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COMMUNITY PERCEPTION ON THE EFFECTS OF MINING ACTIVITIES ON WILD FRUITS DIVERSITY,VEGETATION STATUS AND SOIL FERTILITY IN WARD 25 OF ZVIMBA DISTRICT IN THE GREAT DYKE REGION

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DECLARATION

The undersigned certify that they have read this research project and have approved its submission for marking in relation to the department's guidelines and regulations.

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DECLARATION

I, Patricia P Garikai, hereby declare that the work presented in this dissertation titled ***Community perceptions on the effects of mining activities on wild fruits diversity, vegetation status and soil fertility in Ward 25 of Zvimba District in the Great Dyke Region*** is my own original work. This project has been completed independently, without assistance from any third party, except for the guidance and support provided by my supervisor and lecturers. All information, data, analysis and conclusions presented are the result of my own research efforts, unless explicitly acknowledged. All sources of information, including publishes works, websites, personal communication ad any other materials used I the preparation of this project have been properly cited and referenced.

DEDICATION

To my parents for their continued support and prayers. To my grandmother, Abbiba for being a constant source of motivation, continue to rest in peace.

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ABSTRACT

Zvimba District in Zimbabwe is known for its rich biodiversity, including a diverse array of wild fruit species that are crucial for the livelihoods and cultural practices of the local community. However, the expansion of artisanal and small-scale mining activities in the area has raised concerns about the potential impacts on the natural environment, especially the diversity of wild fruits and soil quality. This research aims to explore the local community's perceptions and experiences regarding the impacts of mining on wild fruit diversity and soil pH in Ward 25 of Zvimba District. The study employs a mixed-methods approach, combining qualitative and quantitative data collection and analysis techniques. The study focused on 11 villages in both mined (n=8) and unmined areas (n=3), and females were more aware than males on the effects of mining and had a higher degree of negativity on mining effects than man. There was a statistically significant difference between unmined and mined groups on soil Ph (t test, p = 0.0001 at ᾳ 0.05) while mining areas showed higher diversity of fruit tree species than unmined areas. Height, DBH and Canopy cover of wild fruit trees showed a significant difference in unmined areas and was the same in mined areas. Females are more aware of the negative impacts of mining on wild fruit diversity compared to males. The study concluded the importance considering the viewpoints of many stakeholders, particularly women, in order to comprehend and lessen the ecological effects of resource extraction. Mining operations have considerably lowered the pH of the soil in mined regions relative to unmined areas hence the mining activities prove to be affecting the environment negatively.

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LIST OF ACRONYMS AND ABBREVIATIONS

AMD- Acid Mine Drainage

CC- Canopy Cover

DBH -Diameter at Breast Height

EIA- Environmental Impact Assessments

H- Height

EMA- Environmental Management Agency

NASA- National Aeronautics and Space Administration

CHAPTER 1: INTRODUCTION

1.1BACKGROUND OF THE STUDY

Zvimba District, a rural area located in the Mashonaland West Province of Zimbabwe. Zvimba District is known for its rich biodiversity, including a diverse array of wild fruit species that play a crucial role in the livelihoods and cultural practices of the local community.

The district has a long history of artisanal and small-scale mining, with a particular focus on the extraction of gold and other precious minerals. Over the past few decades, the expansion of mining activities in the area has raised growing concerns among the local population regarding the potential impacts on the natural environment, especially the diversity of wild fruits and the quality of the soil. The economy is mostly based on agriculture; the community's livelihood strategies heavily rely on subsistence farming, fruit gathering, and other non-timber forest products. The collection, preparation, and use of wild fruits which provide an additional food supply and a means of producing income are mostly carried out by women in the neighborhood.

Previous studies conducted in the region have highlighted the importance of wild fruits to the local community, both in terms of their nutritional value and their cultural significance. However, there is limited understanding of the community's perceptions and experiences regarding the impacts of mining activities on the diversity and availability of these wild fruit species, as well as the potential effects on soil properties, such as pH levels.

Heavy metal pollution emerges as a global environmental problem that is posing serious threats to the environment and health of living organisms (Toppi and Gabrielli, 1999, Jabeen et al,2009, Shao et al 2010). A majority of soil in the world is contaminated with heavy metals as well as organic compounds that originate from natural processes and human activities at a greater extent as noted by Naida et al (2010) and Meghara, (2012). The Environment has been essential source for the livelihood of people and other living things. The environment and its ecosystem in general have been subjected to anthropogenic impacts due to mining and consequently polluted the environment (Mathe and Phiri, et al ;2016). Mining has always been a major sustaining activity but with negative impacts on the environment (Gabarrón et al.,2019).

Mineral extraction is the most destructive industry to the environment (Chenje et al.,2000), and artisanal small-scale mining contributes to this destruction. these miners are unskilled, lack knowledge and have little appreciation of the environment (Viega and Hinton et al.,2002). Artisanal mining sustains the livelihood of at least two million people in Zimbabwe directly and indirectly through ancillary services and secondary economic activities (Maponga et al.,2003). However, its negative impacts seemingly outweigh the benefits that come with it as evidenced by much depreciation of the environment that include gulley formation, reduced fauna and flora diversity, contamination of the soil and siltation of rivers etc.

The research aims to address this knowledge gap by exploring the local community's perceptions and experiences regarding the impacts of mining on wild fruit diversity and soil pH in Zvimba District. The findings from this research could provide valuable insights to inform the development of more sustainable mining practices and community-based natural resource management strategies in the region.

1.2 PROBLEM STATEMENT

Zvimba district is mainly characterized by farming activities and mining activities that has resulted in much land degradation that also include destruction of roads, ecosystems and soil contamination among others. The vegetation mainly constitutes of shrubs, densely populated areas and quite a number of animal diversity. However large parts of the district have been affected by the mining activities as it has resulted in much land degradation. Efforts to reclaim the disturbed sites have been put in place by the Environmental Management Agency but up to date not much change has been noticed that can be attributed to the actions of the Agency (EMA). To ensure a sound reclamation, this research aims to assess the effects of mining activities along the Great Dyke on soil fertility and wild fruits diversity

1.3 JUSTIFICATION OF THE STUDY

Mining being an important business venture for any countries with minerals thus studies that had been conducted look at the environment and socio-economic impacts of mining on the environment. It was found that some mines had put in place measures to mitigate their impact on the environment and the people’s livelihood. (Mathe and Phiri et al.,2006). Alves (2008) noted that heavy metal contamination on various sites is one of the most dangerous environmental problems. This assessment if proven to be useful, it will help government agencies or the Ministry of environment, water and climate in Zimbabwe to restore degraded areas of land thus benefiting the local communities of ward 25 in particular as well as restoration of ecosystems. Disturbance of the ecosystems and soil fertility does not only affect Zvimba district or Ward 25 of the district but turn to affect areas surrounding the ward or district.

Land is a finite resource hence need not to be abandoned hence a need for effective remediation techniques. remediation of heavy metal contaminated soils makes the ecosystem self-sustain itself as well as living it intact (Perelo et al., 2010) legislatures and policy makers would find the issues important in policy debate, which may inform policy making.

1.4 AIM

To access the effects of mining activities along the Great Dyke on wild fruit diversity and soil fertility

1.5Specific Objectives

- To determine the effects of mining on community perception, vegetation status and soil fertility in Zvimba Ward 25
- To determine the effect of mining activities on soil pH in Zvimba district
- To determine the effects of mining activities on the diversity of wild fruits and vegetation status in Ward 25 Zvimba district along the Great Dyke

1.6 RESEARCH QUESTIONS

- There is no significance difference on reduced soil fertility
- There is reduced plant diversity on contaminated soils
- There is no significance difference on vegetation status over mined and unmined areas

CHAPTER 2

LITERATURE REVIEW

2.1AN OVERVIEW OF THE MINING ACTIVITIES AND THEIR NEGATIVE EFFECTS ON THE ENVIRONMENT

Mining industries have the financial power to build resilient local economies, create jobs and provide adequate infrastructure to drive sustainable economic growth and development. Globally many nations rely on the natural resources for economic growth hence the contributions of the natural resources to the economies of developing countries is of crucial importance. Specifically, mineral extraction is booming but with notable irreversible environmental damage. (Tambol et al., 2023)

Mining activities are known to have a negative impact on soil quality and wild fruits diversity. Disturbance of land due to mining activities has been associated with the destruction of vegetation in the surrounding areas (Kuzevic et al., 2022). This is likely to have a detrimental effect of the plant communities and disruption of natural habitats.

Soil quality is an important factor for wild fruits species, as they rely on nutrients and soil moisture for growth and development. Changes to soil characteristics by mining activities are likely to alter the types of species that can grow in that area. This is due to the fact that soil characteristics are important determinants of the types of vegetation and the structure of plant communities. One of the most commonly reported changes in the soil characteristics of land disturbed by mining is the loss of topsoil and organic matter (Magidi et al., 2023). These materials are important sources of nutrients and energy for plant growth and play an important role in determining soil structure and water retention.

Depth of soil compaction is also changed by mining activities and can restrict root growth and water infiltration if compaction is severe. Acid mine drainage is one of the most severe problems caused by chrome mining and it is also one of the main causes of damage to the water environment (Coetzee, et al., 2020). Acid mine drainage lowers the pH of the soil and water and thereby affects plant and aquatic life. Acid mine drainage causes dissolution of heavy materials and causes toxicity in the soils, thereby affecting plant growth and development.

2.2 BACKGROUND OF MINING ACTIVITIES

Surface and underground mining has been the primary method of mineral extraction in the world. It involves a range of ecosystem-altering activities, such as clearing of vegetation, digging, drilling, and detonating with the use of explosives, dumping overburden and tailings, and the construction of haul roads and access to further and further remote locations. On a global scale, mining has been amongst the most destructive of industries in terms of its effect on the environment (Ofosu et al., 2020). It is in this context that the focus of the current study is based upon, with the argument being that mining activities are a significant promoter of deforestation, a precursor to the degradation of public and private land, and a threat to the existence of National Forests.

The clearing of vegetation is part and parcel of mineral extraction and can result in profound detrimental effects on forest communities. The most direct effect is the complete removal of forest from an area of land being mined. This usually occurs in the development of open pit mines, such as the Ok Tedi Mine in Papua New Guinea (Kiwingim et al., 2024) or the Connemara mine in Zimbabwe. However, the more dangerous effects come from the partial clearing of forests, purportedly for the creation of roads and infrastructure. This has been the case for the Simberi Mine, also in Papua New Guinea, and Ghana's Golden Star (Bogoso/Prestea) mining complex (Mudd et al., 2020; Wiafe et al., 2022). In each of these instances, roads were constructed through primary and secondary forests in order to access more remote areas of land. This creates a ripple effect which is difficult to control. With the mining of the immediate area finished, the roads provide thorough fare for farmers, loggers, and hunters, resulting in further deforestation of areas that would otherwise be left untouched.

According to statistics about 44% of the extensive mineral mines in Africa are in reserved areas or a distance of 10km, compared to 25% in Asia and South America. (Tambol et al., 2023). In Africa, mining among other capital investments has generally been welcomed but the alleged benefits seem to be undermined by the losses especially among communities (Wilson et al., 2019).

The ecological consequences emanating from mining have significant implications for animals and their biodiversity. Small scale artisanal gold mining, popularly known in Zimbabwe as *chikorokoza* (illegal gold panning), has become one of the major causes of environmental degradation currently taking place at alarming proportions countrywide. The country's mineral rich Great Dyke, cutting across the country is mostly affected. (Moyo, et al., 2015).

2.3 IMPORTANCE OF WILD FRUITS DIVERSITY AND SOIL pH

Soils of different pH have different characteristics, and these, in turn, affect the types of plants and vegetation that grow. Soil pH influences the availability of plant nutrients. Nutrient availability is at its highest level when pH is close to neutral. Changes in pH can result in nutrient deficiencies due to the relative unavailability of some nutrients at extreme pH levels (Msimbira, et al., 2020) Changes in the abundance and types of plant species can have further impacts on the availability of soil nutrients, as different plant species have different effects on nutrient levels. In general, each plant species and type has a different pH level for it to reach its full capacity. Wild fruits are also influenced by the pH of the soil, and some are quite sensitive to changes in pH and nutrient availability.

Soil pH can be simply defined as the measure of the acidity and alkalinity of the soil. It is defined in hydrogen ion concentration (pH), which is a measure of the relative quantity of hydrogen ions (Kicińska, et al., 2022). The pH scale runs from 1 to 14, where 7 is considered neutral. Values lower than 7 are acidic, and values higher than 7 are alkaline.

Wild fruits have been an important food item in human diets, as they provide a good alternative to agricultural goods for rural people and act as a safety net during times of food shortage. Wild fruits are highly perishable and only occur in some seasons, yet they are still considered a valuable resource to rural people and a significant item of trade in local markets. Wild fruits are also a favorite food source for many people and a source of food and income for the very poor. In addition to human subsistence from the forest, wild fruits are also valuable to non-human primates, rodents, birds, elephants, and other animals who also depend on the fruits as a seasonal food source. Changes in habitat potentially have serious effects on the availability of this resource. Alterations in the forest may affect the structure of the plant and animal communities and the resulting regeneration processes of the forest. This, in turn, would affect the availability of wild fruits in various ways. Reducing the availability of wild fruits to humans could lead to an increase in reliance on agriculture, a shift by some people to areas of conservation significance, and possibly even an increased use of the forest resources and degraded areas to obtain an income.

2.4 NEGATIVE EFFECTS OF MINING ACTIVITIES ON WILD FRUITS DIVERSITY

Mining activities can have several direct and indirect impacts on wild fruit diversity worldwide. These impacts can arise from habitat destruction, and also changes in ecosystem dynamics. Mining activities have led to habitat destruction where mining operations often lead to the clearing of large areas of land, which can disrupt the natural habitat of wild fruit-bearing plants. Mining activities have led to the depletion of over 577.15 km^2 of forest area in the West African Sahel zone. These have destroyed the habitats of mammals, including elephants and giraffes, as well as economic trees and grass species, and polluted ground and surface water. In addition, mining activities are responsible for degrading more than 1,000 acres of farmland. (Tambol et al., 2023).

Smith and Johnson (2018) have explored the cultural significance of wild fruits in many indigenous communities and the implication of mining activities on their traditional practices. Community conservation practices have been undertaken in many indigenous communities to protect and sustain wild fruit diversity. These practices often involve traditional ecological knowledge and sustainable harvesting methods that can offer valuable insights for broader conservation initiatives.

Ecosystem disruption as a whole is also a major effect of mining activities in the mining communities with a decline in pollinators. Pollinators like bees and butterflies are essential for fruit production. Miming related disturbances and pollution can severely harm their population. A study by (Garcia, et al., 2018) mining can disrupt the delicate balance of ecosystems, leading to changes in plant and animal communities. This disruption can affect the pollination, seed dispersal and overall reproductive success of wild fruit bearing plants.

Understanding the complex interplay of factors contributing to the decline in plant diversity due to mining activities is essential for developing sustainable conservation and restoration efforts to mitigate the environmental impact and preserve the unique ecosystem of the Great Dyke.

In addition, a decrease in the diversity of wild fruits has limited gene pool and climate resilient crops in the surrounding. An integrated reference genetic diversity is offered to assist in enhancement o particular traits, wild germplasm aids in improving the genetic performance of agricultural plants. Consequently, wild fruits serve as genetic diversity repositories and can be utilized to produce novel allelic variation required for breeding initiatives (Khoury et al., 2022)

Furthermore, the environmental cost of mineral extraction in the Great Dyke extends beyond the immediate vicinity of the mining sites. It encompasses issues such as water and air pollution, loss of natural habitats, and disruption of ecological processes. These wider implications highlight the need for a comprehensive assessment of the long-term effects of mining activities on the Great Dyke ecosystem.

Vegetation status and wild fruits diversity can be checked using the Shannon weiner Index. The Shannon-Wiener Index is a widely used metric in ecology to measure the diversity and evened of plant species within a given ecosystem. The index can be used to compare the diversity of plant species across different habitats, ecosystems, or management regimes.

This allows for the identification of areas with high or low diversity, which can inform conservation and management decisions.

2.5 NEGATIVE EFFECTS OF MINING ACTIVITIES ON SOIL NUTRIENTS

The soil plays an important role in governing various subsystems in the mining areas such as plants, water and landscape subsystems, since it is a vital component of the mining and reclamation system. Additionally, mine soil quality largely determines the future orientation of reclamation, hence improved knowledge on the effects of mining and reclamation processes on changes in soil properties is needed. The effects of mining on soil properties globally are a matter of significant concern due to the widespread impact of mining activities on the environment and their profound and lasting effects on soil quality, which in turn can have an impact on the overall health of ecosystems and human communities.

Physical properties such as soil texture, bulk density and aeration have a large influence on soil remediation by controlling soil hydraulic properties and hydrological stability (Feng et al.,2019) these properties are also vital for promoting plant growth, maintaining ecosystem integrity and maintaining agricultural productivity. In addition, soil microbes play a vital role in breaking down organic matter and realizing nutrients for plants thus disturbance by mining activities can disturb these microbial communities, hindering soil health.

At present, satellite and drone remote sensing have been widely used in mining areas (RShahmoradi et al.,2020), thus making high spatial resolution possible. Combined with field survey, they were widely used in determination of land deformation (Ćwiąkała et al 2020; Gong et al.,2021) soil erosion survey (Carabassa et al.,2021), and coal fires monitoring (Yuak et al.,2021) and soil quality in mining areas.

There are several types of mining, each with its own methods and environmental consequences. Surface mining, which includes open-pit mining, strip mining, and mountaintop clearing, involves the removal of overlying soil and rock to reach mineral deposits. This process can result in extensive soil erosion, compaction, and erosion, leading to the loss of topsoil and changes in soil structure (Cheng et al.,2020).

Subsurface mining, such as underground mining and hydraulic fracturing, can also affect soil properties by ground subsidence, soil compaction, and the release of toxic substances into the soil and groundwater. An important environmental consequence of subsurface mining is Acid Mine Drainage in the mining areas and it poses as serious environmental problem. Pyrite (iron sulfide) are exposed to air, water and micro bacteria, undergo a chemical reaction thus generating AMD. AMD has been described as a special type of acidic drainage that has a low pH and contains high levels of sulfide and heavy metals. These characteristics contribute to soil pollution ad degradation. Soil toxicity, soil heavy metals pollution and crop health in AMD polluted soil environments are critical issues that have been investigated across the world. (Dong et al.,2018). AMD leads to the formation of highly acidic water thus altering the environment and have detrimental effects of the aquatic life and flora and most importantly water and soils. The high acidity from AMD can decrease the groundwater Ph as low as 1, hence having impacts on the fertility and health of the soil. The generation of AMD from overburdened soil piles at open-pit lignite mines is another source of AMD that affects soil pH.

Heavy metal in the soil does not only affect plant development but also threaten the health of the surrounding inhabitants through the food chain (Kumar et al.,2020). In addition, artisanal and small-scale mining activities, which are often conducted informally and with rudimentary equipment, can result in widespread soil degradation and contamination in many areas.

Exploitation of the mineral base does not only lead to excessive environmental withdrawals (Magidi et al.,2023) but also puts the natural environment at a serious threat of massive destruction. Apart from environmental withdrawals, Long et al, (2012) noted that mining also come along with environmental additions which occur in form of waste substances, solid, liquid or gas and are commonly referred to as pollutants. Additions onto the environment as a result of mining can therefore exist as mine residual material, exhaust fumes, smoke, dust, chemical substances, oils, as well noise. Put together, environmental withdrawals and additions as well as destruction (Moyo et al.,20202).

Mining activities in the Great Dyke region have had substantial impact on the quality of soil (Nyenda et al.,2020). Studies have shown that mining activities can significantly alter the pH levels in the Great Dyke region. The extraction and processing of minerals can lead to the release of acidic compounds into the soil, causing a decrease in pH levels. This acidic soil can negatively affect the growth of native plant species and reduce overall plant diversity in the area.

Organic matter is essential for soil fertility and water retention hence expanding more mining operations can remove or destroy organic matter thus making the soil less fertile. Soil microbes play a vital role in breaking down organic matter and realizing nutrients for plants thus disturbance by mining activities can disturb these microbial communities, hindering soil health. The amount of soil organic carbon (Yua et al.,2018), nitrite(N), phosphorus (P) (Liu et al.,2017) and potassium (K) (Zhou et al.,2017) present in the soil are major determining factors and indicators of its fertility and quality, which are closely related to vegetation restoration.

Soil acidity can promote the dissolution of heavy metals, which can subsequently lead to their increased mobility, breakdown of binding agents and potential toxicity. This increased mobility and release of heavy metals due to soil acidity can lead to several problems that may include plant uptake leading to bioaccumulation and potentially harming consumers of those plants and contamination of water by leaching into groundwater thus contaminating drinking water sources.

2.6 NEGATIVE EFFECTS OF MINING ACTIVITIES ON AGRICULTURAL LANDS

Soil is a basic substrate in terrestrial ecosystems and is also the primary basis for agricultural production. Mining activities have seen the destruction of ecosystems with the soil included in particular. Clearing of land for mining activities has led to destruction of farmland and leaving some places with land that is not suitable for farming due to the spills and chemicals used during mining. In West Africa mining has had effects on land uses with area land of 1,574.13 km^2 undergoing degradation, mining production has caused a significant change in the arable farming land size from 779.64 km^2 to 549.74 km^2 and 673.04 km^2 from 1975 to 1986 and 2005, respectively. (Tambol et al., 2023).

Land for agricultural production has been reduced gradually thus posing dangers to the ecosystem leading to social problems that may include food security and malnutrition being attacked. A good reported example can be the Baryte mines with over 100 acres of land being destroyed (Tambol, et al 2023). Farmland depletion, soil erosion and rapid deforestation are challenges associated with mining activities due to high requirements of human labor and tract. (Tambol et al.,2023). Mashonaland west particularly the Zvimba district is characterized by red clay soil that are fertile and well drained thus the area is richly endowed in agricultural produce, hence a disturbance in the agricultural land may be of great impact to the surrounding communities.

The environmental cost of mineral extraction in the Great Dyke has led to changes in the physical properties of the soil that may include increased soil erosion, soil compaction, soil irrigability and salinity of the soil due to the release of heavy metals and toxic substances thus affecting soil fertility and agricultural output.

2.7 CONSERVATION EFFORTS AND MITIGATION STRATEGIES ON THE EFFECTS OF MINING ACTIVITIES TO THE ENVIRONMENT

Globally comprehensive environmental regulations for the mining industry and federal regulations aimed directly at the mining industry have not yet been put in place. However broadbased statutes such as the Clean Water Act and Clean Air Act and National Environmental Policy Act apply to mining activities.

Strategic planning is of much importance as a mitigation measure. Thorough identification of areas with high wild fruit diversity should take place before any mining approvals. These areas can be set aside as conservation zones. A notable action is by the Environmental Management agency and Forestry commission to reduce impacts of mining activities through EIAs (Environmental Impacts Assessments), issuing of license to miners and inspection in a bid to conserve the environment (Chipagura et al., 2019)

Vegetation restoration is a major key to the restoration of dumpsites left by mining companies. Vegetation restoration can complete the soil- plant composite system thus improving the local environment and promote a regional ecological balance and also improve the soil properties (Wang et al., 2016)

The amount of soil organic carbon and other nutrients present in the soil act as a major indicators of soil fertility and quality hence they are closely related to wild fruit diversity and vegetation restoration. Heavy metals within the soil have proved to be a threat to plat development and also health of the surrounding inhabitants through the food chain thus acting as a pullback in the ecosystem and biodiversity as large.

However, there is a lack of symmetric research on the associated degradation mechanisms and effect on the soil nutrients having an impact on agriculture and livelihoods. Soil erosion and land degradation pose a threat to sustainable agriculture productivity, impacting food security and livelihoods particularly in the Zvimba District. Zvimba District being a very agricultural district factors affecting land degradation and agriculture development will be of much damage to them. In addition, land degradation has had global environmental effects where erosion constitutes one of the most significant global environmental problems due to its severity and scale.

An important factor to take note of is the regulatory system within the ministry or government at large. It is of much importance to include community partnership, through engaging with local communities who rely on wild fruit can ensure their needs are considered, potentially through developing projects to cultivate wild fruits in a much more conserving manner. This may be further archived through strategic planning by identifying areas with high wild fruit diversity through thorough Environmental Impact Assessments thus these areas can be set as conservation zones. Careful pollution control by introduction of strict regulations and technologies as a means to minimize the release of toxins is vital to protect fruit species and reduce contamination.

CHAPTER 3

METHODOLOGY

3.1DESCRIPTION OF STUDY AREA

The research was carried out in Zvimba, Mashonaland West Province. Zvimba district is bordered by (Fig3.1)Makonde District to the North, Mazowe District to the east, Harare to the southeast, Chegutu district to the south, Kadoma District to the southwest and Chegutu District to the west and northwest. Murombedzi being the main town is located about 110 kilometers west of Harare. Zvimba District is in Natural Region 2a with rainfall pattern ranging between 750mm to 1000mm. The dominant soil types in Zvimba are *Ferralsols* and *Acrisols* with both sandy and loamy soils with the pH level ranging from slightly acidic to neutral. Zvimba district is dominated by miombo woodland dominated by Msasa (*Brachystegia spiciformis*), natal orange (*Strychnos spinosa*) and sugar plum (*Uapaca kirkiana*) among others.

The fertile land in Zvimba supports the cultivation of crops such as maize, tobacco, cotton and various vegetables (Mazwi et al., 2020). The district is also characterized by agricultural activities that include horticulture, fish and crocodile farming and eco-tourism. Zvimba district is endowed with resources such as gold, platinum, chrome and copper as the Great Dyke cuts across the district. The district has a population of 348,002 according to Zimbabwe National Statistics Agency July 2022 census with females making up 50.7% and males constituting the remaining 49.4%.

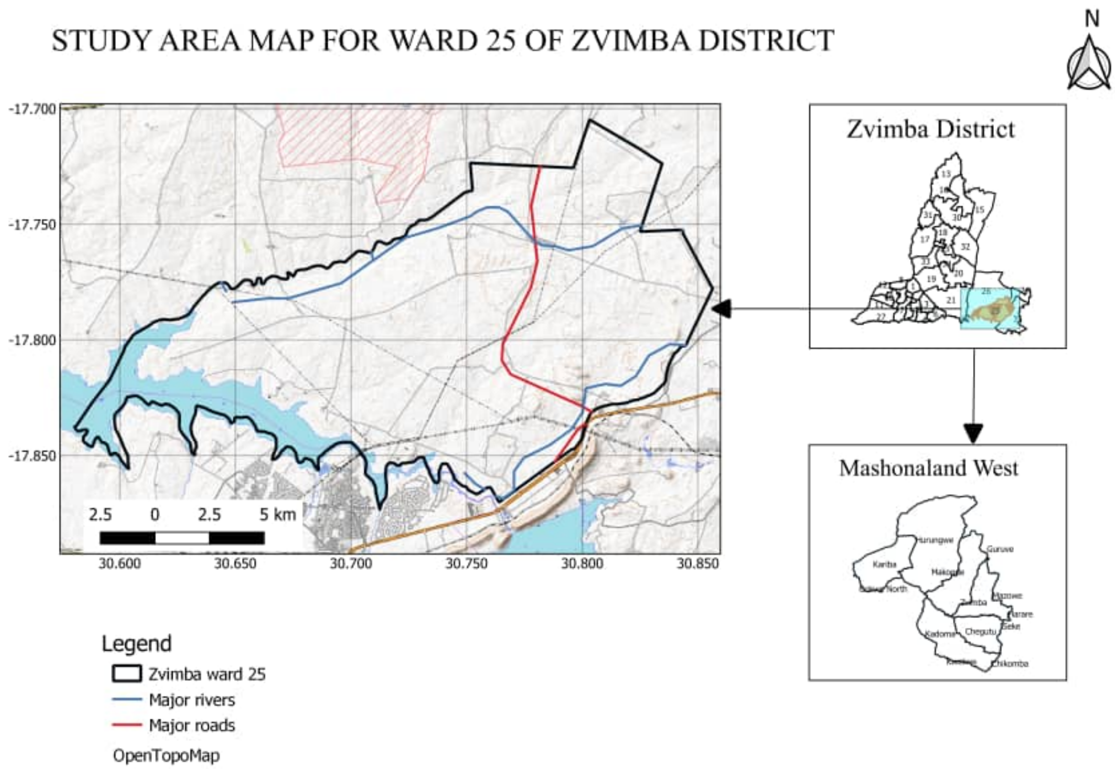

Figure 3.1 study area map ward 25 Zvimba district

3.2 RESEARCH DESIGN

The stratified random sampling protocol by (Baker et al., 2022)was adopted. Sampling sites were chosen using location of people who took part in the wild fruits' diversity and soil quality questionnaire survey. The areas that were sampled were selected adjacent to sites where questionnaire respondents were administered.in the district's 11 villages with some being involved directly in mining activities. Quadrants mapping 30*30 meters were used with guidance of the Geographical Positioning System to determine sample points for soil and edible wild tree species diversity.

3.4 SAMPLE COLLECTION AND PREPARATION

Vegetation species composition and diversity was recorded from the mapped 30 by 30 meters quadrants. The selected sampling quadrants were identified on the ground using the Global Positioning System (GPS) for location. Wild fruit species was recorded for vegetation status considering variables that include Soil sampling was done using modified Random sampling at depths of (0-10cm) and (10-20cm) using a soil auger. Within the 30m by 30m quadrants five soil samples were collected from the four corners of the quadrant and the one at the center. A 1m by 1m quadrant was used to sample edible herbaceous species as identified by key informants. Samples were collected for purposes that include color and texture which was performed during collection of soil samples in the field using the Munsell chart and in the laboratory soil pH was done (Rufty et al., 2020). Samples were collected and stored in air tight polythene bags and taken for analysis at the Environmental Management Agency Laboratory. To determine the soil Ph, soil was measured on site in suspension at a soil to water ratio of 1:2.

To determine vegetation status variables that include Canopy cover (CC), Height(H) and Diameter at Breast Height (DBH) was collected. Canopy cover was recorded using spherical densiometer. DBH was measured using a diameter tape and height a tape measure was used

3.5 DATA ANALYSIS

3.5.1 STATISTICAL ANALYSIS

A simple t-test was used to compare only 2 variables that is soil pH in mined areas over unmined areas. Species diversity and abundance was analyzed using the Shannon-Wiener Index.

The Shannon Index, denoted as H', is calculated using the following formula:

$H' = -\Sigma (pi * \ln pi)$

Where:

- pi is the proportion of individuals belonging to the number of species in the dataset
- ln is the natural logarithm

To determine if there was a difference in height, DBH (diameter at breast height) and canopy cover a one-way analysis of variance ANOVA to assess the significance of the tested parameters with depth and also difference within the mined and unmined areas. The ANOVA was used to compare two or more sample mean when the means are from single factor between subject design. An LSD post hoc test was used to test for pairwise differences. All analysis were conducted in the statistical package SPSS at 95% level significance.

CHAPTER 4: RESULTS

4.1 COMMUNITY PERCEPTIONS ON THE MINING EFFECTS ON WILD FRUITS DIVERSITY AND SOIL FERTILITUNIY

A total of 11 villages were sampled, both in mined (n=8) and unmined areas (n=3) to determine the diversity of fruit trees.

4.1.1 MINING EFECTS ON WILD FRUITS SPECEIES DIVERSITY

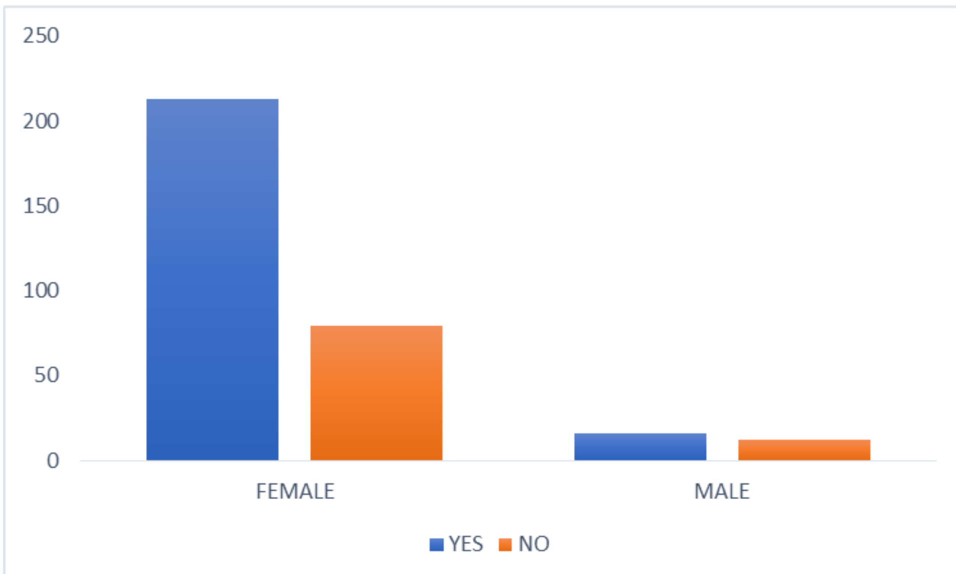

Figure 4.1.1 mining effects on wild fruits diversity

There is a clear gender difference (FIG 4.1.1) in the perception of the effects of mining on wild fruits within the ward. Females are more aware of the mining effects as compared to males.

4.1.2 MINING EFECTS ON SOIL FERTILITY

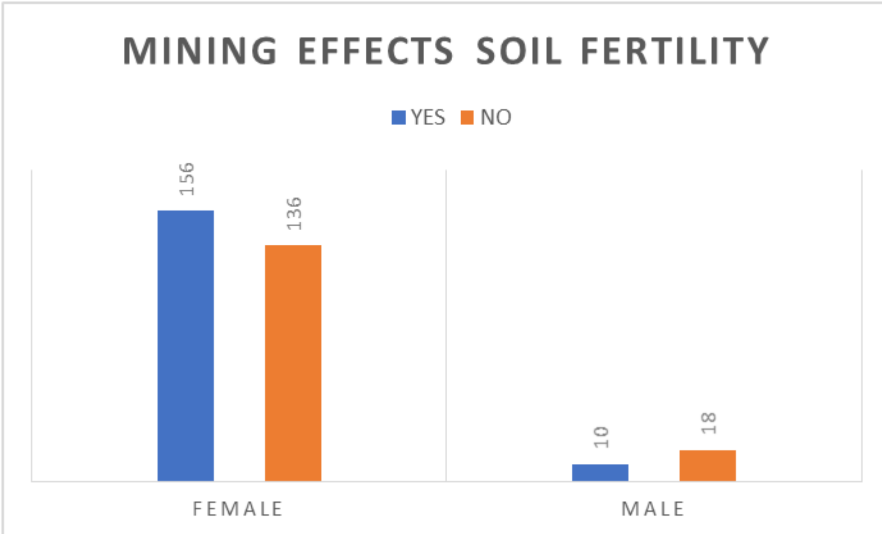

Figure 4.1.2 Mining affects soil fertility

Perceived effects of mining on soil fertility (FIG 4.1.2), comparing the responses between females and males. Females constituting the majority (156) responded "YES" to the negative impacts of mining on soil fertility, while a smaller number (136) responded "NO". In contrast, for males, the pattern is reversed, with a higher number (18) responding "NO" compared to those who responded "YES" (10).

4.2 MINING EFFECTS ON SOIL pH

There was a statistically significant difference between unmined and mined groups on soil Ph (p = 0.0001 at ᶐ 0.05) (Table 4.2). The unmined group having a mean value that is 1.88714 higher than the mined group, on average. This suggests that there is a statistically significant difference in wild fruit diversity between unmined and mined areas, with unmined areas having a higher diversity of wild fruits.

Table 4.2 soil pH significance on mined and unmined areas

			Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
		Mean			Lower	Upper			
Pair 1	Unmined - Mined	1.88714	.73068	.15945	1.55454	2.21974	11.836	20	.0001

4.3 COMPARING THE TWO SHANNON DIVERSITY INDEX VALUES:

The Shannon Weiner diversity index (H') was ranging from 0.67301167 to 1.098612289 in mined areas and unmined areas it was ranging from 0.636514 to 2.022805. Individual measurements of wild fruit diversity for each village, with two values per village one for a mined area and one for an unmined area(Table 4.3). The higher Shannon Diversity Index value for the mined area (2.9271) indicates that the mined areas have greater diversity compared to the unmined areas (2.3093). This suggests that the mined areas have a more even distribution of species or values, with fewer dominant species or values.

Table 4.3 overall species diversity

Village name	Mined area	Unmined area
Umzururu	0.67301167	1.320888
Umzururu	0.63651417	1.029653
Umzururu	0.63651417	1.011404
Royden	0.63651416	0.682908
Royden	1.05492168	1.351784
Royden	0.673012667	0.682908
Nyabira	0.636514168	0.636514
Nyabira	0.682908105	1.320888
Nyabira	1.098612289	1.329661
Lillyfordia	1.08219553	1.004243
Lillyfordia	0.562335145	1.310784
Stockfelt	0.693147181	0.943384

Stockfelt	0.562335145	1.32295
Parklands farm	1.011404265	1.011404
Parklands farm	0.562335145	1.342113
Jere KR	0.636514168	1.05492
Jere KR	0.63011667	0.900256
Saffron	0.950270539	1.039721
Saffron	1.011404265	0.867532
Kintyre	0.673011667	1.054292
Kintyre	0.92871252	1.044275
Aberdeen	0.612991074	0.636514
Aberdeen	0.376770161	0.9557
Aberdeen	0.683079424	0.983274
Rasper Farm	0.636514168	1.378718
Rasper Farm	1.029653014	2.022805
Overall diversity	**2.9271**	**2.3093**

4.4 ONE-WAY OF VARIANCE (ANOVA) FOR VEGETATION CHARECTERISTICS

Height 1, DBH 1, CC1: The p-values for these measures are all greater than 0.05, indicating that there is no statistically significant difference in mean wild fruit diversity between mined and unmined areas for these areas. Height 2 (p-value = 0.045): There's a marginal statistical significance (Table 4.4), suggesting a possible difference in mean height 2 of wild fruits between mined and unmined areas. There is a statistically significant difference in mean DBH2 and CC2 of wild fruits between mined and unmined areas.

Table 4.4 ANOVA to access the significance of the tested parameters with depth and also difference within the mined and unmined areas

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.

Height 1	Between Groups	300.523	10	30.052	.642	.770
	Within Groups	2200.033	47	46.809		
	Total	2500.556	57			
DBH 1	Between Groups	1051.024	10	105.102	.278	.983
	Within Groups	18171.682	48	378.577		
	Total	19222.706	58			
CC1	Between Groups	7491.213	10	749.121	1.287	.265
	Within Groups	27948.189	48	582.254		
	Total	35439.402	58			
Height 2	Between Groups	826.035	10	82.604	1.004	.045
	Within Groups	3950.380	48	82.300		
	Total	4776.415	58			
DBH2	Between Groups	6059.748	10	605.975	1.038	.027
	Within Groups	28014.556	48	583.637		
	Total	34074.304	58			
CC2	Between Groups	4621.978	10	462.198	.814	.001
	Within Groups	27262.189	48	567.962		
	Total	31884.167	58			

4.5 OBJECTIVES 2 AND 3 SUMMARIZATION

4.5THE EFFECT OF MINING ON HEIGHT(H), DIAMETER AT BREAST HEIGHT(DBH), CANOPY COVER (CC) IN MINED OVER UNMINED AREAS

SUMMARY TABLE

Table 4.5 objectives 2 and 3 summarization

Variable	Mean	Sig (p)	Significance
H1	.642 ± S.E	0.77	NS
DBH1	.278± S.E	0.983	NS
CC1	1.278± S.E	0.265	NS
pH1	14		Alkaline
H2	1.004± S.E	.045	*
DBH2	1.038± S.E	.027	*
CC2	.814±S.E	.001	*
pH2	1.887		Acidic

Significance level $p < 0.05$, NS- not Significant, Significant $p > 0.05$, H1- mined areas, H2- unmined areas

Table 4.5 shows that there are statistically significant differences between the groups for Height 2, DBH2, and CC2, however it was there was no significant difference across for Height 1, DBH 1, and CC1

CHAPTER 5 : DISCUSSION

5.1 AGE AND GENDER DISTRIBUTION

The results showed that the female population is significantly larger than the male population across all age groups with the largest group dominated by females aged 30-39 years old, making up 48.8% of the total population. The gender balance is more even in the younger age groups (20-29;30-39), but becomes more skewed towards females in the older age groups. This may be because in most communities, women are often more involved in activities related to gathering wild fruits and managing household resources. Women having a more intimate understanding and awareness of the impacts of mining on wild fruits and soil fertility. Women mostly use the natural resources at household level that may include wild fruits and wild vegetables as relish and baskets woven rom woodland products. (Mashapa et al., 2020).

In addition, most of the responses came from the females which may indicate or support stereotyping within African communities were males dread or choose not to respond or attend to female interviewees due to personal preferences and experiences.

In some most African communities, women may have less decision-making power and presentation in formal structures, such as community leadership and resource management (Mashapa et al.,2020). As a result, women may tend to respond more to surveys taking it as a need to voice out their concerns and perceptions over their surrounding and environment.

5.2 PERCEPTIONS ON MINING EFFECTS

Females are more aware of the negative impacts of mining on wild fruit diversity compared to males. Females also perceive a more negative impact of mining on soil fertility, with the majority (156) responding "YES" to the negative impacts, compared to a smaller number of males (10) responding "YES". This may be because women gather forest products and have unique ecological knowledge that can assist in species diversity and conservation.

Respondents also disclosed that the red soil in the district were fertile and very good at moisture conservation that even during times of dry spells crops could survive water stress. Parts of the mined areas supported the cultivation of different farm crops that included maize, tobacco, cotton and various vegetables and also other agricultural activities that included horticulture and crocodile farming among others thus taking advantage of the fertile soils and abundant water (Magidi et al.,2022).

The majority of survey participants stated that the majority of wild fruits are collected in forests. This may be because cultivated fruits typically face less direct competition from other fruits, or because wild fruit species are exempted from the agricultural practices that commercial fruit crops must endure in more controlled environments. Furthermore, as indigenous cultures have a long history of collecting and harvesting wild fruits from forests this may also be an attempt to preserve traditional knowledge and traditions which serves as these communities' main supply of wild fruit.

5.3 SOIL pH

There is a statistically significant difference in soil pH between unmined and mined areas ($p = 0.0001$ at α 0.05). The unmined group has a mean soil pH value that is 1.88714 higher than the mined group, on average. There is a statistically significant difference in soil pH between unmined and mined areas, with unmined areas having a higher pH. This may be due to mining activities that affect the environment by altering its physical, chemical and biological properties thus affecting the ecosystem at large (Fazekašová and Fazekaš, 2020; Mishra and Das, 2020; Prematuri et al., 2020).

Mining activities typically involve the removal of natural vegetation cover, which can expose the soil to increased erosion and leaching. This can lead to the loss of topsoil and nutrients, potentially affecting the buffering capacity and pH of the remaining soil.

Mining activities can disrupt the delicate balance of soil microbial communities, which play a crucial role in regulating soil pH through various biogeochemical processes. The loss or alteration of these microbial communities can contribute to changes in soil pH (Agbola et al.,2020). Many mining operations, particularly those involving the extraction of sulfur-containing minerals, can lead to the oxidation of sulfides such as pyrite ($FeS2$), during mining processes can release hydrogen ions (H+) into the soil, leading to a decrease in pH which can generate Acid Mine Drainage (AMD), this acid can lower the soil pH with values as low as 3 reported in some cases.

The removal of vegetation and organic matter can reduce the soil's ability to neutralize acidity. Soils in natural, undisturbed environments often have a good buffering capacity, maintaining a relatively stable pH. Mining activities can deplete these buffering substances, such as carbonates and organic matter, leading to a more pronounced shift in soil pH.

Among other losses, soil bacteria, funguses and other organisms are displaced by the deposited material that will be heaped on top soil as mine dumps (Magidi et al.,2022). This has led to the smothering and suffocation vital soil bacteria.in addition, disruption of microbial habitats due to compaction and mining waste has led to the altering of physical, chemical and environmental conditions which in turn are adopted by microorganisms' overtime.

5.4 MINING EFFECTS ON WILD FRUIT DIVERSITY

The Shannon Diversity Index (H') values for mined areas range from 0.67301167 to 1.098612289, while for unmined areas, the range is from 0.636514 to 2.022805. The higher overall Shannon Diversity Index value for the mined areas (2.9271) compared to the unmined areas (2.3093) suggests that the mined areas have a more even distribution of wild fruit species, with fewer dominant species (Hendrychová et al.,2020). This may be due to mining activities that have disrupted the ecosystem, removing the dominant vegetation as they clear land for mining thus competitive advantage of the previously dominant species is reduced, allowing other fruit species to grow in the open niches created by the disturbance off mining activities.

The greater Shannon Diversity Index in the mined regions indicates a more evenly distributed wild fruit species with fewer dominating species. There is a complicated link between mining operations and wild fruit diversity, as seen by the changes in some wild fruit diversity metrics that do not show a statistically significant difference.

Mining disturbances have the potential to momentarily decrease the diversity or presence of herbivores and predators, which could put pressure on wild fruit species. For instance, monkeys that feed on the fruits and roots of wild fruit trees, such as *mazhanje (Uapaca kirkiana)*, *matamba (Strychnos spinosa), and snot apple (Azanza garckeana),* may experience this. In the absence of these biotic interactions, this has made it possible for a more equal distribution to arise.

There is no statistically significant difference in the mean heights between the mined (H1) and unmined (H2) groups, with no statistically significant difference in the mean DBH between the mined (DBH1) and unmined (DBH2) groups.The mining activities do not appear to have a significant impact on the tree diameters in the mined areas compared to the unmined areas for this measured parameter. This indicates that there is no statistically significant difference in the mean canopy cover between the mined (CC1) and unmined (CC2) groups .The mining activities do not appear to have a significant impact on the tree canopy cover in the mined areas compared to the unmined areas for this measured parameter. The mining activities do not appear to have a significant impact on the tree heights in the mined areas compared to the unmined areas for this measured parameter (Frouz et al.,2015). The ANOVA results suggest that the mining activities did not have a statistically significant impact on the measured parameters of Height , Diameter at Breast Height and Canopy Cover in the mined areas compared to the unmined areas.

In many cases, restoration comes with pioneers which sometimes serve as a nurse crops for shade-tolerant late successional more native species (Nero et I.al.,2021). As they offer shade that aids in the growth and establishment of native species that would find it difficult to thrive in the open after being disturbed by mining operations, pioneer plants can serve as shade crops. Additionally, the pioneer species improve the environment by paving the way for the desired native plant community to gradually establish itself, facilitating the ecological succession's natural progression and simultaneously displacing some native wild fruit tree species that existed prior to mining.

CHAPTER 6

6.1 CONCLUSIONS AND RECOMMENDATIONS

This study emphasizes the gendered aspects of mining's environmental effects as well as the connection between the variety of wild fruits and mining activity.

The study concluded the importance considering the viewpoints of many stakeholders, particularly women, in order to comprehend and lessen the ecological effects of resource extraction.

Mining operations have considerably lowered the pH of the soil in mined regions relative to unmined areas hence the mining activities prove to be affecting the environment negatively.

Recommendations

Adopt conservation and restoration measures for the soil through adding organic matter

Implementation of focused conservation methods and development of an extensive monitoring program to help monitor and restore wild fruit diversity

additional investigation is required to determine the long-term effects of disruptions caused by mining on wild fruit diversity

Boost community-based management of natural resources by involving women in particular in the management and stewardship of wild fruits and soils

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APPENDICES

QUESTIONNAIRE

My name is Patricia Garikai (B201537B) a student at Bindura University, currently studying towards Bachelor of Environmental Science Honors degree in Natural Resources Management. In fulfillment of the requirements for the degree, I am carrying out a research titled **COMMUNITY PERCEPTION ON THE EFFECTS OF MINING ACTIVITIES ON WILD FRUIT DIVERSITY AND SOIL NUTRIENTS IN WARD 25 ZVIMBA DISTRICT IN THE GREAT DYKE REGION.** Your co-operation will be highly appreciated.

Background information

The Great Dyke section is an area rich in minerals and this project is mainly focusing in the Zvimba district under Mashonaland West Province. It is located within Natural Ecological region 2. For this study Ward 25 of the other six districts in the North of the Zvimba District that include wards (15,20,21,23 and 26) is under focus. The project site is characterized by resettlement farming areas and small to large scale mining activities.

Section A

Questionnaire number: ……… Date of interview: ………..

Respondent information (tick where necessary)

Name of interviewee: …….. Village name: ………….

Sex: male/female

Age group years: (20-29) (30-39) (40-49) (50-59) (60+).

Duration of stay in village (years) (5-10) (10-20) (20-30) (30-40) (40+)

Educational level: None/Primary/Secondary/College/University

Livelihood practice: farming mining F/M vendor employed other(specify)

Section B

Question	Response (tick where appropriate)
What are the wild fruits eaten by people from this area	
Where are these wild fruits found in this area	Mountains/ farms/mines/forest
How are these wild fruits accessed by the communities	Harvested/from the market
Which common wild fruits where found in the Zvimba region in the past	
Have you noticed a decline/ disappearance of specific wild fruits	
How often are wild fruits consumed	Daily/weekly/monthly/seasonally/year-round

Section C

question	response
Do you believe that mining has had an impact on the soil fertility in the Great Dyke	Yes/no
Have you observed any changes in the organic matter content of the soil over the past few years? If yes ,what changes have you noticed	Yes/no
In your perception, how does change in	

organic matter affect the growth and diversity of wild fruits?	
Do you believe that the methods used for chrome mining in the Zvimba district could be improved to reduce the impact on wild fruits diversity and soil fertility	Yes/no (please support your response)

B201537B Patricia Garikai B201537B

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