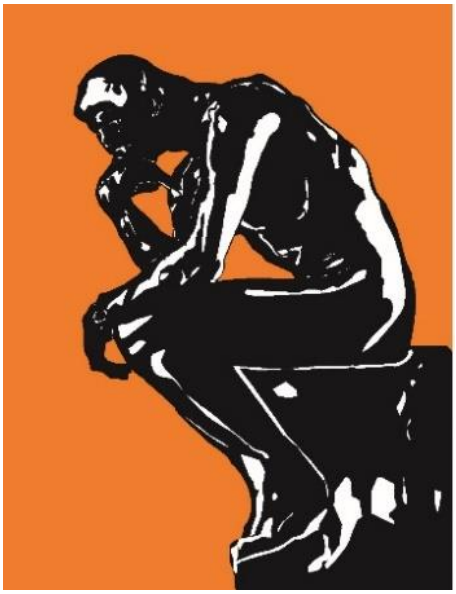
The overlooked contributors to climate and biodiversity crises: Military operations and wars

Quan-Hoang Vuong [1], Minh-Hoang Nguyen [1,*], Viet-Phuong La [1,2]

[1] Centre for Interdisciplinary Social Research, Phenikaa University, Yen Nghia Ward, Ha Dong District, Hanoi, Vietnam

[2] A.I. for Social Data Lab (AISDL), Hanoi, Vietnam

***** Correspondence: hoang.nguyenminh@phenikaa-uni.edu.vn



December 12, 2023

Preprint v.2 (un-peer-reviewed)

*** * ***

"You once contributed to this *karma* [...]. Now, these vengeful spirits have come to seek justice."

—From "Ghosts"; *The Kingfisher Story Collection* (2022)

Abstract

The military-industrial complex, military operations, and wars are major contributors to exacerbating both climate change and biodiversity crises. However, their environmental impacts are often shadowed due to national security reasons. The current paper aims to go through the devastating impacts of military operations and wars on climate change and biodiversity loss and challenges that hinder the inclusion of military-related activities into environmental crisis mitigation efforts. The information blind spot induced by concerns about national security reasons jeopardizes the efforts to involve the military-industrial complex and military operations in the global climate and biodiversity agendas. Besides that, many challenges in military operations, such as specificity of operational requirements and lifecycles, dependence on fossil fuels, complex supply change, inadequate civilian technologies and innovations, and requirements of structural changes, can hinder emission reduction. Meanwhile, wars and conflicts not only threaten to drain all human and material resources available to tackle environmental problems but also inflict long-lasting destructions, pains, and trauma that can lead to hatred and distrust among nations and parties. With the rising hatred and distrust, global agreement and commitment to address climate change and biodiversity will hardly be achieved. Thus, promoting peace is the humanistic and planetary conscience.

Keywords: military-industrial complex; conflicts; humanistic conscience; environmental conscience; peace-making; peace-building

1. The (largely unknown) scale of military emissions

In the global discourse on climate change, a significant contributor often remains in the shadows: the military-industrial complex. With growing concerns about global warming, the environmental impact of military activities has become increasingly apparent. Recent studies and reports have shed light on just how significant greenhouse gas (GHG) emissions are from armed forces worldwide, challenging traditional notions of environmental responsibility. While many efforts are being made to reduce emissions and transition to cleaner energy sources in civilian sectors, the military-industrial complex continues to have significant environmental repercussions. Furthermore, the destructive nature of warfare poses a critical threat to the environment and ecosystem diversity, often overlooked in the face of climate change challenges. As “the problem of a problem solver is his inability to define the problem” (Vuong, 2023), this paper aims to examine the impacts of military operations and wars on the environment and the challenges of incorporating them into the global climate and biodiversity agendas.

The military is a substantial source of greenhouse gas emissions, largely due to its reliance on fossil fuels to power tanks, aircraft, aircraft carriers, and other vehicles. In addition to

direct emissions from these activities, military emissions also encompass emissions from logistics and transportation, operations at bases and facilities, as well as emissions within the weapons and equipment supply chain. In 2019, the top 25 largest weapons manufacturers alone sold products estimated at $361 billion, each with its own carbon footprint (Lancaster University, 2021).

Preliminary estimates indicate that militaries worldwide contribute approximately 5.5% of the total global greenhouse gas (GHG) emissions, a figure equivalent to the emissions of many countries (Parkinson, 2022). Particularly noteworthy in this regard is the United States (U.S.) military, accounting for 31.2% of historical GHG emissions (Transnational Institute, Stop Wapenhandel, & Tipping Point North South/Transform Defence Project, 2023). If we consider the U.S. military as a separate nation, their fuel usage alone is equivalent to the greenhouse gas emissions of a major nation ranked 47th in the world, nestled between Peru and Portugal (Mcfarlane & Volcovici, 2023). The U.S. military's emissions surpass those of entire countries like Denmark, Portugal, Switzerland, Ghana, and New Zealand (Kehrt, 2022). In 2017, the U.S. military purchased approximately 269,230 barrels of oil per day and emitted over 25,000 kilotons of carbon dioxide when burning those fuels (Neimark, Belcher, & Bigger, 2019). However, the true extent of military emissions remains somewhat elusive and unclear. Some countries lump military emissions into civilian data or do not provide comprehensive information, while others keep this data classified for national security reasons.

2. Greenhouse gas emissions in wars and military operations

In addition to indirect greenhouse gas emissions stemming from the military supply chain and equipment production, armed conflicts themselves directly cause a substantial amount of global emissions. While emissions from the military-industrial complex and annual activities can be somewhat estimated, emissions from military conflicts and wars are challenging to assess accurately. As the shadow of war looms over humanity, with violence, destruction, and displacement, the environmental footprint of armed conflicts often goes unnoticed. Greenhouse gas emissions, the primary drivers of climate change, rise significantly during wars and military operations, leaving a lasting legacy of environmental degradation.

Information about heavy weaponry used in warfare is often kept classified, making it difficult to approach from an environmental science perspective. Therefore, assessing their environmental impacts often relies on indirect and uncertain information, such as casualty figures and fuel consumption data. Based on estimates from the War Carbon initiative—a group of experts researching the climate impact of the conflict in Ukraine—the total CO2 emissions after 18 months of warfare were estimated to be around 150 million tons. Of these emissions, frequent wildfires along the frontlines accounted for approximately 15% of the total emissions (Agence France Presse, 2023).

In a conflict, sources of greenhouse gas emissions are diverse, including fuel consumption, emissions from exploding munitions, and the destruction caused by vehicles and infrastructure. For instance, airstrikes and artillery strikes can damage or destroy critical infrastructure such as power plants and oil refineries, thereby contributing to greenhouse gas emissions in the atmosphere. Another specific example is an old Russian T-55 tank with two auxiliary fuel tanks of 200 liters each. When detonated, it can burn more than 600 liters of fuel, releasing substantial emissions into the environment, not to mention other hazardous materials it may carry.

Fuel consumption is one of the primary sources of greenhouse gas emissions in warfare. Military vehicles, aircraft, and machinery consume large amounts of fossil fuels, thereby emitting significant carbon dioxide (CO2) into the atmosphere (Choudhury, 2013). Additionally, military bases consume large amounts of energy for heating, cooling, and power supply, often relying on fossil fuels, further contributing to increased greenhouse gas emissions (Samaras, Nuttall, & Bazilian, 2019).

Military activities not only consume fuel but also affect greenhouse gases through ecosystem destruction. Forests, wetlands, and other natural carbon sinks are often damaged during conflicts, leading to the release of carbon reserves into the atmosphere. Moreover, the use of explosives and various weapons not only causes environmental degradation but also releases pollutants and disrupts natural processes that absorb carbon.

3. Impact of wars and military operations on biodiversity

The impact of war and military operations extends beyond greenhouse gas emissions and deeply affects biodiversity. Armed conflicts and warfare rapidly degrade the environment as the struggle for survival and related environmental mismanagement inflict severe damage on crucial ecosystems. Over the past six decades, armed conflicts have occurred in more than 2/3 of the world's important biodiversity regions, posing serious threats to environmental conservation efforts (UN Environment Programme, 2018).

A prominent and frequently cited example of the impact of military operations on biodiversity is the use of Agent Orange by the U.S. military during the Vietnam War. From 1961 to 1971, millions of liters of herbicides and defoliants, including Agent Orange, were sprayed over South Vietnam as part of a strategy to clear forests and destroy hiding places for Viet Cong insurgents, resulting in widespread ecological damage (UN Environment Programme, 2018). During the Vietnam War, the U.S. frequently conducted airstrikes on Asian elephants, believing they were used to transport supplies for the opposition forces (Earth.com, 2019).

In the Democratic Republic of Congo, a series of armed conflicts since the mid-1990s has devastated wildlife populations (Bonessi, 2016). These conflicts led to the widespread hunting of forest animals by combatants, civilians, and traders, seriously impacting species

from small rodents to larger animals like gorillas and forest elephants. The conflicts also fueled illegal logging and harmful extraction processes.

Another clear example is the draining of the Mesopotamian Marshes, the largest wetland ecosystem in the Middle East, in the early 1990s. This action, undertaken by Saddam Hussein's military, reduced the largest wetland ecosystem in the Middle East to less than 10% of its original size, turning it into a desert with a salt crust (UN Environment Programme, 2018). Additionally, in 2017, ISIS militants set fire to oil wells in Mosul, releasing a tremendous amount of hazardous chemicals into the environment (Smith, 2016). Afghanistan's forests have also been affected by prolonged conflict, with over half of the country's forest area destroyed. Deforestation reached up to 95% in some areas due to people's coping strategies and lax environmental management during decades of war. This deforestation has made the region more vulnerable to natural disasters such as floods and landslides.

In Nepal, during an armed conflict from 1996 to 2006, the redeployment of military forces for counter-insurgency operations led to irresponsible exploitation of wildlife and plant resources. This included the harvesting of valuable medicinal plants in conservation areas like Khaptad National Park and Makalu Barun Conservation Area. In Colombia, uncontrolled mining and gold extraction in areas controlled by FARC rebels have had a severe impact on the environment. This activity, a major source of funding for the rebels, led to mercury contamination in rivers and land, particularly in the Quito River basin. Deforestation rates increased in 31 protected areas, with a 177% rise destroying nearly 130 square miles of habitat. Buffer zones around conservation areas, critical for genetic flow and animal migration, also witnessed a 158% increase in deforestation, equivalent to about 265 square miles of lost forests (Clerici et al., 2020).

These examples illustrate the highly negative impact of war and military operations on the structure and functioning of ecosystems. These impacts include dramatic changes in habitats, environmental pollution, and disruption resulting in significant biodiversity loss in terrestrial and aquatic systems (Lawrence, Stemberger, Zolderdo, Struthers, & Cooke, 2015).

Weapons of war that remain after conflicts, such as unexploded cluster bombs, can have long-lasting effects on the environment (Fares & Fares, 2018). Furthermore, radioactive weapons, including depleted uranium left over from the Gulf War, continue to pose environmental concerns. Although their radioactivity is only 60% that of natural uranium, depleted uranium still possesses chemical and radioactive toxicity (Pizzino, Durham, & Michael, 2023; Young, 2021). In a recently published study, scientists explained that the reason behind the high radiation levels in wild boars in Ukraine is not directly due to the Chernobyl disaster but rather the result of nuclear weapons testing before the disaster

occurred, resulting in residual radiation in the surrounding areas for decades (Limb, 2023; Stäger, Zok, Schiller, Feng, & Steinhauser, 2023).

4. The information blind spot and the gap in global climate agreements

The lack of transparency, often referred to as the "military emissions gap," arises from the voluntary reporting of military emissions within the United Nations Framework Convention on Climate Change (UNFCCC). Consequently, many governments choose not to report them.

For example, in 2020, 40 industrialized nations spent approximately $1.27 trillion on their armed forces, but only five countries reported their military emissions in line with United Nations guidelines. Furthermore, 15 other countries, including China, India, and Saudi Arabia, spent a combined total of about $510 billion on their military yet failed to provide any disaggregated data on military emissions. Emissions from U.S. military activities abroad, including operations such as jet flights, naval sailings, and military exercises, have been exempt from reporting requirements under both the 1997 Kyoto Protocol and the 2015 Paris Agreement.

This lack of transparency has created a problem of incomplete reporting and accountability regarding military-related emissions in international climate agreements. The 1997 Kyoto Protocol and the 2015 Paris Agreement exempted military emissions reporting, citing national security concerns. This exemption has resulted in a blind spot in global emissions calculations, undermining the world's comprehensive understanding and addressing of global greenhouse gas emissions.

Efforts are currently underway to address this blind spot in greenhouse gas calculations. Environmental groups and scholars are advocating for more comprehensive and transparent reporting of military emissions. These efforts include research papers, letter-writing campaigns, and conferences aimed at engaging with the UNFCCC to incorporate all military emissions into global carbon accounting. In just the first five months of 2023, 17 peer-reviewed articles on this topic were published, indicating a growing awareness and concern about this issue (Mcfarlane & Volcovici, 2023).

5. Complexities and challenges in containing military emissions

Even if the emission reporting within the military industry becomes transparent, reducing emissions presents several complex challenges, primarily due to the unique operational requirements and the nature of military technology and infrastructure.

Specificity of operational requirements and lifecycles: One of the primary challenges is keeping a balance between the need to reduce emissions and maintaining critical defense capabilities. Military equipment, such as tanks and jet-powered aircraft, often has long lifecycles, meaning that the fossil fuel-powered machinery currently in use may remain operational for many decades. This inherent characteristic of defense-related systems

complicates the transition to cleaner technologies without compromising safety, reliability, and performance. The use of indispensable heavy-duty systems for defense, such as missiles and weapons, also poses difficulties in achieving carbon reductions due to the chemical reactions essential for their functionality (Serhal, 2023).

Dependency on fossil fuels: The reliance on fossil fuels for military transportation, including combat vehicles, fighter aircraft, naval vessels, and submarines, further complicates the shift to clean energy. The significant fuel consumption by military units and the need to transport fuel to various global locations make reducing emissions without compromising defense capabilities challenging.

Complex supply chain: Addressing emissions in the military supply chain is a challenge due to the intricate nature of suppliers and the unique characteristics of defense products. This complexity hinders the creation of a mutually beneficial ecosystem between defense forces and their suppliers, similar to developments in other sectors like automotive. One potential solution is to establish carbon reduction requirements for suppliers in line with national goals rather than attempting direct quantification and emissions reductions (Bowcott, Gatto, Hamilton, & Sullivan, 2021).

Inadequate civilian technologies and innovation: Military forces can leverage the benefits of adopting low-carbon civilian technologies, such as sustainable aviation fuels, fuel cells, and electric vehicles (E.V.s). However, this approach still faces limitations and must be complemented with the development of specific military capabilities that are more sustainable. Military assets impose high demands on mobility and operational time, leading to unique and complex requirements compared to civilian equipment.

Infeasible monitoring of emissions from vital military operations: To optimize carbon reduction efforts, military forces can categorize their emissions into two types: those directly under their responsibility and those originating from the supply chain. Typically, emission reduction efforts focus on sources less related to national security, that is, the suppliers. Emissions from security-related mission activities are often subject to careful evaluation to ensure minimal impact on military efficiency. Some emissions from vital military operations are difficult to classify, measure, and reduce.

Requirements of structural changes: As climate change gains prominence, governments increasingly recognize the importance of decarbonizing their military forces to achieve sustainability goals. Initiatives like NATO's commitment to reducing military emissions and individual nations' efforts to integrate sustainability into their military activities reflect this shift. However, achieving net-zero emissions in the defense sector is a complex task that demands strategic planning, innovation, and potentially significant changes in military operations, procurement, and underlying military doctrines to balance the need to reduce emissions and maintain critical defense capabilities.

The challenges in reducing emissions in the military industry are highly intricate, involving balancing operational requirements, breaking free from fossil fuel dependence, managing complex supply chains, adopting and innovating sustainable technologies, monitoring emissions from vital military operations, and addressing the structural change requirements. These challenges require a comprehensive, strategic approach to ensure that emission reduction efforts do not compromise military effectiveness and national security.

6. Humanistic and environmental conscience: Peace

In the context of a world facing an escalating climate crisis, addressing all sources of greenhouse gas emissions, including those from the military, becomes crucial in our collective effort to build a sustainable future. While the lack of transparency and accountability for military emissions in international climate agreements remains contentious, there are also signs of progress in increasing transparency and accountability in this field. An increase in academic research and pressure from environmental organizations drives this progress.

Human conscience, which today encompasses the environment, needs peace (Vuong & Nguyen, 2023). The far-reaching impact of war, military operations, and the military-industrial complex on biodiversity and climate change underscores the urgent need for global peace and environmental management. War and conflict, as illustrated by examples from Vietnam, the Democratic Republic of the Congo, Iraq, Afghanistan, Nepal, Colombia, and currently occurring ones, have led to catastrophic environmental destruction. These events have resulted in significant loss of biodiversity, ecosystem degradation, and disruption of natural habitats, affecting land and water life.

In the absence of peace, no matter how much we progress in mitigating climate change and protecting biodiversity, they will all be obliterated when the violence escalates and the economy becomes devastated. Wars and conflicts risk depleting all the human and material resources to tackle climate change (Vuong, 2021b). Moreover, the more severe the destruction, pains, and trauma the wars and conflicts cause, the greater the hatred and distrust that remains among nations and parties (Vuong, Nguyen, & Le, 2021). Such hatred and distrust will be great obstacles in achieving the agreement and commitment to address the global climate change and biodiversity problems, of which success requires local actions and cooperation.

Therefore, the call for peace is synonymous with the call for the preservation of our planet. We need to acknowledge that war and military operations not only bring tragedy to humans but also cause environmental disasters. People claim to be righteous in wars, but the destruction of the environment and the devastating consequences left behind are sinfulness to Mother Nature. The need for global cooperation in conflict resolution, reduction of military activities, and focusing on sustainable and peaceful activities becomes more crucial than ever. As we face daunting challenges of climate change and biodiversity

loss, pursuing peace is not just a moral imperative; it is a critical component of the eco-surplus culture that helps maintain the survival and well-being of our planet (Nguyen & Jones, 2022; Vuong, 2021a).

Nick Buxton, a researcher at the Transnational Institute, has noted, “Money is being spent on militarization rather than on climate action, though the climate crisis is the biggest [common] security threat that we face today.” The transition of military spending into climate aid is a call being made at COP28 by activists. Perry O’Brien, the head of the Common Defense organization, a group led by U.S. veterans, has argued that reallocating a portion of military finances toward climate efforts would make the world safer (Noor, 2023).

Thus, in addition to promoting peace, the impact of the military industry on the environment is an urgent issue that demands global attention and action. As a significant contributor to greenhouse gas emissions, the role of the military in climate change cannot be overlooked. Efforts by environmental organizations, researchers, and some military organizations represent an important step toward increased global transparency and mitigating the environmental impact of military activities.

Environmental groups and scholars are increasingly focusing on military emissions. Organizations like Tipping Point North South, The Conflict and Environment Observatory, and universities such as Lancaster, Oxford, and Queen Mary are actively advocating for more transparent and comprehensive reporting of military emissions. Their efforts include in-depth research, letter campaigns, and participation in international conferences aimed at influencing the UNFCCC to recognize and account for military emissions.

There are indications that the military sector is starting to acknowledge and address its environmental impact. Some military forces are preparing for changes in their reporting requirements. For example, NATO has developed a method for its member states to report military emissions, signaling a shift toward greater transparency. Furthermore, countries like New Zealand, the U.K., and Germany have been seeking ways to include previously excluded areas, such as emissions from overseas operations, in their national reporting (Mcfarlane & Volcovici, 2023). The U.S. military has also shown progress in reducing its use of oil and associated emissions in recent years. In 2017, the U.S. military purchased 84 million barrels of oil, a decrease from previous years, decreasing emissions from 51 million tons in the previous year to 48 million tons in 2022.

Nations and individuals are compelled to work towards peaceful solutions for conflicts and reconsider the priorities of national and global security. Investing in peace is investing in the health and resilience of our planet’s ecosystems. It is a commitment to future generations, ensuring a world where biodiversity thrives and the impacts of climate change are minimized. Let us, therefore, embrace peace not just as a political ideal but as an ecological necessity vital for preserving our planet and the intricate web of life it sustains.

References

Agence France Presse. (2023). Ukraine war responsible for 150m tons of CO2 emissions: Experts. Retrieved from https://www.barrons.com/news/ukraine-war-responsible-for-150m-tons-of-co2-emissions-experts-78b7cbf9

Bonessi, D. (2016). Gorilla population decimated by decades of war in Democratic Republic of Congo. Retrieved from https://www.pbs.org/newshour/world/gorilla-population-decimated-by-decades-of-war-in-democratic-republic-of-congo

Bowcott, H., Gatto, G., Hamilton, A., & Sullivan, E. (2021). *Decarbonizing defense: Imperative and opportunity*. Retrieved from https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/decarbonizing-defense-imperative-and-opportunity

Choudhury, N. (2013). US military to spend $2.4 billion on electric vehicles by 2020. Retrieved from https://www.climatechangenews.com/2013/11/07/us-military-to-spend-2-4-billion-on-electric-vehicles-by-2020/

Clerici, N., Armenteras, D., Kareiva, P., Botero, R., Ramírez-Delgado, J., Forero-Medina, G., . . . Lora, C. (2020). Deforestation in Colombian protected areas increased during post-conflict periods. *Scientific Reports, 10*(1), 4971. doi:10.1038/s41598-020-61861-y

Earth.com. (2019). War can have a devastating impact on wildlife populations across the globe. Retrieved from https://www.earth.com/news/war-devastating-impact-wildlife/

Fares, J., & Fares, Y. (2018). Cluster munitions: military use and civilian health hazards. *Bulletin of the World Health Organization, 96*(8), 584. doi:10.2471/BLT.17.202481

Kehrt, S. (2022). The U.S. military emits more carbon dioxide into the atmosphere than entire countries like Denmark or Portugal. Retrieved from https://insideclimatenews.org/news/18012022/military-carbon-emissions/

Lancaster University. (2021). Scientists call on world's military forces to come clean on carbon emissions. Retrieved from https://phys.org/news/2021-11-scientists-world-military-carbon-emissions.html

Lawrence, M. J., Stemberger, H. L., Zolderdo, A. J., Struthers, D. P., & Cooke, S. J. (2015). The effects of modern war and military activities on biodiversity and the environment. *Environmental Reviews, 23*(4), 443-460. doi:10.1139/er-2015-0039

Limb, L. (2023). Chernobyl: Scientists solve mystery of why wild boars are more radioactive than other animals. Retrieved from https://www.euronews.com/green/2023/09/02/chernobyl-scientists-solve-mystery-of-why-wild-boars-are-more-radioactive-than-other-anima

Mcfarlane, S., & Volcovici, V. (2023). Insight: World's war on greenhouse gas emissions has a military blind spot. Retrieved from https://www.reuters.com/business/environment/worlds-war-greenhouse-gas-emissions-has-military-blind-spot-2023-07-10/

Neimark, B., Belcher, O., & Bigger, P. (2019). US military is a bigger polluter than as many as 140 countries – shrinking this war machine is a must. Retrieved from https://theconversation.com/us-military-is-a-bigger-polluter-than-as-many-as-140-countries-shrinking-this-war-machine-is-a-must-119269

Nguyen, M.-H., & Jones, T. E. (2022). Building eco-surplus culture among urban residents as a novel strategy to improve finance for conservation in protected areas. *Humanities & Social Sciences Communications, 9*, 426. doi:10.1057/s41599-022-01441-9

Noor, D. (2023). Divert military spending to fund climate aid, activists urge Cop28. Retrieved from https://www.theguardian.com/environment/2023/dec/02/cop28-climate-change-military-funds?CMP=Share_AndroidApp_Other

Parkinson, S. (2022). *Estimating the military's global greenhouse gas emissions*. Retrieved from West Yorkshire: https://ceobs.org/wp-content/uploads/2022/11/SGRCEOBS-Estimating_Global_MIlitary_GHG_Emissions_Nov22_rev.pdf

Pizzino, S., Durham, J., & Michael, W. (2023). Conflict pollution, washed-up landmines and military emissions – here's how war trashes the environment. Retrieved from https://theconversation.com/conflict-pollution-washed-up-landmines-and-military-emissions-heres-how-war-trashes-the-environment-216987

Samaras, C., Nuttall, W. J., & Bazilian, M. (2019). Energy and the military: Convergence of security, economic, and environmental decision-making. *Energy Strategy Reviews, 26*, 100409. doi:10.1016/j.esr.2019.100409

Serhal, G. B. (2023). Decarbonizing Defense: The Harsh Reality of Military Emissions. Retrieved from https://moderndiplomacy.eu/2023/05/13/decarbonizing-defense-the-harsh-reality-of-military-emissions/

Smith, A. (2016). Iraqis near Mosul in 'smoke-filled hell' as ISIS burns oil wells. Retrieved from https://www.nbcnews.com/storyline/isis-terror/iraqis-near-mosul-smoke-filled-hell-isis-burns-oil-wells-n677866

Stäger, F., Zok, D., Schiller, A.-K., Feng, B., & Steinhauser, G. (2023). Disproportionately High Contributions of 60 Year Old Weapons-137Cs Explain the Persistence of Radioactive Contamination in Bavarian Wild Boars. *Environmental Science and Technology, 57*(36), 13601-13611. doi:10.1021/acs.est.3c03565

Transnational Institute, Stop Wapenhandel, & Tipping Point North South/Transform Defence Project. (2023). *Why the military's impact on climate change can no longer*

be ignored at COP28. Retrieved from https://www.tni.org/en/publication/climate-collateral-COP28

UN Environment Programme. (2018). Why we need to protect biodiversity from harmful effects of war and armed conflict. Retrieved from https://www.unep.org/news-and-stories/story/why-we-need-protect-biodiversity-harmful-effects-war-and-armed-conflict

Vuong, Q.-H. (2021a). The semiconducting principle of monetary and environmental values exchange. *Economics and Business Letters, 10*(3), 284-290. doi:10.17811/ebl.10.3.2021.284-290

Vuong, Q.-H. (2021b). Western monopoly of climate science is creating an eco-deficit culture.

Vuong, Q.-H. (2022). *The kingfisher story collection*.

Vuong, Q.-H. (2023). *Meandering sobriety*.

Vuong, Q.-H., & Nguyen, M.-H. (2023). Kingfisher: Contemplating the connection between nature and humans through science, art, literature, and lived experiences. *Pacific Conservation Biology*. doi:10.1071/PC23044

Vuong, Q.-H., Nguyen, M.-H., & Le, T.-T. (2021). *A mindsponge-based investigation into the psycho-religious mechanism behind suicide attacks*: De Gruyter.

Young, S. (2021). Depleted Uranium, devastated health: Military operations and environmental injustice in the Middle East. Retrieved from https://hir.harvard.edu/depleted-uranium-devastated-health-military-operations-and-environmental-injustice-in-the-middle-east/