

IMPACT OF ARMED CONFLICT ON THE NIGERIAN ENVIRONMENT

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Abstract

Nigeria has experienced numerous conflicts both before and after its formation as a nation, with varying levels of severity. The country's civil war from 1967 to 1970 resulted in a staggering death toll estimated at over 100 million people. The Boko Haram insurgency poses a significant security threat, particularly in the northeast, where violent crimes such as bombings, kidnappings, and killings of unarmed civilians are commonplace. Unfortunately, the environmental consequences of these conflicts often go unreported, undocumented, unpublished, and unspoken. The most significant environmental impacts of armed conflicts in Nigeria are pollution, drought, desertification, and deforestation. These negative effects on the environment are particularly alarming since polluted environments can have a detrimental impact on human health. Therefore, it is crucial to establish an environmental protection legal framework to preserve and conserve the environment, even during times of conflict. Countries that fail to implement environmental policies should face sanctions, and nations alongside communities must be held accountable for any damage caused by armed conflict to the environment. International law aims to limit the use of weapons that pose a significant threat to the environment and to ban the deliberate destruction of the environment during hostilities. The study highlighted some of the consequences of armed conflict.

Keywords: Conflicts, Environment, Insurgency, Nigeria, Weapons

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1.0 Introduction

Nigeria is being plagued by numerous security issues.¹ Herdsmen-farmer conflicts are wreaking havoc in the North-Central, South-East, and South-West while the South-South geopolitical zone faces the threat of militancy, the Northern part of Nigeria has the problem of the Boko Haram insurgency, and the South-east faces the threat of militancy². The above-mentioned areas in Nigeria are not completely peaceful and are also ravaged by the effect of armed conflicts.

The protection of the environment is crucial to achieving security and peace. Armed conflict is a significant concern in the world today, affecting many nations, such as Sudan³, El Salvador⁴ Nigeria⁵, Kurdistan⁷, Syria⁸, Ukraine⁹

¹AUmar, “Environmental Consequences of Armed Conflict: A Case of the Northeastern Nigeria” (2020) 19 International Journal of Humanities & Social Sciences 281

²“Global Terrorism Index 2015: Measuring and Understanding the Impact of Terrorism - World” (*ReliefWeb*) <<https://reliefweb.int/report/world/global-terrorism-index-2015-measuring-and-understanding-impact-terrorism>> accessed January 23, 2024

³ PB Spiegel and others, “Health-Care Needs of People Affected by Conflict: Future Trends and Changing Frameworks” (2010) 375 *The Lancet* 341

⁴ A Ugalde, “Conflict and Health: The Health Costs of War: Can They Be Measured? Lessons from El Salvador” (2000) 321 *BMJ* 169

⁵ G Dunn, “The Impact of the Boko Haram Insurgency in Northeast Nigeria on Childhood Wasting: A Double-Difference Study” (2018) 12 *Conflict and Health*

⁶ UE Ekhaton-Mobayode and A Abebe Asfaw A, “The Child Health Effects of Terrorism: Evidence from the Boko Haram Insurgency in Nigeria” (2018) 51 *Applied Economics* 624

⁷ M Gurses and AE Ozturk, “Religion and Armed Conflict: Evidence from the Kurdish Conflict in Turkey” (2020) 59 *Journal for the Scientific Study of Religion* 327

⁸ M Heisler, E Baker and D McKay, “Attacks on Health Care in Syria — Normalizing Violations of Medical Neutrality?” (2015) 373 *New England Journal of Medicine* 2489

These conflicts, which result into loss of lives, economic hardship, and irreparable damage to the environment and natural resources, account for a major portion of today's misery among people. In a war, protecting people's lives and property seems to take precedence over protecting the environment¹⁰. It should be noted that humanity is heavily dependent on the environment, and as a result, the destruction of the environment and natural resources almost inevitably results in the extinction of human life support systems¹¹.

This article projects that the environment must be scrupulously conserved if human existence is to be preserved. This is because environmental damage is a blatant sign that the future is in danger and that it jeopardizes the security of livelihood. In some cases, the effects of armed conflict on the environment are widespread and last for years or even decades after hostilities have ended. During an armed war, the natural environment may be destroyed or degraded, which could have detrimental effects on humanity. It may pose a long-term threat to entire populations' survival, health, and well-being.

Numerous human actions have a negative impact on the environment. Warfare is prominent among these. The impact of war on the environment is extensive and far-reaching¹². Countries battling at home or abroad, as well as developed and less developed nations, all have different

⁹reporter G staff, "The Climate Costs of War and Militaries Can No Longer Be Ignored" The Guardian (January 9, 2024)
<<https://www.theguardian.com/commentisfree/2024/jan/09/emission-from-war-military-gaza-ukraine-climate-change>> accessed January 22, 2024

¹⁰AUmar, "Environmental Consequences of Armed Conflict: A Case of the Northeastern Nigeria" (2020) 19 International Journal of Humanities & Social Sciences 281

¹¹AUmar, "Environmental Consequences of Armed Conflict: A Case of the Northeastern Nigeria" (2020) 19 International Journal of Humanities & Social Sciences 281

¹²GE Machlis and T Hanson, "Warfare Ecology" (2008) 58 BioScience 729

effects on the environment because of war. Depending on the aspect of the environment considered, war has different effects on the environment¹³.

1.1 History of Conflicts in Nigeria

Nigeria is not a nation that is spared by war. Before and after the creation of the Nigerian state, there have been a number of conflicts of varying intensities that were documented. Between 1967 and 1970, the post-colonial nation of Nigeria saw a civil war in which it is estimated between one and three million people died¹⁴. In Nigeria, ethnic and racial conflicts have frequently occurred. Numerous skirmishes caused by religious disputes resulted in hundreds of deaths in Kano, Bauchi, Kaduna, Kafanchan, Zaria, Jos, Maiduguri, and other locations. Weapons have been used in these conflicts. Guns are the most often used weaponry. There have been several conflicts and riots in Nigeria over the years, including the Maitatsine Riots in Kano¹⁵, the Ife-Modakeke conflict, and the Aguleri and Umuleri crisis¹⁶ crisis that began many years ago and has resulted in several violent clashes between the warring communities.

Riots were a series of violent uprisings instigated by Islamist militants in northern Nigeria between 1980 and 1985. They represented northern Nigeria's first major wave of religiously

¹³R Reuveny, AS Mihalache-O'Keef and Quan Li, "The Effect of Warfare on the Environment" (2010) 47 *Journal of Peace Research* 749

¹⁴ L Heerten and AD Moses, "The Nigeria-Biafra War: Postcolonial Conflict and the Question of Genocide" (2014) 16 *Journal of Genocide Research* 169

¹⁵ M Hiskett, "The Maitatsine Riots in Kano, 1980: An Assessment" (1987) 17 *Journal of Religion in Africa* 209

¹⁶ I Onwuzuruigbo, "Horizontal Inequalities and Communal Conflicts: The Case of Aguleri and Umuleri Communities of South-Eastern Nigeria" (2011) 81 *Africa: Journal of the International African Institute* 567

inspired violence and prompted immense ethno religious discord between Muslims and Christians in years to follow. Ife-Modakeke conflict was an inter-communal.

. In the present, weapons have developed beyond these original purposes and have become tools for human crime, with the environment receiving less attention.

Gun proliferation and illegal arms trafficking were made worse by the Nigerian government's failure to carry out a comprehensive disarmament and arms destruction program in the wake of the civil war (1967–1970)¹⁷. War has a known human cost. However, no attempt or calculation has been made to determine the exact cost of war on the environment. Despite the fact that nations have been at war for thousands of years, the damaging impacts of war on the environment and the widespread implications on human health have gotten comparatively little continuous scientific study.

1.3 Nature and Tactics of Conflicts and its effect on the Environment

Armed conflicts generally differ in terms of their environmental impacts and derived humanitarian effects in relation to the nature of the armed conflict. In a situation involving non state actors then it means engaging in guerilla tactics. Such conflicts are often drawn out and fought with different types of means of warfare when compared to practices involving international armed conflicts between two or more states¹⁸. Most state actors continue to rely on so-called Blitzkrieg tactics (Lightening War) - involving mechanized machinery used at high

¹⁷SS Olayiwola, “Proliferation of Arms and Security Challenges in Nigeria” (2017) 3: *International Journal of History and Cultural Studies (IJHCS)* 33

¹⁸“The Transformation of War Revisited: Martin van Creveld,” *Non-state Threats and Future Wars* (Routledge 2012) <<http://dx.doi.org/10.4324/9780203045862-8>> accessed January 24, 2024

speed in coordination with air support, while guerilla movements most often conduct their hostilities at a slower pace, taking shelter in remote mountainous or forested areas ¹⁹. As is the case with the insurgency in the northeastern region of Nigeria where the insurgents are taking cover in the Sambisa Forest and the Lake Chad areas where any attack launched in the area of their hideout has been surely causing the destruction of the environment. Farmlands, fishing facilities, water, forests, animals, fish, and birds are destroyed. These tactics are likely to expose the environment to different types of damage and degradation²⁰.

1.4 Effect of Wars on the environment.

The environmental effects of war include any harms and pollutants that affect the air, water, soil, and wildlife. Ecocide, or the destruction of the environment, has a significant impact on the ecosystem today. There have been environmental disruptions brought on by battle for thousands of years. Studies on environmental pollution caused by conflicts identify several possible pollution sources. For instance, during the Gulf War, water resources in Kuwait were heavily polluted from oil spills following attacks on oil fields²¹, increasing the concentration of trace metals along the coast in the Persian Gulf²² and impacting regional aquaculture²³. During the

¹⁹ Hammes 2008 Hammes, T.X. (2008). *The Sling and the Stone*. St. Paul, MN, Zenith Press

²⁰ AUmar, "Environmental Consequences of Armed Conflict: A Case of the Northeastern Nigeria" (2020) 19 *International Journal of Humanities & Social Sciences* 281

²¹ P Literathy, "Environmental Consequences of the Gulf War in Kuwait: Impact on Water Resources" (1992) 26 *Water Science and Technology* 21

²² A Buolayan and others, "Effects of the Gulf War Oil Spill in Relation to Trace Metals in Water, Particulate Matter, and PAHs from the Kuwait Coast" (1998) 24 *Environment International* 789

²³ CP Mathews and others, "Preliminary Assessment of the Effects of the 1991 Gulf War on Saudi Arabian Prawn Stocks" (1993) 27 *Marine Pollution Bulletin* 251

Syrian civil war, discharge of untreated wastewater into the environment, both intentionally and unintentionally, deteriorated the water quality in affected areas²⁴. Following the civil war in Sri Lanka, explosives; remnants of war, such as landmines, remained scattered throughout the landscape, report higher-than-usual concentrations of heavy metals, fluoride, and calcium in the groundwater in these areas. Other possible sources of contamination include hazardous waste from industries and waste disposal sites, pathological waste from hospitals that were damaged in the conflict, the unregulated incineration of municipal waste, and the use of chemical weapons²⁵

1.4.1 Oil Spillage

Oil spillage may not appear as a direct cause of conflicts, but numerous times, we have seen militants vandalizing pipelines when in combat with the nation as a result of the fact that the nation is not yielding to their demands of development. In recent years, the bombing of fuel pipelines in Nigeria's Niger Delta has increased in frequency. The effects of this unlawful and damaging activity on the local economy and ecosystem are extensive. Bombings of fuel pipelines may result in the environmental release of significant quantities of crude oil and other petroleum products²⁶. Oil spills have a substantial negative influence on the environment and human health since they can contaminate the land, water, and air²⁷.

²⁴ G Faour and A Fayad, "Water Environment in the Coastal Basins of Syria - Assessing the Impacts of the War" (2014) 1 *Environmental Processes* 533

²⁵ P Literathy, "Environmental Consequences of the Gulf War in Kuwait: Impact on Water Resources" (1992) 26 *Water Science and Technology* 21

²⁶ C Ejioko & I Idris, "The environmental impacts of pipeline vandalism on the Niger Delta region of Nigeria" (2015) 22 *Environmental Science and Pollution Research*, 17576

²⁷ Muhammad Tariq Bashir, "Environmental, Public Health and Socio-Economic Issues of Oil Spillage in Niger Delta, Nigeria" (2021) V10 *International Journal of Engineering Research*

Fish and birds can also be harmed by the oil spill by having fewer habitats and food sources²⁸. Oil spills harm crops and make it more difficult to access clean water for drinking and irrigation, which can also result in decreased food security and worsening health conditions for locals²⁹.

1.4.2 Deforestation

Nigeria is not the only country with armed conflicts associated with the forest. It has been observed that about 40% of the world's countries have experienced conflict in their forests³⁰. Some of these countries include Angola, Bangladesh, Bosnia and Herzegovina, Cambodia, Central African Republic, Colombia, the Congo, Côte d'Ivoire, the Democratic Republic of the Congo, Guatemala, India, Indonesia, Liberia, Mexico, Mozambique, Myanmar, Nepal, Nicaragua, Pakistan, Peru, the Philippines, Rwanda, Senegal, Sierra Leone and the Solomon Islands³¹. In many of these countries, insurgents used forested regions to hide from government troops.

²⁸O Adeleke & C Ejiogor, "The Impact of pipeline vandalism on the Niger Delta environment and communities" (2019) 7 *Journal of Clean Energy Technologies*, 270

²⁹Muhammad Tariq Bashir, "Environmental, Public Health and Socio-Economic Issues of Oil Spillage in Niger Delta, Nigeria" (2021) V10 *International Journal of Engineering Research* .

³⁰PC Aju & JA Aju (2018) "Occupation of Sambisa Forest and Boko Haram Insurgency in Northeastern Nigeria as Security Threat and Challenges to Sustainable Forest Management" (2018) 18 *Global Journal of Science Frontier Research: D Agriculture and Veterinary*, 1

³¹"Which Country Has the Highest Rate of Deforestation?"
<<https://worldpopulationreview.com/country-rankings/deforestation-rates-by-country>> accessed January 24, 2024

It is a common warfare tactic that forest is destroyed to deprive enemies of cover ³². Armies often burn or clear forested areas to enable them to spot the enemy more readily ³³.

No information as yet exists of any deliberate attempt to assess the effects of the Sambisa Forest occupation by the Boko Haram insurgents and the subsequent military expedition to root out the terrorist group from the forest. It is obvious however that most of the negative consequences of armed conflicts on forests as earlier highlighted are already playing out in the case of the Sambisa Forest occupation. For one, since its take-over by the insurgent group, the game reserve has been under no kind of any management. On the other hand, the rebels have continued to be physically present in SambisaForest since 2013³⁴.

Large tracts of forest were destroyed during the Biafran War in Nigeria, which took place between 1967 and 1970. This was because both sides in the fight exploited the forests as cover

³²Wang J, “Developing Needs-Based Inventory Methods for Non-Timber Forest Products Report of the ETRN Research Workshop Held 4–5 May 2000 at FAO in Rome” (2001) 11 Forests, Trees and Livelihoods 81

³³Abbott P mname, Tsinda A mname and Mugisha R mname, “Review of Policies for Biodiversity Informatics in Central Africa: Case Studies of the Democratic Republic of Congo (DRC) and Gabon” [2018] SSRN Electronic Journal

³⁴PC Aju& JA Aju (2018) “Occupation of Sambisa Forest and Boko Haram Insurgency in Northeastern Nigeria as Security Threat and Challenges to Sustainable Forest Management” (2018) 18 Global Journal of Science Frontier Research: D Agriculture and Veterinary, 1

and a source of fuel ³⁵. The loss of many plant and animal species and the near extinction of others have had a severe negative influence on the nation's biodiversity.

The local and global environments are significantly impacted by the clearance of trees. By absorbing carbon dioxide (CO₂) from the atmosphere, forests contribute significantly to reducing the negative consequences of climate change. As part of the photosynthetic process, trees take in CO₂ and store it in their biomass and soil. When forests are cut down, the carbon that has been stored there is released back into the atmosphere, raising atmospheric CO₂ levels and perhaps changing the planet's climate ³⁶.

Because fewer trees are available to collect CO₂ from the atmosphere as a result of deforestation, the impacts of climate change are exacerbated³⁷. Additionally, the destruction of trees throws off the equilibrium of other greenhouse gases, such as nitrous oxide and methane, which can accelerate global warming ³⁸. Other climatic effects of deforestation also exist. By taking water from the soil and releasing it into the atmosphere through transpiration, trees play a significant

³⁵Posibi AP, “Aftermath of the Nigerian Civil War (1967-1970): The Struggle for Peaceful Coexistence between Parties in Post-War Nigeria” *Asia and Africa Today* 71

³⁶IR Egbenta, “The Causes and Consequences of Deforestation of the Rain Forest Belt of Nigeria,” *Management of Environmental Problems and Hazards in Nigeria* (Routledge 2017) <<http://dx.doi.org/10.4324/9781351153409-6>> accessed January 24, 2024

³⁷IPCC (2018)<https://www.ipcc.ch/site/assets/uploads/2018/02/AR5_SYR_FINAL_Front_matters.pdf> accessed January 24, 2024

³⁸J Lynch and others, “Agriculture’s Contribution to Climate Change and Role in Mitigation Is Distinct From Predominantly Fossil CO₂-Emitting Sectors” (2021) 4 *Frontiers in Sustainable Food Systems*

part in controlling the local water cycle. This process can be hampered by the loss of forests, which may affect the local water cycle and increase heat and evaporation³⁹.

Soil erosion and biodiversity loss floods are consequences of deforestation⁴⁰.

Increased atmospheric carbon dioxide levels are a result of deforestation. As part of the process of photosynthesis, trees take in carbon dioxide from the environment and store it in their wood, leaves, and roots⁴¹. When forests are cut down, the carbon they contain is released back into the atmosphere, increasing greenhouse gas emissions, and causing global warming.

The soil quality declines because of deforestation. As their roots assist in holding soil in place and preventing erosion, trees are essential for maintaining the quality of the soil⁴². The loss of forests can expose the soil to wind and water erosion, which can result in soil degradation and a fall in soil fertility⁴³.

³⁹O AdelekeACrawford&O Ogundipe, “Deforestation in Nigeria: Causes, Effects, and Solutions” (2020) 12Sustainability251

⁴⁰M Tariq &R Aziz, “An Overview of Deforestation Causes and Its Environmental Hazards in Khyber Pukhtunkhwa” (2015)5 *Journal of Natural Sciences Research*. 52

⁴¹G Bala &Z Milkic“The role of forests in the carbon cycle and climate change”. (2020) 26 *Global Change Biology*, 26(5), 2040.

⁴²J.C C, “Deforestation and Soil Erosion in Trinidad. Deforestation and Soil Erosion in The Foothills of the Northern Range Caused by Shifting Cultivation” (1940) 27 *madrass agricultural Journals* 25

⁴³V Singh, “Impacts of Climate Change on Biodiversity and Ecosystem Services,” *Advances in Environmental Engineering and Green Technologies* (IGI Global 2019)
<<http://dx.doi.org/10.4018/978-1-5225-7387-6.ch008>> accessed January 21, 2024

Nutrient levels in the soil alter as a result of deforestation. Because they take nutrients from the soil and release them through their leaves and roots back into the environment, trees are essential to the ecosystem's ability to cycle resources⁴⁴.

1.4.3 Pollution

The Boko haram insurgency has caused significant damage to the country's soil and water resources, as the group has used the region's rivers and lakes for dumping toxic waste, including chemicals and medical waste eventually making the water unfit for aquatic habitation and human usage and drinking⁴⁵.

The contamination of water resources due to damage to infrastructure is a recurring theme in studies on the impacts of conflict. Specific examples include the damage to wastewater treatment plants in the Gaza Strip during the Israeli military operations "CastLead" in 2008⁴⁶ and "Protective Edge" in 2014⁴⁷ from which untreated wastewater leaked, and damage to sewage lines and a waste water treatment plant in Israel during the 2006 Lebanon War, where large amounts of sludge were consequently deposited directly into the Mediterranean Sea⁴⁸ The former

⁴⁴ G Bala & Z Milkic "The role of forests in the carbon cycle and climate change". (2020) 26 *Global Change Biology*, 26(5), 2040.

⁴⁵ A. Oluyinka, "The environmental impact of the Boko Haram insurgency in Nigeria" (2015) 2 *Environmental Science and Pollution Research*, 18310.

⁴⁶ M Mason, M Zeitoun and R El Sheikh, "Conflict and Social Vulnerability to Climate Change: Lessons from Gaza" (2011) 3 *Climate and Development* 285

⁴⁷ Weinthal E and J Sowers, "Targeting Infrastructure and Livelihoods in the West Bank and Gaza" (2019) 95 *International Affairs* 319

⁴⁸ M Zeitoun and M Talhami, "The Impact of Explosive Weapons on Urban Services: Direct and Reverberating Effects across Space and Time" (2016) 98 *International Review of the Red Cross* 53

ammunition plant Werk Tanne in Clausthal-Zellerfeld, Germany, produced about 100,000 tonnes of 2,4,6-trinitrotoluene. The Allies' fabrication and subsequent detonation of explosives around 1944 resulted in significant contamination in this region. A total of four soil samples and three water samples were collected from this location and subjected to chemical-analytical techniques and multiple bioassays for characterization. Ecotoxicological test systems, such as the assay for inhibiting algal growth using *Desmodesmus subspicatus*, and genotoxicity tests, such as the umu and NM2009 tests, were conducted. The Ames test, as specified by International Organisation for Standardisation 16240, and an Ames fluctuation test were also conducted. The hazardous mechanism was investigated by conducting bacterial gene profiling experiments utilising a range of *Escherichia coli* strains and the human liver cell line hepG2, employing the PIQOR™ Toxicology cDNA microarray. Furthermore, the molecular mechanism of 2,4,6-trinitrotoluene in hepG2 cells was examined. The current assessment suggests a risk of contaminant leaching from the soil to the groundwater with potential implications for human health⁴⁹.

2.0 Overexploitation of Natural Resources and exploration

Over-exploitation of natural resources is often directly linked to armed conflict and occurs for both subsistence and commercial reasons. One immediate result of political instability during a war is that local people often cannot grow basic crops. This further prevents the achievement of the Sustainable Development Goal (SDG), which borders on zero hunger.

⁴⁹ A Eisentraeger and others, “Hazard Characterization and Identification of a Former Ammunition Site Using Microarrays, Bioassays, and Chemical Analysis” (2007) 26 Environmental Toxicology and Chemistry 634

Displaced people usually collect firewood, food plants, and other natural resources in the areas they have moved to. Such exploitation on a large scale may be unsustainable even in the short term. The situation may be made worse if these people lack local knowledge of optimal resource management practices. When displaced people return to their homelands, moreover, they are often forced to rely heavily on natural resources until they can re-establish their normal livelihoods, including agriculture. In addition, humanitarian organizations themselves often use excessive amounts of local wood for construction.⁵⁰

2.1 Habitat and wildlife Destruction

Armed wars have a demonstrable impact on the environment when they destroy habitat, which has consequences for both humans and wildlife. Armed conflicts are typically fought for tactical, strategic, or economic reasons by the rebels or troops involved. Destruction of vegetation for the purpose of facilitating or enhancing mobility can occasionally have a direct negative impact on the environment. In Rwanda in 1991, the Rwandan army cut a swath 50 to 100 meters wide through the bamboo forest connecting the Virunga Volcanoes in order to reduce the possibility of ambush along a key trail⁵¹.

Using the natural environment as a weapon, or directing attacks against it, can cause immense harm. Most conflict-related damage to the environment, however, is incidental. For instance, attacks against military objectives often cause environmental damage; and conflict-sustaining activities such as poaching also do harm. During the 15-year civil war in Mozambique, the

⁵⁰AUmar, “Environmental Consequences of Armed Conflict: A Case of the Northeastern Nigeria” (2020) 19 *International Journal of Humanities & Social Sciences* 281

⁵¹AUmar, “Environmental Consequences of Armed Conflict: A Case of the Northeastern Nigeria” (2020) 19 *International Journal of Humanities & Social Sciences* 281

Gorongosa National Park lost more than 90% of its animals. The African buffalo went down from 14,000 to 100 individuals, and the hippo population from 3,500 to 100. The elephant population declined from 2,000 to 200, as elephants' meat was used to feed soldiers and their ivory sold to finance the purchase of weapons, ammunition and supplies⁵².

2.2 Weapons/ Gas flaring

Greenhouse and toxic gas emissions caused by firearms and improvised explosive devices (IEDs) are not uncommon by-products of weapons in armed conflicts. The Nigerian terrorist organization Boko Haram has carried out assaults using a variety of improvised explosive devices (IEDs). The Global Terrorism Database (GTD) said that Boko Haram uses a variety of IEDs, including grenades, improvised roadside bombs, and ScAR BOMBS. Boko Haram's use of IEDs in Nigeria has seriously injured civilians and military personnel ⁵³. Several IEDs are composed of poisonous gases such as lead, Arsenic, Uranium, and others. Because it is readily available and has favorable physical characteristics, metallic lead has been used in ammunition

⁵²H Huang, "Curtailing Environmental Harms in Armed Conflict" (Human Rights Watch, November 4, 2022) <<https://www.hrw.org/news/2022/11/04/curtailing-environmental-harms-armed-conflict>> accessed January 22, 2024

⁵³ISSAfrica.org, "Boko Haram Brings IEDs Back to Cameroon" (*ISS Africa*, June 27, 2023) <<https://issafrika.org/iss-today/boko-haram-brings-ieds-back-to-cameroon>> accessed January 24, 2024

for ages⁵⁴. Injury has been caused by the toxicological effects on wild birds, aquatic animals and the health effects on people⁵⁵.

Due to their explosive nature, improvised explosive devices (IEDs) have the potential to discharge dangerous chemicals and greenhouse gases into the environment. Explosions may produce poisonous substances such carbon monoxide, nitrogen oxides, and sulfur dioxide. These substances not only contribute to air pollution and global warming but also hurt the ecosystem and the people who live there⁵⁶.

Along with (S =O), (C-H), and (C=O), gunpowder also contains NO₂, NO₃, and other elements⁵⁷. These are typical pollutants that are discharged into the environment and have a harmful effect on the environment. They are the kind of pollutants that the Environmental Protection Agency (EPA) has identified as being harmful to both people and the environment⁵⁸. Gases are flared which can be dangerous to the environment⁵⁹

⁵⁴VG Thomas, “Chemical Compositional Standards for Non-Lead Hunting Ammunition and Fishing Weights” (2018) 48 *Ambio* 1072

⁵⁵N Kanstrup and others, “Hunting with Lead Ammunition Is Not Sustainable: European Perspectives” (2018) 47 *Ambio* 846

⁵⁶Y Wang, LWang &L. Nie, Emissions of harzadous air pollutants from improvised explosive devices. (2019) 378, *Journal of Harzadous Materials*, 199.

⁵⁷Mohammed HK, Muklive AJ and Zageer DS, “Characterization of Gunpowder Component by Using Analytical Chemistry Techniques from Different Ammunition Types” (2020) 23 *International Journal of Medical Toxicology & Legal Medicine* 270

⁵⁸Jue, M. and Tonkovich, G. (2017) Air Quality and Greenhouse Gas Emissions Impact Analysis. Sunset Gap Monitoring Wells BS13 and BS24 Project. Naval Weapons Station Seal Beach. Vista Environmental, 1021 Didrikson Way, Laguna Beach, California 92651.

⁵⁹U Afinotan, “How Serious Is Nigeria about Climate Change Mitigation through Gas Flaring Regulation in the Niger Delta?” (2022) 24 *Environmental Law Review* 288

2.3 Sulfur Oxides

Sulfur oxides gases, including sulfur dioxide (SO₂), can be released during armed conflicts, leading to harmful effects on the environment and human health. SO₂ is one of a group of highly reactive gases known as "oxides of sulfur" and is emitted into the air as a result of burning sulfur-containing materials⁶⁰

Sulfur oxide is one of the chemicals released during armed conflicts. When sulfur-containing fuels, such as coal and oil, are burned, as well as when gasoline is refined, sulfur oxide (SO_x) gases are produced. It is simple for SO_x to dissolve in water vapor to create acid, and it combines with other gases and airborne particles to create sulfates and other potentially hazardous compounds for both people and the environment.

At high concentrations, gaseous SO_x can harm trees and plants by damaging foliage and decreasing growth⁶¹. SO₂ and other sulfur oxides can contribute to acid rain which can harm sensitive ecosystems.

Sulfur dioxide (SO₂), a colorless, nonflammable gas produced by the burning of materials that contain sulfur, poses a significant risk to human health⁶². Over long-term exposure, it is associated with an increased risk of adverse cardiopulmonary events⁶³ ischemic cerebrovascular

⁶⁰“Sulfur Dioxide Basics” (US EPA, June 2, 2016) <<https://www.epa.gov/so2-pollution/sulfur-dioxide-basics>> accessed January 23, 2024

⁶¹“_____” (US EPA, June 2, 2016) <<https://www.epa.gov/so2-pollution/sulfur-dioxide-basics>> accessed January 23, 2024

⁶² Olson KR, Anderson IB, Benowitz NL, et al: Poisoning & Drug Overdose. McGraw Hill Medical; 2012.

⁶³TM Chen and others, “Outdoor Air Pollution: Nitrogen Dioxide, Sulfur Dioxide, and Carbon Monoxide Health Effects” (2007) 333 The American Journal of the Medical Sciences 249

events,⁶⁴ and oxidative damage.⁶⁵ Increases as little as 100 µg/m³ in the ambient environment are associated with increased mortality⁶⁶Sulfur dioxide can be fatal in acute doses as well. In a high enough inhaled concentration, it will rapidly deposit on the mucus membrane of the upper respiratory tract. A highly soluble substance, SO₂ is rapidly hydrated into a mix of sulfite, bisulfite, sulfonate, and hydrogen ions that easily diffuse into the bloodstream.⁹ Those affected experience burning of the airways, chest tightness, dyspnea, severe airway obstruction, sloughing of the respiratory mucosa, bronchial plugging, and hemorrhagic pulmonary edema, often leading to death secondary to asphyxia.⁶⁷

2.4 Greenhouse Gases

Greenhouse gases which are produced from a variety of sources affect the environment adversely. These gases are produced from the deposition of chemicals used in combats. Several explosives are made up of greenhouse gases which are eventually released into the environment during armed conflicts. Green house gases are known to affect the earth by capturing infrared radiation from the Earth's surface that would otherwise escape to space. Atmospheric greenhouse gases (GHGs), which are constituent gases of the Earth's atmosphere, play a crucial role in the

⁶⁴M Szyszkowicz and others, “Sulfur Dioxide and Emergency Department Visits for Stroke and Seizure” (2012) 2012 Stroke Research and Treatment 1

⁶⁵XB Wang, JB Du and H Cui, “Sulfur Dioxide, a Double-Faced Molecule in Mammals” (2014) 98 Life Sciences 63

⁶⁶SA Venners, B Wang, Z Xu, Y Schlatter, L Wang, X Xu: Particulate matter, sulfur dioxide, and daily mortality in Chongqing, China. *Environ Health Perspect* 2003; 111(4): 562–7. 10.1289/ehp.5664.

⁶⁷E Wigenstam and others, “Inhaled Sulfur Dioxide Causes Pulmonary and Systemic Inflammation Leading to Fibrotic Respiratory Disease in a Rat Model of Chemical-Induced Lung Injury” (2016) 368–369 *Toxicology* 28

quantity of radiation that the planet emits. Carbon dioxide (CO₂), methane (CH₄), ozone (O₃), water vapour, nitrous oxide (N₂O), and chlorofluorocarbons (CFCs) are notable greenhouse gases that contribute to this process (CFCs). The Greenhouse Effect is the phenomena that keeps the climate suitable for human habitation. The Greenhouse Effect is enhanced by anthropogenic (made or generated by humans) emissions of these greenhouse gases above ambient levels, which has resulted in a trend of artificial warming of the Earth's natural temperature, sometimes known as global warming or climate change is caused by its release via weapons used in armed conflicts⁶⁸.

2.4.1 Effect of Boko Haram Insurgency on the Environments

Nigeria faces a serious security threat from the Boko Haram insurgency, particularly in the nation's northeast. This group has committed numerous violent crimes, including bombings, kidnappings, and the murder of unarmed civilians. The insurgency has had a huge impact on the environment in addition to the human cost, which is frequently ignored. The Boko Haram insurgency has had a substantial negative impact on the environment since it has destroyed natural resources including forests and wildlife. As a result of the rebels' use of the forest as a hiding place, there is frequently deforestation, biodiversity loss which impacts negatively on the ecosystem's viability, and ecological balance; and the destruction of habitats for endangered species⁶⁹. The contamination of water resources occasioned by the damage of pipelines and oil

⁶⁸M Jue and G Tonkovich "Air Quality and Greenhouse Gas Emissions Impact Analysis. Sunset Gap Monitoring Wells BS13 and BS24 Project"(2017) Naval Weapons Station Seal Beach. Vista Environmental, 1021 Didrikson Way, Laguna Beach, California 92651.

⁶⁹M Abu A Adamu &H Saleh, "Environmental degradation: The impact of Boko Haram insurgency in Northeastern Nigeria" (2018) 20 Journal of Sustainable Development in Africa, 137-148.

facilities is another negative impact of the Boko Haram insurgents⁷⁰. The environment has been strained greatly due to the displacement of people as a result of Boko Haram activity. The numerous people who have been uprooted from their homes have burdened the ecosystem and caused an overuse of natural resources like land and water. Overuse of these resources result in environmental degradation such as soil erosion and desertification.

Deforestation is a major effect of armed conflicts in an environment which has severe environmental chemical effects. When trees are cut down, the soil is exposed to more sunlight, which can cause the soil to dry out and lose its fertility⁷¹. Reduced plant growth due to soil fertility loss may have a negative impact on the ecosystem. Moreover, the soil becomes more prone to erosion, which can result in landslides and other natural disasters⁷². Deforestation also impacts the environment negatively via the release of carbon into the atmosphere, causing climate change and global warming⁷³. According to Fernández-Lugo *et al.*⁷⁴, deforestation is thought to be responsible for 10 to 15% of the world's carbon emissions.

⁷⁰LC Obianuju AI Udo-Inyang &AO Eze, “Oil spills and environmental degradation in the Niger Delta region of Nigeria” (2019) 50 *Journal of Environmental Management*, 210-222

⁷¹K Robinson, HR Bogena, Q Wang, E Cammeraat and R Bol, “Effects of deforestation on dissolved organic carbon and nitrate in catchment stream water revealed by wavelet analysis” (2022) 4 *Front. Water*. 2022. 1 -14

⁷²X Chen Q Zhu, &C Peng, “Effects of deforestation on hydrological processes in the humid tropics: A review” (2019) 33 *Hydrological Processes*, 251-265.

⁷³R Wu, Y Chen, Y Zhang&Y Chen, “Impacts of deforestation on the carbon cycle: A review of the evidence” (2021) *Global Ecology and Conservation*, 27.

⁷⁴S Fernedez -Lugo, B Martín-López, A.JCastro, &J.D Delgado. “Impacts of deforestation on ecosystem services and livelihoods in tropical rainforests: A systematic review”, (2019) 10*Forests*,893

Deforestation has an impact on the water cycle as well. Trees help to regulate the water cycle by absorbing water from the soil and releasing it back into the atmosphere via a process known as transpiration. When trees are cut down, less transpiration occurs, which can result in changes in rainfall patterns and a decrease in groundwater levels, altering many environmental processes and nutrient dynamics over a variety of timeframes⁷⁵.

Forests sequester a substantial amount of carbon; of the 450-650 Pg of carbon stored in plants, forest vegetation contains over 360 Pg⁷⁶. Forests also account for the majority of carbon removal by terrestrial ecosystems, which collectively account for 29% of yearly CO₂ emissions⁷⁷. Worldwide, forest loss not only releases a huge amount of carbon into the atmosphere, but it also severely reduces a main channel for carbon reduction for the foreseeable future⁷⁸.

Tropical forests have the highest deforestation pressure since they contain the most aboveground biomass and have one of the quickest carbon sequestration rates per unit land area⁷⁹.

The amount of carbon (C) and nitrogen (N) stored in forest ecosystems have an impact not only on the immediate ecology, but also on global C and N cycling. Because these two cycles are

⁷⁵W Li, QWang &M Zhang (2020),“The effect of deforestation on soil fertility in subtropical areas: A review”(2020) 12 Sustainability, 2442

⁷⁶Y Pan R.A Birdsey O.L Phillips andR.B Jackson, “The structure, distribution, and biomass of the world’s forests”. (2013) 44 Annu. Rev. Ecol. Evol. Syst. 593–622.

⁷⁷P FriedlingsteinM Jones M O’Sullivan R Andrew J Hauck, G Peters, “Global carbon budget”(2019) 11*Earth Syst.Sci. Data*1783–1838.

⁷⁸R.A Houghton and A.A. Nassikas,“Negative emissions from stopping deforestation and forest degradation, globally” (2018) 24 *Glob. Change Biol.* 350–359.

⁷⁹N.L Harris D.A Gibbs A. Baccini RA Birdsey S De Bruin, M Farina, “Global maps of twenty-first century forest carbon fluxes” (2021) 11 Nat. Clim. Change, 234–240.

inextricably linked, changes in the cycling of these compounds affect the availability and demand for the other element ⁸⁰.

Forest disturbances, such as armed conflict like the boko haram insurgent can alter the availability of C and N, influence soil structure, biological activity, long-term performance of ecosystems and increase in global warming ⁸¹.

2.4.2 Environmental protection during armed conflict

The role and effects of an environmental protection legal framework must be protected. Belligerent parties to armed conflicts are expressly required by international law, based on the Protocol I of 1977, to protect the environment. Additionally, unique laws governing humanitarian relations give the environment significant protection. Laws that deal with fundamental principles concerning the tools and techniques of war that could seriously and widely harm the environment. There must be specific rules that safeguard the environment during war or armed conflict and forbid environmental assaults as retaliation.

⁸⁰K Haghverdi and Y Kooch, "Soil carbon and nitrogen fractions in response to land use/cover changes", (2020) 109 Acta Oecologica, 103659.

⁸¹KB Georgiev B Beudert, C Bässler H Feldhaar C Heibl P Karasch, "Forest disturbance and salvage logging have neutral long-term effects on drinking water quality but alter biodiversity" (2021) 495 Forest Ecol. Manage 119354.

2.4.3 Sanctions on countries defaulting in environmental destruction by war.

Nations and communities should be forced to face the wrath of the law to lessen or eradicate the damaging effects of conflict on the environment. Umar,⁸² makes the following suggestions.

The International Court of Justice should deal with any country or group that adopted the strategy of environmental destruction intentionally or unintentionally within the provisions of international law; country or groups supporting those involved in the destruction should also be dealt with; there should be a comprehensive plan to be worked out and agreed upon by all countries regarding the protection of the environment while prosecuting any type of armed conflict, locally or internationally; In the event of conflict, a war impact assessment should be conducted, and the responsible parties should be required to restore any damaged or polluted environments.

3.0 International treaties on the act of war

International law has made an effort to restrict the use of weapons that pose a significant threat to the environment and to outlaw the intentional manipulation and eradication of the environment during hostilities. The various treaties and arms control agreements that currently exist and prohibit the specific use of specific weapon classes or methodologies include the 1925 Geneva Protocol on Chemical Weapons, the 1972 Biological Weapons Convention, the 1977 Protocols to the Geneva Conventions, the 1977 Convention on the Production of Military or any other Hostile Use of Environmental Modification Technologies (the "En-Mod Convention"), and the 1987 Convention on the Prohibition of nuclear weapons⁸³.

⁸²AUmar, "Environmental Consequences of Armed Conflict: A Case of the Northeastern Nigeria" (2020) 19 *International Journal of Humanities & Social Sciences* 281

⁸³ A Bouvier, "Protection of the natural environment in time of armed conflict". (1991) 285 *International Review of the Red Cross*, 567- 578

CONCLUSION/RECOMMENDATIONS

The effect of armed conflict cannot be measured because its effect goes way into the future. The environment suffers most from conflicts, because all the weapons of war be it solid, liquid or gas are eventually deposited in the environment. From poisonous gases escaping into the atmosphere to recalcitrant materials in the soil to the numerous materials washed into the sea; they all impact the environment in a negative manner. The solution to the effect of armed conflict would be the abolition of conflicts that impact negatively on the environment. However this cannot be achieved as conflict is a common occurrence amongst man. As such, the feasible way out would be the possible enactment and adherence to existing laws that forbids the use of certain weapons or the possible and intentional remediation of the environment after wars. In Nigeria, the war against insurgents, inter – tribal wars, and the pockets of conflicts in the Niger Delta area of the country which leads to oil spills are conflicts that impact greatly on the environment and needs urgent attention. The environment is home to man and it is a source of livelihood and materials. Even in conflict, humanity must be preserved by preserving the environment. Conflicts may end but its effect on the environment may not abate.