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ASSESSING THE ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS OF ARTISANAL CHROME MINING IN KAMUSHA, WARD 14, MVURWI, ZIMBABWE (2021–2024)

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DEDICATION

This research is dedicated to my family, whose unwavering support, love, and encouragement made this journey possible. To my parents, for instilling in me the value of education and perseverance. To the community of Kamusha, Ward 14 your voices shaped this work, and I hope it contributes meaningfully to your future.

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ABSTRACT

This study examines the environmental and socio-economic impacts of artisanal chrome mining in Kamusha, Ward 14, Mvurwi, Zimbabwe, between 2021 and 2024. Artisanal and small-scale mining (ASM) has emerged as a critical livelihood strategy for many rural communities in Zimbabwe, yet it presents significant environmental and regulatory challenges.

A mixed-methods approach was adopted, combining Geographic Information System (GIS)-based land use and land cover (LULC) change detection with qualitative data from focus group discussions (FGDs) and semi-structured interviews (SSIs). GIS analysis of Sentinel-2 satellite imagery revealed substantial land degradation, with a marked increase in bare land and loss of vegetated areas over the four years. Qualitative findings from local community members, artisanal miners, agricultural landowners, and government officials revealed widespread concerns about declining agricultural productivity, water contamination, deforestation, poor health outcomes, and weak policy enforcement.

The study found that although Zimbabwe's Mines and Minerals Act and Environmental Management Act provide regulatory frameworks for mining, enforcement remains limited. Local governance structures feel disempowered, and community coping mechanisms are under-supported. The study concludes that sustainable management of artisanal chrome mining requires improved monitoring, inclusive policy implementation, formalisation support, and stronger institutional coordination. The findings contribute to current debates on sustainable mining, environmental justice, and rural development in Zimbabwe and across sub-Saharan Africa.

LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Full Term
ASM	Artisanal and Small-Scale Mining
EMA	Environmental Management Agency
GIS	Geographic Information Systems
FGD	Focus Group Discussion
SSI	Semi-Structured Interview
LULC	Land Use and Land Cover
ZELA	Zimbabwe Environmental Law Association
SDG	Sustainable Development Goal
EIA	Environmental Impact Assessment
PPE	Personal Protective Equipment
SADC	Southern African Development Community
UN	United Nations

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CHAPTER 1: INTRODUCTION

1.1 Background

Artisanal and small-scale mining (ASM) has developed into a considerable global economic enterprise, especially in developing countries where ASM supports the livelihoods of millions of people. However, it is also associated with environmental destruction including deforestation, soil erosion, loss of biodiversity and pollution of water bodies (Hilson, 2019). The 2024 United Nations Sustainable Development Goals (SDGs) Progress Report noted that ASM contributes to environmental harm as well as negatively affects SDG 13 (Climate Action) and SDG 15 (Life on Land). It is believed regulators in ASM may not be well established thus leading to an increase in greenhouse gas emissions, pollution and land degradation as well as escalating vulnerabilities to climate change (UN, 2024).

The global demand for minerals, such as chrome, gold, and diamond has risen due to their extensive utilisation in technology and infrastructure development (Marara, 2018). Many countries are faced with managing ASM impacts on the environment and social responsibility alongside the economic benefits it brings. Poor policy frameworks in many resource-rich developing nations mean that ASM has proliferated while worsening environmental and socio-economic risks (Sithole & Nyamadzawo, 2020).In Southern Africa, the Southern African Development Community (SADC) recognises ASM as an essential driver of economic growth hence this has led to the development of informal sustainable practices and regulations in its member states (SADC, 2021). The 2021 SADC Annual Report highlights the absence of enforcement of sustainable mining policy leading to continued deforestation, land degradation, and pollution regulation. Chrome mining usually occurs in mineral-rich areas such as Zimbabwe, South Africa, and the Democratic Republic of Congo. (Kamete, 2020).

The African Union's Agenda 2063 intends to drive towards sustainable resource management and responsible mining practices across the continent. Many SADC countries have been known to suffer from poor governance, and economic strength which has contributed to an increase of ASM with limited environmental management (Mangena, 2014). Artisanal small-scale mining is often

linked to conflicts over land use, health hazards, and displacement of local communities, resulting in socio-economic tensions that require urgent policy interventions (Bhebhe, 2019).

Mining is critical in Zimbabwe's economy. It contributes significantly to employment, national revenue, and foreign exchange earnings. However, the sharp increase in ASM, particularly in chrome-rich areas, has created significant environmental and social challenges (Marara, 2018). Due to Zimbabwe's economic downturn, high unemployment rates, and poverty many individuals have been pushed into artisanal mining, often carried out without adherence to environmental regulations (Government of Zimbabwe, 2019).

Chrome deposits are primarily found in geological formations that make extraction relatively easy and profitable for artisanal miners (Ndlovu, 2021). The Zimbabwe Environmental Law Association (ZELA, 2020) noted that the lack of enforcement of mining policies, such as the Mines and Minerals Act and Environmental Management Act, has aided uncontrolled ASM expansion. This in turn has led to deforestation, soil erosion, siltation of rivers, and contamination of water sources, particularly in areas where mining and agriculture compete for land (Sithole & Nyamadzawo, 2020).

Kamusha, located in Mvurwi Mashonaland Central Province, was previously known as an agricultural hub, for its production of maize, tobacco, and horticultural products (Zimbabwe National Statistical Agency, 2023). However, since 2021, there has been a surge in artisanal chrome mining. The outbreak of the COVID-19 pandemic further worsened the situation, as formal employment opportunities declined. Most partakers of ASM are driven by economic hardship and the increasing demand for chrome on international markets (Bhebhe, 2019). The unregulated expansion of mining activities has in turn led to conflicts between farmers and miners, as large tracts of agricultural land are converted into mining sites. This affects food security and livelihoods (Mangena, 2014).

Sithole and Nyamadzawo (2020) document significant environmental changes in Mvurwi due to artisanal chrome mining. This included widespread deforestation, soil degradation, and pollution of local water bodies. Water contamination from unregulated mining activities poses health risks to communities that rely on the water sources for domestic and agricultural use (Ndlovu, 2021). Informal mining operations also expose workers and residents to occupational hazards, which may

include exposure to heavy metals, poor working conditions, and lack of personal protective equipment (Marara, 2018).

Despite Zimbabwe's mining legal framework, weak enforcement at the local level has given room for artisanal chrome mining to expand without environmental safeguards (ZELA, 2020). Although previous studies examined ASM in Zimbabwe, most of their focus was on economic and policy aspects rather than the localised environmental and social impacts (Kamete, 2020). As a result, there seems to be limited research on how Geographic Information Systems (GIS) can be used to monitor land degradation and land use change, particularly in Mvurwi (Bhebhe, 2019).

This study seeks to address the gap by providing empirical evidence on the environmental and social impacts of artisanal chrome mining in Kamusha. Using GIS technology, the research will track environmental changes over the period from 2021 to 2024, focusing on land cover changes (Sithole & Nyamadzawo, 2020). Additionally, community-based research methods will be employed to assess the social consequences of ASM, including conflicts over land use, health risks, and economic trade-offs (Mangena, 2014). The findings are intended to inform policy recommendations that align with sustainable development objectives, to balance economic benefits with environmental protection and social well-being (Government of Zimbabwe, 2019).

1.2 Problem Statement

Small-scale artisanal chrome mining (ASM) has developed extremely rapidly in Kamusha, Mvurwi Ward 14, Mashonaland Central Province, Zimbabwe. This has led to a multitude of complicated environmental and social issues. Although this is a source of livelihood for many due to poor formal employment, it typically falls beyond legal and regulatory control. As a result, this type of mining has contributed to significant degrees of environmental degradation like deforestation, erosion, and contamination of water. These impacts threaten biodiversity and reduce agricultural productivity, which is a significant source of livelihood and food for the local people (Sithole & Nyamadzawo, 2020; Marara, 2018).

Mvurwi is located close to important farming areas, this aggravates the effects of environmental degradation, especially since communities such as Kamusha experience heightened threats to both food security and public health. The residents of the community have cited escalating loss of arable land, water pollution, and health problems. However, sufficient empirical data is yet to be collected to estimate the degree and magnitude of such problems. Despite continued challenges mounted by traditional leaders, local authorities, and stakeholders against national development, interventions have been affected by inefficiency due to a lack of data, weak regulation enforcement, and poor community involvement in decision-making (Mangena, 2014; ZELA, 2020).

If left unaddressed, the unplanned expansion of ASM in Kamusha poses long-term threats to sustainable development, including increased land-use disputes, environmental degradation, and socio-economic unrest. The problem is also exacerbated by a lack of integrated research that combines spatial environmental analysis with community-level information. This study seeks to fill this knowledge gap by using Geographic Information Systems (GIS) to analyse environmental effects related to ASM for the past four years and by analysing experiences at the local level with focus group discussions and semi-structured interviews with local community members. These findings will guide evidence-based policymaking and action per the SDGs, SADC's Agenda 2063, and Zimbabwe's Vision 2030.

1.3 Aim

To investigate the interactions among sustainable development, natural resource exploitation, environmental protection, and human rights safeguards in the context of artisanal chrome mining in Kamusha, Mvurwi, Zimbabwe

1.4 Research objectives

1. To assess land use and land cover (LULC) changes in Kamusha, Mvurwi, from 2021 to 2024 using GIS and satellite imagery.
2. To evaluate the socio-economic impacts of artisanal chrome mining on local livelihoods, health, and land use.
3. To examine the effectiveness of Zimbabwe's mining and environmental policies specifically the Mines and Minerals Act and the Environmental Management Act in regulating ASM activities.

1.5 Research Questions

1. What land use and land cover changes have occurred in Kamusha, Ward 14, between 2021 and 2024 due to artisanal chrome mining?
2. How has artisanal chrome mining affected the livelihoods, health, and agricultural productivity of local communities?
3. How effective are existing legal and policy frameworks in managing and regulating artisanal chrome mining in the study area?

1.6 Justification

The increasing growth and expansion of artisanal chrome mining (ASM) in Mvurwi, specifically in Kamusha, Ward 14, highlights the urgent need to investigate and address the interconnected challenges it poses. Though ASM is key to providing livelihoods to individuals facing economic difficulties, its informal and unregulated status has led to much ecological degradation in the form of deforestation, soil erosion, and water pollution (Sithole & Nyamadzawo, 2020; Ndlovu, 2021). These environmental effects pose a risk to Mvurwi's agricultural foundation and may lead to socio-economic vulnerability within the community

Socio-economically, ASM is marked by dangerous working conditions, poor protection for workers, and significantly high health risks. These kinds of informal activities usually exclude miners from accessing legal protection. This in turn leads to exploitative ventures with higher likelihoods of exposure to toxic environments. Vulnerable people in the community, like women and children, bear the consequential effects of such conditions. It also fosters conflict with local farmers regarding land use and access to resources (Marara, 2018; Mangena, 2014).

This study aligns with global, regional, and national development goals. Globally, it aligns with the United Nations Sustainable Development Goals, particularly SDG 10 (Reduced Inequality) SDG 13 (Climate Action), and SDG 15 (Life on Land), by promoting sustainable resource use, management and inclusivity in development. Regionally, the research aligns with the Southern African Development Community (SADC)'s Agenda 2063, promoting inclusive growth, environment management, and policy harmonisation among all member states (SADC, 2021).

Nationally, the study recognises Zimbabwe's Vision 2030, which seeks to turn the nation into an upper-middle-income economy. This objective can only be achieved through balanced growth that reconciles the three pillars of sustainable development which include economic growth, environmental sustainability and social justice. By generating empirical evidence through GIS-based land use change analysis and capturing lived experiences through focus group discussions, the study will provide community-informed inputs for the development of more effective ASM regulation.

Conclusively, this study intends to assist in formulating policies for attaining sustainable livelihoods, conserving natural ecosystems and empowering local communities. It offers a model that integrates technological advancement with participatory approaches in guiding responsible mining activities in Zimbabwe and the entire SADC region.

1.7 Assumptions

This research is built on several assumptions that form the foundation of its approach, guiding the methodology, data collection, and interpretation of findings;

1.7.1 Reliability of Data Sources

It is assumed that the satellite imagery and GIS data used to assess environmental impacts, such as deforestation, soil erosion, and water quality, are accurate and reliable for tracking changes over the past four years. This assumption underpins the study's ability to draw valid conclusions on environmental degradation trends linked to artisanal chrome mining in Mvurwi.

1.7.2 Participant Honesty and Openness

The study assumes that participants involved in interviews and focus group discussions community members, local leaders, miners, and government officials will provide truthful and open responses. This assumption is essential for gathering authentic insights into the social impacts of artisanal mining, including health risks, displacement, and resource conflicts.

1.7.3 Policy Consistency

It is assumed that Zimbabwe's regulatory framework for mining, including the Mines and Minerals Act and the Environmental Management Act, will remain consistent during the study period. This assumption allows for a stable evaluation of current policies' effectiveness in managing artisanal mining impacts.

1.7.4 Generalizability of Findings

Lastly, the research assumes that the environmental and social impacts observed in Mvurwi can offer broader insights applicable to other regions in Zimbabwe facing similar artisanal mining challenges. This assumption supports the study's goal of proposing scalable recommendations for sustainable resource management.

These assumptions are foundational to the study and are necessary for ensuring a coherent approach to addressing the research questions. Without these assumptions, the validity of the findings and their implications for policy and practice would be limited.

1.8 Delimitations of the study

This study has specific boundaries to maintain focus and relevance, which clarify what is included and excluded in the scope of research.

1.8.1 Geographical Scope

The research is limited to Kamusha, Ward 14, Mvurwi, Mashonaland Central Province, Zimbabwe, where artisanal chrome mining is significantly impacting local communities and the environment. Other regions or mining sectors, such as gold or diamond mining, are outside the study's focus.

1.8.2 Type of Mining

The study exclusively examines artisanal and small-scale mining (ASM) of chrome, excluding large-scale or industrial mining. This focus allows a deeper understanding of ASM-specific challenges and impacts, particularly in terms of informality and lack of regulatory oversight.

1.8.3 Environmental and Social Dimensions

The study's focus is on the environmental impacts (e.g., deforestation, soil erosion, water contamination) and social implications (e.g., health risks, community conflicts, displacement) associated with ASM. Economic assessments or financial analyses of mining profitability are outside the scope.

1.9 Limitations

This study acknowledges several limitations that may affect the scope, implementation, and findings.

1.9.1 Restricted Access to Mining Sites

Access to some artisanal mining sites in Mvurwi may be limited due to safety concerns, logistical challenges, or restricted permissions. This limitation could constrain direct observation and data collection at certain locations, potentially affecting the comprehensiveness of environmental assessments.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction to Sustainable Development

Sustainable development is a widely accepted framework to balance economic growth, environmental integrity, and social equity. The Brundtland Commission (1987) defines it as: 'development that meets the needs of today without compromising opportunities for future generations to meet theirs'. It recognises some very important principles like intergenerational equity, efficient resource use, and participatory democracy. It emphasises economic needs together with ecological systems protection and community resilience is the core of natural resource management.

In developing countries like Zimbabwe, which are rich in natural resources, sustainable development is particularly important because they have come to rely increasingly on natural

resource extraction such as mining. The United Nations Sustainable Development Goals (SDGs) give a global framework with specific targets like SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), and SDG 15 (Life on Land) urging nations that resource extraction must be managed in a sustainable fashion. Yet in Zimbabwe, these are often undercut by informal miners whose activities may result in widespread environmental damage, especially in rural areas such as Mvurwi.

The global and regional sustainability frameworks form the background against which this study is placed. Furthermore, although the literature has emphasised sustainable development generally, fewer studies have connected such a broadly promoted aim with informal mining activities at the level. This research aims to narrow that gap using spatial analysis for environmental change and integrating community voices into the sustainability discussion.

2.2 Natural Resource Exploitation

Artisanal and small-scale mining (ASM) has become an important source of livelihood across sub-Saharan Africa in economically vulnerable communities that are mineral-rich. In Zimbabwe, ASM accounts for a large proportion of the national mineral production and provides livelihoods for between 500,000 - 1 million people directly (Maponga, & Mutemererwa 2021). The industry has expanded over the years because of the economic downturn coupled with fewer formal employment opportunities and an increased global need for minerals like gold and chrome.

Artisanal chrome mining is now firmly established in the Mvurwi, Guruve and Bindura areas. Several members of the community benefit directly from the activity. Particularly chrome mining has seen thousands of artisanal small-scale miners, mainly from across the Great Dyke and other sectors coming in to find their fortunes extracting this commodity as its value soars increases. Even though it is the major revenue source in Zimbabwe, ASM is undeniably informal, uncontrolled and environmentally damaging. Most chromite miners are informal and unlicensed whilst it is supposed to be regulated under the Mines and Minerals Act and Environmental Management Act, resulting in immense environmental degradation and adverse occupational health and safety conditions (ZELA, 2020; Nyamunda, 2017).

The profits of ASM are unevenly spread. Although it employs women and youth, these groups are often confronted with systemic disadvantages. These include wage discrimination, restricted access to tools and capital, and exposure to hazardous working conditions (ILO, 2019); Hentschel et al., 2003). Additionally, artisanal miners sell their chrome to the informal trade which consequently makes the profit unreliable and subject to abuse. ASM's small-scale nature also means that it does not make any significant contribution to national tax and local development projects, restricting its macroeconomic potential.

Despite numerous research looking at the economic contribution of ASM in Zimbabwe, limited attention has been directed towards the geographical and environmental impacts of socio-economic changes on selected rural areas such as Kamusha. Furthermore, the paper adds to the literature by blending an economic, social and environmental analysis (using GIS) to empirically test how artisanal chrome mining changes landscapes and livelihoods in the community over time.

2.3 Environmental Changes and Impacts from Artisanal Chrome Mining

Numerous studies have reported ASM as a major driver of environmental damage, particularly in rural mineral-endowed areas where regulation is weak. In Zimbabwe, ASM is associated with extreme deforestation, abandoned pits, soil erosion and water contamination. These impacts do not only affect biodiversity, reduce available land for agriculture, and deteriorate water quality, but also contribute to long-term ecological loss (Sithole &Nyamadzawo, 2020; Spiegel et al., 2018).

The changes in the natural environment, because of mining activities (open-pit mining, non-systematic waste disposal) are also significant and can lead to hydrological disturbances. In Mvurwi, where agriculture is a mainstay for local economies, loss of vegetation cover and water pollution greatly compromise food security and public health. Several researchers have provided evidence of these changes in Zimbabwe in places like Shurugwi and Mutorashanga but there is little evidence specific to the Kamusha area of Ward 14 (Mutemeri & Petersen, 2002; Bhebhe, 2019).

Geographic information systems (GIS) applications and remote sensing are extremely effective techniques in the identification and monitoring of the environmental impacts of mining. With the aid of GIS methods (supervised classification, post-classification comparison), land cover changes can be traced through time and the proportion of deforestation, expansion of bare land, and loss of agricultural zones can be quantified (Lu, Mertens, & McElwee, 2004; Congalton & Green, 2019). Contrarily, in Zimbabwe GIS application, to ASM research, has been limited and restricted mostly to policy or regional level based on analysis.

This has resulted in an absence of local evidence on which specific intervention by regulators can be developed. This study fills this gap by employing ArcGIS for the analysis of LULC in Kamusha, Mvurwi between 2021 and 2024. By examining one of the impacted administrative wards, the research provides in-depth spatial data that can inform responsive local-level environmental management. The use of qualitative community responses in combination with GIS further supports the connection between lived experiences and perception of environmental change but is indicative of a more holistic understanding of ASM affect.

2.4 Socio-Economic Impacts of Artisanal Chrome Mining on Local Communities

Artisanal Small-scale chrome mining has become essential to the livelihoods of many rural Zimbabweans, especially in regions such as Mvurwi where formal employment opportunities are scarce. But the socio-economic implication of ASM is much broader than mere income, and can also involve fundamental issues on livelihoods, community action and social well-being. Though mining provides an additional source of income, it also undermines customary land use systems, heightening conflicts over scarce resources, particularly in agro-based areas such as Kamusha, Ward 14 (Mangena, 2014; Mkodzongi & Spiegel, 2021).

The negative side of ASM is the farming disruption that occurs from land degradation and displacement. Farmers tend to lose access to arable land, leading to declining crop yields, and rising food insecurity as more land continues to be developed into mining areas. In addition, grazing grounds, points of access to water and traditional homesteads may be lost by community

members. Such changes lead to economic vulnerability and forced adaptation, as households attempt to diversify income sources or migrate to less affected areas.

The health effects are another related consequence of ASM for the miners. The informal state of work means there is little to no personal protective equipment (PPE). Without PPE, exposure to dust, toxic chemicals, and polluted water sources contributes to high rates of respiratory tract infection (RTIs), skin diseases, and waterborne infections (Shoko, 2002; WHO, 2019). The miners also have limited access to health care services, insurance or compensation for injuries. Women and children are disproportionately at risk, with children frequently engaged in laborious mining activities and women at risk of abusive work and constrained access to mining inputs and decision-making spaces (Hentschel et al., 2003; ILO, 2019).

Social cohesion is also affected. The influx of out-of-area miners and confusion around land tenure has resulted in conflict between miners and farmers, as well as friction between local leaders overseeing conflict resolution. In other instances, these conflicts have resulted in violence or permanent community rifts over issues relating to land rights and environmental degradation (Marara, 2018).

Despite the extensive literature on these socio-economic concerns, it has either taken the form of being policy-centric or anecdotal. Few studies for small administrative areas like Kamusha have described the community-level experiences and perceptions of ASM. The current paper attempts to fill that gap by documenting the narratives of miners and farmers through focus group discussions and semi-structured interviews with all concerned stakeholders. The process opens new dimensions of understanding how ASM affects livelihoods including health and social relations that cannot be revealed by economic or environmental data alone.

2.5 Environmental Protection Measures

Environmental management in the context of artisanal and small-scale mining (ASM) in Zimbabwe is a significant challenge. Although there are laws aimed at regulating mining and

preserving the environment, enforcement is weak, particularly in rural communities such as Kamusha, where the majority of ASM is conducted informally and the regulators have limited reach.

The main environmental law in Zimbabwe is the Environmental Management Act (Chapter 20:27), which mandates Environmental Impact Assessments (EIAs) for all projects. However, such assessments are rarely ever carried out in ASM practices, due to their costly nature, complexity and lack of knowledge amongst miners (ZELA, 2020). Likewise, while the Mines and Minerals Act (Chapter 21:05) includes measures for licensing, safety, and land rehabilitation, the Act has been accused of favouring large corporates over artisanal operations and being poorly suited to the informal nature of artisanal mining (Government of Zimbabwe, 2021; Nyamunda, 2017).

The attempts at formalizing and regulating ASM through the National ASM Policy (2020) have encountered challenges. Although the policy aims to encourage registration, training and environmental responsibility, the execution of these measures has been slow. Unwillingness to formalise is usually associated with fear of paying taxes, losing earnings, and all the bureaucratic steps. Moreover, tasks overlap across government agencies such as the Ministry of Mines, the Environmental Management Agency (EMA) and local authorities which leads to confusion and compromise from enforcement (Mkodzongi & Spiegel, 2021).

There are shining examples in other places of the world of practices, which should inform developments in Zimbabwe. Governments in Ghana, Rwanda and Tanzania have been evidencing the proof of concept of this model, where cooperative mining models that incentivise formalisation and promote environmental compliance have been established (Hilson & Maconachie, 2020). These models include technical support, fair trade certification and environmental training, which ultimately incentivise miners to mitigate environmental damage while enhancing their material well-being.

Although there are several ASM development frameworks in Zimbabwe, there is little evidence of community-level, context-specific and evidence-based approaches to incorporating environmental protection in the regulation of ASM. This paper aims to add value to these types of approaches by GIS-based assessment of land degradation and by providing a voice to affected communities in

participatory approaches. In doing so, it links local realities with broader regulatory objectives and proposes practical, community-informed approaches to environmental governance.

2.6 Human Rights Safeguards

The human rights dimensions of artisanal and small-scale mining (ASM) have now emerged as an important issue within the last decade. Especially in contexts where informal mining intersects with poverty, marginalization, and weak governance. In the Zimbabwean context, the growth of ASM activities, such as in Kamusha, Ward 14, highlights the potential violations of the rights of local communities, including those related to land access, health, protective labour legislation and environmental justice.

Mining, whether formal or informal will typically displace local communities from their traditional land. In rural Zimbabwe, the tenure systems are mostly customary, but not necessarily legally safeguarded once extraction takes place. This has also led to a legal grey area where communities, are relocated or excluded from their ancestral land without due consultation or compensation (Mangena 2014). The African Charter on Human and Peoples' Rights (ACHPR, 1981) and the United Nations Declaration on the Rights of Indigenous Peoples both highlight the principle of free, prior and informed consent in all resource exploitation projects, but it is rarely implemented at the local level.

Human rights in matters of health are also an important aspect. The dust, contaminated water and unsafe conditions in which the workers are forced to toil every day are a serious violation of these workers' right to a safe and healthy environment. The absence of regulatory oversight, protective equipment, and access to healthcare services exposes miners and their families and therefore at risk of becoming ill from preventable diseases (WHO, 2019; ILO, 2019). Child labour is also an issue, with children engaged in carrying ore, crushing it and using mercury, despite international conventions banning these activities in hazardous work (Hentschel et al., 2003).

Gender-based human rights abuses have also been reported in artisanal mining communities. Women tend to staff lower-paid, high-risk jobs and are usually excluded from decision-making.

In certain places, sexual exploitation and gender-based violence have been reported to be associated with mining camps and informal trade areas (Marara, 2018).

There are numerous human rights studies and case reports detailing abuses in large-scale mines, but less research is focused on ASM situations in Zimbabwe at present. Relatively few studies show how human rights abuses play out at the micro level, inside specific communities such as Kamusha. This study fills this gap by qualitatively collecting data directly from impacted communities, which include women and traditional leaders, as to the impact of ASM both on their rights and on their well-being. Such observations can inform holistic and equitable policies and systems for natural resources management.

2.7 Policy Effectiveness in Zimbabwe

Zimbabwe has a comprehensive legal and policy framework designed to control mining, ASM included. The most prominent is the Mines and Minerals Act (Chapter 21:05), which sets out the rules for licences, land access, and environmental obligations for miners. This is supplemented by the Environmental Management Act (Chapter 20:27), which requires mining entities to conduct EIAs for all operations. Although these statutes offer a framework for sustainable mining, their enforcement is weak, especially at local levels where the sector is situated, such as Kamusha, Ward 14 (ZELA, 2020).

One of the biggest problems is a mismatch between policy and what is happening on the ground. For instance, the Mines and Minerals Act does not respond adequately to the informality with which ASM is conducted. Many artisanal miners do not have the money or the technical expertise to meet the standards of the formal licensing process, and the bureaucratic process makes registration unattractive (Nyamunda, 2017). Since then, a high number of ASMs have remained informal in Zimbabwe, challenging enforcement and increasing the risk of environmental damage.

In response, the government introduced the National ASM Policy (2020) to facilitate formalisation, technical skills and environmental compliance. Nevertheless, enforcement has been hindered by

institutional deficiencies, disintegrated management and low political determination. The Environmental Management Agency (EMA) and the Ministry of Mines, as regulators, are unable to effectively regulate widespread ASM activity, which occurs far from the reach of these offices in remote rural wards (Mkodzongi, & Spiegel, 2021).

Corruption also undermines policy effectiveness. Selective application of rules, bribe-taking and political intervention have all contributed to undermining the legitimacy of regulators in the eyes of both communities and miners (Dreschler 2001). As a result, informal mining continues to flourish with minimal oversight, despite its documented environmental and social costs.

Though the difficulties of enforcement identified in the literature have been well established, there is little research that looks at how these problems play out on the level of the ward or that consults the views of local stakeholders. This paper bridges that gap by investigating the effectiveness of policy from the directly affected community of Kamusha. By conducting interviews and focus groups, the study hopes to document local circumstances surrounding enforcement policies and opportunities for more inclusive, realistic governance approaches.

2.8 Conflict Between Development, Environment, and Rights

The relationship between natural resource extraction, sustainability of the environment, and rights of the people, often involves controversies, especially in weak governance and economic hardship. Such is the case of artisanal chrome mining (ASM) in general, ward 14, in Kamusha illustrates the conflict in which sustainability income generation or local livelihood is pursued at the expense of environmental degradation and social stability.

While ASM grows, land that was previously reserved for agriculture or community needs is being reallocated to mining, sparking conflicts between miners, landowners, and the local government. In Mvurwi, farmers have complained of losing fertile arable land, grazing land and clean water as mining claims encroach. Such disputes are frequently compounded by insecure land tenure and non-participatory decision-making. Access rights are often given informally by traditional leaders if at all, while formal regulations are either ignored or poorly enforced (Marara, 2018; Kamete, 2020).

Social friction caused by these disagreements can spill over into larger community discord. Conflict is triggered when one group feels another is being given an undue advantage, especially at times of scarcity where resources such as water and arable land are limited. In some instances, big concession-holding mining companies have clashed with artisanal miners and accused them of trespassing on licensed concessions. Alternatively, miners contend that they have no choice, and the land is their means of survival (Mkodzongi & Spiegel, 2021).

This conflict is not only about access to resources but also about the distribution of benefits and harms. The degradation of the environment mostly affects people who depend on natural resources for food and income, and profits from mining often end up in the hands of middlemen or outside purchasers. Women and children suffer the most from environmental pollution, displacement, and loss of household productivity, but they are often overlooked in mining governance and conflict resolution mechanisms.

While other scholars have analysed resource-based conflict in sub-Saharan Africa, most focus on large-scale mining or national-level disputes. There is limited, indigenous research which has studied the dynamics of such conflicts within the rural village settings which are involved in ASM. This article adds to that by recording the views of members of the Kamusha community and identifying areas of tension between competing interests in land, livelihood and the environment. In so doing, it emphasizes the necessity for participatory governance systems capable of mediating contradictory interests in a fair and sustainable way.

2.9 Research Gaps

Although an increasing number of sources have analysed the impacts of ASM in Zimbabwe, there are still major ommissions, at the intersection between environmental science and socio-economic analysis as well as the policy implications. There is relatively little research that considers how these components interact with one another and how they influence local development processes in ASM, with much of the literature that exists at one end of the spectrum viewing either the

environmental or economic aspects of ASM in relative isolation, and neglecting the complexities of ASM, governance, and local livelihoods themselves.

To begin with, there is an inadequate amount of empirical work that has applied Geographic Information Systems (GIS) to measurably compute the levels of land use and environmental transgressions brought about by ASM. While Bhebhe (2019) and Mutanga and Kumar (2019) have both found remote sensing useful for monitoring deforestation and land degradation, few have used these tools specifically in areas inhabited by rural communities like Kamusha, Ward 14. Hence this creates a significant data gap with regard to spatial and temporal effects of artisanal chrome mining on a micro-geographical scale.

Secondly, there are a lot of studies that focus on socio-economic impacts. These are framed as policy reviews or macro-economic studies and often the narratives and lived experiences of affected communities are neglected. Studies including qualitative data collected from the public, including focus group discussions and semi-structured interviews, are lacking. This constrains policymakers' capacity to develop interventions that are embedded within the contexts of affected populations in informal mining (Mangena, 2014; Hentschel et al., 2003).

Despite the various policy measures enacted by Zimbabwe to control ASM, there is limited understanding of how these policies are implemented and understood at the local level. Most policy effectiveness studies have concentrated on national institutions or urban centres. Rural localities such as Kamusha remain largely under-represented in governance research. This study adds to the literature by examining community barriers, institutional support gaps, and perceived fairness and accountability.

Finally, relatively little attention has been paid to the human rights implications of ASM. This includes issues around access to land, clean water, health service provision and decent working conditions in the wider Zimbabwean context. While international models and examples from abroad do address these concerns, there is a need for more in-depth, local-level analysis that can be used to further rights-based approaches to mining governance.

This research seeks to fill these gaps by combining spatial data with community-based qualitative feedback, to provide a more complete picture of the environmental and socio-economic

dimensions of ASM in Kamusha, Mvurwi. In the process of doing so, it seeks to contribute to the creation of inclusive, evidence-based policies that are consistent with national development goals and international sustainability commitments.

CHAPTER 3: METHODOLOGY

3.1 Study area description

Kamusha is a rural area found in Ward 14 of Mvurwi, Mashonaland Central Province in Zimbabwe. Located about 100km north of Harare. Mvurwi acts as an agricultural and economic centre for the surrounding rural areas. Flat land and fertile soils in the area are suitable for tobacco, maize and horticultural production, which are the main income-generating activities (Zimbabwe National Statistical Agency, 2023). The region has semi-arid weather with seasonal rainfall, which impacts both agricultural productivity and local environmental conditions.

However, in recent years, Kamusha has been seeing a boom in the artisanal mining of chrome, which has been facilitated by the availability of chrome ores close to the surface. The community is now poised between its farming roots and the seismic realignment of the economy brought on by mining. Kamusha is mainly occupied by Shona people among whom traditional beliefs and customs play a significant role in people's social and economic activities. The community has ancient food crop production dating from the pre-colonial era, and the new trend of mining is a major social transformation. The transition has, however, presented challenges such as land use conflicts, resource degradation and socioeconomic instability (Agricultural Journals, 2023).

Overall, Kamusha represents a rural community undergoing economic and environmental transition, balancing between agriculture and artisanal mining, with both sectors shaping its future development. Fig 3.1 illustrates the spatial context of Kamusha within Mvurwi, Mashonaland Central Province, Zimbabwe.

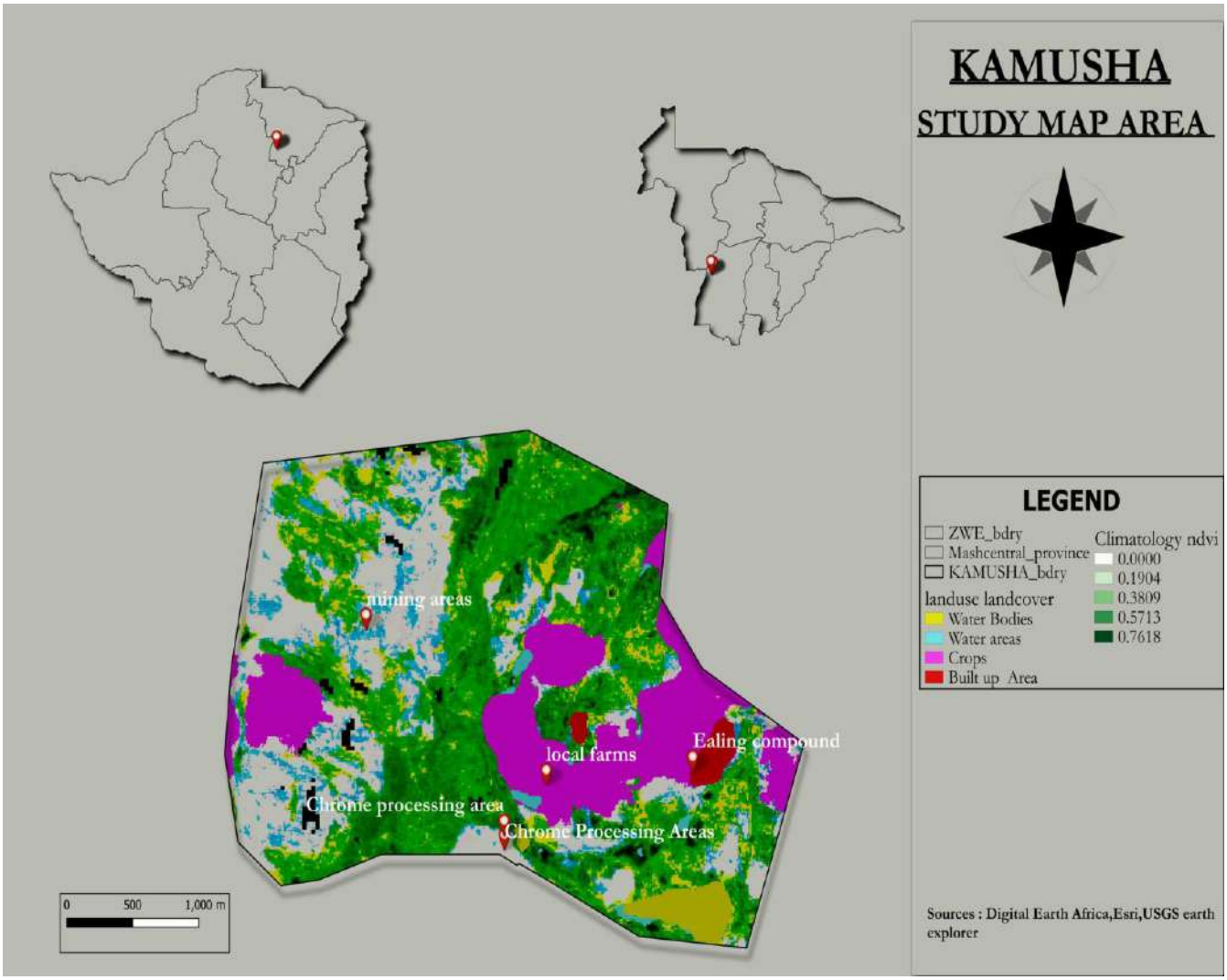

Figure 3..1 Study Area Map

3.2 Research Design

The research design for this study is mixed methods, using qualitative and quantitative approaches to gain a comprehensive insight into the environmental and social consequences of artisanal chrome mining in Mvurwi. The combination of these approaches provides a comprehensive understanding of how mining activities have affected land use, water quality, and the livelihoods of local communities between 2021 and 2024.

The quantitative aspect of this study will use Geographic Information Systems (GIS) to track environmental changes over the study period. Remote sensing technology will be used to monitor variations in vegetation and mining spread to provide indications to the environment. Using GIS, the research will develop visual records of the changes in the environment thus providing a scientific interpretation of the long-term effects of artisanal chrome mining on Kamusha (Bhebhe, 2019).

The qualitative aspect of the project will address social aspects of artisanal mining such as impacts on local livelihoods, conflicts concerning land use, and risks to health associated with pollution from mining. The research will draw on semi-structured interviews and focus group discussions with stakeholders including artisanal miners, farmers, community leaders, local government and environmental groups. In this thesis, interviews will generate local knowledge on how communities view the impact of mining, and the extent to which the Mines and Minerals Act and the Environmental Management Act (ZELA, 2020) have been effective in governing the activities of artisanal miners.

This will lead to an integrated understanding of the environmental and social effects of small-scale chrome mining in the Mvurwi area by putting quantitative GIS analysis together with qualitative community-based research. The results will inform evidence-based policy recommendations for more sustainable and environmentally and socially less damaging mining practices. The combination of methods in the research enables a holistic picture of the scientific data and community experiences to be gathered.

3.3 Data Collection

The study will adopt a mixed-methods approach, combining both qualitative and quantitative techniques to provide a comprehensive understanding of the environmental and socio-economic effects of artisanal chrome mining.

3.3.1 Quantitative Collection

Geographic Information Systems (GIS) and remote sensing techniques will be used in this study to collect quantitative data on land use and land cover (LULC) changes associated with artisanal chrome mining in Kamusha, Ward 14. This approach is appropriate for documenting spatial and temporal environmental transformations in areas where field-based environmental data are limited or non-existent.

To carry out this analysis, the study will acquire multispectral satellite images from the United States Geological Survey (USGS) Earth Explorer platform. Sentinel-2 imagery, with a spatial resolution of 10 meters, will be used for the years 2021 and 2024. These years were selected to represent the period during which artisanal chrome mining reportedly expanded in the study area. Image acquisition will focus on the dry season months of May and June in all the years to ensure consistency in vegetation cover and minimize cloud contamination.

Before classification, the satellite imagery will be pre-processed using ArcGIS 10.8 software. Radiometric correction will be applied to adjust for sensor-related brightness variations, and geometric correction will align the images to a standard coordinate reference system (WGS 84). Cloud masking techniques will be used to eliminate interference from cloud cover and shadows. Finally, image enhancement methods such as contrast stretching will be applied to improve visual clarity and prepare the imagery for classification.

The selection of GIS and remote sensing as a data collection method is justified by its ability to provide consistent, objective, and spatially detailed information about land use changes over time. In rural communities such as Kamusha, where environmental monitoring by regulatory authorities is often limited, satellite-based methods enable researchers to generate reliable data that would otherwise be inaccessible.

GIS enables the analysis of land degradation, deforestation, and mining expansion at a landscape scale, allowing for spatial comparisons between different periods. Remote sensing has been widely used in mining impact assessments and is especially suited for detecting surface-level changes such as vegetation loss and bare land expansion (Lu et al., 2004). ArcGIS software is a powerful tool that allows for the integration of satellite imagery, field observations, and classification

techniques into a single analytical framework. The use of supervised classification using the Maximum Likelihood Classifier (MLC) will further enhance accuracy by incorporating ground-truth data and human interpretation.

By adopting a GIS-based approach, this study will generate spatial evidence to support qualitative insights from community members and key informants, thereby strengthening the validity of findings and supporting data-driven decision-making.

3.3.1.1 Quantitative Data Analysis Process

The following procedure will be used for analysing environmental changes in ArcGIS

1. Land Cover Classification Supervised classification will be applied using the Maximum Likelihood Classifier (MLC). Three land cover types will be used:

   Vegetation – crops, forest, bush

   Bare land – exposed soil, mining pits, cleared ground

   Water bodies – streams, ponds, dams

Training samples will be collected using Field visits and GPS-marked reference points as well as High-resolution images from Google Earth and ArcGIS base maps

2. Post-Classification Smoothing using a majority filter to remove salt-and-pepper noise from the classified images.

3. Change Detection using the Post-Classification Comparison (PCC) method:

   - Comparison of 2021 and 2024 maps pixel by pixel
   - Creation of change matrices to summarise transitions between land cover types
   - Calculation of area statistics (in hectares) for each transition (e.g., vegetation to bare land)

4. Accuracy Assessment

   Classification results will be validated using a confusion matrix. Ground truthing data and visual verification from Google Earth will be used. The following metrics will be reported Overall accuracy, Producer's accuracy, User's accuracy, Kappa coefficient (Foody, 2002). An accuracy of at least 85% will be considered acceptable.

5. Visualisation and Interpretation

   Spatial data will be visualised using ArcGIS tools to produce LULC maps for 2021 to 2024, Change detection maps, and Hotspot maps showing zones with the highest land degradation. These outputs will support the interpretation of mining-related environmental changes and serve as a visual basis for policy recommendations.

3.3.2 Qualitative Data Collection

The study population consists of various stakeholders in Kamusha Rural Community, Mvurwi, Mashonaland Central, Zimbabwe, who are either directly involved in or affected by artisanal chrome mining (ASCM). These groups provide diverse perspectives on the environmental and socio-economic impacts of ASCM, ensuring a comprehensive analysis. Based on estimates from community records and local authorities, the total population of Kamusha Rural Community is approximately 1,000 individuals. The key stakeholder groups and their estimated population sizes are shown in table 3.1

Table 3.1: Key stakeholder groups and estimated population

Subgroup	**Estimated Population Size**	**Description**
Local Community Members	500	Residents living near mining sites, including farmers, households, and other affected groups.
Artisanal Miners and Mining Workers	350	Individuals directly involved in chrome extraction, processing, and transportation.
Local Leaders and Traditional Authorities	25	Village chiefs, headmen, and elders responsible for land and community affairs.
Government Officials and Regulatory Authorities	15	Representatives from the Environmental Management Agency (EMA) and the Ministry of Mines and Mining Development, though their presence is limited in rural areas.
Agricultural Workers and Landowners	110	Farmers and landowners affected by land degradation, deforestation, and water pollution.
Total Population	≈1,000	The estimated number of individuals relevant to the study.

3.3.2.1 Sampling Strategy

Using Krejcie and Morgan's (1970) formula, the recommended sample size for a population of 1,000 is 278 participants. This sample will be proportionally distributed among the subgroups for fair representation. The proportional sample size per subgroup according to estimated population sizes is shown in Table 3.2.

Table 3.2 Proportional Sample Size per Subgroup

Subgroup	**Estimated Population Size**	**Proportional Sample Size**
Local Community Members	500	139
Artisanal Miners and Mining Workers	350	97
Local Leaders and Traditional Authorities	25	7
Government Officials and Regulatory Authorities	15	4
Agricultural Workers and Landowners	110	31
Total Sample Size	1,000	278

Within each subgroup, participants will be selected using:

- **Simple random sampling** for large groups (community members, miners, farmers), based on household lists obtained from local authorities.
- **Purposive sampling** for smaller, expert groups (traditional leaders and regulatory officials), was selected based on their positions and relevance to the study objectives.

This approach will ensure that both commonly affected individuals and those with policy oversight or traditional leadership roles are adequately represented in the study. This mix of methods is the best way to ensure fairness while capturing all the different perspectives on artisanal chrome mining. Purposive sampling brings in expert opinions from decision-makers. Random sampling ensures that selection is unbiased and reflects the wider community. By using this approach, the

study will provide a well-rounded understanding of the environmental, social, and economic impacts of artisanal chrome mining in the Kamusha Rural Community.

3.3.2.2 Focus group discussions

Focus group discussions will be conducted with larger stakeholder groups that share common experiences related to artisanal mining. Focus group discussions are particularly useful for understanding community perceptions, social interactions, and shared challenges associated with mining activities (Krueger & Casey, 2015). This method will be applied to local community members, artisanal miners and mining workers, as well as agricultural workers and landowners. These groups are directly impacted by artisanal mining, whether through environmental degradation, health risks, or economic consequences.

Each focus group will consist of six to ten participants selected using stratified random sampling to ensure fair representation (Onwuegbuzie et al., 2009). Discussions will last between 60 and 90 minutes and will take place in a neutral and accessible location within the community. A trained moderator will facilitate the discussions using a semi-structured discussion guide, See Appendix A that covers key topics such as:

- Perceptions of environmental change (e.g., land degradation, water contamination)
- Impacts on health, livelihoods, and agricultural productivity
- Relationships between miners, farmers, and traditional authorities
- Community strategies for coping with change

All discussions will be audio-recorded with participant consent, and field notes will be taken for additional context. The transcriptions of these discussions will be analyzed thematically to identify recurring patterns and shared concerns (Braun & Clarke, 2006). This method encourages open and interactive dialogue, allowing participants to build upon each other's responses while collectively identifying key challenges and possible solutions (Morgan, 1996).

3.3.2.3 Interviews

In addition to focus group discussions, semi-structured interviews will be conducted with key informants who possess specialized knowledge about artisanal mining's governance, environmental implications, and socio-economic effects. This method is particularly useful for obtaining detailed policy insights, expert opinions, and first-hand accounts of decision-making processes (Patton, 2015). Semi-structured interviews will be conducted with local leaders and traditional authorities, as well as government officials and regulatory authorities. These individuals hold influential positions in the community and have direct involvement in decision-making processes related to mining regulation and land management.

Interviews will be conducted one-on-one to ensure privacy and encourage honest responses (Brinkmann, 2014). Each session will last between 30 and 60 minutes and will follow a flexible question guide see Appendix B to allow exploration of emerging themes (DiCicco-Bloom & Crabtree, 2006). Interview topics will include:

- Experiences with mining governance and regulation
- Challenges in enforcing the Mines and Minerals Act and Environmental Management Act
- Customary practices around land allocation and conflict resolution
- Environmental monitoring and response capacity

Participants will be purposefully selected based on their roles and expertise in mining regulation and community leadership (Palinkas et al., 2015). As with the focus group discussions, interviews will be audio-recorded with consent, and detailed notes will be taken to supplement recorded data. The collected data will be analyzed using thematic coding to identify patterns in policy enforcement, land management, and community conflicts related to mining (Guest et al., 2012). Semi-structured interviews provide an opportunity to explore complex governance and regulatory issues in greater depth than would be possible in group discussions (Kvale, 2008).

The combination of focus group discussions and semi-structured interviews ensures that the study captures both broad community experiences and detailed expert perspectives. FGDs help to identify collective challenges, social conflicts, and community-wide trends in artisanal mining, while semi-structured interviews provide expert knowledge on policies, governance, and land management. This mixed-method approach allows for triangulation, improving the validity and reliability of the findings by comparing insights from different stakeholder groups (Denzin, 2012). By employing these qualitative data collection methods, the study will provide a comprehensive, well-rounded understanding of the environmental and socio-economic effects of artisanal chrome mining in Kamusha Rural Community.

3.3.2.4 Qualitative Data Analysis

The data collected from focus group discussions (FGDs) and semi-structured interviews will be analyzed using thematic analysis, a widely used qualitative data analysis method. Thematic analysis helps identify, analyze, and interpret patterns (themes) within the data, allowing for a comprehensive understanding of the participants' perspectives on artisanal chrome mining in the Kamusha Rural Community (Braun & Clarke, 2006). This study will use a manual approach to thematic analysis without relying on paid software, ensuring accessibility and ease of replication.

1. Data Preparation and Familiarization

The first step in data analysis is data preparation, where all audio recordings from FGDs and interviews will be transcribed verbatim. Transcriptions will then be reviewed multiple times to ensure accuracy and gain an in-depth understanding of the responses. During this stage, initial observations and emerging ideas will be noted in the margins of transcripts or a research notebook.

2. Coding and Categorization

Once familiar with the data, the next step is coding, which involves identifying key phrases, words, and concepts that frequently appear in the data. This will be done manually using Microsoft Excel. Codes will be assigned to sections of text based on their relevance to the study’s objectives. For example, statements about land degradation, deforestation, and water pollution may be assigned the code "Environmental Impacts", while discussions about income, employment, and poverty will

be categorized under "Economic Effects". After coding, similar codes will be grouped into broader categories to help identify overarching themes. This process allows for the organization of data into meaningful patterns, ensuring that all relevant aspects of the study are covered.

3. Identifying and Refining Themes

Once the codes are organized, themes will be developed by grouping related categories. For instance, "loss of farmland," "soil erosion," and "deforestation" may fall under the broader theme "Environmental Degradation." Similarly, "child labour," "health hazards," and "displacement" may be categorized under "Social Impacts." To refine the themes, the researcher will review and revise them, ensuring they accurately reflect the data. Some themes may be merged if they overlap, while others may be split into sub-themes to capture specific details more effectively. A thematic map will be created using a simple chart in Excel or drawn manually to visualize the relationships between themes.

4. Data Interpretation and Reporting

After finalizing the themes, the next step is interpreting the data by linking the findings to the study's research questions and existing literature. Direct quotes from participants will be used to support each theme, providing real-world evidence of the challenges and experiences associated with artisanal chrome mining. Findings will then be structured into a narrative format, discussing how the themes align with or differ from existing research. Policy implications, recommendations, and potential solutions will also be highlighted.

5. Validating Findings

To enhance the credibility and reliability of the findings, data triangulation will be applied. This means comparing responses from different subgroups (e.g., miners, local community members, and government officials) to identify consistent patterns and differing perspectives. Member checking may also be used, where selected participants review the interpretations to confirm accuracy. By employing a manual, cost-free thematic analysis approach, this study ensures that findings remain transparent, reproducible, and reflective of participant experiences, providing a well-rounded understanding of the environmental and socio-economic effects of artisanal chrome mining in Kamusha Rural Community.

3.3.2.5 Ethical Considerations for Qualitative Data Collection

In both interviews and FGDs, participants will be informed about the purpose of the study, their rights to confidentiality, and the voluntary nature of participation. Informed consent will be obtained, and efforts will be made to create a safe environment where participants feel comfortable sharing their views (Orb, Eisenhauer, & Wynaden, 2001). This study adheres to strict ethical standards to protect participants' rights and ensure the integrity of the research process. Ethical approval will be obtained from the relevant authorities before any data collection begins. Key ethical principles guiding this study include:

Informed Consent

All participants will be fully informed about the purpose, procedures, and potential risks of the study. Written consent will be obtained from each participant, ensuring that they willingly agree to take part without any form of coercion or undue influence.

Confidentiality and Anonymity

To protect participants' privacy, all personal information gathered during interviews and focus group discussions will be kept confidential. Data will be anonymized in the reporting process, and identifiers will be removed to ensure that individuals cannot be linked to specific responses.

Voluntary Participation

Participation in this study will be entirely voluntary, and participants will have the right to withdraw at any time without penalty or loss of benefits. This principle ensures respect for individual autonomy and personal choice.

Minimizing Harm

Efforts will be made to minimize any potential harm to participants, including psychological distress or discomfort related to discussing sensitive issues. Participants will be provided with information on available resources if they experience any discomfort due to the research topics.

Data Security

All collected data will be securely stored, with access limited to the research team only. Digital data will be encrypted, and physical data will be stored in locked cabinets to prevent unauthorized access.

Responsiveness to Cultural Sensitivity

Given the community context, the research will be conducted with cultural sensitivity. Research methods will be adapted to respect local norms and values, ensuring that community members feel comfortable and respected throughout the process.

These ethical considerations are essential for maintaining trust and transparency with participants and ensuring that the research respects their rights and well-being.

3.4 Research Timeframe

The research project will follow a structured timeline to ensure systematic data collection, analysis, and reporting. The study is expected to span approximately 12 months, divided into specific phases for each stage of the research as shown in Table 3.3. Each phase aligns with the study's objectives and methodologies, enabling efficient allocation of resources and adherence to ethical guidelines throughout the process (Creswell, 2014; Saunders, Lewis, & Thornhill, 2016).

Table 2.3 Phases and time frame of research stages

Phase	Time Frame	Activities
1. Preparation and Literature Review	Month 1–2	✓ Conduct a comprehensive review of relevant literature on artisanal mining, environmental impacts, and social consequences in Zimbabwe and similar contexts (Hilson, 2019; Mangena, 2014). ✓ Develop research instruments, including interview guides and focus group discussion guides. ✓ Obtain ethical approval and permissions from relevant authorities, such as the Environmental Management Agency and local government representatives (Orb, Eisenhauer, & Wynaden, 2001).
2. Data Collection	Month 3–6	✓ Qualitative Data Collection: Conduct in-depth interviews and focus group discussions with community members, miners, local leaders, government officials, and environmental advocates. ✓ GIS Data Collection: Acquire satellite imagery and GIS data for monitoring environmental changes, including land degradation and water contamination, over the past four years (Bhebhe, 2019). ✓ Transcribe and organize data for qualitative analysis (Patton, 2002).
3. Data Analysis	Month 7–9	✓ Analyse qualitative data using thematic analysis, by coding responses from interviews and focus groups to identify key themes related to social and environmental impacts (Braun & Clarke, 2006; Guest, MacQueen, & Namey, 2012).

		✓ Use GIS software to process and interpret satellite imagery, quantifying changes in deforestation, land degradation, and water quality over time (Creswell, 2014). ✓ Triangulate findings from qualitative and GIS data to strengthen the study's conclusions.
4. Interpretation and Reporting	Month 10–11	✓ Synthesize findings from both qualitative and GIS data to conclude the impacts of artisanal mining in Mvurwi. ✓ Develop policy recommendations based on the research findings, aimed at enhancing sustainable mining practices and environmental stewardship in line with Zimbabwe's Vision 2030 and SADC's Agenda 2063 (Government of Zimbabwe, 2019; SADC, 2021). ✓ Prepare the final research report, detailing methodology, findings, policy implications, and recommendations.
5. Dissemination of Results	Month 12	✓ Share research findings with stakeholders, including local communities, government agencies, and environmental organizations. ✓ Present findings at relevant academic conferences and community workshops to inform policy debates and raise awareness of ASM impacts (Saunders et al., 2016). ✓ Submit the final report for publication in relevant academic journals and disseminate summaries to policymakers and community leaders.

This period ensures that each phase is completed with careful planning and attention to detail, easing meaningful and actionable results

CHAPTER 4: RESULTS

4.1 Introduction

This chapter presents the findings of the study on the environmental and socio-economic impacts of artisanal chrome mining in Kamusha, Ward 14, Mvurwi. The results are organised according to the study's aims and derived from both quantitative data collected through Geographic Information Systems (GIS) analysis and qualitative data collected through focus group discussions and semi-structured interviews.

The GIS analysis was used to track land use and land cover changes between 2021 and 2024, focusing on environmental indicators such as deforestation, land degradation, and expansion of mining sites. This spatial evidence is presented using maps and quantitative summaries that highlight the extent and nature of environmental changes in the study area. The qualitative part of the study captures the lived experiences and perceptions of local stakeholders including community members, artisanal miners, farmers, traditional leaders, and local authorities regarding the social, economic, and health-related impacts of artisanal chrome mining. These findings are thematically presented, reflecting emerging issues such as resource conflicts, displacement, livelihood shifts, and institutional responses.

By combining spatial data with community narratives, this chapter provides a holistic account of how artisanal mining is reshaping both the physical landscape and social structures in Kamusha. The next section begins with the environmental findings based on GIS analysis.

4.2 Quantitative Findings from GIS Analysis of Environmental Change (2021–2024)

This section presents the quantitative findings from the analysis of satellite imagery using ArcGIS. The primary objective was to evaluate environmental changes in Kamusha, Ward 14, Mvurwi, over four years (2021–2024) using a supervised classification of Sentinel-2 satellite images. Land cover changes were analysed across three major categories: vegetation, water bodies, and open land. This analysis addresses Objective 1 and Objective 4 of the study, which seek to understand the environmental impacts of artisanal chrome mining and to apply GIS methods to detect changes over time.

Table 4.1: Land Cover Change in Kamusha (2021–2024)

Land Cover Class	2021 (km^2)	2022 (km^2)	2023 (km^2)	2024 (km^2)	% Change (22–21)	% Change (23–22)	% Change (24–23)	% Change (24–21)
Vegetation	5.9584	5.3372	2.8692	2.84	-10.43%	-46.26%	-1.02%	-52.34%
Water	0.1832	0.1836	0.1660	0.1896	+0.22%	-9.60%	+14.21%	+3.48%
Open Land	4.7660	5.3608	7.8464	7.8520	+12.49%	+46.36%	+0.07%	+64.78%

Source: ArcGIS LULC classification using Sentinel-2 data (2021–2024)

The data reveals a consistent and substantial reduction in vegetation cover, with a 52.34% decline over the four years. The most dramatic drop occurred between 2022 and 2023, aligning with reports of increased artisanal chrome mining. Conversely, open land expanded by 64.78%, supporting evidence of extensive land clearance and exposure of bare ground due to unregulated mining. Waterbody coverage remained relatively stable with minor fluctuations, though participants in focus group discussions reported deteriorating water quality, a concern not captured by land cover classification alone.

4.2.1 Spatial Distribution of Land Cover (Map Series)

The following figures present the classified land cover maps for Kamusha, Ward 14, between 2021 and 2024. These maps visually show the spatial extent and transformation of vegetation, water bodies, and open land over the years.

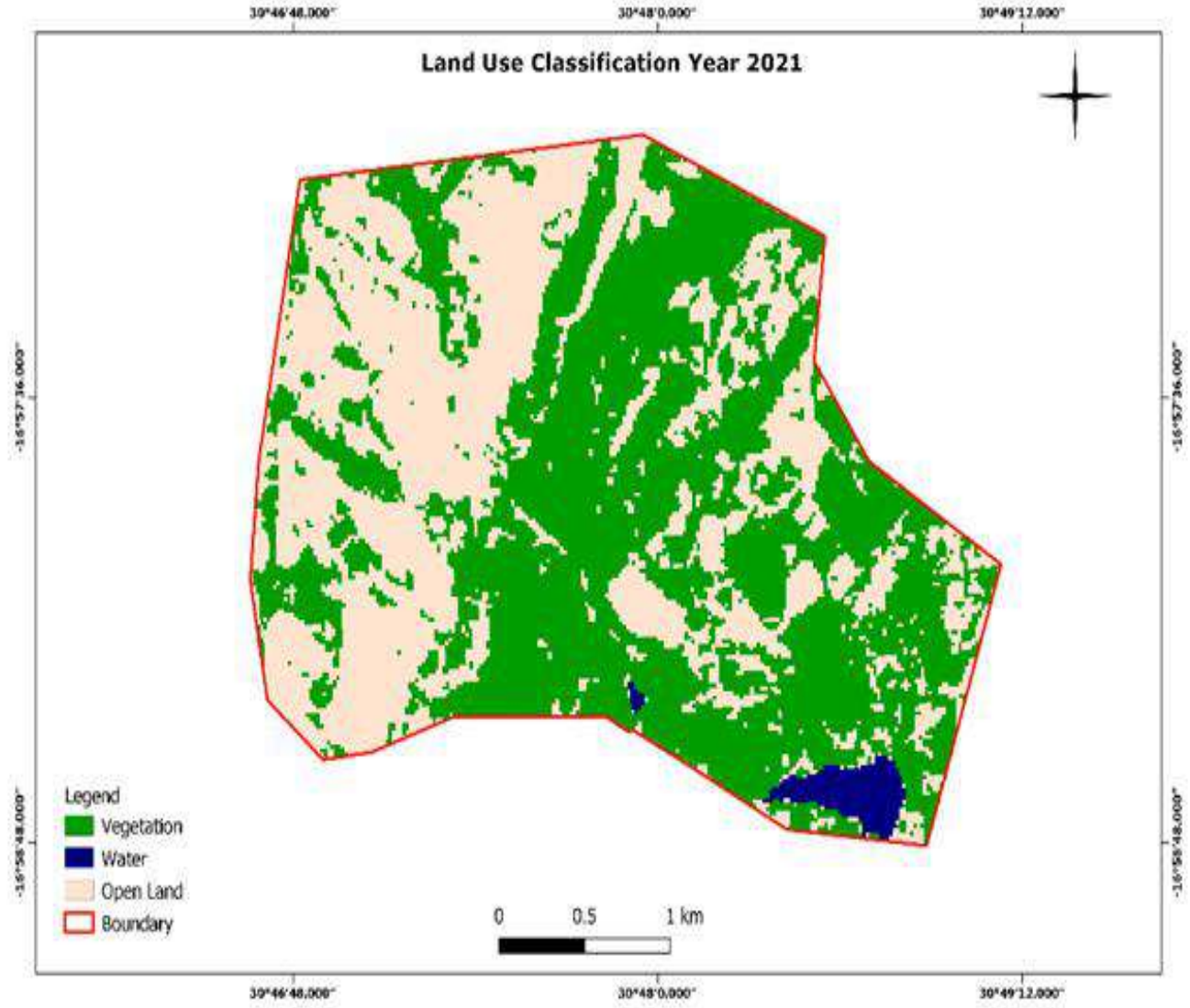

Figure 4.1: Land Cover Classification of Kamusha in 2021

Classified using supervised classification in ArcGIS based on Sentinel-2 imagery (Author, 2025).

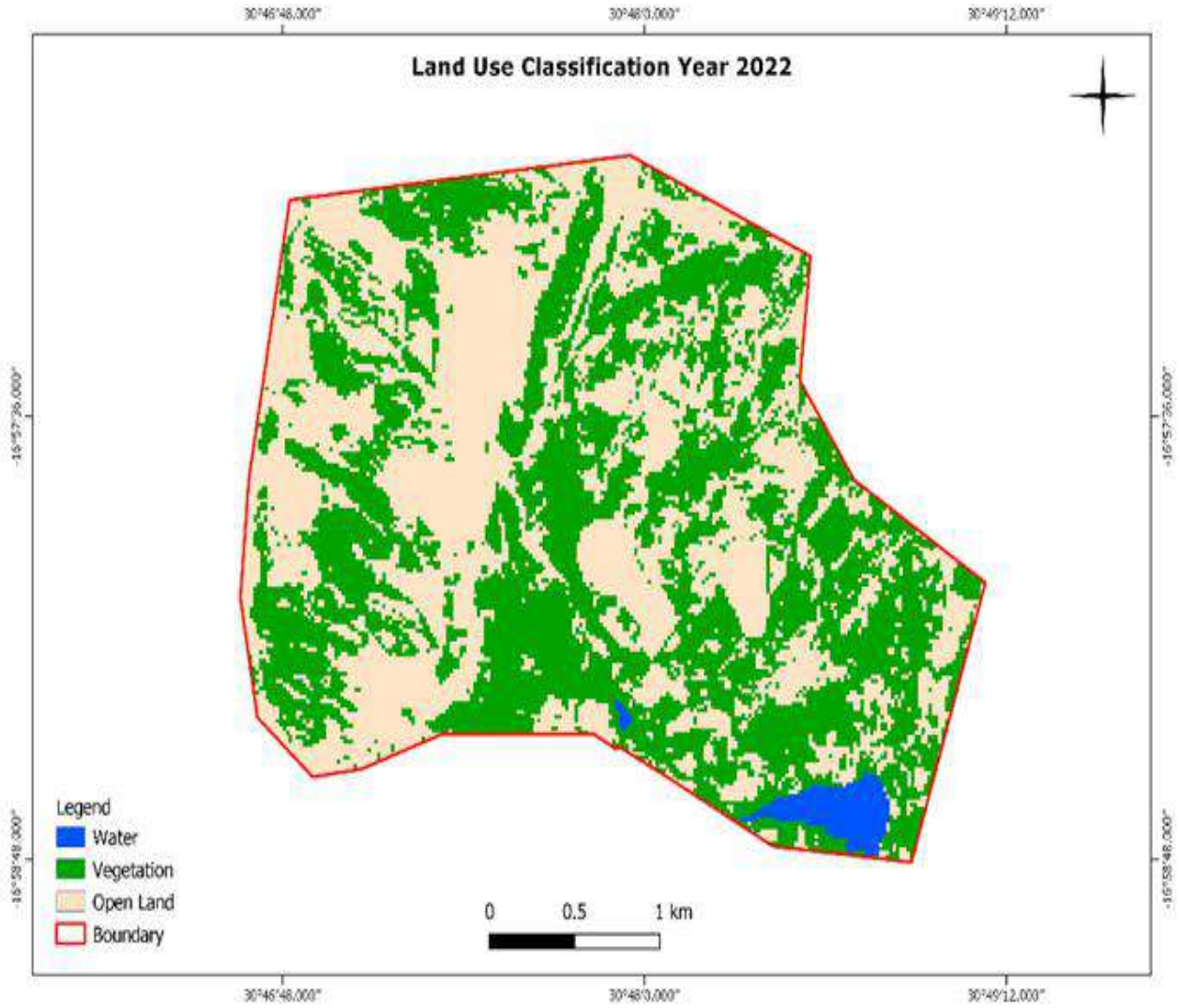

Figure 4.2: Land Cover Classification of Kamusha in 2022

Classified using supervised classification in ArcGIS based on Sentinel-2 imagery (Author, 2025).

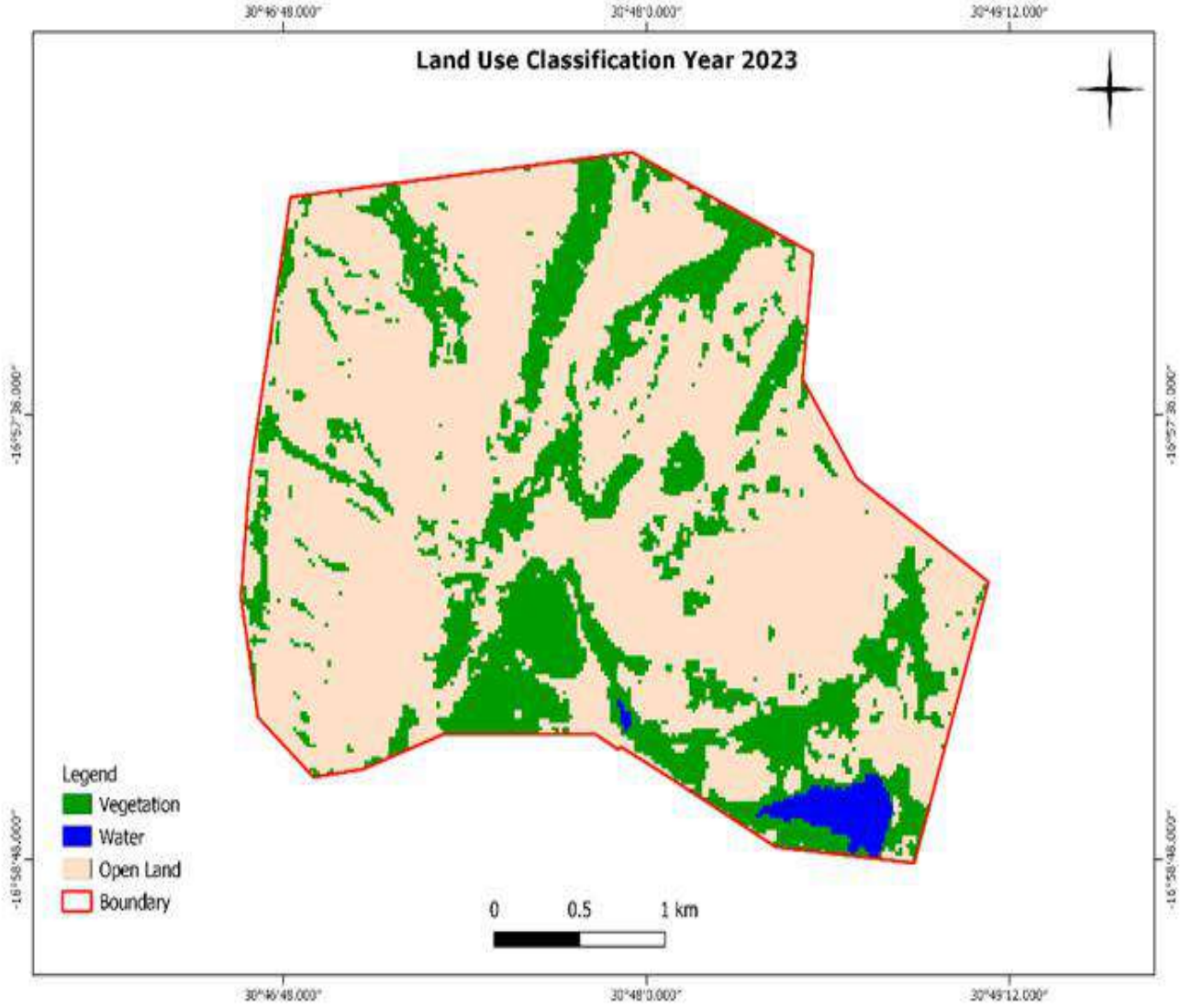

Figure 4.3: Land Cover Classification of Kamusha in 2023

Classified using supervised classification in ArcGIS based on Sentinel-2 imagery (Author, 2025).

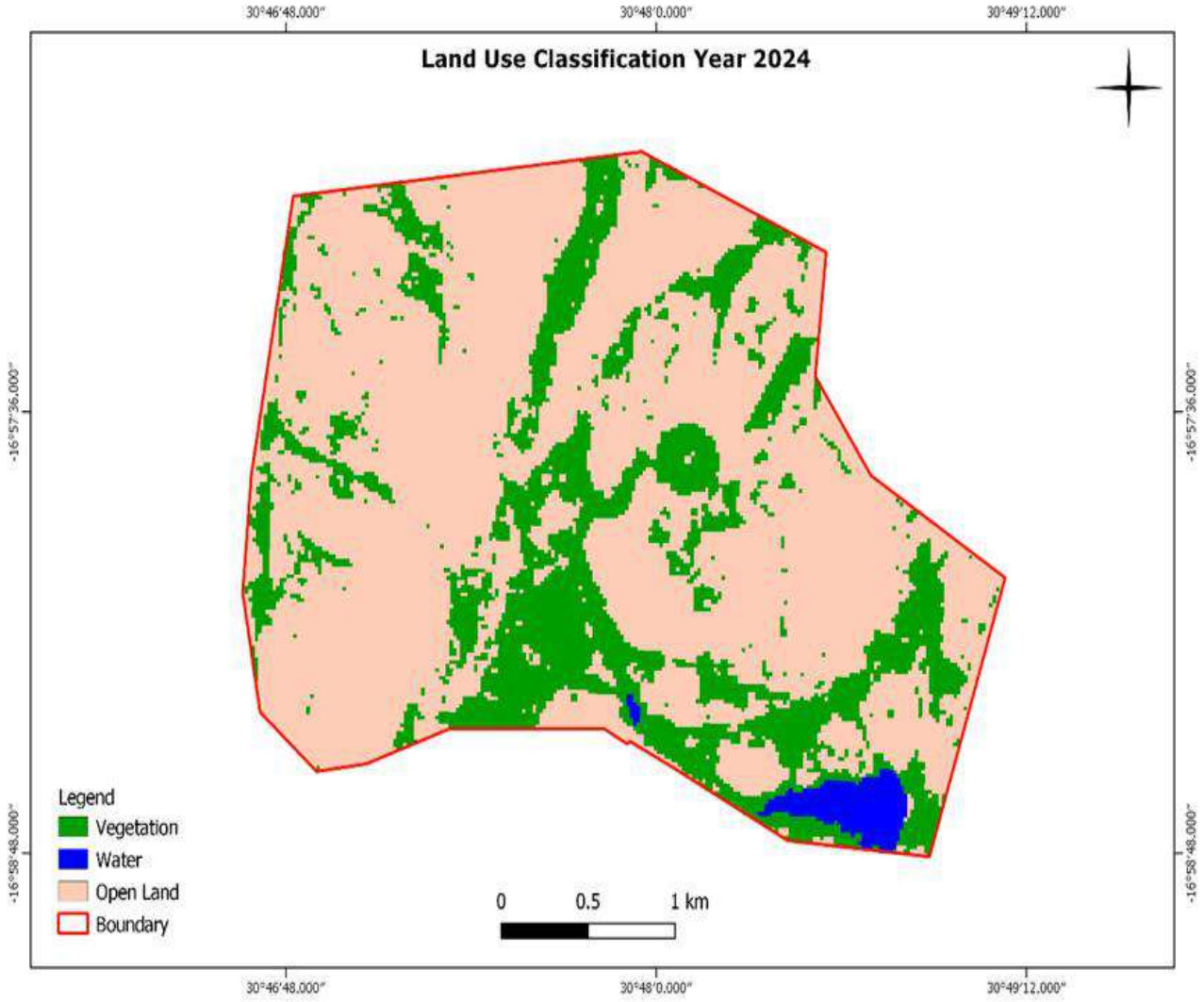

Figure 4.4: Land Cover Classification of Kamusha in 2024

Classified using supervised classification in ArcGIS based on Sentinel-2 imagery (Author, 2025).

4.2.2 Accuracy Assessment of Land Cover Classification

To ensure the reliability of the classified maps, accuracy assessments were conducted for each year. Confusion matrices were generated using reference points from Google Earth and local ground-truthing. Metrics used include User's Accuracy, Producer's Accuracy, Overall Accuracy, and the Kappa Coefficient.

Table 4.2: User's Accuracy per Land Cover Class

Year	Vegetation	Water	Open Land	Overall Accuracy
2021	93.3%	100.0%	86.0%	93.0%
2022	93.3%	96.7%	90.0%	93.0%
2023	96.7%	96.7%	96.7%	96.7%
2024	96.7%	96.7%	96.7%	96.7%

Table 4.3: Producer's Accuracy per Land Cover Class

Year	Vegetation	Water	Open Land
2021	87.5%	100.0%	92.9%
2022	87.5%	100.0%	93.1%
2023	93.5%	100.0%	96.7%
2024	93.5%	100.0%	96.7%

Table 4.4: Overall Accuracy and Kappa Coefficient

Year	Overall Accuracy	Kappa Coefficient
2021	93.0%	0.895
2022	93.0%	0.895
2023	96.7%	0.950
2024	96.7%	0.950

These results confirm that classification outputs are exceptionally reliable. In 2023 and 2024, both overall accuracy and Kappa values increased to 96.7% and 0.950 respectively, showing

Strong agreement beyond chance. Water features were classified with the highest consistency, while vegetation and open land categories showed progressive improvements across the study period.

4.2.3 Visual Representation of LULC Trends

The classified satellite images for 2021, 2022, 2023, and 2024 were analysed to determine land use and land cover (LULC) changes in Kamusha. The findings revealed a consistent decline in vegetated areas and a corresponding increase in open land, which is closely linked to intensified artisanal chrome mining activities. Water bodies remained relatively stable in coverage over the four years. This trend is further visualised in Figure 4.5, which shows the progression of land cover change over time using a line graph. The sharp reduction in vegetation and growth of open land over just four years provides spatial evidence of unsustainable land transformation due to artisanal chrome mining in the area.

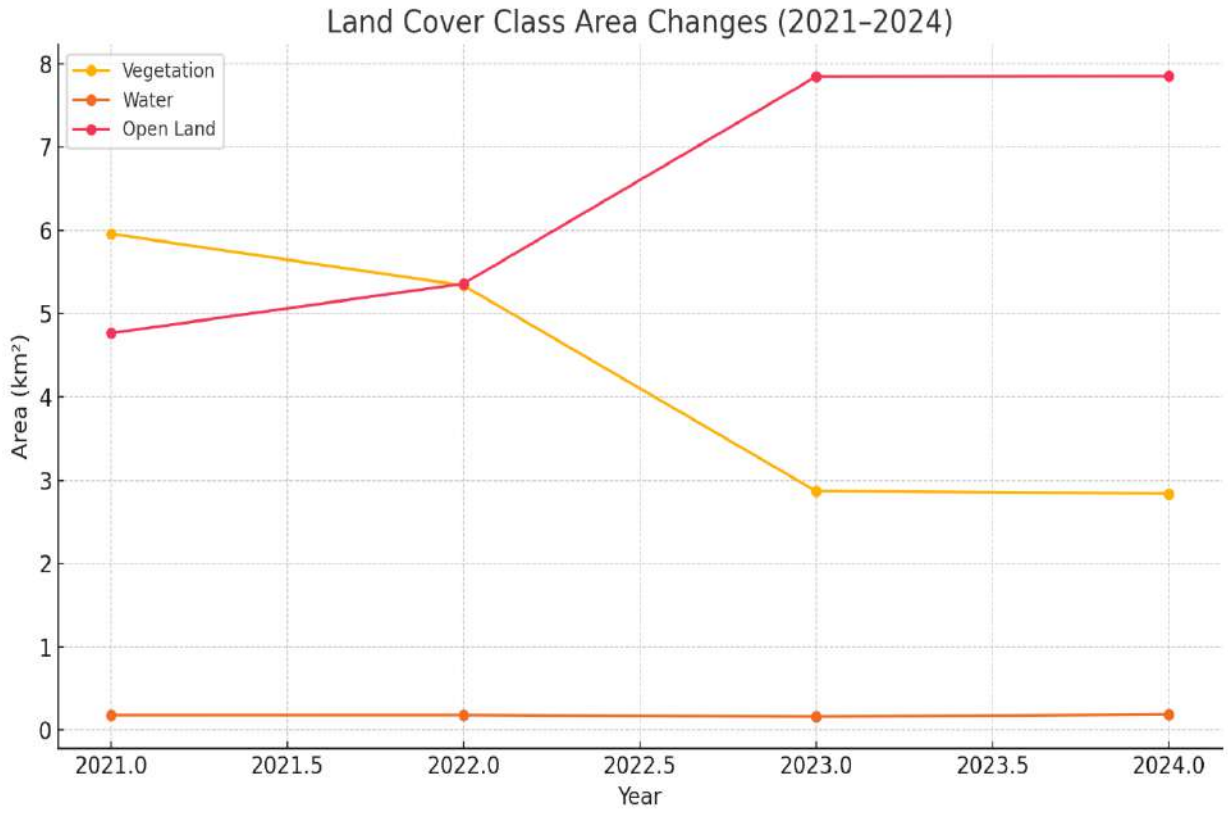

Figure 4.5: Line graph showing changes in land cover classes (vegetation, water, open land) from 2021 to 2024.

Source: Author's ArcGIS analysis using Sentinel-2 imagery

4.3 Thematic Presentation of Qualitative Findings

This section presents qualitative findings from focus group discussions (FGDs) conducted with three key stakeholder groups in Kamusha, Ward 14: local community members, artisanal miners, and agricultural landowners. A total of 27 FGDs were held, involving participants selected through stratified random sampling shown in the sample table 4.5. Data were analysed using Braun and Clarke's (2006) six-step framework and coded manually in Microsoft Excel. The results are organised under four main themes that appeared consistently across the discussions.

Table 4.5: Sample Profile of Focus Group Discussion Participants

Group Code	Stakeholder Group	No. of Participants	Gender Composition	Age Range	Sampling Method
FGD-A	Local Community Members (A)	10	6 Female, 4 Male	25–60	Stratified Random
FGD-B	Local Community Members (B)	9	5 Female, 4 Male	30–65	Stratified Random
FGD-C	Local Community Members (C)	8	3 Female, 5 Male	20–50	Stratified Random
FGD-D	Artisanal Miners and Workers (A)	10	2 Female, 8 Male	22–48	Stratified Random
FGD-E	Artisanal Miners and Workers (B)	8	1 Female, 7 Male	25–45	Stratified Random
FGD-F	Agricultural Landowners (A)	6	1 Female, 5 Male	35–70	Stratified Random
FGD-G	Agricultural Landowners (B)	7	2 Female, 5 Male	40–65	Stratified Random

4.3.1 Perceptions of Environmental Change

Most participants reported visible environmental degradation due to artisanal chrome mining. Common concerns included deforestation, open pits, dust pollution, and drying water sources. While community members and farmers described these changes as damaging, some miners expressed resignation, stating the environmental cost was the price of survival. These are summarised in table 4.6.

Table 4.6: Summary of Environmental Change Perceptions

Stakeholder Group	Key Responses
Local Community Members	Drying boreholes, disappearance of vegetation, dust affecting homes
Artisanal Miners	Acknowledged degradation, attributed to livelihood needs
Agricultural Landowners	Decline in soil fertility, loss of grazing land, polluted water sources

"We used to have forests and rivers. Now the land is just dust and holes."
– *Local Community Group B*

4.3.2 Health and Livelihood Impacts

Participants voiced concerns about increased illness and decreased productivity. Farmers noted the loss of income due to reduced yields, while community members highlighted waterborne diseases and poor air quality. Miners acknowledged injury risks and lack of protective gear but viewed mining as their only economic option. These are summarised in table 4.7.

Table 4.7: Summary of Health and Livelihood Impacts

Stakeholder Group	Key Responses
Local Community Members	Increased coughing, contaminated water, food insecurity
Artisanal Miners	No PPE, risk of accidents, dependence on mining for survival
Agricultural Landowners	Lower harvests, polluted irrigation, sick livestock

"We drink the same water the miners use to wash chrome because it flows here we have no choice."

– *Farmer Group A*

4.3.3 Land Use Conflicts and Social Tensions

Frequent conflicts were reported over land access, especially between farmers and miners. Participants described illegal land occupation, destruction of crops, and weak traditional leadership. Some elders were accused of accepting bribes to allow mining, which fuelled resentment. These are summarised in table 4.8.

Table 4.8: Summary of Land Conflict Issues

Stakeholder Group	Key Responses
Local Community Members	Land disputes, perceived favouritism by leaders
Artisanal Miners	Felt unfairly blamed, lacked clear mining zones
Agricultural Landowners	Crop destruction, lack of compensation, loss of ancestral fields

"We report to the headman, but nothing changes. Maybe he was paid to look away."

– *Local Community Group E*

4.3.4 Coping Strategies and Community Responses

Participants described various survival strategies, including reducing farming activities, engaging in casual work, or relocating temporarily. However, they expressed frustration with the lack of government action and ineffective community interventions. These are summarised in Table 4.9.

Table 4.9: Summary of Coping Mechanisms

Stakeholder Group	Key Responses
Local Community Members	Relying on food aid, shifting homes, skipping cultivation
Artisanal Miners	Changing mining locations, and cooperating with locals to avoid conflict

Agricultural Landowners	Downsizing farms, focusing on small livestock, seeking off-farm income

"We've adapted, but for how long? Every year it gets worse."
– *Farmer Group C*

4.3.5 Summary of Thematic Emphasis

To quantify the prominence of each theme, participants' coded responses were tallied across all focus group transcripts. The resulting bar chart in Figure 4.6 below shows the percentage of participants who raised each theme as a major concern.

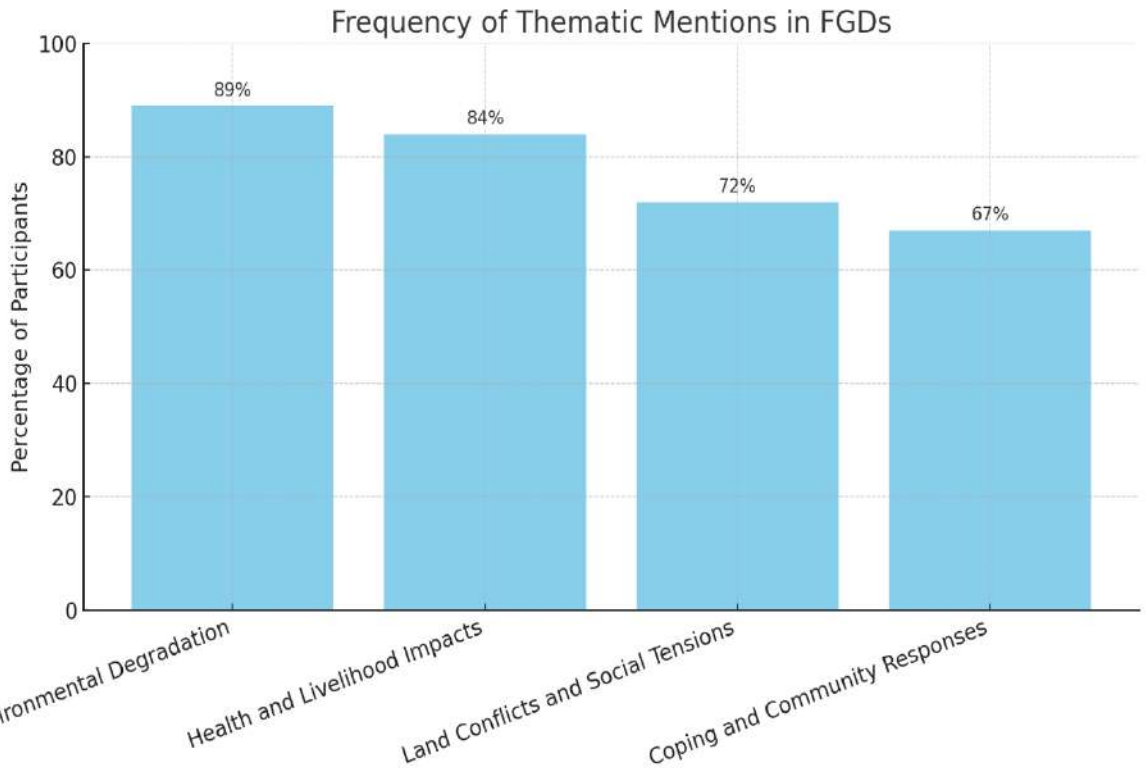

Figure 4.6: Frequency of Thematic Mentions in FGDs

Source: Author's thematic analysis using Excel coding

These results confirm that environmental and health issues are the most widely experienced and discussed consequences of artisanal chrome mining in Kamusha. The findings complement quantitative GIS results, providing a deeper community-level understanding of mining's impacts.

4.4 Semi-Structured Interview Results

To complement focus group discussions, eleven semi-structured interviews were conducted with key stakeholders in Kamusha, Ward 14. These included traditional leaders, environmental and health officers, ward councillors, farmers, educators, youth and women's representatives, and chrome transport operators with profiles shown in Table 4.10. All interviewees responded to a common set of questions, and their answers were analysed thematically. Thematic analysis revealed five dominant themes: (1) Environmental Change, (2) Health and Livelihood Impacts, (3) Land Use Conflicts, (4) Governance and Policy Implementation, and (5) Coping Strategies and Institutional Support. All 11 participants are represented under each theme.

Table 4.10: Profile of Semi-Structured Interview Participants

Participant Code	Role/Stakeholder Group	Gender	Estimated Age Range	Area of Representation
SSI-01	Traditional Leader	Male	50–65	Kamusha Village
SSI-02	Community Health Worker	Female	30–45	Ward 14 Clinic
SSI-03	Environmental Management Officer (EMA)	Male	35–50	District Environmental Office
SSI-04	Ministry of Mines Official	Male	40–55	Provincial Office, Bindura
SSI-05	Farmer and Landowner	Male	45–60	Affected farmland in Kamusha
SSI-06	Ward Councillor	Male	35–50	Ward 14 Council
SSI-07	Local Headman	Male	50–70	Traditional Leadership Zone
SSI-08	School Teacher	Female	30–45	Local Primary School
SSI-09	Youth Representative	Male	20–30	Kamusha Youth Committee
SSI-10	Women's Group Leader	Female	35–50	Kamusha Women's Association
SSI-11	Chrome Transport Operator	Male	30–45	Mining Logistics Sector

4.4.1 Theme 1: Environmental Change

All stakeholders noted significant environmental degradation due to artisanal chrome mining. Common concerns included deforestation, polluted boreholes, dust from haulage trucks, and unrehabilitated open pits. These are summarised in Table 4.11.

Table 4.11: Stakeholder Observations on Environmental Change

Stakeholder	Observation Summary
Traditional Leader	Extensive forest loss; uncontrolled digging across communal lands.
Community Health Worker	pollution affecting household water access.
EMA Officer	Rampant land degradation; no resources for rehabilitation.
Ministry of Mines Official	Acknowledged surface disruption due to unregulated mining.
Farmer	Farming land contaminated by run-off and topsoil loss.
Ward Councillor	Residents complain of visible damage and dust hazards.
Local Headman	Mining activities are damaging ancestral and productive lands.
School Teacher	Dust pollution increasing in school zones.
Youth Representative	Play areas and youth spaces are overtaken by pits and vehicles.
Women's Group Leader	Firewood zones were lost to mining; women were forced to walk further.
Chrome Transport Operator	Roads are damaged; increased dust is affecting nearby homes.

"We used to have running streams, but now they're clogged with mud. Vegetation is disappearing." — *Traditional Leader*

4.4.2 Theme 2: Health and Livelihood Impacts

Participants linked mining to increased respiratory illness, skin infections, and loss of livelihoods. An urgent concern was the rise in school dropouts and teenage pregnancies, with

some girls being exploited by miners who offer money or groceries. These are summarised in Table 4.12.

Table 4.12: Stakeholder Observations on Health and Livelihood Impacts

Stakeholder	Observation Summary
Traditional Leader	Girls dropping out due to pregnancy; families destabilised.
Community Health Worker	Spike in infections and diarrhoea; poor water quality.
EMA Officer	Air quality is compromised; miners lack protective gear.
Ministry of Mines Official	No structured health or safety protocols in ASM areas.
Farmer	Decreased productivity due to poor soil and irrigation.
Ward Councillor	Child labour and dropout rates increasing.
Local Headman	Complaints of noise, unsafe conditions, and exploitation.
School Teacher	School absenteeism is linked to mining, pregnancies, and fatigue.
Youth Representative	Reports of underage sexual exploitation
Women's Group Leader	Increased burden on mothers; high teen pregnancy rates.
Chrome Transport Operator	Persistent respiratory problems from dust.

"You find a girl with a baby and no support. The miner is nowhere to be found." — *Women's Group Leader*

4.4.3 Theme 3: Land Use Conflicts and Social Tensions

Interviewees noted frequent disputes between miners and farmers, often caused by lack of zoning, illegal land occupation, and marginalisation of traditional authorities. These are summarised in Table 4.13.

Table 4.13: Stakeholder Observations on Land Use Conflicts

Stakeholder	Observation Summary

Traditional Leader	The land was taken without consultation; elders were sidelined.
Community Health Worker	Tensions between neighbours over land boundaries.
EMA Officer	Mining sites often overlap with protected areas.
Ministry of Mines Official	Weak enforcement of land use zoning.
Farmer	Fields destroyed by heavy machinery and pits.
Ward Councillor	Bylaws are ineffective; no mechanism to address complaints.
Local Headman	Traditional systems are ignored in favour of political power.
School Teacher	School fences were encroached upon by trucks and miners.
Youth Representative	Community conflict deters youth engagement.
Women's Group Leader	Women were excluded from land decisions.
Chrome Transport Operator	Faced with threats and protests over road access.

4.4.4 Theme 4: Governance and Policy Implementation

Participants highlighted severe enforcement gaps, under-resourced institutions, and a lack of coordination. EMA and the Ministry of Mines were described as reactive, while traditional and local leaders lacked decision-making power. These are summarised in Table 4.14.

Table 4.14: Stakeholder Observations on Governance

Stakeholder	Observation Summary
Traditional Leader	Regulations bypass customary authority.
Community Health Worker	No inspections or health outreach in mining zones.
EMA Officer	Shortage of fuel, staff, and field equipment.
Ministry of Mines Official	ASM policy exists but remains largely on paper.
Farmer	No compensation or engagement on land loss.
Ward Councillor	No training or support from central ministries.
Local Headman	Decisions are made without community participation.
School Teacher	No protection of school zones under mining law.

Youth Representative	Youth ignored in mining planning.
Women's Group Leader	No women consulted or trained.
Chrome Transport Operator	Confusing permit system; corruption reported.

4.4.5 Theme 5: Coping Strategies and Institutional Support

Stakeholders described coping strategies such as reducing farm size, hosting community dialogues, forming informal groups, and petitioning for government support — with limited success. These are summarised in Table 4.15.

Table 4.15: Stakeholder Observations on Coping Strategies

Stakeholder	Observation Summary
Traditional Leader	Called village meetings; but no response from the authorities.
Community Health Worker	Raised concerns at clinics; no results.
EMA Officer	Conducted workshops, but they lacked follow-up.
Ministry of Mines Official	Proposed formalisation; not yet implemented.
Farmer	Reduced cropping area; moved to livestock.
Ward Councillor	Suggested by-laws for land control.
Local Headman	Mediated disputes informally.
School Teacher	Organised school-parent dialogues.
Youth Representative	Formed informal safety and support network.
Women's Group Leader	Petitioned for water infrastructure.
Chrome Transport Operator	Avoided mining hotspots and coordinated routes.

These results demonstrate strong thematic convergence among institutional stakeholders. Concerns about environmental damage, youth vulnerability, institutional inaction, and social fragmentation dominated responses. These insights support the study's second and third objectives by revealing how artisanal chrome mining affects communities and tests the limits of current policy frameworks.

4.4.6 Thematic Results Summary

Table 4.16 is evidence that the results demonstrate strong thematic convergence using findings from the semi-structured interviews and the focus group discussions

Table 4.16: Summary of Socio-Economic Impacts by Stakeholder Subgroup

Stakeholder Group	Livelihood Impacts	Health Impacts	Land Use Impacts	Additional Notes
Local Community Members	- Reduced income from farming due to soil damage- Increased dependency on mining-based vending	- Respiratory issues from dust- Contaminated water sources- Rising teenage pregnancies	- Loss of communal farming plots- Restricted grazing space	Reported increase in crime, alcohol abuse, and school dropouts
Artisanal Miners and Workers	- Irregular income, mostly cash-based- No formal contracts or protections	- Injuries from unprotected pits- No PPE- Fatigue from long hours	- Occupy land without long-term claims- Often in conflict with farmers	Expressed frustration over the lack of support or training from the government
Agricultural Workers and Landowners	- Loss of crops and income- Land disputes with miners	- Exposure to polluted irrigation water- Anxiety over land loss	- Destruction of irrigation infrastructure- Encroachment by mining activities	Resentment over lack of consultation or compensation
Traditional Leaders and Councillors	- Undermined by state-issued permits overriding community input	- Stress from managing rising conflict and violence	- Limited power to prevent land misuse by outsiders	Demand stronger role in land and resource governance

Government & Regulatory Officials	- Lack of capacity to formalise or monitor miners	- Frustration at limited health and safety enforcement	- Aware of land abuse but poorly resourced to intervene	Acknowledge the need for stronger inter-agency coordination

CHAPTER 5: DISCUSSION

5.1Introduction

This chapter interprets and synthesizes the findings presented in Chapter 4 concerning the study's objectives and research questions. The discussion is organized around three major themes that align with the study objectives: environmental impacts of artisanal chrome mining, socio-economic consequences for local communities, and the effectiveness of regulatory frameworks. By integrating insights from GIS analysis, focus group discussions (FGDs), and semi-structured interviews (SSIs), the chapter provides a comprehensive understanding of how artisanal chrome mining has reshaped Kamusha, Ward 14, Mvurwi.

5.2 Environmental Impacts of Artisanal Chrome Mining (Objective 1, RQ1)

Geospatial analysis using GIS confirmed that land use and land cover (LULC) in Kamusha changed significantly between 2021 and 2024, with a notable increase in bare land and a decrease in vegetative cover. These changes are attributed to unregulated artisanal chrome mining operations. Community members and local officials reported extensive deforestation, open pits, and polluted water sources. EMA officers acknowledged limited capacity to monitor these sites. These findings are consistent with previous research (e.g., Sithole & Nyamadzawo, 2020) on environmental degradation from ASM in Zimbabwe.

5.3 Socio-Economic Impacts on Livelihoods, Health, and Land Use (Objective 2, RQ2)

Artisanal mining has disrupted livelihoods, reduced agricultural productivity, and contributed to serious health and social challenges. Farmers have lost access to productive land, while miners

operate in unsafe conditions without protective equipment. Community health workers and residents reported increased respiratory illness and cases of teenage pregnancy linked to miners. School dropouts and food insecurity were also common. Thematic analysis of FGDs and SSIs revealed these impacts were more severe among women and youth and echoed regional patterns of vulnerability documented in ASM literature.

5.4 Governance, Policy Gaps, and Enforcement Challenges (Objective 3, RQ3)

Although Zimbabwe's Mines and Minerals Act and Environmental Management Act exist to regulate mining activities, their enforcement in Kamusha is weak. Interviews with EMA and Ministry of Mines officials revealed that lack of resources, overlapping mandates, and bureaucratic inefficiencies undermine implementation. Traditional leaders felt excluded from decision-making, and most miners resisted formalisation due to high costs. This disconnect between policy and practice illustrates governance failures, supporting findings from ZELA (2020) and Mangena (2014). As illustrated in Table 5.1, there is a significant gap between statutory mining requirements and the realities on the ground in Kamusha, largely due to weak enforcement and limited institutional capacity.

Table 5.1: Comparison Between Mining and Environmental Laws and Field Realities in Kamusha

Policy/Act	**Legal Provisions**	**Field Reality in Kamusha**
Mines and Minerals Act (Chapter 21:05)	Requires formal registration and licensing for all mining operations.	Most artisanal miners operate informally without licences due to costs and red tape.
	Provides for land access only after consultation with landowners and community.	Traditional leaders and landowners report being bypassed during land allocation decisions.

	Mining permits should not override customary land use rights without due process.	Displacement of farmers is common; land conflicts are unresolved due to a lack of community input.
Environmental Management Act (Chapter 20:27)	Mandates Environmental Impact Assessments (EIAs) before mining activities begin.	EIAs rarely conducted for ASM; EMA officials report limited enforcement capacity.
	Empower EMA to monitor environmental compliance and penalize violations.	EMA presence in Kamusha is minimal due to a lack of vehicles, fuel, and manpower.
	Requires rehabilitation of mined land.	Open pits and deforestation persist; no rehabilitation is observed in artisanal mining sites.
Statutory Instruments (e.g., SI 92 of 2014)	Sets regulations for waste management and water use in mining zones.	Waste is disposed of in rivers and open land; water contamination is widely reported.
National ASM Policy (2020)	Promotes formalisation and technical support for artisanal miners.	No support structures exist locally; most miners are unaware of the policy or its benefits.

5.5 Community Coping Mechanisms and Resilience

In response to the disruptions caused by mining, communities have adopted coping strategies including livelihood diversification, informal dispute resolution, and youth and women-led advocacy. However, these efforts are largely unsupported by formal institutions and remain fragile. Sustainable resilience requires stronger institutional collaboration and formal recognition of community structures.

5.6 Synthesis with Study Objectives

The findings of the study align with all three research objectives. GIS data validated changes in LULC (Objective 1), qualitative data documented health and livelihood impacts (Objective 2),

and stakeholder feedback exposed weaknesses in policy enforcement (Objective 3). The study demonstrates how unregulated ASM in Kamusha affects both the environment and the well-being of rural populations while highlighting the failure of existing regulations to control these outcomes.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study assessed the environmental and socio-economic impacts of artisanal chrome mining in Kamusha, Ward 14, using a mixed-methods approach. GIS analysis revealed significant environmental degradation, while FGDs and SSIs highlighted serious socio-economic consequences, including reduced agricultural output, health risks, and weakened governance. The research objectives and questions were adequately addressed, contributing to knowledge of rural ASM dynamics in Zimbabwe.

6.2 Recommendations

The following recommendations are proposed based on the study findings:

- Equip EMA and relevant agencies with adequate resources for monitoring.
- Simplify ASM formalisation processes to encourage compliance.
- Integrate GIS monitoring into local planning and land management.
- Support livelihood diversification and agricultural rehabilitation.
- Improve youth and women-focused development programmes.
- Enhance community participation in mining governance.

6.3 Areas for Further Research

Future research should explore the long-term health outcomes of mining exposure, the effectiveness of policy interventions, and quantitative measures of economic losses due to land degradation. Comparative studies across districts could deepen understanding of ASM dynamics in Zimbabwe.

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APPENDICES

Appendix A

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FOCUS GROUP DISCUSSION GUIDE

Researcher: Ropafadzo Dzumbunu
Programme: MSc in Occupational Health, Safety, and Environmental Management
Study Title: *Environmental and Socio-Economic Impacts of Artisanal Chrome Mining in Kamusha, Ward 14, Mvurwi*
Supervisor: Dr. Mabhungu, Department of Environmental Science, Bindura University of Science Education
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Introduction

My name is Ropafadzo Dzumbunu, and I am a postgraduate student at Bindura University of Science Education. I am conducting a study on the *environmental and socio-economic impacts of artisanal chrome mining in Kamusha, Ward 14*. I would like to invite you to participate in this focus group discussion to help me understand your experiences and perceptions related to this issue.

Participation is voluntary. Your responses will be kept confidential, and pseudonyms will be used instead of your real names. You are free to leave the discussion at any point without any consequences. The discussion will be audio-recorded (with your permission) and will last approximately **60 to 90 minutes**.

If you agree to participate, please sign the consent form provided.

Signature: _____

Date: ___ / ___ / 2025

Group Information

- **FGD Code:** FGD–[Group Type/Number]
- **Stakeholder Group:** (Community Members / Miners / Farmers)
- **Venue:** _____
- **Ward/Village:** _____
- **Date:** ___ / ___ / 2025
- **Start Time:** _____
- **End Time:** _____

Ground Rules

- Only one person speaks at a time.
- Everyone's opinion is important and should be respected.
- Mobile phones should be in silent mode.
- Participants are free to disagree respectfully.
- There are no right or wrong answers.

Discussion Themes and Questions

(Facilitator to guide and prompt discussion where needed. Use probes as appropriate.)

1. Perceptions of Environmental Change

- What environmental changes have you observed in your area over the past 3–5 years?
- Has there been any change in vegetation, water quality, or soil?
- What do you think has caused these changes?

2. Health and Livelihood Impacts

- How has chrome-mining affected people's health in your community?
- Are there specific diseases or injuries you think are related to mining?
- Has mining improved or worsened your ability to earn a living?
- For farmers: how has mining affected agricultural productivity?

3. Land Use Conflicts and Social Dynamics

- Have there been conflicts between miners and farmers? What happened?
- How are land disputes or mining-related disagreements resolved?
- What role do traditional leaders play in these matters?

4. Coping and Community Responses

- What strategies have individuals or households used to cope with the negative effects of mining?
- Have there been any community-level initiatives or assistance?
- Do you think authorities have done enough to manage mining in this area?

Closure and Reflection

- Is there anything else you would like to add?
- What message would you want to send to policymakers or local leaders?

Vote of Thanks (Facilitator):

Thank you for taking the time to share your experiences and ideas. Your input is very important and will help improve understanding and support better environmental and social outcomes in our community.

Appendix B

BINDURA UNIVERSITY OF SCIENCE EDUCATION
P. Bag 1020, Bindura, Zimbabwe
Tel. (+263) 712 842 712-4

SEMI-STRUCTURED INTERVIEW GUIDE

Researcher: Ropafadzo Dzumbunu
Programme: MSc in Occupational Health, Safety, and Environmental Management
Study Title: *Environmental and Socio-Economic Impacts of Artisanal Chrome Mining in Kamusha, Ward 14, Mvurwi*
Supervisor: Dr. Mabhungu, Department of Environmental Science
Email: Ropafadzodzumbunu@gmail.com
Cell: 0774948779

Introduction to Participant

Good day. My name is Ropafadzo Dzumbunu, and I am conducting a study on the *environmental and socio-economic impacts of artisanal chrome mining in Kamusha, Ward 14, Mvurwi*. I would like to ask you some questions based on your role and experience in the community or institution.

Participation is voluntary and you may skip any questions or stop the interview at any time. Your responses will be kept confidential and only used for academic purposes. With your consent, this interview will be audio-recorded and will take approximately **30 to 60 minutes**.

Do you consent to participate in this interview?
Yes / No
Signature of Participant: _____
Date: ___ / ___ / 2025

Interviewee Information

- **Interview Code:** SSI–[Stakeholder/ID]
- **Role/Title: _____**
- **Organisation/Affiliation: _____**
- **Location: _____**
- **Date: ___ / ___ / 2025**
- **Start Time: _____**
- **End Time: _____**

Interview Questions and Prompts

1. Background and Role

- Can you briefly describe your role in this community or institution?
- For how long have you been in this role?

2. Observations of Environmental Change

- Have you noticed any environmental changes in Kamusha over the last few years?
- What specific impacts have you observed related to land degradation, vegetation loss, or water quality?

3. Health and Livelihood Concerns

- In your opinion, how has artisanal chrome mining affected the health of residents?
- Are there particular health concerns or cases that stand out?
- How has the community's livelihood been impacted—positively or negatively?

4. Land Use Conflicts and Community Relations

- Have you encountered or mediated any disputes between miners, landowners or farmers?
- How are these conflicts usually resolved?
- What challenges arise in regulating land use when mining overlaps with agriculture?

5. Governance and Policy Implementation

- What laws or policies govern artisanal mining in this area (e.g., Mines and Minerals Act, EMA Act)?
- How effectively are these policies being enforced in Kamusha?
- What challenges does your office/community face in enforcing or complying with these regulations?

6. Institutional Response and Support

- What has been done by your institution to manage the impacts of artisanal mining?
- Have there been any interventions, public meetings, or rehabilitation efforts?
- How does your office work with traditional leaders or community members to manage mining issues?

7. Recommendations

- What changes or support would you recommend to improve the situation?
- Are there any policy reforms or practical solutions you believe could make a difference?

Closure

- Is there anything else you feel is important that we haven't discussed?
- Would you be willing to review a summary of the study findings once the research is complete?

Vote of Thanks:

Thank you for taking the time to share your insights. Your contribution is valuable and will help inform efforts to improve environmental management and community well-being in mining-affected areas.