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**Barriers to community involvement in forest fire management and strategies to enhance community participation in Ward 19 Bindura District, Mashonaland Central, Zimbabwe**

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## DEDICATION

This dissertation is dedicated to the resilient and passionate communities of Ward 19 in Bindura District, Mashonaland Central, Zimbabwe. Your unwavering commitment to protecting and preserving your natural environment in the face of numerous challenges has been a profound source of inspiration throughout this research journey. To my family, whose unwavering support and encouragement have been my anchor, thank you for believing in me and providing the strength I needed to complete this work. Especially my mother's prayers have been the bedrock of my work "*Ngiyabonga Madawu*", your love and understanding have been invaluable. To my academic advisor Dr. Manyangadze your guidance, wisdom and insightful critiques have been instrumental in shaping this dissertation. Your dedication to educational excellence and commitment to fostering a deeper understanding of community dynamics and environmental management have been truly motivating. Finally, to all those who work tirelessly towards sustainable forest fire management and community involvement, your efforts are deeply appreciated and have not gone unnoticed. May this research contribute to the ongoing dialogue and inspire effective strategies for enhancing community participation in environmental stewardship.

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## ABSTRACT

Forest fires threaten communities, ecosystems, and economies globally. In Zimbabwe, forest fires cause environmental degradation, loss of biodiversity, and in some cases loss of property and human lives. Forest fire monitoring programs should involve local communities in fire prevention, detection, and response, thus enhancing community resilience. As such, this study investigated the effectiveness of implementing participatory forest fire monitoring systems in Ward 19, Bindura. This study sought to determine the role of the community in the existing forest fire management systems, identify the barriers to community involvement in forest fire management systems, and establish enhancement strategies for community involvement in forest fire management. The study used a cross-sectional design for the assessment of barriers to community involvement in forest fire management. In addition, a randomized design was employed in selecting the study participants. The research tools used in this study were questionnaires, focus group discussions (FGDs), key informant interviews, and personal observations. The major causes of forest fires in Ward 19 were agriculture, hunting, and gold panning, whereas the major forest fire management systems implemented by respondents in Ward 19 were fireguards and firebreaks. The barriers to community involvement in forest fire management were lack of knowledge and unfriendly weather conditions. On the other hand, the major challenges to participation in community forest fire management were lack of manpower, knowledge, and funding. The most mentioned strategies for enhancing community involvement in forest fire management in Ward 19, were increasing manpower, improving tools and equipment, and awareness campaigns. It was also deduced that gender, marital status, and residence period significantly influenced community forest fire management participation. From the study outcomes, it can be recommended that the community should be trained on fire-fighting, and awareness campaigns should be done to increase community participation in forest fire management. Also, policies that mandate farmers to acquire a permit before burning should be formulated. In addition, communities should continuously maintain fireguards and minimize burning.

*Keywords:* barriers, challenges, community involvement, forest fire, and management.

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## **LIST OF ACRONYMS**

CBD – Convention on Biological Diversity

CBFiM – Community-Based Fire Management

EMA – Environmental Management Agency

FAO – Food and Agriculture Organisation

UNFCCC – United Framework Convention on Climate Change

UNCCD – United Nations Convention to Combat Desertification

UNISDR – United Nations Office for Disaster Risk Reduction

## CHAPTER 1: INTRODUCTION

### 1.0 Introduction

Forest fires pose significant threats to communities, ecosystems, and economies worldwide. In Zimbabwe, forest fires are a recurring phenomenon, particularly during the dry season, causing environmental degradation, loss of biodiversity, and endangering human lives and property. Participatory approaches to forest fire monitoring empower local communities to actively engage in fire prevention, detection, and response, thereby enhancing community resilience. This research proposes to investigate the effectiveness of implementing participatory forest fire monitoring systems in Ward 19, Bindura District, Mashonaland Central, Zimbabwe, as a means to enhance community resilience.

### 1.1 Background of the study

Forest fires are a pervasive environmental issue with far-reaching ecological, economic, and social consequences. Globally, they contribute to the degradation of ecosystems, loss of biodiversity, and release of greenhouse gases into the atmosphere (Bowman *et al.*, 2017). According to recent studies, the occurrence and severity of wildfires have been on the rise worldwide due to climate change, land-use practices, and human activities (Bowman *et al.*, 2017). These fires not only contribute to the loss of biodiversity and habitat destruction but also emit large quantities of carbon dioxide and other greenhouse gases (GHGs) into the atmosphere, thus aggravating climate change (Hanston *et al.*, 2016).

In Africa, forest fires are a recurring issue, particularly in regions with a dry climate and extensive forest cover. Zimbabwe, located in southern Africa, experiences periodic outbreaks of forest fires, driven by factors such as prolonged droughts, land-use changes, and human activities (Mugandani *et al.*, 2012). These fires significantly affect biodiversity conservation, soil fertility, and water resources, affecting both rural and urban communities. Within Zimbabwe, the Mashonaland Central Province, where the Bindura District is situated, grapples with forest fire incidents that threaten agricultural productivity and livelihoods. The spread of forest fires is often exacerbated by deforestation, illegal logging, and inadequate fire management practices. Consequently, there is an urgent need for comprehensive strategies to address the root causes of forest fires and build resilience at the local level.

Ward 19, nestled within the Bindura District, is characterized by a mosaic of forests, farmland, and human settlements on the far end. The community relies heavily on forest resources for farming purposes, fuelwood, timber, and non-timber forest products, making them vulnerable to the impacts of forest fires. The recent increase in forest fire incidents has raised worries pertaining the sustainability of forest ecosystems and the resilience of local livelihoods. Furthermore, the socio-economic context of Ward 19, marked by poverty, limited access to resources, and inadequate infrastructure, compounds the challenges posed by forest fires. Vulnerable populations, including women, children, and the elderly, are disproportionately affected by the loss of forest resources and disruptions to agricultural activities. In light of these challenges, the importance of community-based approaches to forest fire management has been under the spotlight. Engaging local communities in monitoring, prevention, and response efforts can enhance resilience and promote sustainable development in Ward 19.

In response to the escalating threat of forest fires, there is a growing recognition of the importance of community involvement in forest fire management. Participatory approaches empower local communities to take ownership of forest resources and implement sustainable management practices (Charnley *et al.*, 2018). By engaging community members in forest fire monitoring, prevention, and response activities, it is possible to enhance resilience and reduce the environmental and societal adverse effects of forest fires.

This research seeks to address the gap in knowledge regarding the implementation of participatory forest fire monitoring systems in Ward 19, Bindura District. By conducting empirical research and engaging with local communities and stakeholders, this study aims to develop context-specific recommendations for the design and implementation of effective forest fire management strategies. Through collaborative efforts between researchers, local authorities, and community members, it is hoped that this research will contribute to building resilience and promoting sustainable development in the face of increasing forest fire risk.

## **1.2 Problem statement**

Although fire plays an essential function in the vegetation structure, and composition and aids in the nutrient recycling, the big worry is that frequency, magnitude, and trends of burning have increased to unbearable levels attributed to anthropogenic activities. To sustain livelihood fire has saved men in their efforts to do land clearing for arable, and removal of unwanted plant species

from the pastures. Forest fires have destroyed large tracts of land making it vulnerable to wind and water erosion. These have destroyed species diversity and perpetuation. Communities experience environmental loss through forest fires, Dube (2015) though regulatory instruments are present, for example, the Forest Act Chapter 19:05, the Parks and Wildlife Act (CAP 20:14) of 1996, and EMA Chapter 20:27. This study on barriers to community involvement in forest fire management and strategies to enhance community participation in Ward 19, Bindura District, Mashonaland Central Province, Zimbabwe was motivated by the fact that the ward faces recurring challenges due to forest fires, posing threats to biodiversity and local communities. According to Nyamadzawo *et al.* (2013) forest fires remain a perennial problem though several governing laws are available. Svotwa *et al.* (2007) emphasized that fire has destroyed property and loss of life around the world causing disturbance to the natural balance of the ecosystems. Commercial farms are the most vulnerable than any other species because among other things, they are isolated and crop residue acts as fuel, especially within Bindura District where most fires sprout up in commercial farmlands. In their study, Svotwa *et al.* (2007) assessed the risk of forest fires in the Norton farming community of Zimbabwe. This was aimed at developing a community-based fire monitoring and management control strategy after realizing the adverse effects have been seized with little or no efforts to at least minimize indiscriminate burning through localized and national awareness campaigns and enactment of legislation to guide the use of fire. Community members are not involved as a primary source in forest fire monitoring and management. This transfers the responsibility to secondary sources including the Environmental Management Agency (EMA), whose response is delayed due to a time-lapse from the point of detection to the point of a report thus a lot of damage that could have been mitigated, is incurred. Problems that are a result of forest fires (global warming, air pollution, destruction of aesthetic beauty, loss of wildlife, food, and habitats, etc.).

### **1.3 Main Objective**

To determine barriers to community involvement in forest fire management and establish strategies to enhance community participation in Ward 19 of Bindura district.

### **1.4 Specific objectives**

- 1) To determine the role of the community in the existing forest fire management systems.
- 2) To identify the barriers to community involvement in forest fire management.



- 3) To establish strategies for enhancing community involvement in forest fire management.
- 4) To determine factors influencing community participation in forest fire management.

## **1.5 Main research question**

What are the barriers to community involvement in forest fire management and which strategies should be employed to enhance community participation?

### **1.5.1 Research questions**

- 1) What is the role of the community in the existing forest fire management system?
- 2) What are the barriers to community involvement in forest fire management?
- 3) Which strategies should be employed to enhance community involvement in forest fire management?
- 4) What are the factors influencing community participation in forest fire management?

## **1.6 Justification of the study**

This study is justified by the urgent need for effective forest fire monitoring and management strategies at community level in the Bindura District, Mashonaland Central Province, Zimbabwe, to protect biodiversity and local communities. By enhancing community resilience through participatory forest fire monitoring systems, this research aims to address the limitations of traditional methods and provide valuable insights into a more efficient and accurate approach. The findings will add empirical knowledge on community-based participation in fire monitoring systems and fire management, informing policy decisions and enhancing strategies for mitigating the impact of forest fires. Furthermore, this study supports the broader goal of sustainable environmental monitoring and disaster management practices.

## **1.7 Assumptions**

The study assumes that there are several causes of forest fires in Ward 19, and the community members seldom participate in forest fire management due to varying barriers and challenges. Also, the strategies they employ to manage forest fires could be inadequate, which could lead to huge damages and losses in the event of fire outbreaks.

## **1.8 Limitations**

- The study will mainly focus on Ward 19 community in Bindura.

- The study will center on barriers, challenges, and strategies of enhancing community forest fire management.
- The study will assume that gender, age, marital status, educational level, and residence period as the major factors influencing participation in community forest fire management.

## **1.9 Conclusion**

This research aims to contribute to the existing knowledge base and fill the gap in understanding the enhancement of community resilience and participation in forest fire monitoring systems in Ward 19 Bindura District. There is a need for research because of the continued occurrence of forest fires whereas the Government has enacted acts to curb and control fire monitoring and management processes through the Environmental Management Agency. This study seeks to assess the trends in fire occurrence within Bindura District and the implementation of community-based forest fire monitoring systems. The findings of this study can inform policy decisions, enhance fire management strategies, and facilitate the integration of community-based forest fire monitoring techniques into existing frameworks for environmental monitoring and disaster management.

## CHAPTER 2: LITERATURE REVIEW

### 2.0 Introduction

The chapter presents the literature found to be related to the study. Thus, it presents a literature review on which the research is based. It also presents the gaps that exist in earlier research. The researcher was assisted by sources that include journals, books newsletters, the internet, and published and unpublished scholarly works. Several theories were analysed in this chapter theories to do with legal interventions to prevent and control forest fires and theories analysing the causes of forest fires. Strategies to prevent and control forest fires were discussed. The framework for Fire Communication Strategy in Zimbabwe was presented and the weaknesses were highlighted. Access, and use such woods are not directly addressed by Zimbabwe's present forest policy or legislative framework, according to Mohomed Katerere (2000). Effective execution of the law's provisions is essential. Starting a forest fire was considered a crime under colonial policy. It failed to acknowledge the ecological reality that burns are essential to preserving the natural ecosystem.

According to the Environmental Management Act, Chapter 20:27, it is forbidden for to start a fire from July 31 to 31 October on the environment (Government of Zimbabwe 2002a). Matose (1999) documents that most forest fires were attributed to the negligent nature of the natives. Africans used it to rebel against white settlers for refusing them access to natural resources. It was against this background that a strong emphasis on criminality was put in drafting the Forest Act. The Forest Act Chapter 19.05 is the country's supreme act that dwells on fire management issues, with Section 78 considering it an offense to start a fire, leave it unattended, and refuse to take part in extinguishing fires on any land. The application of this act in Zimbabwe has largely been done in state forests, where the government has a keen interest in high commercial value timber resources.

It is interesting to note that the Forest Act was imported into the independent Zimbabwe. Matose (1999) further observed that this was possible because there were not any notable changes in the land tenure system to warrant any alterations since most of the prime farming and forest land was largely owned by white colonialists. The Forest Act focuses much on state forests, a scenario that leaves a void in the management of fires outside the state forests. Techniques for managing fires to prevent the loss of forests and agricultural land, environmental policies and other environmental protection laws have been implemented (Zimbabwe Environmental Policy, 2003; Statutory Instrument 116 of 2013). This is done to make sure that the ecosystems can continue to sustainably

produce goods and provide environmental services. Zimbabwe has prioritized both in-situ and ex-situ conservation as an adaptation strategy for the preservation of forest and rangeland ecosystems, and it has extended this effort to forest habitats outside of conventional protected conservation areas. This stipulates that to find these new locations that will be designated as conservation zones, local government representatives and traditional leaders must be involved.

The promulgation of statutory instrument 7 of 2007, (Ecosystems Protection and EIA Regulations) under the Environmental Management Act Chapter 20:27 sought to redress the fire management in all lands in Zimbabwe. The regulation came as an addition and not as a substitution of the Forest Act. The said regulation stipulates the protective procedures in the management of veldt fires in both commercial and non-commercial areas. Its roots are however rooted in the anti-fire policy. The effectiveness of these regulations however is questionable since not all farmers are adhering to them. Implementation is affected by a lack of both financial and human resources as well as a lack of institutional coordination.

## **2.1 Forest fires and their effects**

### **2.1.1 Beneficial effect**

Forest fires clear out accumulated dead vegetation, creating space and resources for new growth. This renewal process is essential for maintaining ecosystem health and biodiversity. In fire-adapted ecosystems such as many pine forests, certain plant species have evolved to depend on periodic fires for seed germination and growth. For example, as noted by Stephen *et al.* (2020), some pine species have serotinous cones that only open after exposure to intense heat from a fire releasing seeds and allowing for regeneration.

According to Keeley *et al.* (2012), when vegetation burns nutrients such as nitrogen, phosphorus, and potassium are released from plant tissues and returned to the soil in the form of ash. This nutrient rich ash acts as a natural fertilizer replenishing soil fertility and promoting the growth of new vegetation. The rapid decomposition of burned organic matter further contributes to nutrient cycling, ensuring that essential nutrients are available for plant uptake. Also, in addition to directly supplying nutrients to the soil forest fires can indirectly enhance nutrient cycling by stimulating microbial activity and decomposition processes. The influx of organic matter from burned vegetation provides a rich substrate for soil microorganisms, which break down dead plant material and release nutrients through mineralization and decomposition (Certini, 2005). Supported by

DeBano *et al.* (1998), these nutrients are then incorporated into the soil organic matter pool, where they become available for plant uptake or further cycling through microbial processes.

Fire is constantly utilized in veldts and forests to manage grazing areas and habitats. Additionally, most annual plants can be established from seed using fires. According to FAO (2006), fire can be useful for maintaining natural ecosystems. Veldt fires aid the regeneration cycle of grasses, trees, and plants. The maintenance, distribution and operation of fire-prone systems, including Savannah ecosystems are thought to be significantly impacted by this frequent and natural event that has been happening for millions of years (Bond and Keeley, 2005). The majority of Zimbabwe's rural livelihoods are dependent upon natural resources, but little is known about how to use them most effectively and sustainably in terms of technology, value adding processes and diversity of uses.

The existing methods of managing fires are expensive, spatially constrained, and unsuccessful. Therefore, encouraging individuals to take part in environmental conservation has not been simple (Chenga, 2009). It is vital to refrain from activities that destroy the environment because fire, although a useful tool for managing veldt, can cause irreparable damages in not properly managed (Nkomo and Sassi, 2009). Additionally, forest fires create a patchy landscape with a mosaic of different vegetation types at various stages of succession., which support a wide range of plant and animal species, each adapted to specific environmental conditions. For example, as noted by Stephens *et al.* (2020), open grasslands created by fires may provide habitat for species such as deer and elk, while dense regenerating forests offer nesting sites for birds such as woodpeckers and thrushes.

### **2.1.2 Adverse effects**

There are numerous negative repercussions of forest fires. According to Dube (2015), forest fires ruined livelihoods, ruined flora and animals, and contaminated the air and water. Wildfires may have short-term effects on the ecosystem, but they can also have long-term, possibly irreversible repercussions on biodiversity. According to Nkomo and Sassi (2009), many farmers continue to conduct harmful fires, and some of them have caused harm to the ecosystem. The destruction of the fields by veldt fires significantly affect livestock development and raising. The management of wildlife is seriously threatened by veld fires, which damage pastures and force animals to

migrate. The tourism sector is impacted by this. The uncontrolled, roaring fires have claimed the lives of some animals.

Forest fires are a concern because they can endanger the lives of people and animals and cause environmental and property damage. Effective forest fire management techniques necessitate an understanding of the detrimental impacts of fire. This means that the best way to avoid veldt fires is through education and awareness. The advantages of fire for the environment are outweighed by the harm caused by forest fires. The most common ecological disturbances in Zimbabwe are veldt fires, which are most noticeable during the dry season and before the onset of rain season when the woodlands contain highly combustible material (Tsiko, 2006). As reported by Nkomo and Sassi (2009), Zimbabwe lost immeasurable and valuable environmental goods and services due to wildfires. In addition, as noted by Global Finance (2012), the Fast track Land Reform Program of Zimbabwe resulted in new conserved areas being converted arable land. Approximately 11 million hectares of land were opened up for agricultural expansion resulting in a 12% loss of forest cover.

The loss of basal cover hastens soil erosion, which causes waterbodies to silt, which means there will be less water available for irrigation and cattle. As a result, wildfires have cumulative consequences on the ecosystem, with the adverse impacts highly dependent on fire frequency, timing, intensity, and magnitude. Uncontrolled burning reduces biodiversity, ruins plants and animals, depletes soil fertility, increases erosion, and compacts the soil, which raises surface runoff and lowers infiltration.

## **2.2 Legal Interventions to control forest fires**

The impacts of forest fires have led Zimbabwe and other countries in Africa enacted legislation to control them. Policies and legal frameworks are both accommodated by these initiatives. Madagascar has rules that lay the groundwork for stopping wildfires, much like Zimbabwe does (Chigurah *et al.*, 2010). According to the Lesotho Forest Act (1998), there is a fine for anyone found to have started a fire. Section 4 of The National Veld and Forest Fire Act Number 101 of 1998 in South Africa mandates that all landowners construct and maintain a fire buffer, according to Bridgett *et al.* (2003). Saket (1999) states that the Mozambican National Forest and Wildlife Law, Section 40, considers the issue of forest fires as a criminal offense.

In Zimbabwe, two laws and regulations were implemented to safeguard natural resources: the Natural Resources Act (No. 9) of 1941 and the Native Land Husbandry Act of 1951 (Stocking 1978). The Natural Resources Board was created to police fire safety laws in protected forests, nature reserves, and commercial and communal farming areas. Zimbabwe's current fire safety system, was developed in the 1960s, and is based on early detection, quick response, and suppression. According to Nyamadzawo *et al.* (2013) forest fire control has roots in the colonial era, and they were on the same wavelength. Therefore, the problem still exists even after multiple pieces of legislation designed to put out veldt fires have been passed. Only when laws are actively enforced can they be considered effective. According to Mohamed Katerere (2000), Zimbabwe's current legislative framework and forest policy do not address the rights of communities residing near protected forests to own, access, and use such woods. The requirements of the legislation must be carried out effectively. Colonial policies saw it as a felony to start a forest fire. It disregarded the ecological fact that burns are necessary to maintain the integrity of the natural environment. According to Matose (1999), the most forest fires were caused by the native people's negligence. Africans rebelled against white colonists using it as a weapon because they were denied access to natural resources.

The promulgation of Statutory instrument 7 of 2007, (Ecosystems Protection and EIA Regulations) under the Environmental Management Act Chapter 20:27 sought to redress the fire management in all lands in Zimbabwe. The regulation came as an addition and not as a substitution of the Forest Act. The said regulation stipulates the protective procedures in the management of veldt fires in both commercial and non-commercial areas. Its roots are however rooted in the anti-fire policy. The effectiveness of these regulations however is questionable since not all farmers are adhering to them. Implementation is affected by a lack of both financial and human resources as well as a lack of institutional coordination.

### **2.3 Barriers and challenges in forest fire management**

According to Holdo *et al.*, (2017), Zimbabwe faces challenges in providing adequate financial resources, equipment, and personnel to help manage forest fires. Insufficient funding for fire management agencies can lead to the demise of investment in fire prevention measures. These prevention measures include fuel reduction treatments and community outreach programs. Also,

delimitations of firefighting equipment and able-bodied personnel can hinder the capacity to stop the spread of forest fires quickly and efficiently leading to more ravaging and damaging wildfires.

Additionally, climate change poses danger and further exacerbates forest fires in Zimbabwe, with the rapid change of weather patterns and intensified temperatures promoting drought conditions. These changes are drivers of favorable conditions for forest fires, hence prolonged fire seasons and an increased frequency and intensity of fires. According to Ziervogel *et al.*, (2014), the rise in temperatures and reduced rainfall exacerbates dry vegetation making landscapes more susceptible to ignition and fire spread. Moreover, the structure of the forest, the topographic conditions, and the prevailing climate in the Republic of Korea make the country vulnerable to forest fires. In addition, the mountainous terrains, irregular seasonal winds and changes in climate, increase the spread of fire rapidly, resulting in 58% forest fire incidences from 2010 to 2019.

Chikumbu et al (2016) support that education and public awareness about fire prevention and safety measures are fundamental for effective forest fire management. Most communities in Zimbabwe especially the rural areas may lack awareness of the risks associated with forest fires and also have no access to information on fire prevention and response mechanisms.

## **2.4 Strategies for Enhancing Forest Fire Management**

The forest fire management strategy has been developed from the ratification of Multilateral and regional environmental agreements (MEAs) Conventions/ treaties/protocols or agreements. MEAs are legally binding international treaties or agreements that are signed by member states (UNFCCC, 1992). The objective of this policy is for member states to jointly confront certain environmental concerns on a regional and global scale. Some global accords have been established to aid in the preservation of natural resources that are in jeopardy due to human endeavors. Environmental sustainability is quickly gaining traction and attention among development professionals throughout the globe. Many nations have signed several ecologically focused international accords as a result of the realization that human activity is, in fact, mostly responsible for climate change (Najam, Papa, & Taiyab, 2006; United Nations, 2015). For example, the UNFCCC's Paris Agreement aims to improve climate resilience and limit global warming, highlighting the vital role that international collaboration plays in environmental protection (UNFCCC, 2015). In a similar vein, the Ramsar Convention on Wetlands seeks to save and manage wetlands sustainably.



The United Nations Convention to Combat Desertification (UNCCD), the Convention on Biological Diversity (CBD), and the United Nations Framework Convention on Climate Change (UNFCCC) are among the international conventions that take note of the positive and negative impacts of veldt fires. Consequently, fire sustains ecosystems that depend on them but however cause deforestation, forest degradation, and the loss of biodiversity, and livelihoods. The National Fire Protection Strategy (2006) and the National Fire Management Policy are based on these multilateral and regional environmental agreements and procedures. Governments, non-governmental organizations, and international organizations are driven by these conventions to encourage people working in natural resource management, forest resource protection, community protection, and ecological restoration to understand the principles and take strategic actions, including when possible the processes that would promote voluntary participation (SADC, 2010). It is from these non-binding principles and strategic actions that most governments adopt fire planning and implementation standards for use in their legal and institutional frameworks.

Concerns about an increase in uncontrolled veldt fires in Zimbabwe contributed to the National Fire Protection Strategy's 2006 inception, according to Phiri et al. (2011). The effectiveness of the National Fire Protection Strategy has been lacking. Chigurah and Jerie (2010) pointed out that the inefficiency was brought on by things like inconsistent fire reports, a lack of tools for gathering data, and the inaccessibility of some places affected by fires. The majority of African nations have long-standing, occasionally violent conflicts between rural communities and government agencies stemming from fire policies. African governments have restricted fire use through laws imposed from the colonial era to lessen the amount of savannah and woods burned (Fairhead and Leach, 1996; Laris, 2004). A century-long push for anti-fire laws, penalties, and public awareness campaigns in Southern Africa has not produced meaningful changes in traditional burning practices or a decrease in the annual area burned. Unsurprisingly, the initiative has made things more tense and contentious between the forest service and the rural populace in most countries.

The 2006 National Fire Protection Strategy's requirements include raising awareness and educating communities and stakeholders about the issue (Ministry of Environment and Natural Resources Management, 2006). Some of the many activities that are conducted during these awareness sessions include the following: Every year, the first two weeks of May mark the start of National Fire Week, which is accompanied by awareness campaigns addressing issues

connected to veldt fire control and workshops (fire Indabas and training). structures that can accommodate (study circles). The competition for managing veldt fires ([www.herald.co.zw/ema-interventions-on-veldt-fires](http://www.herald.co.zw/ema-interventions-on-veldt-fires)). Nyamadzawo et al. (2013) state that training is provided to communities and stakeholders regarding the origins, consequences, and containment of veldt fires. EMA frequently conducts fire awareness programs in which fire committees are selected and formed. This arrangement begins at national level and cascades to the community level, and includes various fire committees at the national, provincial, district, ward and community level (EMA, 2012). In addition, for publicity and veldt fire education, electronic and print media were used (Mapira, 2012).

At a regional scale, fire management systems are being implemented through community-based initiatives such as the Fire Management Working Papers presented in Southern Africa by Tanzania, South Africa, and Zimbabwe (FAO 2012). The 5 International Wildland Fire Conference (IWFC) which was held in South Africa in 2011 was organized under the auspices of FAO and UNSIDR, veld fire issues were centred on community-based fire management (CBFiM) and traditional fire management. FAO's efforts include integrated fire management, accessing fire information globally, and enhancing stakeholder participation (FAO, 2012) These awareness fora, however, are not very effective at the grassroots level because they lack funding.

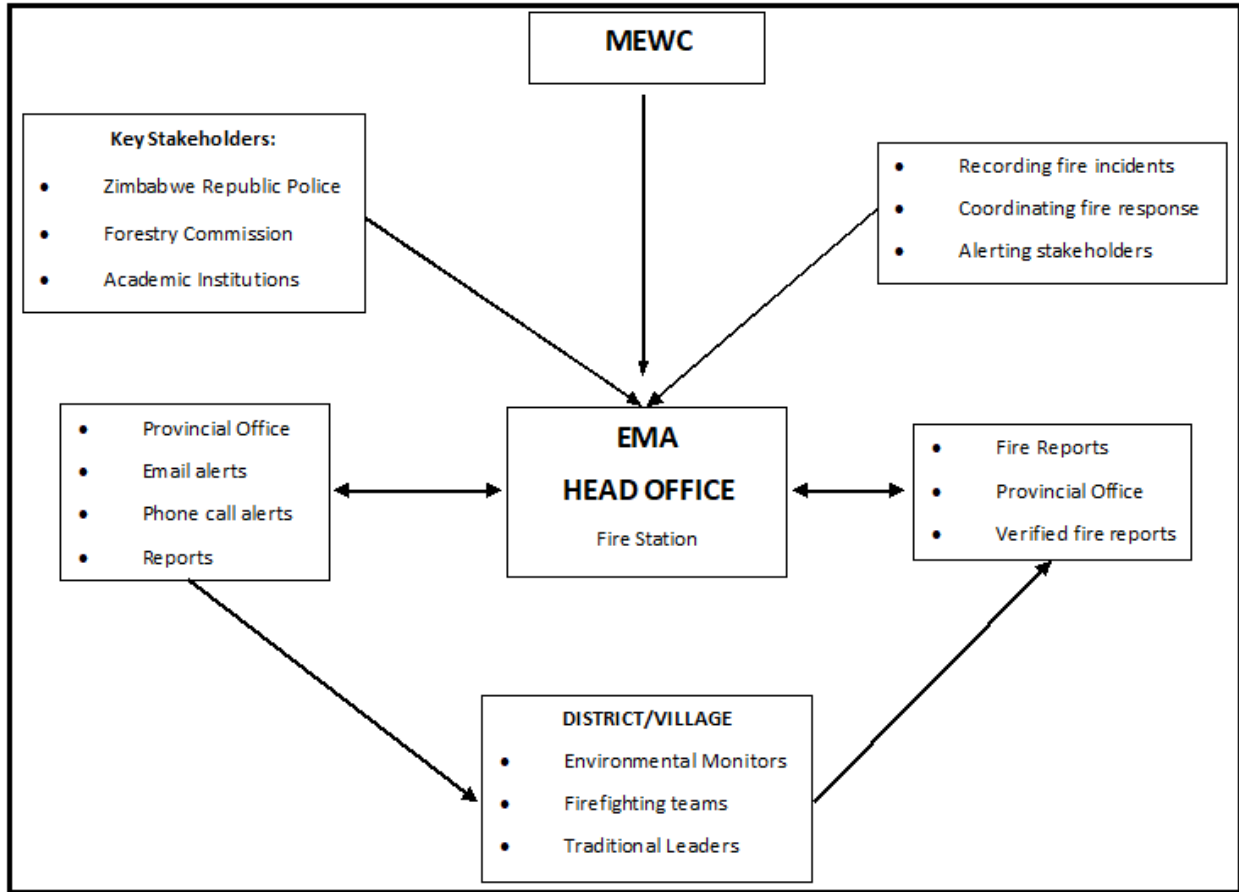


Figure 2.4: Fire Communication Strategy in Zimbabwe. [Source: EMA,2014]

The fire communication strategy framework is currently in use in Zimbabwe. The EMA head office in Harare is where the fire station is located. At this level, fire events are documented at the Head Office level. At the EMA headquarters, fire response coordination is also carried out, followed by notification of pertinent parties. Reports, phone call alerts, and email notifications are used for this communication. Local governments, university institutions affiliated with the Forestry Commission, and ZRP are the main players. These reports originate at the head office and are routed through the EMA province offices, district offices, and the hamlet where the fire was reported. Local communities, fire departments, traditional leaders, and environmental monitors are informed and mobilized. These are expected to put out the fire and produce reports within 7 days. The reports of the fire incidences are to be sent to the EMA district offices, who verify the reports and present them to the headquarters. However, the framework has some weaknesses in that at the provincial and district level, the only communication strategy is phone call alerts and emails. At

head office, there is monitoring and recording every day and every hour whereas at province and district offices, there is no working personnel available or on call 24/7. More so the limited personnel at the district level are immobile. At the district and village level, there is a need for vehicles for communication since phones and mobile network is not guaranteed. Firefighting teams, environmental monitors, and the local communities are not well trained in firefighting and they also have no firefighting equipment.

## **2.5 Factors influencing participation in forest fire management**

In order to effectively manage forest fires, education is essential. Higher education levels are correlated with a greater understanding of environmental issues, such as forest fires, according to Mudavanhu (2014). In Zimbabwe, access to educational resources is often better in urban areas than in rural areas, which causes differences in awareness and engagement. Government and non-profit awareness efforts seek to close this knowledge gap by teaching local populations about fire hazards and prevention techniques.

For fire management efforts to be mobilized, traditional leadership and community involvement are essential. Mutekwa and Gambiza (2017) claim that traditional leaders have a major impact on community mobilization for collective action in Zimbabwe's rural communities. Participation in fire management efforts is improved when communities exhibit social cohesion, which is demonstrated by cooperative farming methods and shared resource management. Robust social networks make spreading information and for people to work together to control forest fires easier.

Strategies for managing fires in Zimbabwe are greatly influenced by indigenous knowledge and cultural customs. Maphosa and Mavhura (2020) stress the significance of fusing traditional knowledge with contemporary methods to enhance fire management. Indigenous groups have important information about how to utilize and manage fires, knowledge that can be used to improve outcomes. However, a balance between cultural customs and fire management is required since some traditional practices like using fire for hunting and land clearing can unintentionally cause forest fires.

A significant aspect affecting involvement in forest fire management is the availability of financial resources. Financial incentives for fire management are hampered by a lack of government

funding, according to FAO (2015). However, NGO initiatives and foreign donations provide crucial support, empowering local communities to put fire safety measures in place. Participation may be further boosted by cost-sharing initiatives, in which local communities and the government split expenses.

The incentive to participate in fire management stems from the economy's reliance on forest resources. In Zimbabwe, a large number of rural populations depend on forests for their fuel, lumber, and non-timber forest products. Participation is highly motivated by the desire to keep these resources safe from fire (Mutekwa & Gambiza, 2017). On the other hand, rural communities may find it difficult to invest in fire management techniques due to financial limitations and high rates of poverty, which emphasizes the need for outside funding help.

Participation in fire management is influenced by land tenure systems; in Zimbabwe, communal ownership of a large portion of rural land can make fire management more difficult because of the shared responsibility for land management (FAO, 2015). Coordinated efforts among community members are necessary for effective fire management, private landowners, particularly those in commercial agriculture and forestry, have a direct financial interest in keeping their properties fire-free.

The legislative framework for fire management in Zimbabwe, including the EMA Act and the Forestry Act, mandates fire management practices (Environmental Management Agency, 2020). Effective implementation and enforcement of these laws are crucial for ensuring widespread participation. However, the effectiveness of these policies depends on the capacity of local authorities and enforcement agencies to implement and monitor compliance with fire management regulations.

Political stability and good governance are essential for effective fire management. Zimbabwe has faced political and economic challenges that can hinder fire management efforts (Mavhura, 2020). Political instability can disrupt coordinated fire management activities and reduce public participation. Corruption further exacerbates these issues by diverting resources away from fire management initiatives and weakening the enforcement of regulations.

Inclusive decision-making processes that involve local communities enhance ownership and accountability in fire management. Approaches that enhance community-based natural resource

management (CBNRM), are effective in fostering local engagement (Mutekwa and Gambiza, 2017). Transparent communication from authorities about fire risks, management plans, and the benefits of participation can build trust and encourage community involvement.

## **2.6 Chapter Summary**

In this chapter, reviewing of relevant literature from various authors and scholars was done. Relevant terms commonly used in forest fire studies have been defined and explained. Forest fire management strategies that are being employed in Zimbabwe were elaborated in this chapter are legal interventions to control forest fires, barriers and challenges in forest fire management, and strategies for enhancing forest fire management such as the fire communication framework. Also taking into account the factors influencing the participation in forest fire management. The suppression measures were also discussed, that is the control measures when a fire ignites.

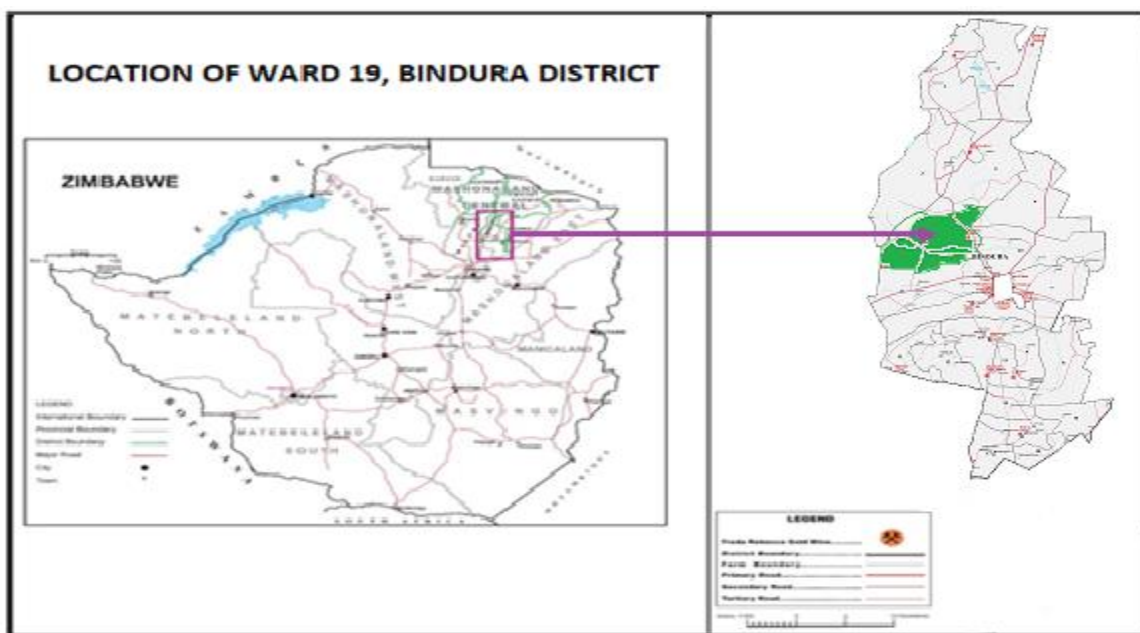
## CHAPTER 3: METHODOLOGY

### 3.0 Introduction

This chapter describes the materials and methods used in this study. The study area is defined, and the research design is explained. In addition, the target population, sample size, and data collection tools are justified, including the statistical analysis.

### 3.1 Description of study area

The study was carried out in Ward 19, of Bindura District (Figure 3.1), which is a town found in the Mashonaland Central Province of Zimbabwe. Bindura is located approximately 88km, northeast of the capital Harare, and is a small town with mining and agriculture as the major economic activities undertaken. However, in Ward 19 the community relies heavily on forest resources for farming purposes, fuelwood, wood, and non-timber forest products, making them vulnerable to the impacts of forest fires. Also, the study area is located in Zimbabwe's agro-ecological region IIb which is typified by distinct wet and dry seasons (Mugandani *et al.* 2012). On average, the mean maximum and minimum temperatures are 27.5°C and 13°C respectively, whereas the annual precipitation ranges from 850 - 1000 mm mostly occurring from November to March (Mugandani *et al.*, 2012).



*Figure 3.1: Location of the study area* : Source: Generated using QGIS 2.8.5 Software based on data from Zimbabwe National Statistics Agency (Zimstat).

### **3.2 Research design and research instruments**

The study used a cross-sectional design for the assessment of barriers to community involvement in forest fire management. A cross-sectional research design was selected as it captures information associated with community involvement in forest fire management. Cross-sectional surveys have been used positively by Abdullah *et al.* (2020) and Daud *et al.* (2021). In addition, a randomized design was employed in selecting the study participants. The research tools used in this study were questionnaires, focus group discussions (FGDs), interviews with key informants, and personal observations which are explained below.

#### **3.2.1 Questionnaire**

Open-ended and close-ended questions were used in the questionnaire (Appendix I) which targeted households in Ward 19 of Bindura. The household head was selected for the interview and if absent, a mature (female or male) or child respectively was selected randomly. Consent to participate in the study was sought before the questionnaire interview, ensuring voluntary participation in the interview. The reason for choosing the questionnaire was that it acquires sociodemographic information which was beneficial in assessing the barriers to respondent involvement in forest fire management.

#### **3.2.2 Personal Observations**

Observations were done with a checklist (Appendix II) to augment the questionnaire. This was done through detecting strategies employed in forest fire management, as well as any indications of forest fire and its impacts.

#### **3.2.3 Focus Group Discussions**

The focus group discussions encompassed both genders and were held at local schools within Ward 19 of Bindura district. The FGDs were mostly done during weekends when most household members were not occupied. Also, those who had participated in previous similar studies were invited. A total of three FGDs were carried out using the FGDs guide (Appendix III). Table 3.1 describes how the FGDs were scheduled at each meeting.



Table 3.1: Focus Group Discussion Inventory

Element	Focus Group Discussion		
	1	2	3
Venue	Foothills Clinic	Foothills Pri. School	Village Assembly Point
Time	0930	1100	1030
No. of people	16	11	15
Facilitator	Forestry Officer	Local Teacher	Researcher

The focus groups were organized with support from a Forestry Officer for environmental insights, a Local Teacher for educational perspectives. Their expertise ensured diverse, inclusive discussions reflecting the community's viewpoints.

### 3.2.4 Key Informant Interviews

A total of 7 interviews (Appendix IV) with key informants were scheduled. These interviews were done through the telephone or face-to-face after seeking approval, and the interview time, date, and place had been agreed upon. In addition, any supplementary information was followed up using the telephone after the interviews.

### 3.3 Study population and sample size

Societies residing in Ward 19 have an estimated population of 2500, from approximately 450 households. According to Cresswell (2014), a sample represents a randomly chosen section of a population for examination and inquiry. In addition, Cohen *et al.* (2011), asserted that the goal of sampling is to acquire an unbiased representative sample of the target population. As such, the sample size was determined using Cochran's formula (Israel, 2009).

$$n = \frac{N}{1+N(e)^2} \dots\dots\dots \text{equation [1]}$$

Where  $n$  = sample size;  $N$  = target population and,  $e$  = level of precision.

$$n = 450 / 1 + [(450) * (0.05)^2]$$

$$450 / 1.125$$

211.7647

≈ 212

Thus a total of 212 questionnaires were disseminated to random households in Ward 19.

### **3.4 Data Collection**

#### **3.4.1 Questionnaire distribution**

The questionnaire (Appendix I) was disseminated to households in communities in Ward 19 of Bindura district to gather data. The questionnaire was divided into three sections, that is, A) socio-demographic information; B) knowledge of forest fire management systems; C) barriers to community involvement in forest fire management systems; and (C strategies for coping with forest fire management.

#### **3.4.2 Focus Group Discussions**

Focus group discussions encompassed all genders and were held at the convenience of the participants. Approximately each FGD took at most 1 hour 30 minutes to be completed and was facilitated by personnel with background knowledge of fire management.

#### **3.4.3 Key Informant Interviews**

Key informants were interviews (Appendix C) done with key personnel like Forestry Commission representatives, Environmental Management Agency (EMA), Environmental consultants, Environmental Health Technicians (EHT), and community leadership. Some interviews were done via telephone and electronic mail, whereas some were done face-to-face depending on the availability of the key informant.

### **3.5 Ethical considerations**

According to APA (2017), ethics represent morals concerning how research methods abide by permissible, and public obligations. The American Psychological Association (APA) code of ethics was used in this study. This included permission, discretion, and respecting the views and opinions of the participants. Authorization to carry out the research was permitted by the Department of Disaster Risk Reduction at Bindura University, and local leadership in Ward 19 of Bindura. Participation in the study was voluntary, after seeking consent. Also, inquiries were

expressed politely to show respect, and the confidentiality of the participants and data was maintained (APA, 2017).

### **3.6 Data analysis**

Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 22.0. Responses that were given in vernacular were translated to English. The factors influencing forest fire management were analyzed using the Chi-square test, at a 95% confidence level and  $p < 0.05$  was considered statistically significant. These factors were sociodemographic characteristics, that is, gender, age, marital status, educational level, and residence period. The results were presented as frequencies and percentages.

### **3.7 Chapter Summary**

This section, describes the study area, research design, and data collection methods. In addition, the data analysis tools were explained. As such, the next chapter will focus on results presentation and discussion.

## CHAPTER 4: RESULTS ANALYSIS, PRESENTATION AND DISCUSSION

### 4.0 Introduction

This chapter presents the research outcomes, which are compared with similar studies and explained. The results include the awareness, barriers, and strategies for enhancing participation in community forest fire management in Ward 19 of Bindura.

### 4.1 Questionnaire and Interview Response Rate

#### 4.1.1 Questionnaire Response Rate

As shown in Table 4.1 a total of 212 questionnaires were administered, and a total of 162 questionnaires were returned with full information whereas some had missing information. Thus, the 76.9% response rate of the questionnaire that was determined was within the required range as reported by Saunders *et al.* (2019). Saunders *et al.* (2019) asserted that the response rate for questionnaires should not be < 70%.

Table 4.1: Questionnaire response rate (where  $n=162$ )

Community	Administered Questionnaires	Responded	Response Rate (%)
Foothills	212	162	76.9

#### 4.1.2 Interview Response Rate

A total of seven key-informant interviews had been planned but only five were successful resulting in a 71.4% response rate which was slightly above the 70% threshold as described by Saunders *et al.* (2019).

### 4.2 Sociodemographic attributes of the study participants

The sociodemographic attributes of the participants are shown in Table 4.3. Most respondents were female (58.0%), with the majority age groups being 25-34 years and 35-44 years, each attaining 37%. In addition, over three-quarters of the respondents were married, and had attained secondary-level education. Also, most respondents had more than 10 years (67.3%) work experience. However, the main source of income for the respondents was farming (56.8%).

Table 4.3: Socio-demographic characteristics of study respondents ( $n = 162$ )

<b>Variable</b>	<b>Category</b>	<b>Frequency</b>	<b>%</b>
1. Gender	Male	68	42.0
	Female	94	58.0
2. Age class	18-24 years	9	5.6
	25-34 years	60	37.0
	35-44 years	60	37.0
	45-54 years	22	13.6
	> 55 years	11	6.8
3. Marital status	Married	127	78.4
	Divorced	10	6.2
	Single	19	11.7
	Widow/er	6	3.7
4. Highest educational level attained	Primary	12	7.4
	Secondary	123	75.9
	Tertiary	27	16.7
5. Residence period in the study area	1-5 years	24	14.8
	6-10 years	32	19.8
	> 10 years	106	65.4
6. Employment status	Employed	110	67.9
	Unemployed	52	32.1
7. Work experience	1-5 years	36	22.2
	6-10 years	17	10.5
	> 10 years	109	67.3
8. Main source of income	Formal	24	14.8
	Informal	19	11.7
	Farming	92	56.8
	Fishing	10	6.2
	Gold panning	17	10.5

### 4.3 The role of the community in the existing forest fire management systems

Table 4.4 shows the respondents' role in forest fire management. The majority of respondents (80.2%) acknowledged the need to protect forests, with nearly three-quarters of the respondents confirming they can contribute to the conservation of forests. In addition, 61.1% divulged that they participated in forest fire management, with 50% always participating in community forest fire management.

*Table 4.4: Respondents' role in community forest fire management*

Variable	Frequency (%)	
	Yes	No
1. Do you think there is a need to protect the forests?	130 (80.2)	32 (19.8)
2. Do you think you can contribute to the conservation of forests?	120 (74.1)	42 (25.9)
3. Do you participate in forest fire management?	99 (61.1)	63 (38.9)
4. How often do you participate?		
Always	81 (50.0)	23 (14.2)
Sometimes	33 (20.4)	69 (42.6)
Rarely	48 (29.6)	70 (43.2)

On the other hand, the major causes of forest fires in Ward 19 were agriculture (49.5%), hunting (18.5%), and gold panning (15.3%) (Figure 4.1). Also, from observations, it was noted that most fires had been initiated in crop fields. The key informants also confirmed:

*Key Informant Interviewee 1: "Forest fires are usually caused by farmers when they burn crop residues, and in some cases, rodent hunters may burn the forest trying to clear up the area".*

On the other hand, the major forest fire management systems implemented by respondents in Ward 19 were fireguards (34%) and firebreaks (28%) (Figure 4.2). This was confirmed by observations where the researcher noted some established fireguards approximately 5m wide. In addition, the key informants and FGDs reported:

Key Informant Interviewee 5: “The forest fire management systems commonly practiced by the communities include the use of fireguards. Also, households try to conserve soil moisture through planting trees which help reduce fire spreading”.

Male participant 2 (FGD): “In this area we usually establish fireguards”.

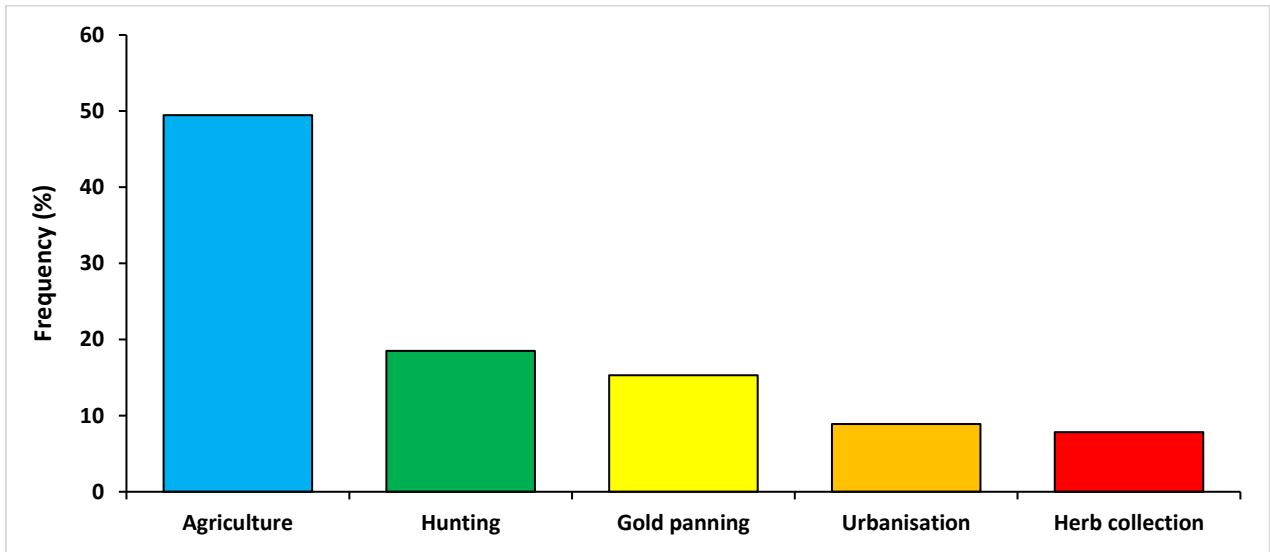


Figure 4.1: Major causes of forest fires reported by respondents in ward 19, Bindura

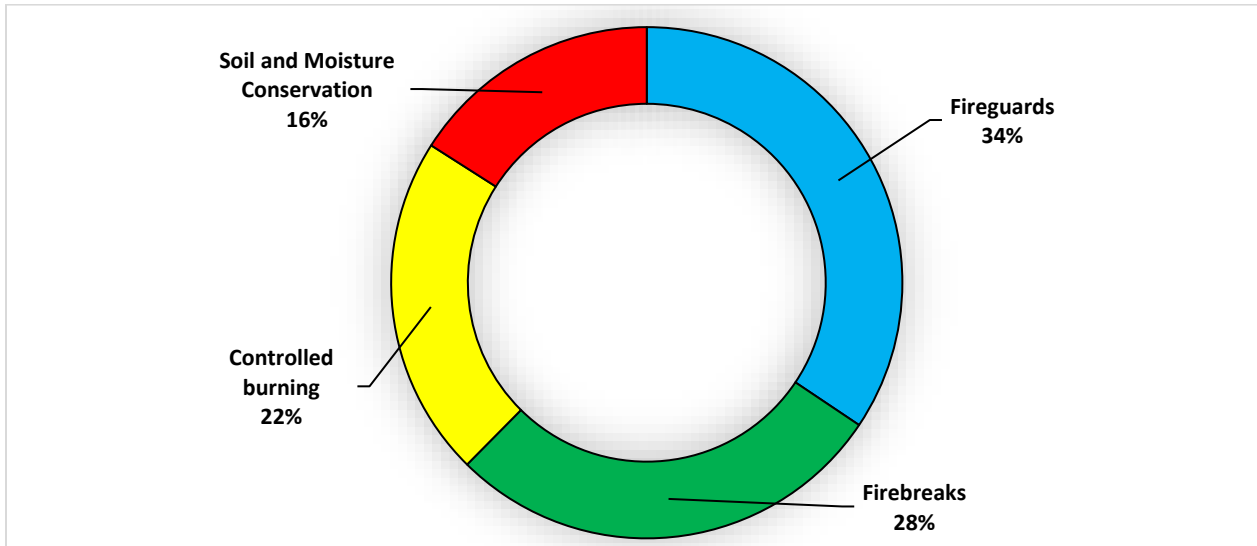


Figure 4.2: The most implemented forest fire management strategies by respondents in Ward 19, Bindura

### 4.3 The barriers to community involvement in forest fire management systems

As shown in Table 4.5, over three-quarters of the respondents were willing to participate in forest fire management, whereas 85.2% acknowledged that awareness campaigns on forest fire management were periodically undertaken in their community. These campaigns were mostly conducted by the Forestry Commission (85.8%).

*Table 4.5: Respondents' attitudes towards forest fire management*

Variable	Frequency (%)		
	Yes	No	Don't know
1. Are you willing to participate in forest fire management?	124 (76.5)	27 (16.7)	11 (6.8)
2. Are awareness campaigns on forest fire management undertaken in your area?	138 (85.2)	13 (8.0)	11 (6.8)
3. Government departments which involves the local community in forest fire monitoring?			
EMA	14 (8.6)	59 (36.4)	89 (54.9)
Forestry Commission	139 (85.8)	8 (4.9)	15 (9.3)
BRDC	9 (5.6)	95 (58.7)	58 (35.8)

The barriers to community involvement in forest fire management are shown in Figure 4.2. The most mentioned barriers were lack of knowledge (35%) and unfriendly weather conditions (30%). In addition, during FGDs, it was stated that:

*“Most people do not participate in community forest fire management due to lack of incentives such as money, food or clothes”.* (male participant 1, FGD).

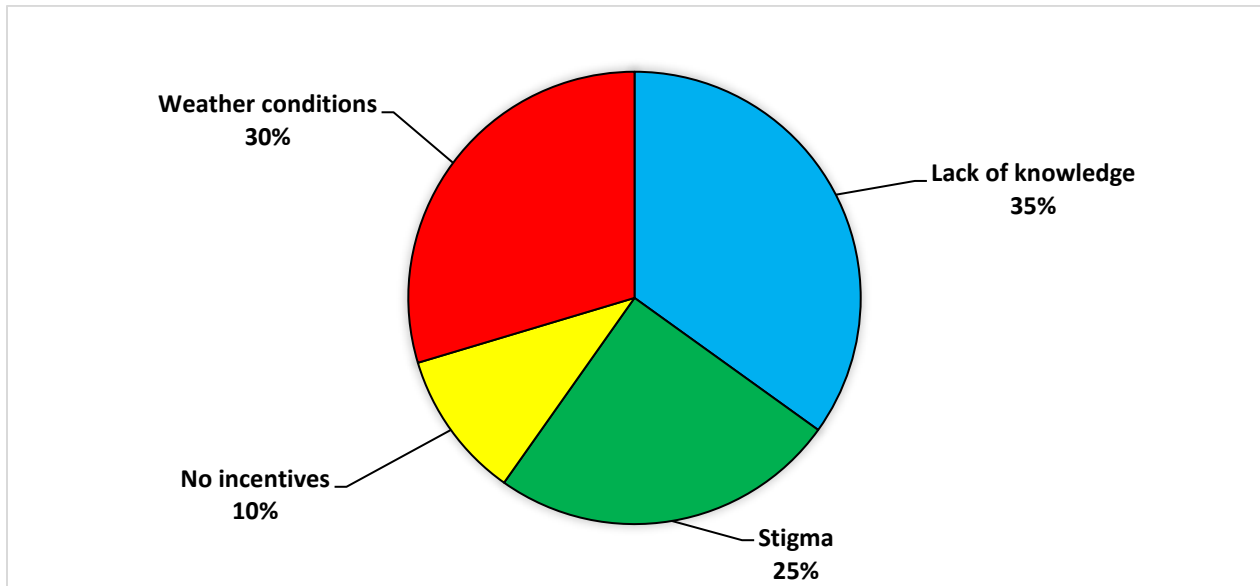
One of the key informants also mentioned stigma and asserted that:

*“Some people fear being stigmatized or labeled as participating in politics”.* (Key Informant Interviewee 7).

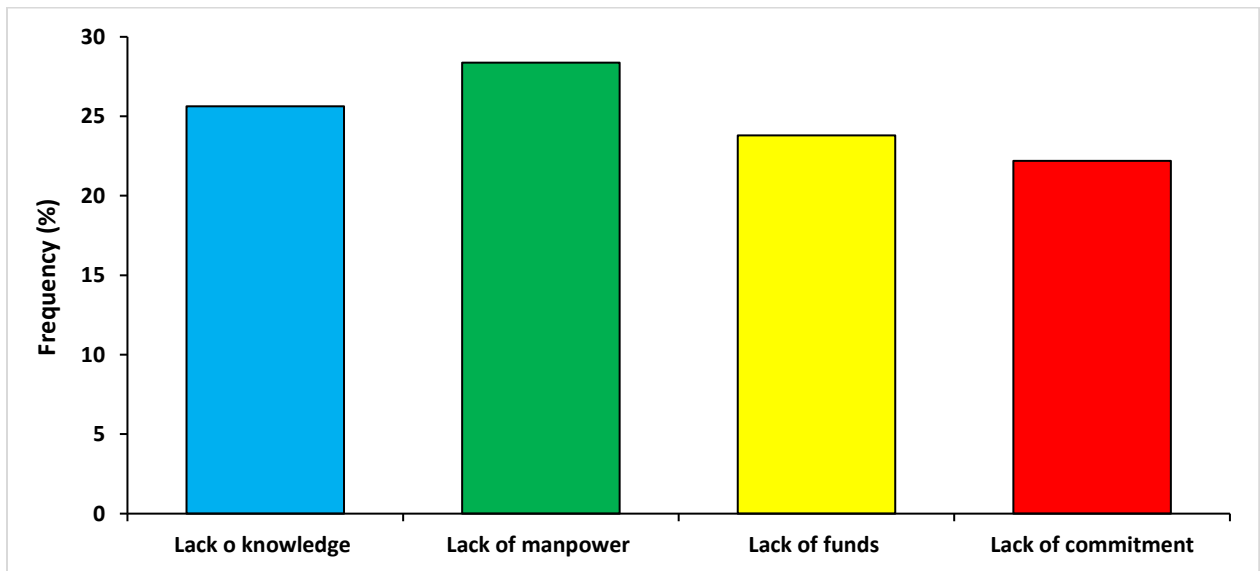
On the other hand, the major challenges to participation in community forest fire management were lack of manpower (28.4%), lack of knowledge (25.6%), and lack of funding (23.8%). This was confirmed by one of the key informant interviewee 3:



*“I think the major challenges faced in community forest fire management is lack of awareness and manpower. Also, the people are not highly committed to being involved in community matters but would rather do it individually.*



*Figure 4.3: Barriers to community involvement in forest fire management in Ward 19, Bindura*



*Figure 4.4: Challenges to community involvement in forest fire management in Ward 19, Bindura*

#### 4.4 The strategies for enhancing community involvement in forest fire management

Most respondents 80.2% acknowledged that forest fire can be controlled, whereas 88.9% confirmed that the forest fire management strategies employed in Ward 19 were inadequate. Figure 4.4 shows the strategies for enhancing community involvement in forest fire management in Ward 19. The most mentioned strategies were increasing manpower (29.3%), improving tools and equipment (21.8%), and awareness campaigns (21.8%). The FGDs and key informants also revealed:

Female participant 3 (FGD): *“To enhance forest fire management, people should work together as one in numbers, and fire-fighting equipment should be bought”*.

Key Informant Interviewee 2: *“To enhance forest fire management, people should be educated on fire management as well as acquire the relevant equipment”*.

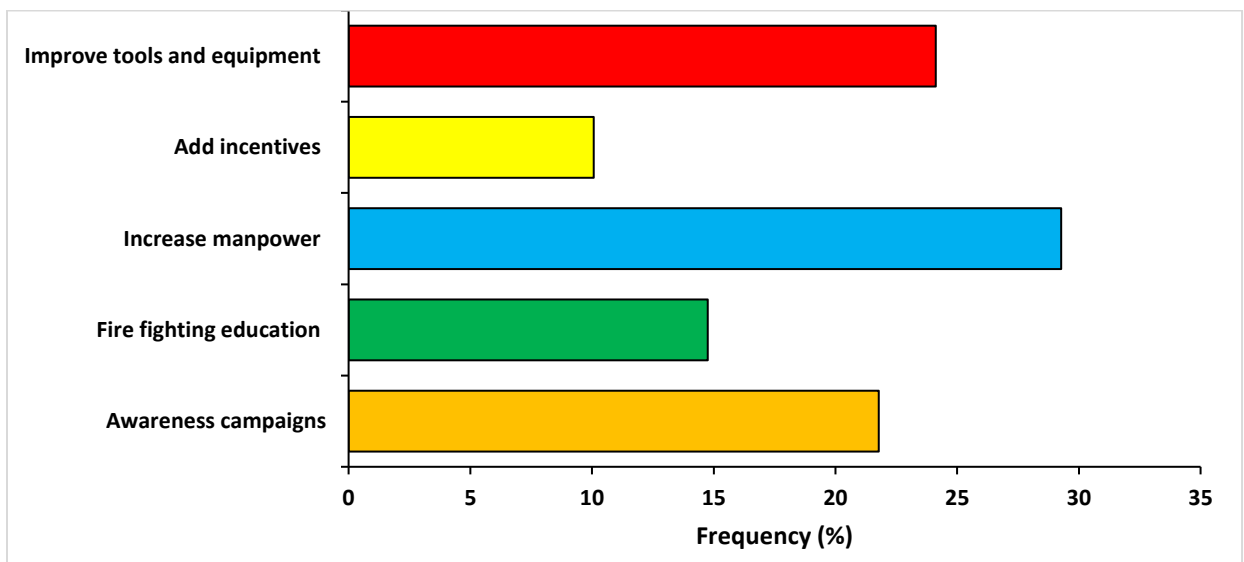


Figure 4.5: Strategies for enhancing community involvement in forest fire management in Ward 19, Bindura

#### 4.5 Factors influencing participation in community forest fire management

Table 4.6 shows the influencers of participation in community forest fire management. Gender ( $X^2 = 2.005$ ;  $p = 0.04$ ), marital status ( $X^2 = 2.218$ ;  $p = 0.028$ ), and residence period ( $X^2 = 2.132$ ;  $p = 0.036$ ) significantly influenced participation in community forest fire management. On the other

hand, age, educational level attained and main source of income had no significant influence on participation in community forest fire management ( $p > 0.05$ ).

Males were more involved in community forest fire management than females, and this could be attributed to the physically demanding nature of establishing fireguards or firefighting. In addition, females would be occupied with household chores thus their absence. For marital status, married people had a sense of responsibility unlike single. Also, the longer an individual stayed in an area, the more they gained a sense of belonging to a particular group thus actively participating in community forest fire management. Therefore, those who had resided in the study area for more than five years voluntarily engaged in community forest fire management.

*Table 4.6: Sociodemographic factors influencing participation in community forest fire management in Ward 19, Bindura*

Sociodemographic Variables	Category	Yes (%)	Pearson's $X^2$ – Test	
			$X^2$ – Test value	$p$ – Value
1. Gender	Male Female	52 (77.6) 72 (75.7)	2.005	<b>0.047*</b>
2. Age	18-24 years 25-34 years 35-44 years 45-54 years > 55 years	5 (50) 42 (68.8) 50 (81.9) 18 (90) 9 (90)	0.295	0.768
3. Marital status	Married Divorced Single Widow/er	94 (75.8) 9 (81.8) 16 (80) 5 (71.4)	2.218	<b>0.028*</b>
4. Highest educational level attained	Primary Secondary Tertiary	6 (60) 91 (73) 23 (82)	0.748	0.455
5. Residence period in the study area	1-5 years 6-10 years > 10 years	21 (84) 22 (73.3) 81 (75.7)	2.132	<b>0.036*</b>
6. Main source of income	Formal Informal Farming Fishing Gold panning	18 (75) 14 (70) 71 (78.8) 9 (90) 13 (72.2)	1.136	0.258

\***Bold figures** represent significantly different ( $p < 0.05$ ).

#### 4.6 Discussion of results

In this study, agriculture was considered the major cause of forest fires. Likewise, Goldammer *et al.* (2010) and Krah *et al.* (2020) reported that in most African and Southeast Asian countries, fire is used as a tool for land preparation, called the slash-and-burn technique. Which is done to improve soil fertility by the addition of potash. Also, some farmers use fire to clear pastures thus promoting the growth of new and palatable shoots for livestock. However, Mitri and Ph (2018) asserted that some fires are triggered by dumping burning cigarette butts or the open burning of garbage which uncontrollably expand. On the other hand, the use of fire guards as fire management systems reported in this study was also deduced by Schultz *et al.* (2019) and Parajuli *et al.* (2022) who stated fire-line development, controlled burning, and increasing the fire fighting force. Fireguards reduce fire intensity thus reducing its spread, whereas the controlled burning helps reduce the dry grass and leaf litter which could increase the fuel load.

The study deduced that most respondents were willing to participate in forest fire management, but the major concern was a lack of awareness of fire management systems as they mostly relied on indigenous knowledge. In addition, unfriendly weather conditions, that is, heatwaves hampered the involvement of most people as they could not cope with the heat. In addition, the management of forest fires faced significant challenges such as a shortage of manpower, and a lack of funding. This affects the effectiveness of the fire management system as the few members are not able to fully establish fireguards or suppress a fire during an emergency (Hajal and Bechara, 2019). Also, the fire management exercises should not coincide with the farming season to reduce competition with other household labor demands (Goldammer *et al.*, 2010).

With respect to the challenges faced in community forest fire management, a lack of funding meant that communities were not able to acquire relevant equipment, for example, tools for maintaining fireguards, fire-beaters or extinguishers, and water storage tanks. According to Hajal and Bechara (2019), the absence of roads to gain access into the forest to reach the fire is also a major challenge and is worsened by rugged terrain in some areas. In addition, Bhujel *et al.* (2017) reported that insufficient understanding of fire suppression techniques, limited fire-fighting equipment, and lack of awareness are serious challenges that could lead to great losses in the event of a fire.

The strategies for enhancing community involvement in forest fire management determined in this study, correspond with Goldammer *et al.* (2010), who deduced that the community should be

trained and mobilized towards improved fire control, maintenance of firebreaks, fire awareness, and public education. This led to reduced fire frequency, and burnt area, as well as improved condition of plants and trees, more forest products, and fodder for livestock. Also, some respondents proposed incentives to improve community involvement in forest fire management. Likewise, FAO (2019), asserted that protective clothing was issued to community members for support during firefighting, which was a significant incentive.

For the factors influencing community participation in forest fire management, Goldammer *et al.* (2010) reported that it is necessary to encourage all members of the community to participate in the management of forest fires regardless of their sociodemographic attributes. For example, widows help meet the basic needs of their families, women can work closest to the village, while men can work further away in the forest. Concerning age, young male school leavers can be recruited, thus providing them with work experience, discipline, and technical skills. Moreover, FAO (2019) asserted that it is essential to encourage participation as groups and as households to ensure cohesion and continuity.

#### **4.7 Chapter Summary**

This chapter explained the results of the study, comparing the study findings with those of corresponding studies. Thus, the subsequent chapter delivers the research conclusion and recommendations.

## **CHAPTER 5: SUMMARY, CONCLUSION AND RECOMMENDATIONS**

### **5.0 Introduction**

This chapter reviews the research findings, deriving conclusions from these results and suggesting recommendations centred on the study findings.

### **5.1 Summary**

The current research investigated the barriers to community involvement in forest fire management and strategies to enhance community participation in Ward 19 Bindura District, Mashonaland Central, Zimbabwe. Employing a mixed methods research design, data collection was conducted using questionnaires, focus group discussions (FGDs), and interviews with key informants. This comprehensive approach facilitated an in-depth understanding of the roles, challenges and potential strategies for community involvement in forest fire management.

The study revealed that while most community members participated in forest fire management activities, their involvement was inconsistent. The primary causes of forest fires in the area were agricultural activities, hunting, and gold panning which often involved the use of fire that could spread uncontrollably. The community mainly relied on fireguards and firebreaks as management strategies. Fireguards are cleared strips of land that prevent fire spread, while firebreaks are gaps in vegetation that act as barriers. However, these methods were not always maintained consistently reducing their effectiveness.

Significant barriers to community involvement were identified. A major obstacle was the lack of knowledge about effective fire management practices. Many community members were unaware of advanced techniques and the importance of their active participation. Additionally, there was a notable lack of incentives to encourage community engagement in fire management activities. Adverse weather conditions, such as prolonged dry seasons and unpredictable wind patterns further complicate efforts. These barriers were compounded by a lack of manpower, insufficient knowledge dissemination and inadequate funding, making it challenging to implement effective forest fire management systems.

To address these issues, the study proposed several strategies. Increasing manpower dedicated to forest fire management was a primary recommendation, which could be achieved by training and deploying more community members to monitor and manage fire prone areas. Improving the tools

and equipment available to the community was also deemed crucial. Providing modern firefighting tools, protective gear, and communication devices would significantly enhance the community's capacity to manage fires. Conducting extensive awareness campaigns was another key recommendation. These campaigns should focus on educating the community about the causes and consequences of forest fires, the importance of their role in fire management, and practical steps they can take to prevent and control fires.

The research also examined factors influencing community participation in forest fire management. Gender, marital status and the duration of residence in the area significantly impacted participation rates. Males were more likely to participate in fire management activities, possibly due to traditional gender roles and perceptions of physical labour. Married individuals showed higher involvement, likely due to their increased sense of responsibility towards their families and property. Those who had resided in the area for more than five years were more engaged, probably due to their deeper connection and commitment to the community. These findings suggest that demographic factors play a crucial role in the level of community engagement and should be carefully considered when designing intervention strategies.

## **5.2 Conclusion**

In Ward 19 of Bindura District, Mashonaland Central, Zimbabwe, the primary causes of forest fires were identified as agricultural practices, hunting, and gold panning. These activities frequently lead to uncontrolled fires that threaten both the environment and the livelihoods of local residents. To combat these fires, the community has implemented traditional forest fire management systems, such as fireguards and firebreaks. While these methods have provided some level of protection, their efficacy is limited by sporadic community involvement and the need for more structured fire management strategies.

However, several significant barriers have hindered the effective participation of the community in forest fire management. Chief among these barriers are a lack of knowledge about effective fire management techniques and unfavorable weather conditions that complicate fire prevention efforts. Additionally, the community faces challenges such as insufficient manpower, inadequate knowledge dissemination, and a lack of funding, all of which severely restrict their ability to manage forest fires effectively. These obstacles highlight the urgent need for targeted interventions that address both educational and resource-based deficits within the community.

To enhance community involvement and resilience, the research proposes several strategic measures. Increasing manpower by mobilizing more community members is crucial, as is improving the availability and quality of tools and equipment necessary for fire management. Furthermore, awareness campaigns are essential to educate the community about the importance and techniques of forest fire management, thereby addressing the knowledge gap. The study also found that demographic factors such as gender, marital status, and the duration of residence significantly influence participation rates. Specifically, males, married individuals, and long-term residents are more likely to engage in fire management activities. Understanding these factors allows for the development of more tailored and effective engagement strategies, ensuring a more comprehensive and sustainable approach to forest fire management in Ward 19. By implementing these strategies, the community can become more proactive and resilient in addressing the challenges posed by forest fires.

### **5.3 Recommendations**

- Awareness campaigns should be done to increase community participation in forest fire management.
- Communities should continuously maintain fireguards and minimize burning.
- Policies that mandate farmers to acquire a permit before burning should be formulated.
- Future research should focus on ways of improving fire detection and monitoring.



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## APPENDICES

### Appendix I: Questionnaire



Good morning/afternoon. My name is Nelly Naledi Phiri, and I am a final-year student at Bindura University of Science Education (Registration: B202073B). I am researching to fulfil the requirements of the Bachelor of Science Honours Degree in Disaster Management Sciences. The research is entitled “*Barriers to community involvement in forest fire management and strategies to enhance community participation in Ward 19 Bindura District, Mashonaland Central, Zimbabwe*”. I invite you to assist me with information on this subject, if you are willing to take part, and the information you will divulge will be classified as confidential. The research outcomes will help in raising knowledge on forest fire management.

Date: .....

Questionnaire ID: .....

*INSTRUCTION: Please tick on the appropriate answer and fill in wherever possible.*

#### SECTION A: SOCIO-DEMOGRAPHIC INFORMATION

1. Gender: Male  Female
2. Age: <20 years  21-40 years  41-60 years  >40 years
3. Marital status: Married  Divorced  Single
4. Highest educational level attained: None  Ordinary  Advanced  Tertiary
5. Residence period in ward 19, Bindura: <5 years  6-10 years  >10 years
6. Employment status: Employed  Unemployed
7. Work experience: <1 year  1-5 years  6-10 years  >10 years
8. Main source of income: Formal employment  Informal employment  Farming   
Fishing  Gold panning  Other *please specify* .....

#### SECTION B: DRIVERS OF FOREST FIRES AND THE ROLE OF THE COMMUNITY FOREST FIRE MANAGEMENT SYSTEMS

9. What do you think could be the drivers or causes of forest fires? Agriculture  Hunting   
 Gold panning  Urbanisation  Herb collection  Other   
.....

10. What do you use for cooking? Solar power  ZETDC electricity  Paraffin   
 Firewood  Liquid Petroleum Gas  Other *please specify* .....
11. Do you think there is a need to protect the forests? Yes  No
12. Do you think you can contribute to the conservation of forests? Yes  No
13. Do you participate in forest fire management? Yes  No
14. If yes, how often? Always  Sometimes  Rarely
15. What current forest fire management systems do you implement? Fireguards  Firebreaks   
 Controlled burning  Soil and Moisture Conservation

**SECTION C: BARRIERS TO COMMUNITY INVOLVEMENT IN FOREST FIRE MANAGEMENT**

16. Are you willing to participate in forest fire management? Yes  No  Don't know
17. Are awareness campaigns on forest fire management undertaken in your area? Yes  No   
 Don't know
18. Which of these government departments involves the local community in forest fire monitoring? EMA  Forestry Commission  BRDC
19. What deters you from participating in forest fire management? Lack of knowledge   
 Stigma  No incentives  Weather conditions
20. What challenges are faced in forest fire management? Lack of knowledge  Lack of manpower   
 Lack of funds  Lack of commitment

**SECTION D: STRATEGIES FOR COMMUNITY INVOLVEMENT IN FOREST FIRE MANAGEMENT**

21. Do you think your current forest fire management strategies are adequate? Yes  No   
 Don't know
22. Do you think forest fires can be controlled? Yes  No  Don't know
23. What else do you think should be done to improve community participation in forest fire management? Awareness campaigns  Fire education  Increase manpower   
 Add incentives  Improve tools and equipment

**END OF QUESTIONNAIRE ..... THANK YOU**

## **Appendix II: Focus Group Discussion Guide**

### **Barriers to community involvement in forest fire management and strategies to enhance community participation.**

Venues included (school, village assembly points, community hall). The discussion time is not to exceed 2 hours.

#### **1. Introduction [Not more than 10 minutes]**

1.1. Self-introduction (facilitator) and assistant: Thanking participants for coming

1.2. Introduction of the study:

i) Purpose and how participants were recruited

ii) Expected duration, use of information collected, and brief description of study

iii) Setting ground rules: how participants will respond, no wrong/correct answers, and use of first/pseudo names during the discussions.

Discussions were audio-recorded

1.3 Self-introductions of participants: First names basis only [Name cards used]

1.4 Informed consent: The consent form is read and consent is indicated.

1.5 Asking for clarifications or any other questions.

1.6 Fill in short demographic data: ward and village, gender, age group, highest level of education, marital status, community leader/worker, and professional qualification.

#### **2.0 Discussion topic [Audio recording starts here]**

2.1 The facilitator starts by asking for general knowledge about forest fires (and their effects) to make respondents comfortable.

*“What are the causes? What are you doing to manage? How do you manage it?”* (**Not more than 15 minutes**)

*The facilitator summarises what participants said and adds to it where necessary.*

2.2 Main discussion question [**About 60 minutes**]

*How do households manage forest fires?*

The facilitator controls the discussion, reflecting probing, and asking participants' experiences, opinions, and beliefs where necessary. When participants feel they have exhausted the question, the facilitator may ask for clarifications, any other contributions or questions, and summaries to make sure participants agree.

Probing questions: *What else can be done? Who should be involved? Motivating factors for participation in forest fire management?*

**3. Closure [About 3 minutes]:** At the end, the facilitator thanks the participants and they depart.

### Appendix III: Personal Observation Checklist

Observations	Response	Comments/Remarks
1. Any indications of forest fire	1. Yes <input type="checkbox"/> 2. No <input type="checkbox"/>	
2. Any residual effects of forest fire	1. Yes <input type="checkbox"/> 2. No <input type="checkbox"/>	
3. Visible effects of forest fire		
Burnt vegetation	1. Yes <input type="checkbox"/> 2. No <input type="checkbox"/>	
Burnt livestock	1. Yes <input type="checkbox"/> 2. No <input type="checkbox"/>	
Burnt properties	1. Yes <input type="checkbox"/> 2. No <input type="checkbox"/>	
Burnt buildings	1. Yes <input type="checkbox"/> 2. No <input type="checkbox"/>	
4. Signs of forest fire management		
Fireguards	1. Yes <input type="checkbox"/> 2. No <input type="checkbox"/>	
Firebreaks	1. Yes <input type="checkbox"/> 2. No <input type="checkbox"/>	
Controlled burning	1. Yes <input type="checkbox"/> 2. No <input type="checkbox"/>	
Soil and Moisture Conservation	1. Yes <input type="checkbox"/> 2. No <input type="checkbox"/>	
5. Fire-fighting equipment present	1. Yes <input type="checkbox"/> 2. No <input type="checkbox"/>	



**Appendix IV: Key Informant Interview Guide**



Good morning/afternoon. My name is Nelly Naledi Phiri, and I am a final-year student at Bindura University of Science Education (Registration: B202073B). I am researching to fulfil the requirements of the “*Barriers to community involvement in forest fire management and strategies to enhance community participation in Ward 19 Bindura District, Mashonaland Central, Zimbabwe*”. I invite you to assist me with information on this subject, if you are willing to take part, and the information you will divulge will be classified as confidential. The research outcomes will help in raising knowledge on forest fire management.

*INSTRUCTION: Please TICK on the appropriate answer and FILL it was ever possible.*

**SECTION A: SOCIO-DEMOGRAPHIC INFORMATION**

1. What is your current position?

Forestry Commission	EMA	Environmental Consultant	EHT	Community leadership
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. Gender: Male  Female

3. Age class: 21-40 years  41-60 years  >40 years

4. Highest educational level attained: Ordinary  Advanced  Tertiary

5. Residence period in Bindura: <1 year  2-5 years  6-10 years  >10 years

6. Work experience: <1 year  1-5 years  6-10 years  >10 years

**SECTION B: DRIVERS OF FOREST FIRES AND THE ROLE OF THE COMMUNITY FOREST FIRE MANAGEMENT SYSTEMS**

7. Which activities are causing forest fires in Ward 19?

.....  
 .....  
 .....  
 .....

8. What have been the impacts of forest fires in Ward 19?

.....  
 .....  
 .....  
 .....

9. Does the Ward 19 community participate in forest fire management? 1. Yes  2. No

10. What measures does the Ward 19 community practice to manage forest fires?

.....  
.....  
.....  
.....

11. Do you think enough is being done to protect forests? 1. Yes  2. No

12. If no, what do you suggest should be done? .....

.....

13. What kind of penalties does the local authority give to people who illegally start forest fires?

1. Fine  2. Imprisonment  3. None  4. Other  *please specify*

.....

**END OF INTERVIEW ..... THANK YOU**

Nelly Naledi Phiri Final Project

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**ABSTRACT**

Introduction: This study explores the impact of digital technology on the education sector, focusing on the role of artificial intelligence (AI) in enhancing learning experiences. The research aims to identify the challenges and opportunities associated with AI integration in educational institutions, and to propose effective strategies for implementation.

Methods: The study employs a mixed-methods approach, combining quantitative data analysis of survey results with qualitative insights from interviews and focus group discussions. The research was conducted over a period of six months, involving 150 participants from various educational levels.

Results: The study found that while AI offers significant potential for personalized learning and administrative efficiency, it also presents challenges such as data privacy concerns, digital literacy gaps, and ethical considerations. The research highlights the need for robust governance frameworks and ongoing professional development for educators to successfully integrate AI into the classroom.

Conclusion: The findings suggest that AI can be a powerful tool for transforming education, but its success depends on a holistic approach that addresses technical, human, and ethical factors. Further research is needed to explore the long-term effects of AI on student outcomes and the role of policy in facilitating responsible AI adoption in education.