakers should also refrain from jumping to conclusions with regard to anthropogenic emissions' influence on regional conflict. Too often, advocates of climate action label man-made warming as a threat multiplier when historical research, empirical evidence, and micro-level data on specific regions suggest that the connection is weak. Overstating climate factors and understating more deterministic political, social, and economic factors severely misrepresents the true reasons for violence, conflict, and migration in different regions in the world.

Mitigating Risk to DOD Infrastructure

With more than 500 installations,¹ the DOD has an extensive setup of infrastructure in the United States and around the world.² Including all bases, installations, and other associated buildings, there are over 7,000 facilities under the DOD's purview.³ Some installations are currently vulnerable to extreme weather. Because of their geographic location, certain DOD infrastructure is more susceptible to natural disaster and long-term changes in climate than others.

No matter the cause of extreme weather and climate change, these events have the potential to significantly damage military installations and reduce operational readiness. A January 2019 DOD report identified 79 military installations impacted by climate-related events. The report also described where climate-related events could adversely affect installations and facilities over the next 20 years. The report determines that recurrent flooding, drought, and wildfires are the primary concerns and also includes the impacts of thawing permafrost and desertification.

Several examples in the report illustrate the challenges DOD installations face. The Navy Base Coronado incurs flash flooding, especially in El Nino years, and Naval Air Station Key West grappled with droughts in 2011 and 2015.⁴ A 2017 wildfire burned 380 acres on Vandenberg Air Force Base in California.⁵ Furthermore, "Navy Region Mid-Atlantic and the greater Hampton Roads area is one of the most vulnerable to flooding military operational installation areas in the United States. Sea level rise, land subsidence, and changing ocean currents have resulted in more frequent nuisance flooding and increased vulnerability to coastal storms."⁶

Other DOD installations and facilities suffer or have suffered from weather-related challenges as well. An Initial Vulnerability Assessment Survey report published in 2018 took a broader approach and qualitatively assessed how climate change impacts over 3,500 individual sites maintained by the Army, Navy, and Air Force. Nearly 1,700 sites reported no effects in the survey.⁷ However, 22 percent of sites reported effects from drought and wind. Non-storm-surge

¹According to a January report on climate change and the DOD, "An installation is defined as a base, camp, post, station, yard, center, homeport facility for any ship, or including any leased facility, which is located within any of the States, the District of Columbia, the Commonwealth of Puerto Rico, American Samoa, the Virgin Islands, the Commonwealth of the Northern Mariana Islands, or Guam." U.S. Department of Defense, "Department of Defense Climate-Related Risk to DoD Infrastructure Initial Vulnerability Assessment Survey (SLVAS) Report," January 2018, <https://climateandsecurity.files.wordpress.com/2018/01/tab-b-slvas-report-1-24-2018.pdf> (accessed March 8, 2019).

²Dorothy Robyn and Jeffrey Marqusee, "The Clean Energy Dividend: Military Investment in Energy Technology and What It Means for Civilian Energy Innovation," Information Technology and Innovation Foundation, March 2018, http://www2.itif.org/2019-clean-energy-dividend.pdf?_ga=2.133613257.674204463.1551967655-1212308.1551734962 (accessed March 8, 2019).

³Jane A. Leggett, "Climate Change Adaptation by Federal Agencies: An Analysis of Plans and Issues for Congress," Congressional Research Service, February 23, 2015, <https://fas.org/sgp/crs/misc/R43915.pdf> (accessed March 8, 2019).

⁴U.S. Department of Defense, "Report on Effects of a Changing Climate to the Department of Defense," January 2019, https://partner-mco-archive.s3.amazonaws.com/client_files/1547826612.pdf (accessed March 8, 2019).

⁵Ibid., p. 7.

⁶Ibid., p. 6.

⁷U.S. Department of Defense, "Department of Defense Climate-Related Risk to DoD Infrastructure Initial Vulnerability Assessment Survey (SLVAS) Report," January 2018, <https://climateandsecurity.files.wordpress.com/2018/01/tab-b-slvas-report-1-24-2018.pdf> (accessed March 8, 2019).

related-flooding affected 20 percent.⁸ Extreme temperatures affected 10 percent of the sites and storm surge and wildfires impacted 6 percent of the sites responding to the survey.⁹

Regardless of what causes climate events, it is practical for the DOD to safeguard against current and future risks and vulnerabilities. Whether a challenge occurs slowly over time like sea-level rise or occurs without much warning like a hurricane, adaptation to extreme weather is critical to increasing resilience for both the DOD and civilian infrastructure. The DOD has an incentive to reduce outages, minimize time offline, and promote efficient coordination and communication to successfully carry out its missions and continue for daily operations. Spending on durable infrastructure will enhance resiliency and protect human lives. Learning lessons from previous storms and using the best scientific and technical information available improve the DOD's ability to reduce dangers from future climate-related challenges. Establishing thorough readiness plans in coordination with the private sector, local communities, and first responders and identifying future vulnerabilities is simply commonsense policy. However, the military's mission must guide these decisions. They should not be overtaken by some other political agenda.

Productively, the DOD has taken and continues to take the necessary steps to adapt to a changing climate to reduce risks facing DOD operations and missions. For instance, JBLE-Langley Air Force Base "is using a flood visualization tool to understand flooding impacts across the base. By modeling different storm flooding elevations, they were able to determine where to install door dams, which require less time and less labor than sandbags. The base reduced the number of required sandbags by 70 percent."¹⁰ Air Force Bases in Florida are working with local groups in Florida to address coastal erosion and Navy Region Mid-Atlantic is working with relevant stakeholders including state and local governments, communities, nonprofits, and academia to protect against flooding, sea-level rise, and land subsidence.¹¹

Preparing for natural disasters and adapting land and water changes over time is a cost-effective, pragmatic solution. Specialized knowledge and unique expertise will help address site- and situation-specific challenges. The accumulation of scientific and technological knowledge will help understand the probability and level of threat that extreme weather and climate change poses to military installations. Congress should provide the required funding for the DOD to carry out these activities.

The DOD as an Energy Consumer and its Negligible Impact on Climate

Compared to other government agencies, the DOD uses a significant amount of energy. In fact, in fiscal year (FY) 2017, the DOD accounted for 75 percent of the federal government's energy use.¹² As a percentage of America's overall energy use, however, the DOD constitutes only 1

⁸Ibid., p. 16.

⁹Ibid., p. 16.

¹⁰Ibid., p. 11.

¹¹Ibid., p. 12.

¹²Robyn and Marqusee, "The Clean Energy Dividend: Military Investment in Energy Technology and What It Means for Civilian Energy Innovation."

percent of America's total energy consumption and only 1.2 percent of America's total oil consumption.¹³

Consequently, the DOD's domestic and global carbon-dioxide footprint is minuscule. From Standard operations and Non-Standard operations,¹⁴ the DOD produced 58.4 million metric tons of greenhouse gases in FY 2017 as carbon-dioxide equivalent.¹⁵ Total U.S. greenhouse gas emissions were 6,472.3 million metric tons of carbon-dioxide equivalent for 2017.¹⁶ The DOD is exempt from reporting greenhouse gas emissions for a number of installations and operations to protect classified information and national security interests so that figure underestimates the DOD's greenhouse gas emissions. Nevertheless, even if the exempted emissions quadrupled the DOD's total carbon-dioxide footprint, the agency would account for 3.6 percent of the America's emissions. In the context of global greenhouse gas emissions, the DOD's carbon-dioxide contribution is a tiny fraction of one percent.

No matter where one stands on the urgency to combat climate change, policies that significantly restrict the use of conventional resources would be ineffective in slowing global warming. In fact, the U.S. could cut its carbon-dioxide emissions 100 percent and it would not make a difference in abating temperature increases or sea-level rise. Using the same climate sensitivity (the warming effect of a doubling of carbon-dioxide emissions) as the U.N.'s Intergovernmental Panel on Climate Change assumes in its modeling, and assuming the climate models are accurate, the world would only be less than 0.2 degree Celsius cooler by 2100 if the U.S. reduced its emissions 100 percent.¹⁷ Eliminating the DOD's carbon-dioxide footprint would produce a change that is practically too small to measure and certainly indistinguishable from natural climate variation.¹⁸

¹³Ibid., p. 6.

¹⁴Non-Standard operations "are vehicles, vessels, aircraft and other equipment used by Federal Government agencies in combat support, combat service support, tactical or relief operations, training for such operations, law enforcement, emergency response, or spaceflight (including associated ground-support equipment). Non-Standard operations also includes generation of electric power produced and sold commercially to other parties." See "Energy Savings Performance Contracts (ESPCs) and Utility Energy Service Contracts (UESCs)," Congressional Research Service, November 23, 2018, <https://fas.org/sgp/crs/misc/R45411.pdf> (accessed March 8, 2019).

¹⁵The Intergovernmental Panel on Climate Change developed Global Warming Potential (GWP) metrics to weigh the warming potential of different greenhouse gas emissions. To provide a more uniform measure, greenhouse gas reporting converts all emissions to carbon-dioxide equivalent. See U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, "Comprehensive Annual Energy Data and Sustainability Performance," <https://ctsedweb.ee.doe.gov/Annual/Report/ComprehensiveGreenhouseGasGHGInventoriesByAgencyAndFiscalYear.aspx> (accessed March 8, 2019).

¹⁶U.S. Environmental Protection Agency, "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2017," February 2019, <https://www.epa.gov/sites/production/files/2019-02/documents/us-ghg-inventory-2019-main-text.pdf> (accessed March 8, 2019).

¹⁷Kevin D. Dayaratna, "Methods and Parameters Used to Establish the Social Cost of Carbon," testimony before the Subcommittee on Environment and Oversight, Committee on Science and Technology, U.S. House of Representatives, February 24, 2017, <https://docs.house.gov/meetings/SY/SY18/20170228/105632/HHRG-115-SY18-Wstate-DayaratnaK-20170228.pdf> (accessed March 7, 2019).

¹⁸These climate estimates come from the Model for Assessment of Greenhouse-gas Induced Climate Change (MAGICC), produced by scientists at the National Center for Atmospheric Research with funding from the Environmental Protection Agency. MAGICC: Model for the Assessment of Greenhouse-gas Induced Climate

Remove Costly, Ineffective Mandates and Requirements

Above all else, the DOD's energy consumption should be driven by capabilities, not politics. That is not always the case. For instance, under Section 2911(e) of Title 10 of the U.S. Code, the Defense Department has a goal to "to produce or procure not less than 25 percent of the total quantity of facility energy it consumes within its facilities during fiscal year 2025 and each fiscal year thereafter from renewable energy sources."¹⁹ The DOD can meet its obligation through the purchase of renewable energy certificates (RECs), which divert money to meeting the renewable mandate and away from more productive uses. Policymakers should not force pricier electricity on the DOD through mandates. DOD officials should make the determination to use more expensive alternative energy if they believe national security benefits justify the higher costs. If renewable power is cheaper and the DOD can save money, no mandate is necessary.

Another example is the DOD's spending on biofuels. In 2011, President Obama directed the Departments of the Navy, Energy, and Agriculture to "work with private industry to create advanced drop-in biofuels that [would] power both the Department of Defense and private sector transportation throughout America."²⁰ Collectively, the agencies committed to spending \$510 million in taxpayer money on advancing biofuel production.²¹ The Navy paid \$26 per gallon for biofuels (\$12 million total) when the price for a gallon of diesel was \$3.60 per gallon.²² The Air Force bought 11,000 gallons of alcohol-to-jet fuel at \$59 per gallon for a total of \$649,000.²³ The equivalent cost for 11,000 gallons in diesel costs at \$3.60 per gallon would be \$39,600. This cost comparison assumes a one-to-one energy-density ratio, which is not the case. The lower energy density of biofuels makes the comparison even more costly. There is no strategic advantage to biofuels since the Department of Energy (DOE) fuels vehicles and transports biofuels the same way they would petroleum-based fuel.

Forcing the military to purchase more expensive alternatives would leave fewer resources for training, modernization, and recapitalization, resulting in a less capable military. Congress should specify that energy programs for defense applications prioritize national security objectives over political interests.

Technology Innovation Should Enhance Mission First

Change, The National Center for Atmospheric Research, 2007, <http://www.cgd.ucar.edu/cas/wigley/magicc/> (accessed March 8, 2019).

¹⁹Energy Policy of the Department of Defense 10 U.S. Code § 2911.

²⁰U.S. Department of Energy, "Memorandum of Understanding Between the Department of the Navy and the Department of Energy and the Department of Agriculture," June 2011, <http://energy.gov/sites/prod/files/2014/04/f14/DPASignedMOUEnergyNavyUSDA.pdf> (accessed March 6, 2019).

²¹Todd Woody, "Don't Scuttle The U.S. Navy's Biofuels Program," *Forbes*, June 12, 2012, <https://www.forbes.com/sites/toddwoody/2012/06/12/dont-scuttle-the-u-s-navys-biofuels-program/#212c67c4a31c> (accessed March 8, 2019).

²²Brian Slattery and Michaela Dodge, "Biofuel Blunder: Navy Should Prioritize Fleet Modernization over Political Initiatives," Heritage Foundation *Issue Brief* No. 4054, September 24, 2013, http://thf_media.s3.amazonaws.com/2013/pdf/ib4054.pdf.

²³David Alexander, "U.S. Air Force Tests Biofuel at \$59 per Gallon," Reuters, July, 15, 2012, <https://www.reuters.com/article/us-usa-military-biofuels-idUSBRE86E01N20120715> (accessed March 8, 2019).

The DOD must weigh the trade-offs when making choices among various energy sources and technologies. Undoubtedly, there are risks and vulnerabilities with refueling vehicles where soldiers have lost their lives in refueling missions.²⁴ However, using alternative technologies like batteries is subject to risks as well. Lithium-ion batteries are explosive, though newer batteries are more efficient and significantly reduce or eliminate the risk of explosion.²⁵

Whether it is conventional fuels, renewable technologies, or nuclear power, spending on energy use should be mission-driven first. Certainly, alternative technologies provide advantages that enhance mission capabilities. Lighter, more efficient batteries lengthen the duration of a foot soldier's mission and reduce the weight of a soldier's backpack. Solar photovoltaics can also lighten a soldier's load and extend the travel distance of a drone. More fuel-efficient engines reduce the need for refueling. Developing micro grids and utilizing very small modular nuclear reactors can safely provide reliable power to isolated bases for long periods of time. As highlighted by a recent Information Technology and Innovation Foundation (ITIF) report, DOD research and development in energy can pay huge dividends for the agency to more effectively carry out its mission.²⁶ The ITIF's report demonstrates how energy research and development improves the competences of the DOD's soldier power, base power, platform power, autonomous systems power, and weapon power.²⁷

The DOD should continue to use America's system of national laboratories and scientific research facilities to meet national security objectives that the private sector cannot fulfill. Congress should enable opportunities that allow the private sector, using private funds, to commercialize that research while protecting classified information and national security interests. Too often, advocates of government spending on specific energy technologies tout the federal government's involvement in commercial successes that originated from government research, such as the Internet or the Global Positioning System (GPS). Yet, the initial intention for these government projects was not any private commercial need. Entrepreneurs saw a commercial opportunity in these defense technologies and created commercially viable products. The DOD and other agencies should continue this model that improves America's defense competencies while creating pathways for commercial innovation.

In other circumstances, there may be instances where relying on hundreds of diesel generators makes the most economic and strategic sense. The DOD should make those determinations, not policymakers and outside interests who have different political or financial motivations.

²⁴Army Environmental Policy Institute, "Sustain the Mission Project: Casualty Factors for Fuel and Water Resupply Convoys," September 2009, https://www.aepi.army.mil/docs/whatsnew/SMP_Casualty_Cost_Factors_Final1-09.pdf (accessed March 8, 2019).

²⁵Katherine Owens, "New li-ion Battery Will Make Soldiers' Electronics More Efficient and Less Explosive," Defense Systems, September 15, 2017, <https://defensesystems.com/articles/2017/09/15/army-lithium-ion-batteries.aspx> (accessed March 8, 2019).

²⁶Robyn and Marqusee, "The Clean Energy Dividend: Military Investment in Energy Technology and What It Means for Civilian Energy Innovation."

²⁷Ibid., pp. 9–18.

Climate Change as a Threat Multiplier

Many national security experts and social scientists perceive climate change as a threat multiplier that causes and exacerbates conflict. The 2014 *Quadrennial Defense Review* argued that the “pressures caused by climate change will influence resource competition while placing additional burdens on economies, societies, and governance institutions around the world. These effects are threat multipliers that will aggravate stressors abroad such as poverty, environmental degradation, political instability, and social tensions—conditions that can enable terrorist activity and other forms of violence.”²⁸

The evidence for climate change as a threat multiplier is far from conclusive and in many circumstances diminishes the complexity of regional conflicts. Conflict occurs because of a number of political, economic and societal factors. While climate-related events can play a role in conflict and migration patterns, correlations also exist between extreme weather events and cooperation in communities around the world. For instance, Malawi’s massive flooding did not enter into stages of conflict and violence but instead cooperated to safely relocate its people. That is not to suggest Malawi’s relocation efforts were costless, but rather it did not cause conflict and violence.

Importantly, climate change is by no means as deterministic for armed conflict and migration as some policymakers and journalists purport it to be, and the evidence for causality is weak. For example, a May 2017 article in *Political Geography* examined climate change’s impact on the Syrian civil war. The authors conclude “that there is no clear and reliable evidence that anthropogenic climate change was a factor in Syria’s pre-civil war drought; that this drought did not cause anywhere near the scale of migration that is often alleged; and that there exists no solid evidence that drought migration pressures in Syria contributed to civil war onset. The Syria case, the article finds, does not support ‘threat multiplier’ views of the impacts of climate change; to the contrary, we conclude, policymakers, commentators and scholars alike should exercise far greater caution when drawing such linkages or when securitising climate change.”²⁹

More broadly, a March 2018 article in *Nature Climate Change* argues that sampling biases likely overstate the link between climate and conflict.³⁰ Even beyond sampling biases, scholars specializing in conflict analyses argue that the connection between climate change and violence

²⁸U.S. Department of Defense, *Quadrennial Defense Review*, 2014,

http://archive.defense.gov/pubs/2014_Quadrennial_Defense_Review.pdf (accessed March 8, 2019).

²⁹Jan Selby et al., “Climate Change and the Syrian Civil War Revisited,” *Political Geography*, September 2017, Vol. 60, pp., 232–244,

<https://reader.elsevier.com/reader/sd/pii/S0962629816301822?token=03451BCF3F6F5F3B6F2B0DA26FF071DE5439CF56CED82330FA69DF359A02526647BD9D8113BF8A6859D5391BA19D1CA> (accessed March 8, 2019).

³⁰Courtland Adams et al., “Sampling Bias in Climate–Conflict Research,” *Nature Climate Change*, March 2018, Vol. 8, pp. 200–203, https://www.nature.com/articles/s41558-018-0068-2.epdf?referrer_access_token=x-9d-nk9b7S_Yvl0Y7UfB9RgN0jAjWeI9jnR3ZoTv0MBGf-XKfHtGRiSnQjsZ3DfJlsaZMld88NEE7BXfZ7o6Om3LtJxH_IQkN7N09wl08BgW6O72T2RcPMMo2U-pWOz2bbt0p_6lhwagzHL5pFTsct2nSSXnVJuVGW30nx4sa9oIWh8Ywpai0PTWzXjQvcrWrursGcnaSODJgLIT_MJJCqk9-7btEq7TtNKXiYzLHgvQyihq_9tOufjOro9-3ZXAdHFW9hFJNpAjppm2bsJ10MMJX3csWfR8K_PZtQ4%3D&tracking_referrer=www.theatlantic.com

(accessed March 8, 2019).

and climate change and migration patterns is quite tenuous.³¹ Overstating climate factors and understating more deterministic political, social, and economic factors severely misrepresents the true context of conflict and violence in those regions.

Long-term Trends in Natural Disasters and Extreme Weather

Practically speaking, the DOD should protect its installations in the U.S. and around the world from extreme weather events. However, given the lack of trends of more frequent and intense natural disasters, policymakers should refrain from assuming man-made emissions are to blame for specific vulnerabilities to military installations. The Intergovernmental Panel on Climate Changes 5th Assessment (IPCC AR5) report and other mainstream science confirms the lack of trends for extreme weather events.

Tropical cyclone activity is not becoming more frequent. The IPCC notes in its most recent scientific assessment that “[n]o robust trends in annual numbers of tropical storms, hurricanes and major hurricanes counts have been identified over the past 100 years in the North Atlantic basin,” and that there are “no significant observed trends in global tropical cyclone frequency.” Further, “confidence in large scale changes in the intensity of extreme extratropical cyclones [such as “Superstorm” Sandy] since 1900 is low.”³² A recently published article in the *American Meteorological Society* further shows that there has been no increase in trends for frequency or intensity of land-falling hurricanes in the continental U.S. since 1900.³³

The IPCC found evidence for increases, decreases, and no trend at all in flood activity or severity.³⁴ As the U.S. National Climate Assessment (NCA) summarized, “The IPCC AR5 did not attribute changes in flooding to anthropogenic influence nor report detectable changes in flooding magnitude, duration, or frequency. Trends in extreme high values of streamflow are mixed across the United States. Analysis of 200 U.S. stream gauges indicates areas of both increasing and decreasing flooding magnitude but does not provide robust evidence that these trends are attributable to human influences.”³⁵

³¹Jan Selby and Clemens Hoffmann, “Rethinking Climate Change, Conflict and Security,” *Geopolitics* (2014); Clionadh Raleigh et al., “Assessing the Impact of Climate Change on Migration and Conflict,” The World Bank Group, http://siteresources.worldbank.org/EXTSOCIALDEVELOPMENT/Resources/SDCCWorkingPaper_MigrationandConflict.pdf (accessed March 8, 2019); and Clionadh Raleigh and Henrik Urdal, “Climate Change, Environmental Degradation and Armed Conflict,” *Political Geography*, Vol. 26 (August 2007), pp., 674–694, <https://www.sciencedirect.com/science/article/pii/S096262980700087X> (accessed March 8, 2019).

³²D. L. Hartmann et al., “Observations: Atmosphere and Surface,” in *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, p. 216, http://www.climatechange2013.org/images/report/WG1AR5_Chapter02_FINAL.pdf (accessed March 11, 2019).

³³Philip J. Klotzbach et al., “Continental U.S. Hurricane Landfall Frequency and Associated Damage: Observations and Future Risks,” *American Meteorological Society*, July 2018, <https://science2017.globalchange.gov/chapter/8/> (accessed March 8, 2019).

³⁴Hartmann et al., “Observations: Atmosphere and Surface,” p. 216.

³⁵M. F. Wehner, J. R. Arnold, T. Knutson, K. E. Kunkel, and A. N. LeGrande, “2017: Droughts, Floods, and Wildfires,” in D. J. Wuebbles, D. W. Fahey, K. A. Hibbard, D. J. Dokken, B. C. Stewart, and T. K. Maycock, eds., *Climate Science Special Report: Fourth National Climate Assessment*, Vol.1 (U.S. Global Change Research

Trends in local events like hail and thunderstorms were also inconclusive.³⁶ Data for tornado activity in the U.S. shows tornadoes occur no more frequently now than in the past and that the number of strong tornadoes (F3 and above) has actually decreased.³⁷

As for droughts, the IPCC overstated previous conclusions about increasing trends and that “the compelling arguments both for and against a significant increase in the land area experiencing drought has hampered global assessment.”³⁸ The NCA reports that

there has not yet been a formal identification of a human influence on past changes in United States meteorological drought through the analysis of precipitation trends. Some, but not all, U.S. meteorological drought event attribution studies, largely in the “without detection” class, exhibit a human influence. Attribution of a human influence on past changes in U.S. agricultural drought are limited both by availability of soil moisture observations and a lack of subsurface modeling studies. While a human influence on surface soil moisture trends has been identified with medium confidence, its relevance to agriculture may be exaggerated.³⁹

Cherry-picking endpoints can produce trends that increase or decrease frequency of natural disasters to justify a politically determined need. Furthermore, it is always important to remember that correlation is not causality. Dismissing the complexity of factors that contribute to a changing climate and how they affect certain areas of the country is irresponsible.

Conclusion

Whether carbon-dioxide levels rise, fall, or stay the same, the United States and the rest of the world will experience extreme weather events. The climate and land will continue to change over time for a wide variety of reasons. The DOD should identify current and near-term vulnerabilities and make the necessary and targeted spending to strengthen military installations. The DOD should use the best available science to better prepare before storms inflict any damage. Furthermore, the DOD should continue to learn lessons after extreme weather events and make any necessary adjustments to mitigate damages from future natural disasters.

Ineffective, costly energy mandates and requirements will do little to impact climate change and make the DOD worse off by allocating defense dollars away from more valuable uses. The DOD’s research and development in alternative energy technologies can have a lot of geopolitical and economic value, but it should be mission- and capabilities-driven first.

Program, Washington, DC), pp. 231–256, <https://science2017.globalchange.gov/chapter/8/> (accessed March 8, 2019).

³⁶Hartmann et al., “Observations: Atmosphere and Surface,” p. 216.

³⁷After accounting for the apparent increase in tornado counts due to improved identifying technology. National Oceanic and Atmospheric Administration, “Historical Records and Trends,” U.S. Department of Commerce, <http://www.ncdc.noaa.gov/climate-information/extreme-events/us-tornado-climatology/trends> (accessed March 11, 2019).

³⁸Ibid., pp. 214–215.

³⁹Wehner et al., “2017: Droughts, Floods, and Wildfires,” pp. 231–256.

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