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## The Impact of Medicinal Herb Demand on Biodiversity Loss in Maseru, Lesotho

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### ABSTRACT

The growing interest in therapeutic plants has become an important ecological concern in many developing countries, including Maseru. In these areas, traditional or ethno-medical systems still play a key role in primary healthcare. For many communities, plant-based remedies are the most affordable and accessible option, especially where modern medical services are limited or costly. This study investigates botanical remedies used for social and therapeutic purposes and examines how their increasing demand contributes to biodiversity decline. The research defines the ecological baseline as the original state of plant diversity and abundance before heavy harvesting began. This baseline helps measure the extent of biodiversity loss over time. The main objective is to understand the link between medicinal plant use and environmental sustainability. A mixed-methods approach was used, combining field data, community interviews and existing literature. Findings show that many households depend on medicinal plants for both healthcare and income through trade. However, increased commercialization and uncontrolled harvesting have placed pressure on wild plant species. Key results indicate that unsustainable practices, high demand and weak policy enforcement are driving the depletion of important flora and the degradation of ecosystems. The main contribution of this study is that it clearly links human dependence on botanical remedies with biodiversity loss. It also highlights the gap between conservation policies and their implementation and recommends sustainable harvesting, cultivation programs and stronger community-based management to protect biodiversity.

**Keywords:** Therapeutic Flora; Biodiversity Decline; Ethno-Medicine; Overharvesting; Preservation and Biomangement

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## 1. Introduction

Therapeutic flora has long played a central role in healthcare across Africa. For centuries, communities relied on plant-based remedies before the introduction of modern biomedical systems. Knowledge developed through close interaction with nature, where people observed plant properties, tested mixtures and refined treatments over time. This process created strong ethno-medical systems that still shape healthcare choices today. In many areas, knowledge is passed down through oral teaching and apprenticeship. Elder healers guide younger practitioners on plant identification, harvesting seasons and preparation methods. As a result, medicinal plants are not only sources of treatment but also part of cultural identity and social cohesion. Biodiversity, which refers to the variety and variability of living organisms within ecosystems, is fundamentally linked to environmental health. Plant species form an essential component of biodiversity and contribute to ecosystem stability, resilience, and productivity. Healthy environments, characterized by balanced soil conditions, adequate rainfall, and intact ecological processes, support the growth and regeneration of medicinal plants. In turn, biodiversity maintains ecosystem services such as nutrient cycling, soil formation, water regulation, and climate moderation, all of which are necessary for sustaining medicinal flora. Thus, the availability and sustainability of therapeutic plants depend directly on the condition of the surrounding environment and the integrity of local ecosystems. This relationship defines biodiversity and its link to environmental health.

In Lesotho, especially in Maseru, these practices remain common due to affordability and limited access to formal healthcare. In some communities, clinics are far, overcrowded or expensive to access. This makes herbal remedies a practical option. Importantly, when modern healthcare services are limited or costly, demand for herbal medicine becomes highly inelastic. This means that even if plant species become rare or expensive, people will continue to harvest and use them because they have few alternatives. This situation increases pressure on natural plant populations. Chaugule and Barve<sup>[1]</sup> note that herbal remedies are used to treat many conditions including respiratory infections, digestive problems and chronic illnesses.

The trade in medicinal plants also supports livelihoods.

Many households in and around Maseru depend on collecting and selling herbs for income. Women and recent rural migrants are often active in this trade, especially in urban markets. Urbanization has increased demand, as migrants bring traditional healing practices into the city. This growing urban consumer base includes low- and middle-income households who prefer affordable and culturally familiar healthcare options. According to Wang et al.<sup>[2]</sup>, plant-based medicine plays an important role in both healthcare and poverty reduction.

From a broader environmental and sustainability perspective, the relationship between biodiversity and human activity is reciprocal. While biodiversity provides resources that support livelihoods and healthcare systems, unsustainable human use—such as overharvesting, land conversion and habitat fragmentation—can degrade ecosystems. In the context of medicinal plants, increased extraction without adequate regeneration disrupts ecological balance, reduces species abundance and alters habitat structure. This highlights the importance of integrating environmental management with biodiversity conservation to ensure long-term ecosystem functionality and resource availability in the broader environmental and sustainability context (human–environment relationship).

Despite these benefits, there is a growing research problem. While many studies focus on the importance of medicinal plants, fewer examine how rising urban demand affects rural harvesting and long-term biodiversity. There is also limited data on how harvesting pressure changes across specific habitats and species in Maseru. This study addresses this gap by linking urban demand, rural supply systems and ecological impacts within a single framework. It also adds new insights through local field data, spatial analysis of harvesting zones and a review of national biodiversity policies.

In Maseru, key habitats at risk include riparian zones along the Caledon River (approx. 29.31° S, 27.48° E), moist mountain slopes in the surrounding highlands and communal rangelands in peri-urban areas such as Ha Thetsane and Roma. Many medicinal species depend on these microhabitats, where moisture and soil conditions support growth. Commonly harvested species include *Aloe ferox*, *Hypoxis hemerocallidea* and *Dicoma anomala*, which are also recognized in conservation discussions due to their ecological and

medicinal value. These species often have slow natural regeneration rates. For example, *Hypoxis hemerocallidea* may take several years to mature, while root-harvested species struggle to recover once removed.

Overharvesting affects ecosystem structure and function in several ways. Removing plants reduces vegetation cover, which can lead to soil erosion and reduced soil fertility. It also disrupts species interactions such as pollination and seed dispersal. In riparian zones, plant loss can affect water regulation and increase riverbank instability. As key species decline, ecosystem balance is weakened, making habitats more vulnerable to further degradation.

This study is also distinct because it connects local livelihood strategies with international biodiversity commitments. Lesotho is part of global conservation agreements that aim to protect biodiversity while supporting sustainable use. However, local communities depend on natural resources for survival. By examining this balance, the study highlights the need for policies that support both conservation and livelihoods. It also evaluates how current practices align with national biodiversity goals, especially in protecting high-value medicinal species. Maseru was selected as the study area because it represents a strong link between urban demand and rural supply. Unlike more remote regions, Maseru has active markets, diverse consumers and strong trade networks. This makes it an ideal location to study how commercialization affects plant harvesting. The city also reflects broader changes in lifestyle, migration and healthcare choices.

Global studies such as Torrance and Tomlinson<sup>[3]</sup> and Saliu et al.<sup>[4]</sup> show that unsustainable harvesting contributes to biodiversity loss. In Maseru, similar patterns are emerging due to increased demand and weak regulation. Without proper management, continued extraction may lead to species decline, habitat degradation and long-term ecological damage. This study, therefore, provides important insights into how medicinal plant demand shapes both local economies and environmental sustainability.

### 1.1. Objectives of the Study

The study aims to examine the growing interest in plant-based remedies and how it affects local biotrade. In recent years, many people in Maseru have turned to medicinal plants because they are often cheaper and more accessible than

modern healthcare. This rising demand has increased the harvesting of wild plants, especially from rural areas that supply the city markets. The research focuses on measuring the level of harvesting and understanding why people prefer herbal remedies. It looks at factors such as cost, cultural beliefs and limited access to formal medical services. Since Maseru is an important urban and business center, the study also explores how demand in the city leads to increased extraction of plants from surrounding rural communities. In addition, the study investigates the environmental effects of this growing demand. It examines issues such as overharvesting, loss of plant species, damage to natural habitats and reduced ability of plants to regrow. Some species may be collected more often than others, which can threaten their survival. The research also looks at how different harvesting methods affect plant health and the overall balance of ecosystems. Moreover, the study aims to provide a better understanding of how increased demand for medicinal plants can lead to biotrade loss and environmental challenges in Lesotho.

### 1.2. Gaps between Policy and Practice

The study helps to bridge the gap between high-level biodiversity policies and the local economic realities of Maseru market traders. Although national frameworks such as the National Environmental Action Plan and the National Biodiversity Strategy and Action Plan (NBSAP) promote sustainable use of natural resources, these policies often remain at the strategic level and do not fully reflect the daily challenges faced by traders, gatherers and traditional practitioners. This research connects policy objectives with real market data, harvesting patterns and livelihood needs in order to provide clearer and more practical strategies.

By collecting field-based evidence from traders, harvesters and officials, the study shows how economic dependence on medicinal plant trade influences harvesting intensity. Many Maseru traders rely on plant sales as a primary source of income due to limited employment opportunities. When demand is high and prices are attractive, there is strong pressure to maintain supply. This situation can lead to continuous harvesting, even when conservation guidelines exist. The study, therefore, explains how poverty, urban market demand and informal trade systems shape resource use in ways that national policies do not always address.

Unlike broad conservation plans, this research provides market-specific insights that can guide targeted interventions. For example, it identifies key species under pressure, quantifies trade volumes and highlights habitat decline from field surveys. These findings allow policymakers to move from general recommendations to species-focused management strategies, such as monitoring high-demand plants, improving market regulation and supporting sustainable harvesting training for traders.

The study also contributes by proposing clearer and more realistic strategies that link conservation goals with local livelihoods. It suggests strengthening collaboration between environmental authorities and market associations in Maseru. Instead of relying only on enforcement, the findings support community-based monitoring, awareness programs and practical harvesting guidelines that traders can realistically follow. This approach recognizes that conservation efforts are more effective when local people are included in decision-making processes.

Furthermore, the research highlights the need to improve implementation mechanisms within existing policies. While national and international agreements encourage biodiversity protection and sustainable use, weak enforcement, limited resources and informal market structures reduce their impact. By documenting these challenges at the local level, the study provides evidence that can help government institutions adjust strategies, allocate resources more efficiently and design interventions that reflect market realities.

Furthermore, the study narrows the gap between policy and practice by combining ecological data, economic analysis and community perspectives. It translates conservation goals into practical recommendations that consider trader livelihoods, market demand and biodiversity protection. In doing so, it supports more balanced, transparent and achievable strategies for sustainable medicinal plant management in Maseru and across Lesotho.

## 2. Literature Review

### 2.1. Global Context

Across developing countries, millions of people depend on ethno-medical systems as their main source of primary healthcare. Miladinov<sup>[5]</sup> confirms that these systems remain very important for rural and low-income popula-

tions. In many areas, plant-based remedies are easier to access. Common examples include *Hypoxis hemerocallidea* (African potato), *Bulbine narcissifolia*, wild aloe species and *Artemisia afra* (lengana). These plants are used to treat infections, stomach problems, wounds and chronic illnesses. Because of their accessibility, many households rely on them daily for basic healthcare needs.

The demand for these herbs is mostly price inelastic. This means that even when prices increase or plants become scarce, people continue to use them because they have limited alternatives. For many households, modern healthcare is expensive and not always easy to reach. Transport costs to clinics often range between M30 and M100 per trip, which can be too high for low-income families. In addition, patients may wait between 3 and 6 h before receiving treatment at public health facilities. These barriers make herbal remedies a more practical option.

A useful conceptual framework combines economic theory and ecological thresholds. From an economic perspective, households make decisions based on cost, distance, availability and perceived effectiveness of treatment. Herbal remedies are often chosen because they are cheaper and trusted within communities. From an ecological perspective, plant species have natural limits of regeneration. These limits are known as ecological thresholds. When harvesting goes beyond these limits, plant populations decline and may fail to recover. The interaction between high demand and limited ecological capacity explains why overharvesting continues even when people are aware of conservation issues.

Ethno-medical knowledge systems are also an important part of social heritage. Knowledge about medicinal plants is passed from elders to younger generations through oral traditions and daily practice. This knowledge is often guided by cultural rules and taboos. For example, some communities do not allow harvesting of immature plants or discourage uprooting the whole plant. Others restrict harvesting during certain seasons to allow regeneration. These practices helped protect biodiversity in the past.

However, commercialization is slowly weakening these traditional systems. As medicinal plants become a source of income, some harvesters ignore cultural rules in order to increase supply and earn more money. This shift reduces the effectiveness of traditional conservation practices. Younger generations may also focus more on profit than on preserving

cultural values, which increases pressure on plant populations.

## 2.2. Southern African Context

In southern Africa, several plant species are heavily harvested for ethno-medical use, especially *Hypoxis hemerocallidea* and *Bulbine narcissifolia*. These species are valued for their healing properties and are widely used to treat infections, inflammation and chronic conditions. Because of strong cultural beliefs in their effectiveness, demand has continued to grow over time. The situation in Lesotho can also be explained using the concept of the tragedy of the commons. Many medicinal plants grow on communal land where there is open access. This means that no single person owns or controls the resource. As a result, individuals harvest as much as they can because they fear that others will take the resource first. This behavior leads to overharvesting and resource depletion.

In areas near roads and markets, especially around Maseru, harvesting pressure is particularly high because access is easier. Collectors often target these areas to reduce travel time and costs. However, this leads to faster depletion of plant populations in accessible locations. As plants become scarce, collectors are forced to travel longer distances into remote areas, increasing both effort and harvesting costs.

Several socio-economic factors influence whether a household chooses herbal remedies or biomedical treatment. These include household income, level of education, distance to health facilities, transport costs, cultural beliefs and trust in modern healthcare systems. Poor households are more likely to rely on herbal remedies because they are cheaper or freely available. In contrast, households with higher income and better education may be more likely to use biomedical services. Long distances to clinics, high transport costs and long waiting times also discourage the use of hospitals. In addition, some people prefer traditional medicine because it aligns with their cultural beliefs and experiences. These combined factors explain why herbal medicine remains widely used even when modern healthcare services are available.

Recent research by Davis and Choisy<sup>[6]</sup> shows that medicinal plants are becoming harder to find. Collectors now spend more time searching for mature and healthy plants

than they did in the past. What was once a small-scale collection for household use has now developed into organized trade systems involving harvesters, middle traders and urban markets. This shift has increased harvesting intensity and reduced the ability of plant populations to regenerate. Subbarayan<sup>[7]</sup> also reports that continued demand is accelerating biodiversity loss across the region.

## 2.3. International and Local Reports

The global trade in botanical remedies reaches billions annually, but unsustainable harvesting threatens many plant species<sup>[8]</sup>. Increasing demand has created strong links between rural collectors and international markets. This has led to destructive harvesting practices such as uprooting entire plants, as reported by Raju and Das<sup>[9]</sup>. Hughes et al.<sup>[10]</sup> also highlight that expanding global markets increase pressure on high-value species. Parks and Tsioumani<sup>[11]</sup> explain that international agreements such as the Convention on Biological Diversity promote sustainable use of natural resources while also supporting local livelihoods. These frameworks encourage conservation, fair sharing of benefits and active community involvement. They recognize that biodiversity is important not only for the environment but also for economic development and human well-being.

However, implementing these policies at national and local levels remains a challenge. In Lesotho, the Environmental Affairs Department has raised concerns about the overharvesting of important plant species. Reports show that some species are becoming less common, especially in areas close to roads and markets where harvesting is easier.

Although the National Biodiversity Strategy and Action Plan provides clear guidelines for sustainable use, enforcement is often weak. Golzary et al.<sup>[12]</sup> note that limited funding, lack of trained staff and weak monitoring systems reduce the ability of authorities to control harvesting activities. As a result, many plants are collected without permits or proper management. This creates a clear gap between policy and practice. While policies support conservation, real-life conditions such as poverty, high demand and limited healthcare access continue to drive overharvesting. This shows that conservation strategies must combine economic understanding with ecological limits. Without addressing both social and environmental factors, biodiversity loss will continue despite existing policies.

### **3. Methodology**

#### **3.1. Study Area**

The study was conducted in Maseru, a key center for plant-based remedy collection, trade and use. As the capital city of Lesotho, Maseru has experienced steady population growth, which has increased the demand for medicinal plants. Markets in the city act as major distribution points where products are sold in raw or processed forms. Street vendors, traditional healers and traders operate in busy areas, creating a strong link between rural harvesters and urban consumers. This setting provided a suitable environment to study both the supply and demand for medicinal plants.

#### **3.2. Research Design**

The study used a mixed-approach design. A mixed approach refers to the use of both quantitative and qualitative research methods in one study. This design allows the researcher to collect numerical data and detailed explanations at the same time. Quantitative data helps measure patterns such as harvesting frequency and trade volumes, while qualitative data explains experiences, perceptions and challenges. Primary field data refers to information collected directly from participants through interviews and observations. This design improves transparency and reproducibility because it clearly shows how data was collected and interpreted. Harle<sup>[13]</sup> supports the use of combined methods to improve research reliability.

#### **3.3. Data Collection**

Primary data was collected through semi-structured, open-ended interviews. These interviews allowed participants to express their views freely while still following a guide of key questions. The criteria for selecting respondents included active involvement in medicinal plant harvesting, trading or regulation, at least two years of experience and willingness to participate. Interviews focused on harvesting practices, trade activities, seasonal patterns and conservation awareness. Specific harvesting activities were also recorded.

#### **3.4. Sampling**

Purposive and snowball sampling methods were used. Purposive sampling targeted individuals with relevant knowledge, such as traditional healers and experienced traders. Snowball sampling allowed participants to refer others who were involved in the trade but not easily identified. These methods are suitable for reaching hidden populations like traditional healers. However, these approaches can introduce selection bias. The study mainly included active and successful traders, while those who had left the trade due to resource depletion were not included. This may create a more positive view of the trade than reality. Despite this limitation, the methods ensured access to detailed and experience-based information. Malmqvist et al.<sup>[14]</sup> support these approaches for studies involving hard-to-reach groups.

#### **3.5. Study Population**

The study involved 85 respondents: 30 traditional practitioners, 25 gatherers, 20 traders and 10 government officials. This wide participation ensured representation of different roles within the medicinal plant value chain. Traditional practitioners explained treatment uses and demand patterns. Gatherers described harvesting methods and field challenges. Traders provided insights into pricing and market demand. Government officials shared information on policies and regulations. Garriga et al.<sup>[15]</sup> highlight that multi-actor participation improves understanding of environmental issues.

#### **3.6. Data Validation and Triangulation**

Triangulation was used to improve the credibility of the study. This involved comparing interview responses with government reports and academic literature. Morgan<sup>[16]</sup> emphasizes that triangulation strengthens validity. In cases where differences were found, both perspectives were carefully examined. For example, official reports may indicate stable plant populations while harvesters report increasing scarcity. These differences were discussed to provide a balanced understanding. Ajayi<sup>[17]</sup> also highlights the importance of using multiple data sources.

### 3.7. Data Analysis

Descriptive statistics were used to analyze quantitative data such as harvesting frequency and trade volumes. Qualitative data were analyzed using thematic analysis. This involved coding responses into categories based on common themes such as “economic dependence,” “resource scarcity,” and “weak enforcement.” To ensure reliability, inter-rater agreement was applied, where more than one researcher reviewed the coding. This reduced bias and improved consistency. DeJonckheere et al.<sup>[18]</sup> recommend combining statistical and thematic analysis to produce meaningful results. The methodology improved transparency and reproducibility by clearly outlining data collection, sampling, validation and analysis procedures.

### 3.8. Ethical Approval Procedures and Consent Protocols

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Before the research started, permission to conduct the study was obtained from local village authorities to ensure that the research followed appropriate academic and ethical standards. Participation in the study was voluntary, and all participants were informed about the purpose of the research, how the information collected would be used, their right to refuse participation and their right to withdraw from the study at any stage without any negative consequences. Verbal informed consent was obtained from all participants before interviews and questionnaires were conducted. Confidentiality and anonymity were strictly maintained throughout the study by excluding personal identifiers such as names and identity details from all records, thereby protecting participants’ privacy and reducing potential risks associated with involvement in resource-based activities. Formal ethical clearance from an Institutional Review Board or Ethics Committee was not required for this study because it involved voluntary community participation and did not include medical or clinical procedures.

Beyond standard research ethics, the study also considered broader ethical implications related to biodiversity conservation and community livelihoods. Particular care was taken to ensure that the research process did not contribute to the overexploitation of medicinal plants or unintention-

ally promote unsustainable or illegal harvesting practices. The study avoided collecting sensitive ecological information, such as exact harvesting locations of vulnerable species, which could expose these resources to further pressure. The research was conducted in alignment with national governance frameworks and legal mechanisms governing biodiversity protection in Lesotho. This includes adherence to principles outlined in national environmental policies and biodiversity strategies, which emphasize sustainable use, conservation of natural resources, and community participation. The study also recognized the role of local governance structures, such as village authorities, in regulating access to natural resources and granting permission for research activities.

Furthermore, the research acknowledged existing legal mechanisms aimed at controlling resource use, including regulations on harvesting, trade, and environmental management. By engaging with both formal institutions and local authorities, the study ensured that data collection remained compliant with national laws and respected community-based resource governance systems. Overall, these measures ensured that the research upheld ethical standards while supporting responsible biodiversity management and reinforcing existing conservation efforts.

## 4. Presentation of Data

Data show several key issues, including economic dependence, resource scarcity and weak enforcement of environmental laws occurring due to drivers and consequences interacting within the biotrade system. Many households rely on medicinal plant harvesting for income. Because of this, people continue collecting plants even when supplies are decreasing. At the same time, demand remains high because many people depend on herbal remedies for health-care. This combination of strong demand and limited income alternatives increases pressure on plant resources<sup>[19]</sup>.

As harvesting continues, resource scarcity develops. Plant species become less available because they are collected faster than they can regenerate. Survey findings support this, showing low plant density and poor regeneration in heavily harvested areas. Many sites had mature plants but very few young ones, indicating weak regeneration. Specific species such as *Aloe vera*, *Harpagophytum procumbens* and

*Warburgia salutaris* are under significant pressure. Harmful harvesting methods worsen the problem. For example, bark stripping in *Warburgia salutaris* leads to tree death, root harvesting in *Harpagophytum procumbens* prevents regrowth and repeated leaf harvesting in *Aloe vera* weakens the plant. These practices also cause environmental damage such as soil erosion, trampling, vegetation loss and reduced biodiversity.

Weak enforcement of environmental laws allows overharvesting to continue<sup>[20]</sup>. When there is little monitoring or few penalties, people are not discouraged from unsustainable practices. As a result, overharvesting becomes common and continues over time. These factors interact to form a reinforcing cycle. Economic dependence and high demand drive continuous harvesting. This leads to resource scarcity. Instead of reducing use, scarcity increases the value of medicinal plants, encouraging even more harvesting. Weak regulation fails to control the situation, allowing overexploitation to continue. Over time, this cycle threatens biodiversity, reduces plant availability and undermines the long-term benefits of biotrade. Evidence from surveys and trade data supports this pattern, including high harvesting rates (73% for *Aloe vera*, 60% for *Harpagophytum procumbens* and 52% for *Warburgia salutaris*). Studies such as Boamong<sup>[21]</sup> confirm that when dependence is high and regulation is weak, overharvesting becomes more likely.

Data also shows that people prefer herbal remedies for different reasons. Firstly, they are cheaper than modern healthcare, making them more affordable for low-income households. Secondly, cultural beliefs and traditional knowledge strongly influence people’s choices, as many communities trust plant-based medicine that has been used for generations. Lastly, in some rural areas, limited access to clinics and hospitals makes herbal medicine a more practical and accessible option.

A survey was undertaken to assess the condition of plant species in their natural habitats. The findings supported information collected from interviews and trade records by providing physical evidence from the field. Plant density was

measured. Regeneration rates were assessed. Signs of harvesting pressure were also recorded. The survey confirmed that areas identified by harvesters as heavily used showed low plant density and poor regeneration. This matches interview responses about overharvesting. Trade records showing high demand for certain species were also supported by the observed decline of those same species in the field. The study found that commonly harvested species such as *Aloe vera*, *Harpagophytum procumbens* and *Warburgia salutaris* are under significant pressure due to frequent collection. Therefore, the survey validates the other data sources by showing that what people reported and what is recorded in trade is consistent with actual conditions in nature.

Surveyed sites had many mature plants, but very few young plants. This shows poor regeneration. The problem is serious for *Warburgia salutaris*, where bark stripping is common. Removing bark harms the tree and leads to its death. For *Harpagophytum procumbens*, when roots are harvested, it disturbs the soil and prevents regrowth. In *Aloe vera*, when leaves are harvested repeatedly, it weakens the plant and reduces its ability to grow and reproduce over time. Different harvesting methods affect plant health and the environment. Harmful practices such as uprooting plants and removing bark reduce plant survival<sup>[22]</sup>. These actions can cause soil erosion and habitat degradation. As a result, both plant species and the wider environment are affected, including soil quality and biodiversity.

Moreover, the data show signs of environmental damage. These include trampling, clearing of vegetation and reduced plant diversity. The findings match the survey results. High harvesting rates were recorded: 73% for *Aloe vera*, 60% for *Harpagophytum procumbens* and 52% for *Warburgia salutaris*, based on raw data presented in **Table 1**. This combined evidence shows that increased demand leads to heavy harvesting. This reduces plant availability and contributes to biotrade loss. Alum<sup>[23]</sup> reports that, without sustainable harvesting methods and stronger management, continued exploitation will lead to further loss of biodiversity and reduce the long-term benefits of the medicinal plant trade.

**Table 1.** Frequency of harvested species in percentages.

Species	Sites Surveyed	Sites with Harvesting Observed	Sites without Harvesting	Calculations
<i>Aloe vera</i>	30	22	8	$22/30 \times 100 = 73\%$
<i>Harpagophytum procumbens</i>	30	18	12	$18/30 \times 100 = 60\%$
<i>Warburgia salutaris</i>	30	16	14	$16/30 \times 100 = 53\%$

Source: Author’s own data.

## 5. Discussion

The results demonstrate a strong link between market demand and harvesting intensity. Data from gatherers, traders and traditional practitioners show that plants with high demand are harvested more often and in larger quantities. Species that are popular in urban markets are collected frequently to meet daily customer needs. This shows that harvesting is not random, but focused on a few high-value plants. These plants are widely trusted for treating common and chronic illnesses, which creates repeat demand. As a result, collectors increase harvesting to maintain supply and earn income. However, this process is strongly shaped by the role of urban middlemen, who connect rural gatherers to city markets and often capture the bulk of the economic value. Gatherers receive relatively low returns despite doing the labor-intensive work of harvesting, which limits their capacity and incentive to adopt sustainable practices. This confirms that economic incentives, as well as unequal benefit distribution within the value chain, are major drivers of harvesting behavior. From a theoretical perspective, this finding aligns with basic market principles of supply and demand, where increased demand stimulates greater extraction efforts, but also highlights how value chain inequalities influence resource use decisions.

A more critical analysis shows that this pattern reflects basic economic theory, where higher demand leads to increased supply efforts. However, in this case, the supply comes from natural ecosystems that have ecological limits, such as slow regeneration rates and habitat constraints. This introduces the concept of ecological thresholds, where continued extraction beyond recovery capacity leads to resource depletion. It also reflects the theory of the tragedy of the commons, where open-access resources are overused due to individual benefit-seeking behavior. Importantly, the presence of middlemen intensifies this dynamic by creating strong and consistent market demand while insulating urban consumers from the ecological costs of extraction. From a policy perspective, this creates a conflict between economic benefits and ecological sustainability. It highlights a gap between conservation goals and real market forces, showing that policies promoting sustainable harvesting often fail to address both the strength of demand and the structure of the supply chain. This finding con-

tributes to broader literature on biodiversity conservation by demonstrating that effective strategies must integrate market regulation and value chain governance alongside ecological protection.

The study also adds to existing research on medicinal plant trade by showing how supply chains shape harvesting practices. Urban middlemen play a key role in this system by connecting rural gatherers to city markets, but they often capture most of the profits. Gatherers, who do the actual harvesting, receive lower payments and have little financial incentive to harvest sustainably. Because of this imbalance, gatherers focus on collecting large quantities rather than protecting plant populations, reinforcing unsustainable extraction patterns. Theoretically, this reflects unequal power relations and value distribution within market systems. From a policy perspective, it suggests the need for fairer trade systems, improved pricing mechanisms, transparency in market transactions and stronger regulation of intermediaries to ensure that benefits are more equitably shared. Addressing these inequalities can help align economic incentives with sustainable resource management. This shows that the structure of the supply chain is a critical factor in biodiversity decline and a major reason why conservation guidelines are often ignored.

Raihan<sup>[24]</sup> identifies similar global patterns, where commercial expansion increases pressure on natural resources. Their work shows that small-scale use can quickly turn into large-scale trade without proper management systems. The findings of this study support this argument by demonstrating how demand-driven markets, reinforced by intermediary actors, lead to unsustainable extraction. Dolis-lager et al.<sup>[25]</sup> also highlight that urban demand in southern Africa encourages rural harvesting. As cities grow, the need for affordable healthcare options increases and this drives further demand for medicinal plants. These studies reinforce the policy implication that both urban consumption patterns and rural supply systems, including the role of intermediaries, must be addressed in conservation planning.

Harvesting practices were reported to be influenced by short-term economic needs. Many gatherers depend on plant trade for daily survival, so they prioritize immediate income over long-term sustainability. This situation is further intensified by the limited financial returns they receive within the value chain, which reduces their ability to invest

in sustainable practices such as cultivation or controlled harvesting. Corli et al.<sup>[26]</sup> state that, without clear rules, monitoring or replanting efforts, plant populations cannot recover. This reflects a common problem in resource management where individual needs conflict with collective environmental goals. From a theoretical perspective, this supports the idea that poverty and unequal benefit distribution can drive unsustainable resource use. From a policy perspective, it emphasizes the need to integrate livelihood support and value chain reforms into conservation strategies.

Effective social value development policies are therefore essential. These policies should support underrepresented communities, such as rural gatherers, by providing alternative livelihoods, fair market access and education on sustainable practices. In addition, policies should address the role of middlemen by promoting transparent pricing, strengthening market regulation and supporting cooperative models that allow gatherers to access markets more directly. Community-based resource management, benefit-sharing mechanisms and inclusive governance structures can help align economic incentives with conservation goals. By improving income opportunities and strengthening community involvement in resource management, these policies can reduce pressure on natural resources. In summary, this study contributes to the broader literature by emphasizing that sustainable management of medicinal plants requires not only environmental policies, but also fair and inclusive economic systems that address market dynamics, value chain inequalities and local livelihood realities.

## 6. Conclusions

The study concludes that the growing demand for medicinal plants in Maseru is a key driver of biodiversity loss. Weak enforcement of environmental laws and limited livelihood opportunities increase pressure on natural plant populations, leading to ecological degradation. Therefore, closing the gap between policy frameworks and practical implementation is essential to ensure the sustainable use of plant resources. Future research should focus on long-term monitoring of plant populations, assessing the feasibility of cultivation programs and evaluating community-based conservation models. Continuous monitoring will help detect early signs

of species decline and support adaptive management strategies. The study further recommends that environmental policy in Lesotho adopt more practical and community-centered approaches to managing medicinal plants. Priority should be given to targeted monitoring of high-demand species and harvesting hotspots, along with strengthened local enforcement. Community-based cultivation initiatives and village nurseries should be supported through seed funding, technical training and secure land access to address challenges related to land tenure and limited start-up capital. To address financial and staffing constraints within the Environmental Affairs Department, public-private partnerships should be promoted and traditional healers should be formally included in regulatory systems to encourage shared responsibility for sustainable resource management.

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## Institutional Review Board Statement

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Formal ethical clearance from an Institutional Review Board or Ethics Committee was not required for this study because it involved voluntary community participation and did not include medical or clinical procedures.

## Informed Consent Statement

Before collecting data, the researcher asked for permission from village or ward Chiefs. Approval processes differed depending on local leadership practices. The study followed ethical standards by explaining the purpose of the research, ensuring confidentiality and obtaining consent from participants.

## Data Availability Statement

The data will be available on request from the writer.

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## Conflicts of Interest

The author declares no conflict of interest.

## AI Use Statement

I confirm that, during the preparation of this work, I, Thabang Sekamane, have used Toolsmart in order to paraphrase, and I did not generate the content using it. After using this tool, I reviewed and edited the content as needed, and I take full responsibility for the content of the published article.

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