

**PROLIFERATION AND USE OF IMPROVISED EXPLOSIVE DEVICES
IN WEST AFRICA: A SUB-REGIONAL APPROACH TO THE
INTENSITY OF PROLIFERATION AND THE NATURE OF USE**

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Abstract

The use and proliferation of Improvised Explosive Devices (IEDs) in West Africa has intensified over the past two decades. Until now, the study of these phenomena and their impacts has rarely provided an overview of the status and evolution of IEDs proliferation and use in the sub-region. Through the implementation of a quantitative and qualitative incident methodology, this paper aims to establish a baseline of the state of proliferation intensity and a perspective on the nature of IEDs use in West Africa from 2010 to mid-2022. The results of this work shed light on how IEDs have proliferated in the sub-region through a geographical, strategic, operational, technical, and contextual intensification of their uses. The paper thus provides a historical overview, while exploring potential future trends in the field.

Keywords: Improvised Explosive Devices; West Africa

Introduction

For several years, understanding the risks posed by improvised explosive devices (IEDs) has been of great interest to the academic and practical community, particularly in the field of conventional disarmament (Liu & Pond, 2016). Knowledge of the state of proliferation and the ways in which these devices are used helps to better respond to the risks and threats that these explosive devices can pose to civilian populations, defence and security personnel, and different types of infrastructure, through the implementation of effective measures and countermeasures (Seddon & Malaret, 2020).

Although often studied in-depth, the question of the risk posed by IEDs and the responses that can be made to it cannot be addressed without an understanding of the nature and intensity of the threats. The West African sub-region appears to have experienced a massive proliferation in the use of these devices, although we still lack established knowledge about the intensity of IEDs proliferation and use in the sub-region.

In order to address this lack of overall knowledge of the sub-regional nature of this threat, this paper aims to provide a sub-regional approach to studying the intensity of proliferation and the nature of IEDs use in West Africa. Drawing on quantitative and qualitative data, this paper aims to establish a comprehensive baseline of the actual proliferation intensity and specific nature of IEDs use in the West African region.

The structure of the paper is organised as follows. The first main section provides a literature review of the various notions related to IEDs, through a categorisation of IEDs and a typology of incidents, while providing a state of the art of IEDs studies in West Africa. The second main section of the paper highlights the methodology used to gather quantitative and qualitative data to put into perspective the trends outlined in the paper. Finally, the third main section of the paper puts the results of this work into perspective by highlighting the various historical and current trends in the proliferation, use and impact of IEDs in West Africa.

Improvised explosive devices in West Africa: State of the art and definitions

To better understand the nature of the IED threat from a regional perspective, it is worthwhile to review the existing literature on the issue of IEDs in general. It is also interesting to look more generally at the region studied in order to put

existing knowledge and definitions into perspective and to see how the qualitative and quantitative work put forward in this paper helps to fill certain gaps regarding academic knowledge on the subject.

Thus, this section is divided into two sub-sections. The first conducts a literature review of the notion of IEDs, while highlighting a specific classification of the types of IEDs and types of IED incidents used in this study. The second part of this section is devoted to the state of the art of the academic and practical literature on the IED threat in West Africa.

The concept of improvised explosive devices, categorisation, and typology of incidents

The notion of an improvised explosive device as a homemade or makeshift explosive device has some important historical origins. The use of 'fougasses' from the 17th century onwards appears to be one of the earliest examples of the use of chemically flammable or explosive substances with other makeshift components (such as stones) to defend strategic positions, moving away from the logic of using standardised explosives (Spiteri, 1999). However, the manufacture of explosive devices from gunpowder throughout the 18th and 19th centuries can also be considered improvised explosive devices, due to the artisanal nature of production (Buchanan, 2016). It is really from the 19th century onwards, with the gradual arrival of industrial explosives (such as, but not limited to, TNT, nitroglycerin, black powder, and blasting agents), that a distinction can be made between standardised conventional explosives and what we now call improvised explosive devices (Meyers & Shanley, 1990). Although the use of improvised explosive devices continued in the first half of the 20th century, particularly during the two world conflicts, it was from 1946 onwards that the term 'improvised explosive device' was first used in the English literature. Although the term was only rarely used thereafter, it was only in the 1990s that the notion became established in the academic field, and later, from 1996, that it became established in the media field, particularly through its use in the conflicts in Iraq and Afghanistan (Wilson, 2007).

In the commonly adopted definition, as used in this research, IEDs are defined by their opposition to conventional or standardised industrial explosives. Thus, industrial explosive devices are explosive devices manufactured in an industrial and standardised manner, through specific processes, and with a specific use. This is referred to as standardised and normalised manufacture, with a design that allows for a particular use (Khomeriki et al., 2015). A distinction can also be made between commercial industrial explosives, used in the construction or

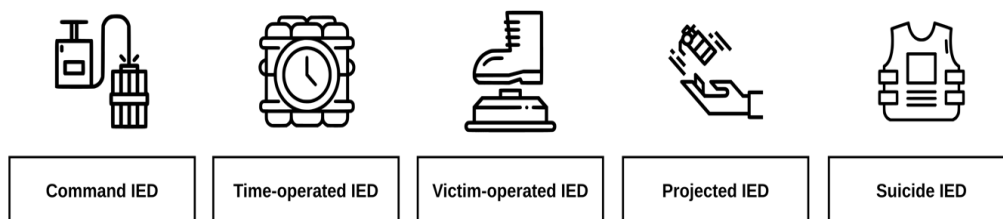
mining sectors, and military industrial explosives. Examples of conventional military industrial explosives include certain types of mines, bombs, grenades, and shells.

In contrast to conventional explosive devices, with a notion of industrial production and standardised use, it is possible to define improvised explosive devices as any kind of improvised explosive device not industrially produced and not used in a standardised manner. This broad definition of IEDs includes any type of conventional explosive device that has been diverted from its standard use through conversion, but also any device, component or substance that has been diverted from its intended use or that has been manufactured in an improvised manner for use as an explosive device, as is commonly accepted in the literature on the subject (Gill et al., 2011).

It is generally possible to classify IEDs according to some of their distinct characteristics, such as the components used, the method of delivery, the type of initiation of the explosive, the types of ingredients, and the substances used (Gill et al., 2011). In order to classify the different incidents studied in this paper in a consistent manner, a standardised classification of IED types has been employed (Seddon & Malaret, 2020), which encompasses the modes of delivery as well as the types of initiation of the explosive (Figure 1).

Figure 1

Standardised classification of improvised explosive device types



Command IEDs are IEDs whose device initiation timing is controlled directly by the perpetrator. There are a variety of command initiation methods, such as radio control, command wire, command pull, and projectile control (Goodrich & Edwards, 2017).

Time-operated IEDs are IEDs designed to operate following a predetermined time delay. These time delays can be implemented by mechanical, chemical, electrical, or pyrotechnical processes (Hollies et al., 1953).

Victim-operated IEDs are IEDs that are activated by the action of an individual, a group of individuals, or any living thing that may interact with a triggering mechanism. This generally requires that the victim or target perform some form of action that causes the IEDs to be triggered and initiated, in a discriminatory or indiscriminate manner. Several types of victim-operated initiation methods exist, such as pressure plate, tripwire, light initiation, movement, collapsing circuit, or even anti-lift (Bilukha et al., 2011).

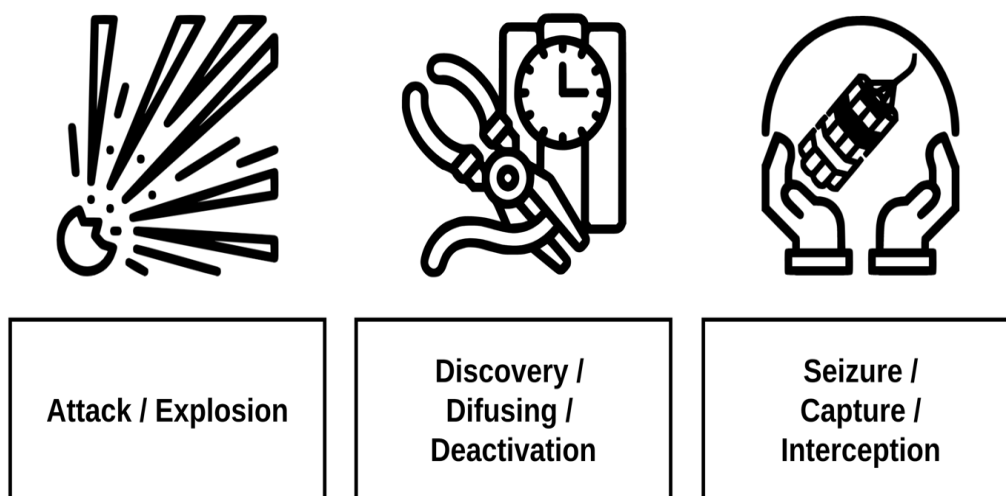
Projected IEDs are IEDs that are launched by an individual, a group of individuals, or a specific mechanism initiated by the perpetrator. The launch can be done directly by an individual with muscle power, but also can use conventional projection mechanisms or improvised baseplates. The intention of this type of IEDs is primarily to defeat a perimeter's security measures or a moving vehicle, hitting it from a distance (Grove, 2016). This category also includes IEDs with a projection force of any kind, including through uncrewed systems, whether air, sea, or land-based

Finally, suicide IEDs are IEDs that are initiated by an assailant—generally the perpetrator—at a specific time, with the intention of killing themselves as part of the attack, or simply to deny capture (Grimland et al., 2006).

In order to classify the types of incidents observed in this work, we have chosen to establish the following classification (Figure 2), which does not only involve cases of actual detonation of IEDs.

Figure 2

Typology of IEDs incidents



Attack/explosion incidents are manifested by the actual activation of the IED through ignition, detonation, and potentially explosion. That is, the triggering of the mechanism through an activation called ignition, which triggers a detonation—which may be through friction, spark, flame, impact, or electromagnetic radiation—resulting in a sufficiently powerful frontal impact to launch a secondary explosion of a relatively less-sensitive explosive materials, leading to the effective explosion. This type of incident includes explosions, but also misfires, whether the misfire is an ignition, detonation, or target misacquisition (Janesheski et al., 2012).

Discovery / diffusing / deactivation incidents include all discoveries of IEDs in their operating environment. Whether these explosive devices are Command IEDs, time-operated IEDs, victim-operated IEDs, projected IEDs or suicide IEDs, this type of event must take place in the time between the device's commissioning and its activation. This discovery may result in attempts at diffusing and deactivation, whether by professional or non-professional teams. In any case, if the explosive device is discovered before it is originally intended to be detonated and is activated during a defusing or deactivation attempt, we categorise these incidents as discovery / diffusing / deactivation (Horváth & Szatai, 2020).

Seizure / capture / interception incidents include all discoveries of IEDs prior to their commissioning and activation. Thus, seizures, captures, or interceptions can occur at different stages in the life of IEDs—whether it is the transfer, procurement, storage or transport of specific components and chemical precursors, the manufacture of IEDs, or their transfer prior to commissioning. These events usually occur on the basis of intelligence or incidental findings (Revell, 2016).

Literature review on the issue of IEDs in West Africa

In addition to the technical concepts of IEDs and the types of incidents resulting from these IEDs, it is interesting to look at the regional particularities encountered in this study. This allows for a literature review of the work and knowledge on this issue in the West African region, which appears to have experienced a considerable increase in the threat over the past decade, through the use by numerous armed groups across diverse purposes and in increasingly large areas throughout the region (Marc et al., 2015).

West Africa as a geographical territory is defined as an African region comprising the western part of sub-Saharan Africa. Generally separated from the

Maghreb countries considered to be part of North Africa, West Africa now includes the 15 member states of the Economic Community of West African States (ECOWAS). It is this geographical, political, and social definition that has been used to restrict the scope of this study, given the security dynamics in the region, with the addition of Mauritania (Walther & Retaillé, 2010).

Figure 3

Map of West Africa as defined in this study



While the security situation in the region since the late 1990s has been destabilised by a number of internal conflicts at the national level (Adebajo, 2002), it is interesting to see how the security threat to regional peace and stability has progressively become regionalised across national boundaries. While local communal conflicts were already often crossing borders through transnational ethnic issues (Davidheiser & Luna, 2008), it seems that by the 2010s, the terrorist threat in the region has intensified from two main hubs—namely northern Mali and north-eastern Nigeria (Dowd & Raleigh, 2013; Chukwurah et al., 2015).

The use of IEDs in West Africa appears to be very sporadic prior to the 2010s and IEDs appear to be employed only in very specific circumstances around specific and localised conflictualities (Evans, 2000). However, the threat intensifies from the 2010s onwards around the two main hubs of terrorism, and

then appears to expand regionally according to the literature on the subject (Adusei, 2015).

While traditionally the study of IEDs in West Africa in the academic literature has been through the study of conflictualities and uses coupled with certain dynamics specific to groups employing IEDs (Pham, 2016), the study of incidents, technical issues, or flows specific to IEDs is gradually gaining attention in the region (Bala & Tar, 2021). The study of dual-use diversion processes and the trafficking of components, precursors, and materials seems to be gaining importance recently with a focus on the region (Hainard & Lochhead, 2021). It also appears that there is a gap in the available literature when it comes to understanding the full extent of the human cost of the proliferation of IEDs in West Africa. This may include the physical and emotional harm suffered by individuals who have been directly affected by IEDs, such as those who have been injured or killed by these devices, as well as the impact on their families and communities

However, there is an academic gap in the literature regarding knowledge of the specific threat intensity of IEDs in the region. Having a clear understanding of the evolution of trends in intensity and the nature of the threat on a regional scale provides a better understanding of current and past trends and how the threat has become more persistent or shifted geographically and in terms of its own acuity. It is also interesting to note how the geographical dynamics of knowledge sharing, IED-maker migration and component trafficking in the region can be influenced by regional conflict dynamics.

Methodology for mapping the proliferation and use of improvised explosive devices in West Africa through incidents

To fill the academic knowledge gap on the intensity and nature of IED incidents in West Africa, a data collection methodology was developed based on several complementary sources to highlight the findings and put the threat in the region into perspective.

The methodology of this research work is based on the definition of IEDs of different types and the incidents related to these IEDs as being of several types, as defined in the first section of this paper. This holistic consideration, not limited to improvised landmine explosions, allows us to study the complexity and diversity of the threat in the West African region.

In order to put into perspective the academic knowledge on the evolution of

trends in the intensity and nature of the threat posed by IEDs in the region, it was decided to have a broad time window for this paper, with data spanning from 2010 to mid-2022 for the West African territory as defined in the previous section. This temporality gives us the opportunity to observe the temporal evolution of the intensity and nature of the threat, but also to follow its geographical shift in time.

By drawing on several distinct sources and using them in a complementary manner, the database created during this research work provides a precise vision of the threat in terms of intensity and nature on several levels. By combining and sorting data from existing databases such as the Armed Conflict Location & Event Data Project (Raleigh et al., 2010) or the Global Terrorism Database (LaFree & Dugan, 2007), and supplementing this data with additional open-source or semi-open-source research and sources, this database seeks to be as comprehensive as possible in terms of IEDs-related incidents, while being mindful of the constraints and biases inherent to the exercise.

Through a detailed complementation based on further research of all incidents collected in the database related to this research work, the following were collected, *inter alia*: the country of perpetration; the date of the incident; the source; a standardised description; a precise location; the type of IEDs used as well as the type of indicator where possible; whether the device had actually exploded; the minimum number of people killed directly or indirectly as a result of the incident; the minimum number of people injured as a result of the incident, where possible; disaggregation by gender and between civilian and military; and comments, particularly where the victims or targets were other than human beings (e.g. bridges, telecommunication antennas, donkeys, or monkeys).

Through this methodology, it was thus possible to collect a large database, but one which is subject to bias due to the very nature of the methodology and the difficulty in accessing information, owing to transparency issues in the region. Although it is possible to have a very interesting number of incidents through this complementarity methodology, it is very difficult to have total exhaustiveness. The number of attack / explosion type incidents is very high and dominates almost the entire database, as there is often much less open or semi-open-source information regarding discovery / diffusing / deactivation or even seizure / capture / interception type incidents. Moreover, it seems that, depending on the conflict and national contexts, it is easier to obtain information on the latter two types of incidents, making it impossible to indicate whether there are more or fewer seizure / capture / interception incidents in certain geographical areas or at certain periods in time. This methodological weakness is also reflected in the

types of IEDs used in the incidents. Indeed, it is sometimes difficult to determine with precision the type of IEDs used, often due to lack of information and lack of knowledge. A final methodological weakness of this work lies in the disaggregation of the data, which is sometimes difficult due to the lack of information. The choice was thus made not to put forward extensive quantitative results and to focus on the presentation of qualitative results regarding these variables in this research work.

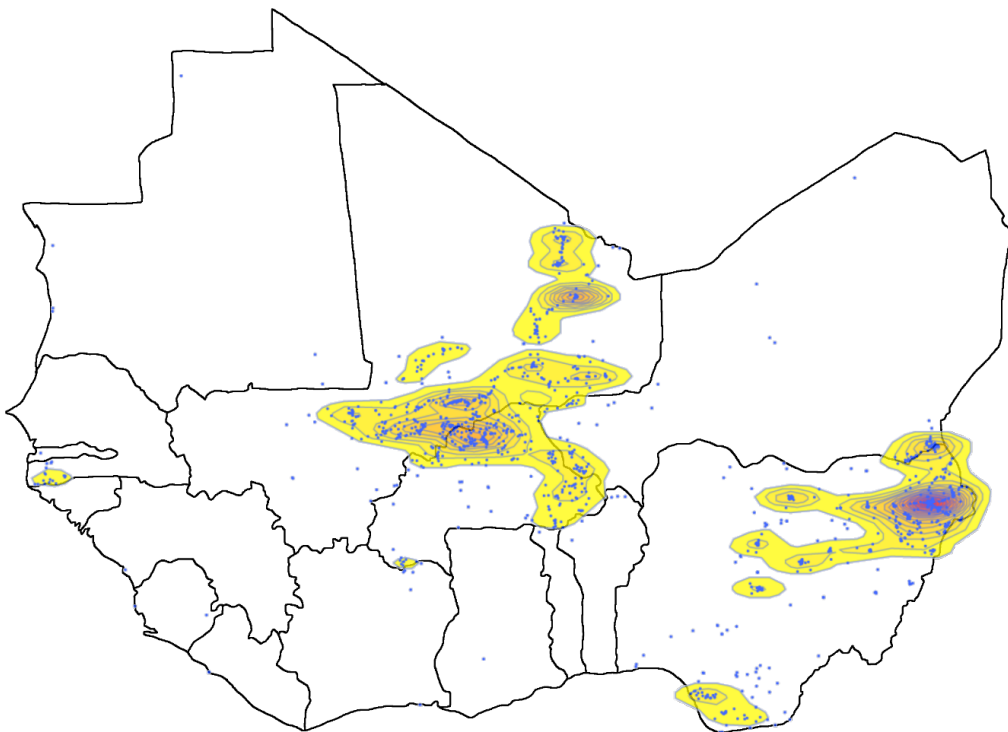
Despite these obvious methodological limitations, the database collected provides an interesting insight into trends and developments in the intensity and nature of the IED threat in West Africa.

Findings and perspectives on the proliferation and use of improvised explosive devices in West Africa

After collecting 1,607 incidents that took place between 1 January 2010 and 1 June 2022 in the West African region, this section puts the quantitative and qualitative results of this study and database into perspective (Figure 4).

Figure 4

Heatmap of IEDs incident densities in West Africa between 2010 and mid-2022

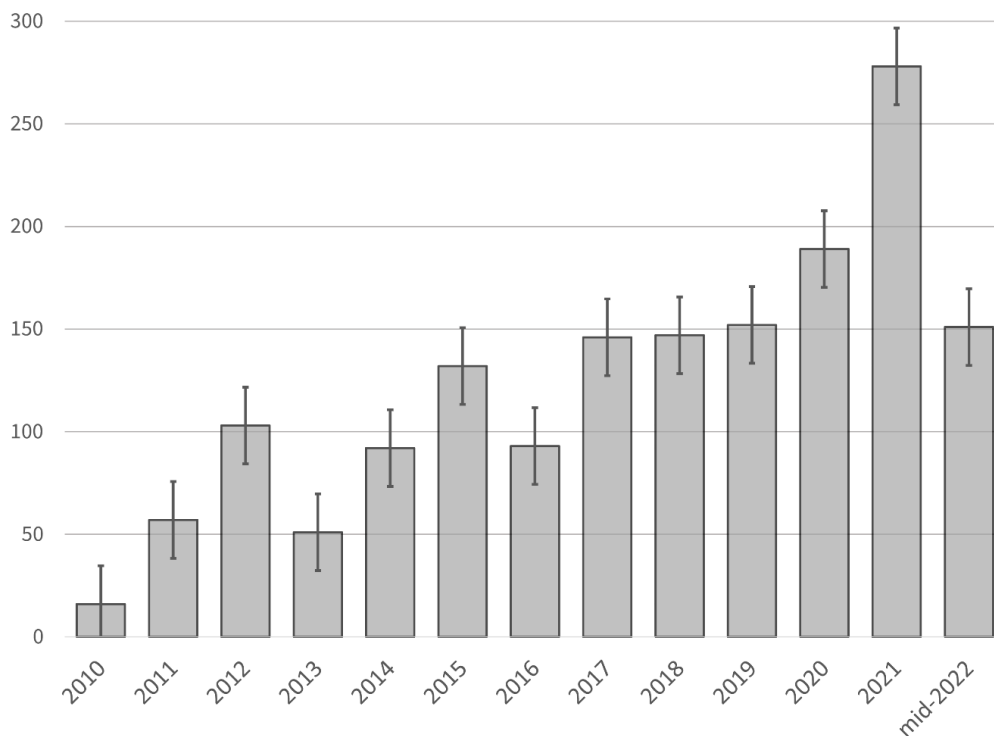


The map of incident densities over the period studied provides several distinct geographical areas characterised by a concentration of incidents. While it is possible to associate certain areas with specific conflicts and timeframes that evolve over the period, the transnationality of the risk is also apparent, in addition to the progressive displacement of this risk.

Careful observation of the occurrences of IEDs incidents in the region over the period studied shows the evolution of the intensity of IEDs use with an important proliferation (Figure 5).

Figure 5

Occurrence of IEDs incidents by year from 2010 to mid-2022 in West Africa



Even if there are biases in consideration, and thus in the reflection of use and proliferation, it seems that the intensification of the use and general proliferation of IED incidents over time is indicative of the intensification of certain conflictualities in the region. It also points to the geographic expansion of specific actors' reach—notably in Central West Africa—via trans-national terrorist organizations and the adoption of IEDs as a means of strategic and operational action by emerging actors who may have previously used IEDs in a marginal way. This trend is particularly evident from a geographical perspective and in the qualitative study of the data. The adoption of IEDs of all types—

particularly command IEDs, victim-operated IEDs, and suicide IEDs—demonstrates a strategic appropriation of these technical means of operation in asymmetric conflicts and in the face of national armies (Briscoe et al., 2011), but also by actors beyond conflicts, such as traffickers, road cutters, or cattle thieves, using IEDs to protect territories and traffic routes.

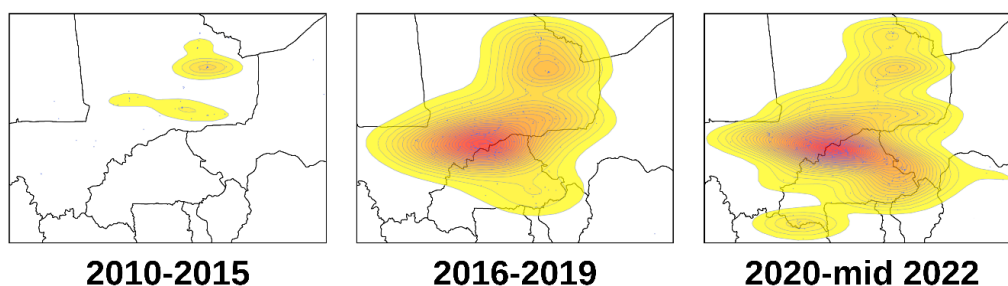
Beyond these asymmetric uses of IEDs from a strategic point of view through sabotage, delayed convoy attacks, or suicide operations on specific targets (Lin et al., 2015), it is interesting to note that IEDs are increasingly used in the region as an operational complement to direct and frontal attacks, carried out by armed contingents against specific strategic objectives, moving beyond the clandestine / indirect asymmetric framework.

The changing strategic nature of the use of IEDs in the region also appears to be accompanied by a geographical evolution of the threat through the extension of the operational frameworks of certain groups, particularly in Central and Eastern West Africa.

To observe more specifically the spatial and temporal evolution of this threat, a focus was made on Central West Africa through the tri-border area between Mali, Burkina Faso, and Niger (Fig. 6).

Figure 6

Heatmaps of IEDs incident densities in Central West Africa between 2010 and mid-2022 compared to other incidents in the region



The maps presented provide a perspective on incident densities in relation to the overall incidents in the region beyond the focus on the case of Central West Africa and the Tri-border area. Although there were a few incidents in the period 2010-2015 in this specific area, this was very sporadic compared to the incidents that took place during the same period in north-eastern Nigeria. The area sees an intensification of incidents from 2012 onwards. It is then possible to note an increasing intensification of incidents, and this is reflected in a density of

incidents in specific geographical areas, and a shift of incidents from the north of Mali to the centre. The period 2016-2019 also sees a cross-border shift in the threat, towards Burkina Faso as well as Niger. The most recent period studied is characterised geographically by a stabilisation of incidences in the regions already affected, a change in targeting (with more civilian infrastructure affected), and a southward movement towards the coastal countries—notably Côte d'Ivoire, Ghana, Togo, and Benin.

As mentioned earlier, it is possible to note with these data the presence of three hotspots of intensive use of IEDs in West Africa: the Tri-border area or Central West Africa—which we have just focused on—North-Eastern Nigeria, and the border area between Togo, Benin, Burkina Faso, and Niger. While these hotspots are the most prominent over the entire study period in terms of intensity of incidents, they also seem to be the ones with the highest number of deaths and injuries per attack. However, there has also been a spreading of the areas of operation and an extension of the densities beyond these hotspots. This geographical extension seems to be taking place over time and can be explained by the pressure on certain historical areas of operation such as North-Eastern Nigeria, but also by the general extension of the areas of operation of certain armed groups taking advantage of the porous nature of borders in general. This trend can be seen in the use of IEDs in the region, but can also in the various other types of attacks (Akanji, 2019).

The conservative approach used in recording the numbers of deaths and injuries associated with all incidents forces one to consider the results of this work as representing a minimalist trend. Thus, the 1,607 incidents that took place between 1 January 2010 and 1 June 2022 in West Africa caused a minimum of 6,680 deaths and 9,032 injuries of various intensities in their entirety. In cases of incidents leading to explosions, it was observed that injuries often led to amputations, and some of the injured may have died indirectly as a result of their injuries (Ramasamy et al., 2008). It is also important to note the economic impact that these incidents can have on the affected infrastructures, the injured people, their relatives, or the affected communities.

The victims and targets of IEDs attacks in West Africa are of all types. While it is difficult to have precise figures, it is particularly interesting to note an important trend that is materialising and being observed in the region. The first phase of this trend is the targeting of defence and security forces and from this comes the collateral targeting of civilians as bilateral victims. The second phase of this trend sees the targeting of civilian infrastructure with shared knowledge and increased availability of components. This knowledge and resource base

leads to a proliferation of IEDs in the hands of different types of actors, including less professional manufacturers, who may be unable to implement IEDs that distinguish military and civilian targets. The third phase is characterised by the indiscriminate use of IEDs, sometimes deliberately targeting civilians, particularly to create a climate of fear and exert a degree of control over certain sections of the population. While the vast majority of IED victims remain military personnel through the targeting of defence and security forces, there is an increasing share of civilian victims, either as collateral damage or as primary targets. In particular, victim-operated IEDs often affect civilians on roads, whether they are civilians on mopeds, women pulling carts, or children herding cattle. In several instances, victim-operated IEDs have been triggered by herds of goats, donkeys, or wild monkeys. One should also note the strategic importance of some of the IEDs targets, with a prevalence of attacks on bridges located on strategic roads or telecommunication antennas.

While the vast majority of incidents have been perpetrated by non-state armed groups of various kinds active in the region (Trémolières et al., 2020), there has been an increase of use of other types of actors in the region. Two types of perpetrators can be distinguished, notably in conflict contexts with a high recurrence and prevalence of non-state armed actors, but also the existence of small, specific, and localised incidents, in very specific political contexts, such as the framework of an election period (Smyth & Best, 2013). While it is, again, sometimes difficult to identify the type of incident precisely and to differentiate between some explosive and non-explosive incidents, it is even more difficult to have precise figures on the types of IEDs used. In general, it appears that suicide attacks are among the most lethal and injurious, compared to victim-operated or command-operated IEDs. There appear to be trends in the use of certain types of IEDs, depending on the non-state armed groups perpetrating the attack, as well as discernible shifts in the use of certain IED-related techniques or *modus operandi* across different groups and geographical areas. Nevertheless, there is a predominant triptych of IED types used in the region, with a predominance of victim-operated IEDs, suicide attacks, and command IEDs.

It is notable how the strategic and operational objectives of non-state armed groups in the use of IEDs in the region fit with strategic and operational developments on the ground. It is thus possible to observe how certain strategic roads, neighbourhoods, or wildlife areas are recurrently affected by IED incidents. The incidents are sometimes articulated in the same sector and in the same timeframe with similar operating modes, suggesting coordinated uses of IEDs. However, there does not seem to be a marked trend in the predominance

of incidents between urban and rural areas.

Regarding the types of incidents, it is difficult to have precise measurements and the vast majority of data relates to attacks or explosions, with some discovery / diffusing / deactivation, and very few seizure / capture / interception, which is related to the methodological biases mentioned earlier.

It is possible to observe marked and significant temporal and geographical evolutions with the aggregation of new strategic, operational, and technical modes in the use of IEDs in the region. Of particular interest is the geographical expansion of the use of IEDs in the region, especially in Central West Africa. Moreover, it appears that the number of IED incidents has multiplied in recent years, suggesting an increase in the use of IEDs in the region and a growing geographical expansion accompanying the increase in the areas of operation of certain non-state armed groups. (Frowd, 2021).

Conclusion

This paper, through its methodological approach, aims to provide a comprehensive view of the proliferation and use of IEDs in West Africa. The main objective of this approach is to cover the evolving patterns of the threat in the region through a study of the proliferation intensity and the nature of use, in order to fill some of the academic and practical gaps in the field.

Through the presentation of quantitative and qualitative results, the study highlights how the risks associated with the proliferation and use of IEDs in West Africa have evolved and intensified significantly over the past decade. In particular, the results of this paper put into perspective the geographical, strategic, operational, technical, and contextual developments of the threat, while providing details on the various harms caused by the use and proliferation of these devices. Despite the inherent limitations of the methodological approach employed, it seems undeniable that the threat from the proliferation and use of IEDs, which has intensified in recent years, is still growing. Future trends in the risks and threats associated with the proliferation and use of IEDs thus already seem to be emerging in the region.

Future work in this area could focus on broadening the knowledge base of IED proliferation and use in the region, through a deeper understanding of the types of IEDs and incidents involved, as well as further analysis of the perpetrators and how they source, innovate, and implement their IED strategies. A geographical extension of this type of study could also shed light on other regions affected by

these types of risks and threats, providing a basis for effective countermeasures and safeguarding the lives of civilians, who are the primary victims of these types of devices (Singleton et al., 2013).

References

- Adebajo, A. (2002). *Liberia's civil war: Nigeria, ECOMOG, and regional security in West Africa*. L. Rienner.
- Adusei, L. A. (2015). Terrorism, insurgency, kidnapping, and security in Africa's energy sector. *African Security Review*, 24(3), 332–359. <https://doi.org/10.1080/10246029.2015.1072967>
- Akanji, O. O. (2019). Sub-regional Security Challenge: ECOWAS and the War on Terrorism in West Africa. *Insight on Africa*, 11(1), 94–112. <https://doi.org/10.1177/0975087818805842>
- Bala, B., & Tar, U. A. (2021). Regional Cooperation in West Africa: Counter-Terrorism and Counter-Insurgency. *African Security*, 14(2), 186–207. <https://doi.org/10.1080/19392206.2021.1929747>
- Bilukha, O. O., Laurence, H., Danee, L., Subedi, K. P., & Becknell, K. (2011). Injuries and deaths due to victim-activated improvised explosive devices, landmines and other explosive remnants of war in Nepal. *Injury Prevention*, 17(5), 326–331. <https://doi.org/10.1136/ip.2010.030312>
- Briscoe, E., Weiss, L., Whitaker, E., & Trehitt, E. (2011). A Systems-Level Understanding of Insurgent Involvement in Improvised Explosive Devices Activities: Insurgent Involvement in IED Activities. *Systems Research and Behavioral Science*, 28(4), 391–400. <https://doi.org/10.1002/sres.1086>
- Buchanan, B. J. (2016). *Gunpowder, explosives and the state: A technological history*. Routledge. <https://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=1432168>
- Chukwurah, D. C., Okechukwu, E., & Ogbeje, E. N. (2015). Implication of Boko Haram Terrorism on Northern Nigeria. *Mediterranean Journal of Social Sciences*, 6(3), 371-379. <https://doi.org/10.5901/mjss.2015.v6n3p371>
- Davidheiser, M., & Luna, A. (2008). From Complementarity to Conflict: A Historical Analysis of Farmer-Fulbe Relations in West Africa. *African Journal on Conflict Resolution*, 8(1), 77–104. <https://doi.org/10.4314/ajcr.v8i1.39421>

- Dowd, C., & Raleigh, C. (2013). The myth of global Islamic terrorism and local conflict in Mali and the Sahel. *African Affairs*, 112(448), 498–509. <https://doi.org/10.1093/afraf/adt039>
- Evans, M. (2000). BRIEFING: SENEGAL: WADE AND THE CASAMANCE DOSSIER. *African Affairs*, 99(397), 649-658. <https://doi.org/10.1093/afraf/99.397.649>
- Frowd, P. M. (2021). Borderwork Creep in West Africa's Sahel. *Geopolitics*, 27(5), 1331–1351. <https://doi.org/10.1080/14650045.2021.1901082>
- Gill, P., Horgan, J., & Lovelace, J. (2011). Improvised Explosive Device: The Problem of Definition. *Studies in Conflict & Terrorism*, 34(9), 732–748. <https://doi.org/10.1080/1057610X.2011.594946>
- Goodrich, D., & Edwards, F. (2017). Improvised Explosive Devices. In A. Farazmand (Ed.), *Crisis and Emergency Management: Theory and Practice* (2nd ed., pp.189-212). <https://www.taylorfrancis.com/chapters/edit/10.4324/9781315095264-11/improvised-explosive-devices-daniel-goodrich-frances-edwards?context=ubx&refId=d062e387-dafa-441c-9f78-76aed909c063>
- Grimland, M., Apter, A., & Kerkhof, A. (2006). The Phenomenon of Suicide Bombing. *Crisis*, 27(3), 107–118. <https://doi.org/10.1027/0227-5910.27.3.107>
- Grove, J. (2016). An Insurgency of Things: Foray into the World of Improvised Explosive Devices. *International Political Sociology*, 10(4), 332–351. <https://doi.org/10.1093/ips/olw018>
- Hainard, E., & Lochhead, D. (2021). *A Primer: IEDs in the Sahel and West Africa*. <https://smallarmssurvey.medium.com/a-primer-ieds-in-the-sahel-and-west-africa-7092007d68ab>
- Hollies, N. R. S., Legge, N. R., & Morrison, J. L. (1953). The Sensitivity of Initiator Explosives to Mechanical Impact. *Canadian Journal of Chemistry*, 31(8), 746–754. <https://doi.org/10.1139/v53-100>

- Horváth, T., & Szatai, J. Z. (2020). History of Detection of Explosive Devices 2. (1951 to the Present). *Land Forces Academy Review*, 25(4), 290–301. <https://doi.org/10.2478/raft-2020-0035>
- Janesheski, R. S., Groven, L. J., & Son, S. (2012). Detonation failure characterization of non-ideal explosives. *AIP Conference Proceedings* 1426, 587–590. <https://doi.org/10.1063/1.3686347>
- Khomeriki, D., Khomeriki, S., Mikhelson, R., Chikhradze, N., & Khvadagiani, A. (2015). Production of Industrial Explosive Substances on the Basis of the Powders and Solid Rocket Fuel Released from the Utilization of the Expired Ammunition. *Procedia Earth and Planetary Science*, 15, 738–741. <https://doi.org/10.1016/j.proeps.2015.08.117>
- LaFree, G., & Dugan, L. (2007). Introducing the Global Terrorism Database. *Terrorism and Political Violence*, 19(2), 181–204. <https://doi.org/10.1080/09546550701246817>
- Lin, J., Qu, B., Wang, X., George, S. M., & Liu, J.-C. (2015). Risk Management in Asymmetric Conflict: Using Predictive Route Reconnaissance to Assess and Mitigate Threats. In N. Agarwal, K. Xu, & N. Osgood (Eds.), *Social Computing, Behavioral-Cultural Modeling, and Prediction* (Vol. 9021, pp. 350–355). Springer International Publishing. https://doi.org/10.1007/978-3-319-16268-3_42
- Liu, T., & Pond, K. (2016). Modeling and estimating continuous Improvised Explosive Device supply chain behavior. *The Journal of Defense Modeling and Simulation: Applications, Methodology, Technology*, 13(1), 67–75. <https://doi.org/10.1177/1548512914550209>
- Marc, A., Verjee, N., & Mogaka, S. (2015). *The challenge of stability and security in West Africa*. The World Bank.
- Meyers, S., & Shanley, E. S. (1990). Industrial explosives—A brief history of their development and use. *Journal of Hazardous Materials*, 23(2), 183–201. [https://doi.org/10.1016/0304-3894\(90\)85027-Z](https://doi.org/10.1016/0304-3894(90)85027-Z)
- Pham, J. P. (2016). Boko Haram: The strategic evolution of the Islamic State's West Africa Province. *The Journal of the Middle East and Africa*, 7(1), 1–18. <https://doi.org/10.1080/21520844.2016.1152571>

- Raleigh, C., Linke, A., Hegre, H., & Karlsen, J. (2010). Introducing ACLED: An Armed Conflict Location and Event Dataset: Special Data Feature. *Journal of Peace Research*, 47(5), 651–660. <https://doi.org/10.1177/0022343310378914>
- Ramasamy, A., Harrisson, S. E., Clasper, J. C., & Stewart, M. P. M. (2008). Injuries From Roadside Improvised Explosive Devices. *Journal of Trauma: Injury, Infection & Critical Care*, 65(4), 910–914. <https://doi.org/10.1097/TA.0b013e3181848cf6>
- Revill, J. (2016). *Improvised explosive devices: The paradigmatic weapon of new wars*. Palgrave MacMillan.
- Seddon, B., & Malaret, A. (2020). *Counter-IED Capability Maturity Model and Self-Assessment Tool*. UNIDIR.
- Singleton, J. A. G., Gibb, I. E., Hunt, N. C. A., Bull, A. M. J., & Clasper, J. C. (2013). Identifying future ‘unexpected’ survivors: A retrospective cohort study of fatal injury patterns in victims of improvised explosive devices. *BMJ Open*, 3(8), e003130. <https://doi.org/10.1136/bmjopen-2013-003130>
- Smyth, T. N., & Best, M. L. (2013). Tweet to trust: social media and elections in West Africa. *Proceedings of the Sixth International Conference on Information and Communication Technologies and Development: Full Papers - Volume 1*, 133–141. <https://doi.org/10.1145/2516604.2516617>
- Spiteri, S. (1999). *The Fougasse: The stone mortar of Malta*. S.C. Spiteri.
- Trémolières, M., Walther, O. J., & Radil, S. M. (2020). The geography of conflict in North and West Africa. *OECD Publishing*. <https://doi.org/10.1787/02181039-en>
- Walther, O., & Retaillé, D. (2010). Sahara or Sahel? The Fuzzy Geography of Terrorism in West Africa. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.1803996>
- Wilson, C. (2007). *Improvised Explosive Devices (IEDs) in Iraq and Afghanistan: Effects and Countermeasures (No. ADA475029)*. Library of Congress Washington DC Congressional Research Service.



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