

Encroachment Challenges for the South African National Defence Force: The Case of Army Support Base Potchefstroom

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Abstract

The study reported on here examined the issue of informal settlements encroaching on military lands, focusing on the effects on military operations and civilian safety in the Potchefstroom region, particularly at the Army Support Base Potchefstroom and the General de la Rey Training Area. The study assessed the extent of settlement growth around military areas from 2011–2020 and its broader implications. Geographic information system and remote sensing technologies were employed, with a geographic information system-based change detection methodology tracking changes in land accessibility due to encroachment. Semi-structured interviews with senior military personnel and former candidates provided qualitative insights used in the interpretative phenomenological analysis, offering first-hand perspectives on encroachment impacts. The findings revealed significant encroachment by the Marikana and Eleazer Emerging Farmers communities (colloquially called ‘Eleazer Up and Coming Farmers Community’), resulting in compromised security, vandalism, and safety risks within military areas. The research highlighted the urgent need for policy intervention to protect military lands and prevent further encroachment, ensuring operational integrity and civilian safety. The innovative combination of geographic information system analysis and qualitative methods contributes to urban geography, security studies, and governance by offering a comprehensive understanding of these challenges. The study advocates for immediate action by policymakers and stakeholders to address encroachment, safeguard military functionality, and protect affected communities. This provides a foundation for future studies and policy measures in similar contexts, emphasising the importance of integrating geographic and social perspectives to resolve such complex issues.

Keywords: Encroachment, Military Lands, Informal Settlements, Geographic Information System, Remote Sensing, Change Detection, Interpretative Phenomenological Analysis.

Introduction

Land encroachment constitutes a significant challenge worldwide, ranging from suburban expansion in prosperous nations to the proliferation of informal settlements around urban areas in less developed regions (Bartels, 2020; Hawker & Livingston, 2010; McFarlane, 2012). The encroachment on military installations by informal settlements is a complex issue that has received limited attention in scholarly and policy discussions so far (Ripley, 2008). Encroachment reflects broad socio-economic inequalities, governance failures, and critical shortages of liveable spaces (Lachman, Wong & Resetar, 2010). The situation in Potchefstroom, South Africa, where informal communities inch closer to crucial military bases, such as the Army Support Base (ASB) in Potchefstroom and the General de la Rey Training Area, exemplifies the complexity of such interactions. The intersection of informal settlements and military territories offers a distinct perspective to evaluate the consequences of urban sprawl, urban planning deficits, and the resultant strain on both governmental and military entities to address these issues effectively.

The phenomenon in Potchefstroom characterises a broad, global conflict between housing rights and the prerogatives of national security and land preservation (Hou, Estoque & Murayama, 2016; Westervelt, 2004). The current research was designed to analyse the underlying factors of this encroachment, including housing affordability, land management inefficiencies, and the socio-economic motivations driving communities toward the fringes of military areas. Moreover, the research assessed the consequences of these encroachments on both the operational security of military facilities and the safety of the encroaching informal communities. By conducting a thorough investigation of the issue, the study aimed to bring to light an overlooked aspect of urban growth and its ramifications for military effectiveness, civilian security, and policy formulation. The investigation sought to bring about a reconsideration of societal space allocation, resource prioritisation, and the safeguarding of vulnerable populations while ensuring national security.

A critical examination of encroachment necessitates an understanding of its drivers, with urban sprawl often serving as a key factor in pushing urban boundaries into previously undeveloped or reserved areas (Bartels, 2020; Bayat, 1997; Mbatha & Mchunu, 2016). The current study extended the dialogue on urban expansion to highlight issues particularly pertinent to the developing world, with a special focus on South Africa. Since the end of apartheid in 1994, South Africa has grappled with managing urban sprawl, a challenge magnified by rapid demographic growth and industrialisation (Govindjee, 2022; Horn, 2019).

The current research examined the issue of informal settlements encroaching on military lands, a topic that remains insufficiently explored despite its significant implications for military operations, civilian safety, and socio-economic dynamics in adjacent communities. While existing research has predominantly focused on formal encroachment (Bartels, 2020; Kamalipour & Dovey, 2020), this study sought to address the complexities of informal settlement encroachment, particularly within the Potchefstroom area, to advance the discourse on urban geography, military security, and land governance.

Although urban sprawl has been extensively studied, the challenges posed by informal settlements encroaching on military lands, especially in emerging economies like South Africa, have received limited attention. Such encroachments threaten military functionality, degrade vegetation, and undermine the structural integrity of installations, presenting risks that warrant immediate scholarly and policy focus (Elwood, 2008; Henrico, Vukea & Smit, 2021; Lachman et al., 2010; Westervelt, 2004). This research aims to fill the gap in the literature by exploring these challenges in the Potchefstroom region, linking urban expansion to its effects on military domains.

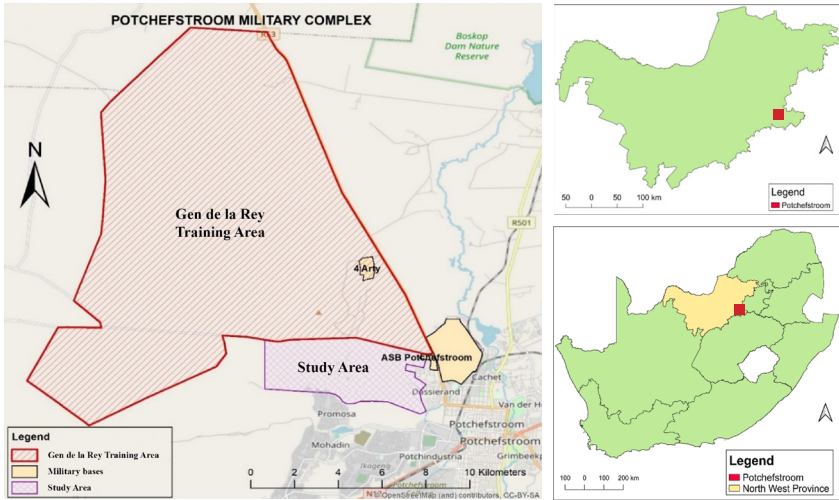
Employing geographic information systems (GIS) and remote sensing (RS) for spatial analysis (Mohamed & Yacout, 2019; Olawole, Msimanga, Adegboyega & Adesina, 2016; Viana, Oliveira, Oliveira & Rocha, 2019), along with interpretative phenomenological analysis (IPA) for qualitative insights (Eatough & Smith, 2017; Gradcoach, 2021), the current study seeks to provide an in-depth understanding of encroachment dynamics. The analysis of informal settlement growth near military bases from 2011 to 2020, coupled with insights from military officials and settlement inhabitants, aimed to illuminate the scope, consequences, and potential policy measures to address encroachment. Positioned to make a substantive contribution to urban geography, security studies, and governance, the current research offers a comprehensive perspective on a complex issue that closely intertwines the destinies of military establishments and civilian populations.

Research Methodology

The current study adopted a mixed-method approach to investigate the encroachment of informal settlements on military lands, focusing on the Potchefstroom region in South Africa. The methodology was structured to capture both spatial changes using GIS and RS, and qualitative insights by way of semi-structured interviews with military personnel and environmental management experts.

Study Area

The area of interest discussed in this article is the town of Potchefstroom, which is located in the North West, a province of South Africa, administered under the JB Marks Local Municipality. Within the town, to the north, is a big military complex collectively administered under the ASB Potchefstroom. The area of significance for the current research was a big multipurpose South African (SA) Army for its combat training needs. Within the General de la Rey Training Area, lies an operational artillery unit of the SA Army, in the form of 4 Artillery Regiment, which is to the north of ASB Potchefstroom (Figure 1). The General de la Rey Training Area covers a total of 235 square kilometres, which is among the top five largest training and live firing ranges in South Africa (Cock & McKenzie, 1998; Matjane, Henrico, Mtshawu & Richmond, 2023).



Note: The main map (A) above shows the Potchefstroom military complex, including the General de la Rey Training Area and the surrounding informal settlements within the study area. The inset map (B) places Potchefstroom within North West, while inset map (C) shows the national context, indicating the location of Potchefstroom within South Africa.

Figure 1: Overview of the study area and its geographical context
 Source: Matjane et al. (2023)

Data Collection and Analysis

High-resolution multispectral satellite imagery obtained from Google Earth Pro and the United States Geological Survey (USGS) facilitated a detailed analysis of land-use changes around the military bases from 2011 to 2020. The imagery was processed using ERDAS Imagine® and ArcGIS software, employing a change detection methodology that highlighted encroachment dynamics through time. The process involved georeferencing, supervised classification, and calculation of land-use changes, ensuring accuracy through cross-validation with ground-truth data. This geospatial analysis allowed for precise quantification of encroachment extents and the identification of patterns over the study period.

Semi-structured interviews (see Doody & Noonan, 2013; Wilson, 2014) were conducted with senior military personnel, former military candidates, and environmental management practitioners to gather in-depth perspectives on the encroachment phenomenon. These interviews explored experiences, perceived impacts, and potential mitigation strategies concerning informal settlement growth near military lands. The interviews were transcribed and analysed using IPA to extract meaningful themes and insights. This

qualitative component provided a nuanced understanding of the encroachment issue from the perspectives of those directly affected by or involved in managing the implications for military operations and environmental conservation.

Sampling Strategy

Purposive sampling was employed to select interview participants who possessed relevant experience or knowledge regarding the encroachment on military lands (see Etikan, 2017; Taherdoost, 2018). Participants included officers and non-commissioned officers from combat and support units of the SA Army stationed in Potchefstroom and experts in environmental and range management associated with the military bases.

Methodological Considerations

The mixed-method approach adopted by the study enabled a comprehensive examination of the encroachment phenomenon, combining spatial analysis with qualitative insights to offer a holistic view of the implications of informal settlement encroachment on military lands. The integration of GIS and RS technologies for change detection provided a robust framework for quantifying encroachment (see Lu, Mausel, Brondizio & Moran, 2004), while IPA offered comprehensive insight into the lived experiences and perceptions of key stakeholders. This methodological design ensured that the research addressed the complexity of encroachment on military lands, capturing both the physical encroachment patterns and their socio-political and operational challenges.

Informal Settlements Encroaching on the Military Complex in Potchefstroom

Informal settlements are not restricted by their structural composition but are characterised mainly by their autonomy from government influence (Huchzermeyer, 2004). The economic structures of these settlements are as diverse as would be found in formally established settlements (Bartels, 2020; Matjane *et al.*, 2023; Mbatha & Mchunu, 2016). The study by Mohamed and Yacout (2019) on informal urban sprawl that took place in Iran, is relevant in establishing a theoretical understanding of the type of encroachment that took place in the current study area. In the study by Mohamed and Yacout, a local community was quietly established on unoccupied land driven by the lack of accessible land, and eventually became a reputable and officially acknowledged settlement. The concept of 'quiet encroachment' was established from the study by Mohamed and Yacout (2019), which was very similar to what has taken place in Marikana and the Eleazer Up and Coming Farmers Community in Potchefstroom (Matjane *et al.*, 2023). The informal settlements under the spotlight are visible from Eleazer Road, which is the parallel boundary of the General de la Rey Training Area. This area serves as the primary and sole practical training area for most military units in Potchefstroom (Figure 2).



(a) *Eleazer Up and Coming Farmers community in relation to Eleazer Road and the*



(b) *Marikana informal settlement visible from Eleazer Road*

Note: The aerial drone imagery was captured by the author in January 2023, highlighting informal settlements near the Potchefstroom military lands. (a) The Eleazer Emerging Farmers community, situated near Eleazer Road and the ASB Potchefstroom in 2021, shows the spread of settlements along key access routes.. (b) The Marikana informal settlement, as visible from Eleazer Road in 2023, illustrates the rapid expansion of settlements in proximity to military areas over two years.

Figure 2: Aerial drone imagery

According to a study by Victor (2019), the informal settlement Marikana was established in 2011, driven by a genuine need for land for housing. The settlement was established in a highly irregular manner but was later formalised following the initiative of the citizens to implement structure and facilitate the regulated provision of basic services. The settlement experienced a physical transformation in its geometric structure, following the steps taken by community leaders to structuralise the layout of the settlements. This transformation is evident when comparing the land-use land-cover maps for 2011 and 2020, depicted below in Figures 3 and 4.

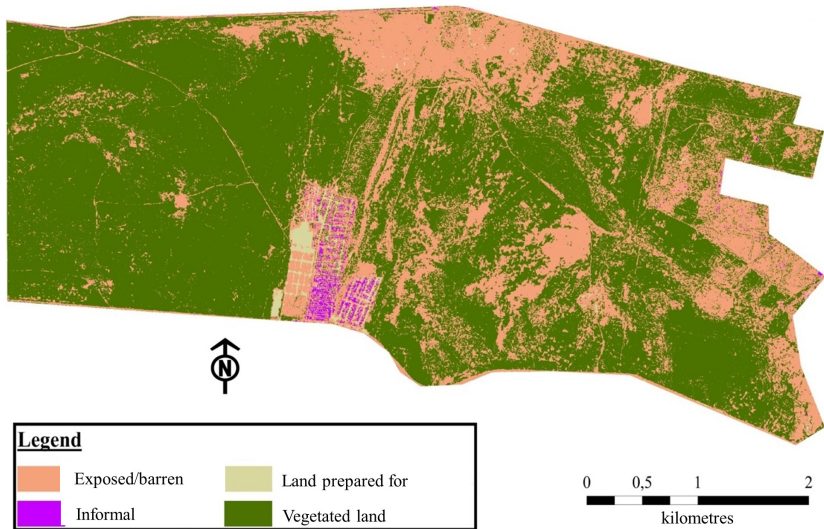


Figure 3: Land use/cover (LULC) map of the area bordering military land in Potchefstroom in 2011

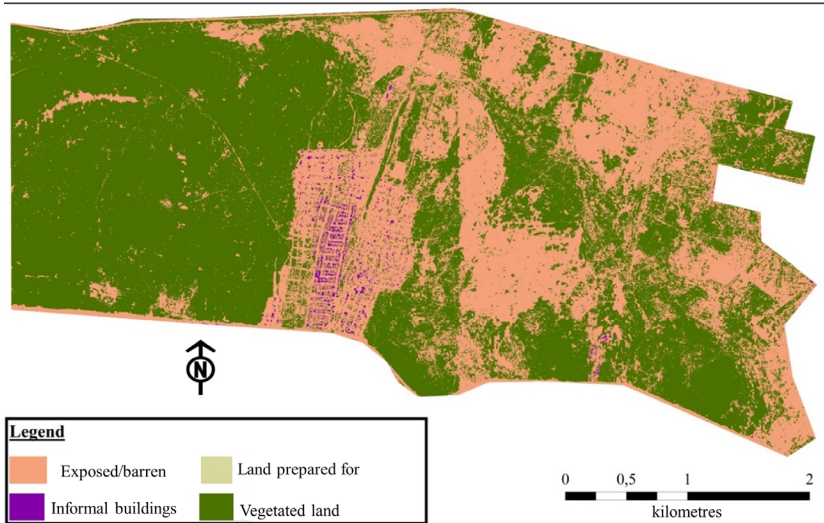


Figure 4: Land use/cover (LULC) map of the area bordering military land in Potchefstroom in 2020

Additional to the observable geometric transformations above, are the quantifiable changes that occurred in the area in terms of vegetation coverage and the space covered by informal or temporary building structures, as depicted on the pie charts in Figure 5.

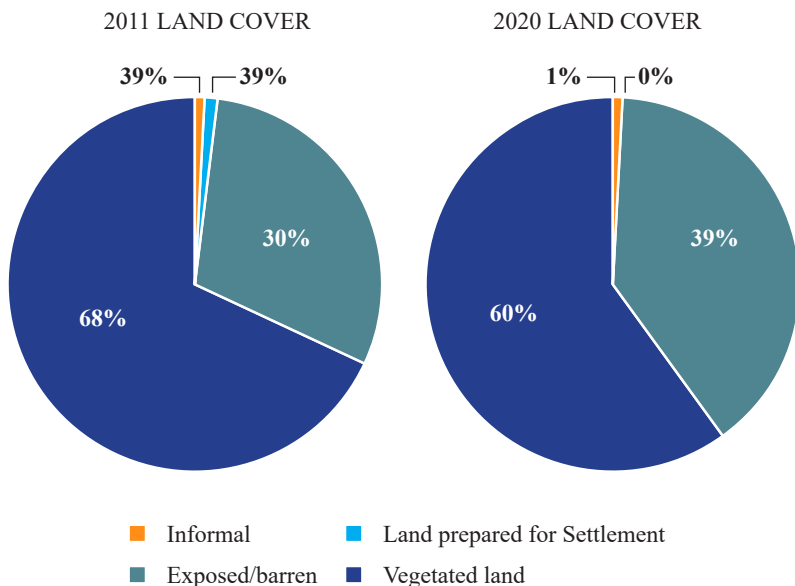


Figure 5: Comparable land use/land cover (LULC) of the area bordering military lands in Potchefstroom between 2011 and 2020

The graphical data presented above indicate a significant change in the area surrounding the Potchefstroom military area. Existing literature and personal accounts from interviews suggest that there were no settlements to the south before 2011, as the Marikana settlement was only established that year. Consequently, it is reasonable to conclude that the area consisted of undeveloped land before that time, making it unnecessary to depict an LULC map of the area before the establishment of Marikana. In contrast, witness accounts date the establishment of the Eleazer Up and Coming Farmers community, located to the northeast, to around 2001. Despite being the older of the two informal settlements, the growth of the Eleazer Up and Coming Farmers community has been relatively slow and difficult to quantify due to its dispersed nature. The data presented also confirm that, since 2011, there has been rapid and aggressive encroachment onto the Potchefstroom military land, which had historically maintained a buffer between the military area and the local community.

Results: Reflection on the Consequences of Encroachment

According to witness accounts acquired from interviews, encroachment onto the military is a reality in Potchefstroom, and the consequences are of serious concern to the military. The consequences do not affect the military exclusively but has repercussions for the ecology of the region. This is a serious concern, which demands a qualified analysis. As reflected in Figure 5, the most notable consequences of the two informal settlements are the degradation of land to establish housing structures and landscaping. Vegetated land and land prepared for settlement were lost to expose barren land. Minimal rehabilitation of the land took place throughout the inquiry.

Due to the economic challenges experienced by the residents of the two informal settlements in question, they are often compelled to employ creative methods to generate income and sustain their livelihoods. According to research by Nkrumah *et al.* (2022), informal settlers are among the most creative and innovative entrepreneurs that exist in the economic sphere, as the disparate circumstances within which they exist inspire them to come up with creative means of survival. This form of creative entrepreneurship is at times risky to the surroundings where the resources necessary for this ingenuity are derived. This phenomenon is a prevalent concern to the military community, which the informal settlements are neighbouring, as observed in Potchefstroom. According to interview data collected, numerous challenges arose following the establishment of the two informal settlements, which were coded and grouped using ATLAS.ti as reflected in Figure 6 below. The diagram illustrates the direct and indirect negative effects of informal settlement encroachment around military areas. Key issues include theft of military property, resource depletion, and environmental degradation, all of which are interconnected and lead to broader operational difficulties. The chart also highlights the effect of these encroachments on military personnel, such as workload stress, frustration, and operational interruptions. The categories in the diagram, such as illegal activities (e.g. poaching, theft, and unauthorised access), lead to harmful effects, such as violence, health and safety concerns, and community conflict. The encroachment also results in significant hazards, including fatal accidents and trauma, demonstrating the gravity of the situation. Furthermore, the spread of pompom, an unwanted plant species,² due to informal farming activities further aggravates environmental degradation. This diagram emphasises how these direct and indirect negative effects stem from both illegal behaviour and operational difficulties, creating a complex and multifaceted set of challenges that military operations must address. The coding and categorisation process helped identify these recurring themes and the relationships between them, providing a clear understanding of the systemic nature of the issues caused by the informal settlements.

² *Eupatorium macrocephalum* (= *Campuloclinium macrocephalum*) (*Asteraceae*) A weed that causes serious degradation of the veld, lowering the biodiversity and reducing the grazing capacity by being unpalatable to large herbivores. This plant is native to Central and South America. Introduced for ornamental purposes but now a noxious weed in the grassland regions of Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga and the Eastern Cape (<https://invasives.org.za/fact-sheet/pom-pom-weed/>).

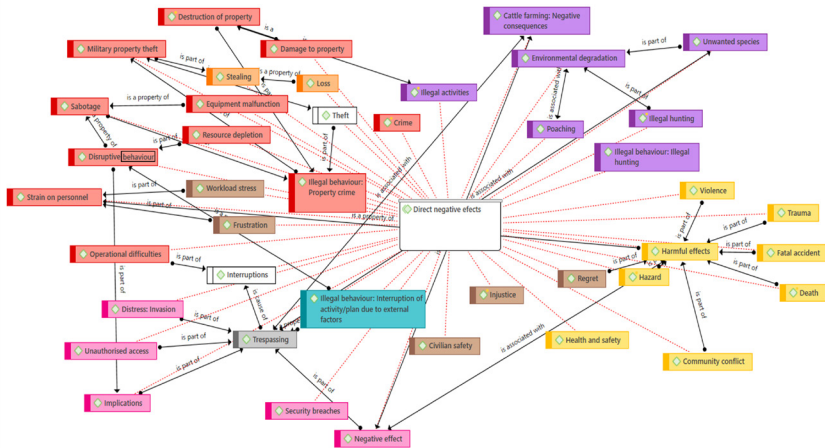


Figure 6: Network diagram of the consequences of Marikana and the Eleazer Up and Coming Farmers Community on the Potchefstroom military
 Source: Author's own compilation

Not conclusively attributed to the formation of the informal settlement Marikana and the subsequent growth of the Eleazer Up and Coming Farmers Community, but bearing credible suspicion, is the unlawful removal of the fence that used to enclose the General de la Rey Training Area. According to numerous officials interviewed, the fence was stolen by the members of the informal settlements, to enclose personal property in the case of the Eleazer Up and Coming Farmers Community, and it was even speculated that the fence was stolen to trade it for cash at the local scrap metal dealer. Former long-serving military officials reported during interviews that, before the establishment of the informal settlements, the fence seldom went missing, and in cases where the fence would be compromised, it would simply be due to it falling to the ground due to non-human actions (Matjane *et al.*, 2023:72).

To illustrate the severity of the encroachment effect on military land in Potchefstroom better, Table 1 comprises a compilation of direct quotations from interviewees. All quotations are reproduced verbatim and unedited. The quotations shed light on various aspects, including:

- Theft and repurposing of military fences;
- Dangers of unexploded ordnance;
- Repercussions for military training and readiness; and
- Broad implications for the safety of both military personnel and the surrounding community.

Table 1: The effects of encroachment on military lands in Potchefstroom

Interviewee description	Quotation
Respondent discussing fence theft and corruption	“The fence was stolen. A contractor was appointed to replace the fence, but it was again stolen during the replacement process. As a phase was completed, that section of fencing would be stolen behind the contractor. Corruption also played a role in the training area not having a fence, as some uniformed members took bribes from the project.”
Respondent on safety challenges and trespassing	“The thing about the settlements around those areas is that they are giving us a challenge regarding the safety of the unit. Firstly, some of the informal area members have cattle and goats and all these animals are grazing in the area around our shooting range. The members of the informal settlement staying next to Promosa [a township] are moving into the training area and they are poaching, they are searching for scrap metals and it’s a challenge. Some of the scrap metals are ammunition that did not explode, and we cannot monitor that since there is no fence to cover the whole range and that is a big challenge.”
Witness of fatalities due to unexploded ordnance	“Yes, I can remember at around 2010/11 a young boy and his grandfather were killed in a shack from an explosion caused by their attempt to dismantle a mortar bomb, which they had taken from the training area. A board of inquiry was done on this. This is the only incident that I’m aware of.”
Respondent recalling various incidents of death and injury	“Yes, I have. About five or seven years ago, a lady soldier rushed running towards us during a training exercise after discovering a dead body in the training area. Also, many years ago, we once found a body on the far western side of the training area. The corpse was of an old person who had probably died from a health or fatigue complication, as there was also a bicycle next to the corpse. I once heard of members who had built their shacks from discarded rocket crates, and the shack burned, killing the inhabitants of that shack. I haven’t heard of any ammunition-related injury or death to a civilian.”

Interviewee description	Quotation
Respondent on unaccounted deaths	“There have been a few deaths of people who are unaccounted for in the training area. Over the past two decades, we used to find unidentifiable remnants of people who had died in the training area and even on this other occasion where a member was killed by a 90 mm HEAT [high-explosive anti-tank] projectile, we could only locate his upper body remains”
Respondent on discovering victims of the ordnance	“Not aware of others, but only one of a decomposing body that was found just close to the fence.”
Respondent on fatalities involving a high-explosive anti-tank (HEAT) round	“I remember in the early stages of the settlements, we found two guys killed by a 90 mm HEAT round that they had tampered with, and it then exploded in their hands.”
Respondent on child injured by grenade	“[A] few years back, but not sure of the date specifically. A child picked a hand grenade that exploded in the child’s hands. I believe it was an unexploded ordnance.”
Respondent on additional security measures	“Are there any additional security measures that were implemented to safeguard the property within this area? It’s normal duty that we do and the issue now that we’re experiencing is because we are now busy with a lot of operations in terms of deployments. The unit ends up not having a lot of people and now they become overstressed when it comes to duty. There are not enough personnel to guard this whole unit and that is currently the challenge we are experiencing. For the personnel, once everyone is on operations, there is not enough personnel to safeguard the property.”
Respondent on compromised military readiness	“Yes, it [the doctrine] is compromised. We used to stand guard mainly after hours and over weekends and during the week, we would engage in various forms of training. Now that our personnel are committed to safeguarding installations, we are deprived of conducting such training for these members.”

Note: Please note that all quotation were reproduced verbatim and unedited.

Following the insightful quotations provided in Table 1, the breach of the perimeter of the military land has led to multiple complications. The General de la Rey Training Area, primarily utilised for discharging military munitions at significant volumes, presents a lucrative opportunity for local scrap metal collectors. This is due to the dense concentration

of military munitions within the area, which, while financially appealing, also introduces substantial risks. The pursuit of scrap metal, often involving unexploded ordnance, has tragically resulted in both fatalities and serious injuries, highlighting the perilous nature of this activity.

The distressing incidents documented during the interviews underscore the traumatic effects on military personnel, although it was noted that the lure of financial gain often outweighs the apparent dangers for those engaging in scrap metal collection. Despite the ongoing challenges posed by illegal scrap metal scavenging, military personnel exhibit an understanding of the struggles of the local community, pointing to a nuanced perspective on the issue. Concern grows, however, as the collection of scrap metal escalates into criminal activities that directly compromise military infrastructure.

The detrimental effects extend beyond mere scavenging, as deliberate sabotage and theft targeting vital military assets have been reported. Informal settlement residents have been implicated in stripping military vehicles and dismantling essential infrastructure for scrap metal, notably damaging the Dirkie Uys shooting range. Such actions severely affect military readiness and the capacity to conduct essential training exercises, particularly affecting the 4 Artillery Regiment based within the General de la Rey Training Area.

To counteract the unrestricted access and ensuing vandalism, the military has been compelled to allocate additional personnel for the security of critical areas, further straining its resources. This adaptation signifies the significant challenges faced by the military in maintaining the integrity of its training grounds and the safety of its operations. The situation calls for an urgent reassessment of security and community engagement strategies to mitigate the risks posed by the encroachment and to safeguard both military assets and the local populace from the unintended consequences of such interactions.

Findings and Potential Solutions

The findings of the current study indicate a significant and accelerating encroachment by informal settlements on military land in Potchefstroom, with detrimental effects on both military operations and civilian safety. Spatial analysis, using GIS and RS technologies, vividly demonstrated how the Marikana and Eleazer Up and Coming Farmers communities have progressively eroded the buffer zone that once separated civilian areas from military operations. This encroachment has resulted in complications, such as theft, vandalism, environmental degradation, and most critically, compromising military readiness.

The interviews with military personnel and community members provided further insight into the challenges posed by this encroachment. The theft of military property, particularly perimeter fencing, and the removal of unexploded ordnance for scrap metal have led to significant safety risks, injuries, and fatalities. Trespassing into live fire training areas remains a persistent problem, affecting both security and operational capacity directly.

Addressing these challenges requires a comprehensive and multi-faceted approach. Strengthening the perimeter security of the military through more robust fencing and the deployment of advanced surveillance technologies, including drones and thermal imaging,

is essential. These measures should however be complemented by community outreach and engagement efforts. Working with local leaders to formalise land-use agreements and provide educational programmes on the dangers of encroachment could mitigate the risks posed by informal settlements.

Equally important is the need for stronger urban planning policies. Co-ordinated efforts between the military, local municipalities, and the national government are required to establish clear buffer zones around military installations and enforce stricter land-use regulations. Environmental rehabilitation efforts, such as reforestation and soil conservation, should also be prioritised to address the degradation caused by informal settlements and to restore ecological balance. These strategies, if implemented, would not only protect military assets but also contribute to a sustainable relationship between military operations and civilian communities.

Conclusion

The current study has provided a detailed exploration of the encroachment of informal settlements on a number of military bases in the Potchefstroom region, specifically targeting the Army Support Base (ASB) Potchefstroom and the General de la Rey Training Area. The findings illustrate the significant transformation of land that once served as a buffer between the military and civilian communities, driven largely by the rapid expansion of informal settlements, such as Marikana. This encroachment presents an existential threat to the operational capabilities of the South African National Defence Force (SANDF) in the region, and introduces heightened safety risks.

The investigation has highlighted a range of consequences – from compromised military security and vandalism of critical infrastructure to broader ecological disturbances. These developments underscore the urgency of addressing this encroachment to safeguard military readiness and community safety.

Reflecting on the research objectives, the need for a proactive and integrated response from government and military authorities is clear. Enhanced perimeter security, stronger urban planning, and a focus on community engagement will be crucial in mitigating the risks posed by these settlements. Establishing regulated buffer zones around military installations and addressing the underlying socio-economic factors driving informal settlement growth are essential steps forward.

While the current research has made significant progress in examining the issue within the Potchefstroom context, it also highlighted the need for further research in other regions and under different socio-economic conditions. Broadening this understanding is vital for developing comprehensive strategies that can tackle encroachment effectively, not just in military contexts, but also in addressing the broader implications of urban sprawl and land-use management on national security and community development. The insights gained from the current study point to the necessity for immediate action, and provide a framework for future investigations and policy interventions

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ENDNOTES

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