ADDIS ABABA UNIVERSITY

COLLEGE OF SOCIAL SCIENCES

DEPARTMENT OF ARCHAEOLOGY AND HERITAGE MANAGEMENT

ETHNOARCHAEOLOGICAL STUDY OF WILD EDIBLE AND MEDICINAL PLANTS IN ARID AND SEMI-ARID AREAS: THE CASE OF MOYALE WOREDA, BORANA ZONE OF OROMIA REGIONAL STATE, ETHIOPIA

By

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Addis Ababa University.

Ethnoarchaeological Study of Wild Edible and Medicinal Plants in Arid and Semi-Arid Areas: the Case of Moyale Woreda, Borana Zone of Oromia Regional State, Ethiopia

A Thesis Submitted to the College of Social Sciences in Partial Fulfillment of the Requirements for the Degree of Master of Arts in Archaeology at the Department of Archaeology and Heritage Management

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This is to certify that the thesis prepared by **Morketa Befikadu Asefa**, entitled **"Ethnoarchaeological Study of Wild Edible and Medicinal Plants in Arid and Semi-Arid Areas: the Case of Moyale Woreda, Borana Zone of Oromia Regional State, Ethiopia"** submitted in partial fulfillment of the requirements for the degree of Master of Arts in Archaeology and Heritage Management, compiles with the regulations of the university and meets the accepted standards for originality and quality.

Approved by the board of examiners

External examiner……Signature……Date…….…….

Internal examiner…….Signature…… Date…….…….

Supervisor……Signature……Date…….…….

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Acronyms

CSA	Central Statistics Agency of Ethiopia
GPS	Global Position System
PDC	Pre-domestication cultivation
UNESCO	United Nations Educational, Scientific and Cultural Organization

Ethnoarchaeological Study of Wild Edible and Medicinal Plants in Arid and Semi-Arid Areas: the Case of Moyale Woreda, Borana Zone of Oromia Regional State, Ethiopia

Morketa Befikadu Asefa

Abstract

The research focuses on the ethnoarchaeology of the wild edible and medicinal plants of Moyale Woreda, Borana Zone, Oromia Regional State, Ethiopia. It includes identification and documentation of a variety of Indigenous and local botanical knowledge and material cultures linked with wild edible and medicinal plants. A comprehensive methodology was employed, including pre-field preparation, fieldwork with semi-structured interviews, and post-field analysis. Plant specimens were obtained on the spot and brought to the National Herbarium at Addis Ababa University for scientific identification. A total of 83 species of plants were collected. Out of which species of medicinal plants, including Senegalia nilotica, Senegalia tortilis, Actiniopteris radiata, Albuca abyssinica, and Caralluma apriogonium were identified in the study site. In addition, 43 wild plants that are edible, including Senegalia hockii, Grewia villosa, and Lenea rivae were documented. Reports on their use for construction, fuel, and other purposes was also recorded. Materials including pots, axes, wooden mortars and pestles, grinding stones, baskets, cups, pick-mattocks, hoes, knives, teapots, and wooden tools have been reported as being linked to wild edible and medicinal plants. The study further elucidates the challenges faced by these plants: habitat destruction, overexploitation, and climate change. Community-based conservation and further actions are recommended long-term use of these important plant resources for the benefit of local communities and towards biodiversity conservation. This ethnoarchaeological study, as a Middle-Range Theory, has helped to appreciate projections in human exploitation of food plants and medicinal plants in pre-historic times. The tools documented in this study can also give us insight into the types of material culture expected to be uncovered in archaeological excavations.

Key words: "ethnoarchaeology," "wild edible plants," "medicinal plants," "Oromia," "biodiversity conservation," "indigenous knowledge." And "archaeological implication"

CHAPTER ONE

1. INTRODUCTION

The Borana Zone is endowed with diverse groups of plants with various uses to the community. Its inhabitants are dependent on plant resources for nutrition and food security. As Gemedo Dalle et al., (2005), their availability and use surpass mere survival. They represent traditional knowledge and cultural heritage that bond people to their environments. These plants represent much more than sources of nutrition; they are crucial to the very identity of a community by providing foods important culturally and even influencing socio-economic dynamics through food and income.

Indeed, Borana Zone is specifically well known for its richness in biological and plant diversity and has always been a living library concerning medicinal plants. Most of these plants have various medicinal qualities that have made them the backbone of the health system in the community for so long. Communities in this area have used these kinds of plants as a natural pharmacy for many years, treating a large number of illnesses (Gemedo Dalle et al., 2005). Besides being of therapeutic importance, the plants have cultural value as they are repeatedly used in several customs and activities of the people. Such sustainable use of medicinal plants reflects an enduring understanding of the importance of the protection of the community environment. Due to the immense diversity and ethnobotanical knowledge of these plants, the Borana Zone is a rich knowledge base for studies and the development of natural medicine.

Although the Borana Zone is one of the most biologically and culturally diverse areas, especially the Moyale woreda, it has been sparsely represented in both archaeological and ethnoarchaeological studies. Current studies in the study region around Yabelo, Dekole, and Mega are limited to rock art, and other sites focus on lithic and bone, like the Gotera archaeological site, with large gaps regarding the understanding of plant biodiversity and their role in local communities. More precisely, the ethnoarchaeological studies regarding wild edible and medicinal plants in the area of the Moyale Woreda are scant. In the local culture and the healthcare system, these plants are almost an important field of study. Hence, this work will also try to fill this gap by paying attention to investigating and documenting wild edible and medicinal plants along with the associated Indigenous and local knowledge. The present study

investigates the broad botanical heritage of the region and its importance to the survival of the resident communities as a means of encouraging improved knowledge of the interrelationships between humans and plants in the area. The relationship between people and plants is important in local areas based on their ecological, economic, health-related, and cultural features. Plants ensure balance, maintain economic benefits, and preserve biodiversity.

The results of this work will not only highlight the diverse floral heritage of the Borana Zone and its importance to the local people but will also demonstrate how these plants can contribute to pressing current concerns related to food security, health, and biodiversity conservation.

This research will significantly contribute to the need for conservation and the documentation of traditional knowledge, which will help in the management of these vital plant resources.

1.1. Background of the Study Area

1.1.1. Location

The Borana zone is located in the southern part of the Ethiopian state of Oromia and is one of the 13 administrative zones. It lies between 3°36' and 6°38' North latitude and 3°43' and 39°30' East longitude, sharing its southern boundary with Kenya. The capital city of the Borana zone is Yabello, which is about 570 kilometers south of Ethiopia capital, Addis Ababa. The Borana zone covers an area of 48,360 km2 and is characterized by its lowlands, which constitute about 75 percent of the landscape. Its administration structure at the zone level is organized into eight districts, further subdivided into 275 kebeles (Ferew Olana, 2018).

Moyale is one of the districts in the Borana region, Ethiopia, and is placed at 3° 31′ 37.2″ North latitude and 39° 3′ 21.6″ East longitude. It shares boundaries with Ethiopian Somali locals on the east, Miyo and Guch woreda on the north, and Kenya in both the south and west directions. It is richly integrated in terms of cultural and biological diversity. Located 771 kilometers away from Addis Ababa, the capital of Ethiopia. According to the contingency plans for 2017-2018 of the district, Moyale hosts a population of 204,380 residents, of which 105,958 are female. This population generally originates from the Borana and Gebra clans of the Oromo ethnic group. The Moyale landscape has an area of 1,130 km2 (Ferew Olana, 2018).

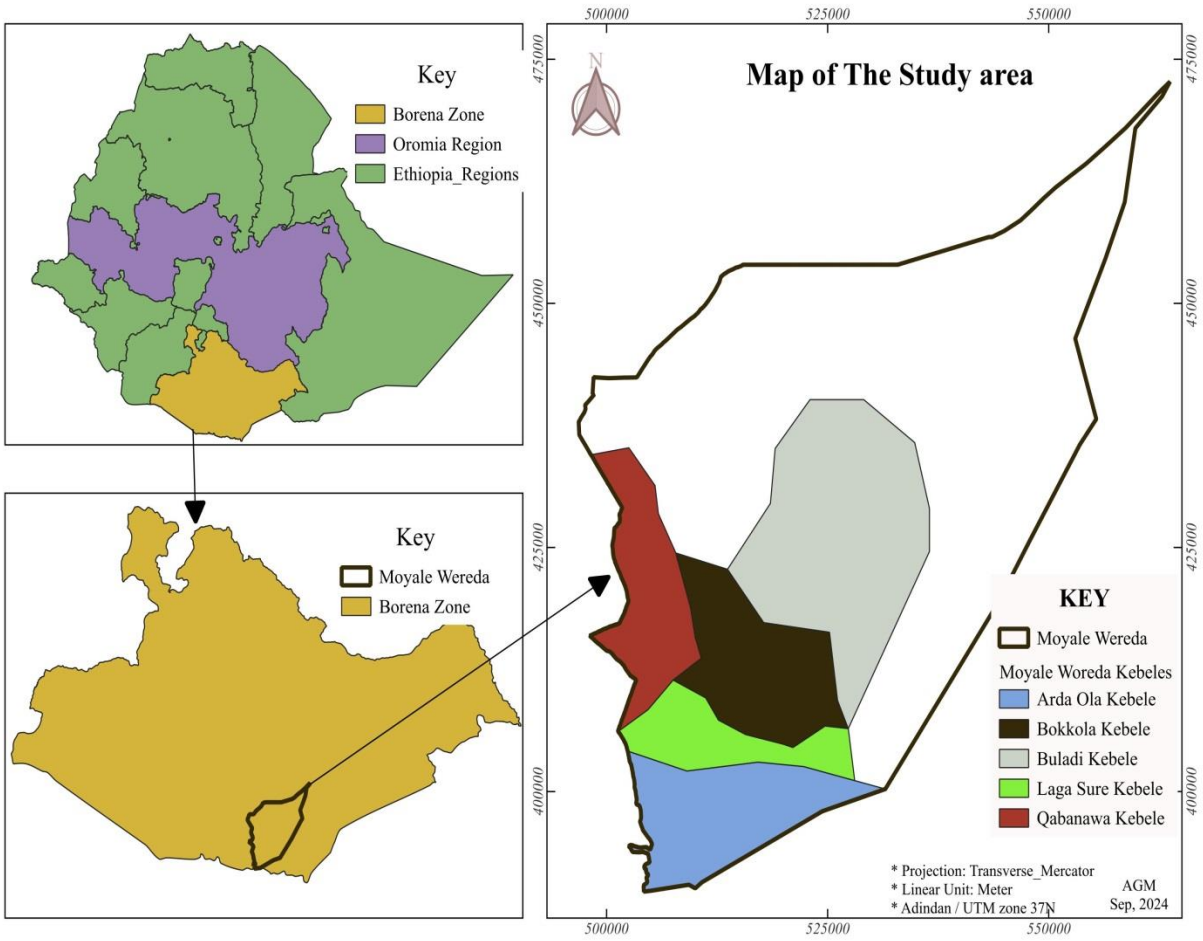


Figure 1: Map of the study area (by Amanuel Getachoo, April 20, 2024)

The arid and semi-arid agricultural ecology of the Moyale region are interconnected at altitudes of 1150 and 1350 m above sea level, reflecting both the harshness and unpredictability of the climate. Earth's terrain is mainly flat, with wide plains covering the entire plain. The area has a mixed land use structure, of which 60% is grassland, 21% is forest, 9% is agricultural land, and the remaining 10% is wetlands. In addition to the complex challenges posed by dry conditions, this demonstrates the exemplary approach of the neighboring group to the environment. Agro-climatic region: The region is mainly lowland, with Kolla accounting for 80% of the area. The remaining 20% of the region is made up of the Midlands (woinadega). In general, the region has two main rainy seasons: Gana (main) and Hagaya (short). On the other hand, rainfall patterns in Moyale are irregular and unreliable (Ferew Olana, 2018).

1.1.2. Geology

The Moyale region of southern Ethiopia has geology constituted of diverse rock units, quite instrumental in the formation and distribution of graphite deposits in the area. The most important such rock types within the Moyale region include quartz, feldspar, mica, schists, granodiorites, quartzites, graphite schists, and amphibole schists. These different rock instruments, with their mineralogical properties, work cooperatively with each other to form an ideal geological environment for the development and accumulation of graphite (Yeneayehu Fenetahun and Tihunie Fentahun, 2020).

The Borana region is influenced by the weather and has four consecutive seasons. Each introduces its own climate. These are: Commit, a long drought between December and February; Belg, a long rainy season from March to May; Kiremt, the rapid dry season between June and August; Between September and November is Meher, a rapid wet period. The average annual precipitation is between 350 mm and 900 mm and usually falls within the two rain seasons throughout the region, accounting for March–May and September–October. Due to this fact, these rains have always been erratic and variable in nature throughout the region, therefore causing droughts. The average temperature in the Borana region accounts for about 19°C, with the maximum and minimum values recommended at about 24.6°C and 12.96°C, respectively (Mitiku Adisu et al., 2022).

1.1.3. Biodiversity and Vegetation

The Borana Zone is one of the regions with specific high biodiversity, divided into different vegetation types. In the Moyale Woreda, there exist different ecosystems to support a wide range of species of flora and fauna. Vegetation includes important vegetation-type exposures to savanna ecosystems and grasslands with scattered trees; at the same time, other areas are made up of acacia woodlands that form habitats for different kinds of wildlife. The montane forests, which are more biologically diverse, occur at higher elevations and form part of the water catchments that help support the lives of aquatic organisms and also provide water for terrestrial animals. The region supports a diverse assemblage of mammals, including elephants, zebra, Grant's gazelle, Beisa oryx, and numerous bird species (Gemedo Dalle et al., 2005).

The botanical diversity exhibits the place particular ecological conditions and also the climatic variations. In the Borana rangelands, the major land cover types include cultivated land, bare surfaces, shrub land, grassland, and forest. Encroaching woody species such as *Senegalis mellifera*, *Vachellia reficiens,* and *Vachellia oerfota* are common everywhere, while *Acacia* and *Commiphora spp*. dominate the bushlands (Fris & Demissew, 2011).

1.1.4. Economy of the study area

The economy of Moyale Woreda is highly embedded in its agricultural and pastoralist lifestyle, as a large proportion of the district population relies on animals for their survival. Some common cattle species include domestic animals, goats, sheep, and camels serving dual purposes to provide food and as a source of income to the local communities. This means access to food and non-food items provided by sales from the livestock and its products boosts the local economy. Along with rearing livestock, crop production is also playing a crucial role in the district economy. Maize and haricot beans are major crops grown, though attempts are being made to diversify into vegetable growing (Mitiku Adisu et al., 2022).

1.2. Background of the study

The Borana Zone is part of southern Ethiopia and is well known for its rich biodiversity and cultural heritage. The people of this region commonly use *Rhus natalensis Engl.* and *Tamarindus indicus* for medicinal and food use. A good variety of medicinal and edible plants in the region have been an important part of the subsistence, traditional healthcare practices, and cultural traditions of its local communities for generations (Gemedo Dalle et al., 2005). Despite these plant resources being very important, no one has done ethnoarchaeological research in documenting and understanding their utilization and significance in the Borana Zone, specifically in the Moyale Woreda area. These wild edibles and medicinal offer cultural, economic, and health benefits to the local communities. They give incentives to sustainable harvest methods, ecotourism, herbal medicine production, and local market opportunities. Secured access to such plants contributes toward improved public health and biodiversity conservation.

Ethnoarchaeology is an investigation of modern-day culture as a sub-discipline of archaeology to understand past human behaviors, practices, and social structures. Integration of archaeological

and ethnographic methods can be done in order to advance the study of cultural objects. The best ways of learning about material culture include participant observation, interviews, visual ethnography, contextual analysis, and collaborative research using community-based researchers. These methods will provide valuable insight not only into the objects but also into their cultural context; they help to build trust and thereby knowledge-sharing. Ethnoarchaeologists study daily activities within the community to establish causes brought about by culture, social, and economic influences, how they evolve, and the role they play in identity, tradition, and environmental relations. They also examine how communities adapt to various changes, a skill useful for sustainable development and cultural conservation (Binford, 1968).

One of the interests in the field of ethnoarchaeology is the study of traditionally used medicinal and wild edible plants. Anthropologists in this field study the perception, management, and use of these plant resources as a means of opening the complex dynamics through time in human-environment interactions. This kind of approach may yield new insights not only about past societies but also about the understanding of modern practices of resource use and management, while underlining the relevance of ethnoarchaeology to addressing problems of today (Binford, 1968; Hodder, 1985).

In Ethiopia, traditional medicine and healthcare systems depend greatly on medicinal plants; available within the rich biodiversity of the country. However, these natural heritages are threatened by several natural and anthropogenic disturbances, coupled with the rapid erosion of traditional knowledge on the conservation and usage of these medicinal property bearing plants. Therefore, this underlines the urgency of conserving this very important wisdom along with the implementation of sustainable cultivation and use of medicinal plants (Elizabeth et al., 2014).

The study covers plants and ethnobotanical knowledge related to biodiversity among the Borana pastoralists in South Oromia, Ethiopia, bringing out the role of plants in subsistence, medicine, construction, and culture. It also throws light on the importance of traditional ecological knowledge for the sustainable management of resources and economic diversification through the commercial viability of plant species like *Boswellia, Commiphora*, and *Acacia senegal* as reported in the works of Gemedo Dalle et al., (2005).

Previous research in the Borana Zone (Girma Hundie, 2001) has targeted the rock art and other archaeological sites, leaving a wide gap in our knowledge about the plant biodiversity of the region and its role within the local community. This research tries to fill the gap through an ethnoarchaeological survey of edible and medicinal plants in the Moyale Woreda area of the Borana Zone. It is in this area that loss of plant biodiversity affects livestock health, food insecurity, and cultural heritage. Filling this gap is urgent in terms of local community durability, cultural preservation, and global ecological understanding, helping match conservation efforts to global biodiversity objectives.

1.3. Ethnoarchaeology as a Methodological Approach

Ethnoarchaeology is the study of archaeological records of traditional societies and cultures concerning their material culture. It takes into consideration both tangible and intangible aspects of culture and encompasses all. Ethnoarchaeology shares a great deal of commonality with ethnography and therefore enables an in-depth investigation into human behavior and cultural performance of humans and the evolution of societies for a better understanding of the past and humankind (David & Kramer, 2001).

Ethnoarchaeologists study modern societies both through observation and even by participating in the creation, use, and disposal of artifacts. In this respect, they elaborate on detailed models for the analysis of data that comes out of archaeological surveys and excavations. Such models allow defining patterns in the production, use, and disposal of artifacts by relating the present to the past. Ethnoarchaeological research is based on such a dynamic process, interpreting ancient societies through present society (Hodder, 1985).

Accordingly, in the field of research, a special place is taken by ethnoarchaeological research into wild edible plants. The value of such research consists not only in the fact that it allows an understanding of the cultural and economic significance of such plants but also in finding out how these wild species were included in the diet of people in the past. Ethnoarchaeologists research these wild edible plants within modern communities, which still depend on them, to piece together the problems of old cultural practices and food systems. This approach also enables them to make comparisons from the past to the present for a dynamic, continuous view of human adaptation and survival. Furthermore, this work also indicates that these plants are

always relevant, even in modern times, a fact that testifies to their potential role in contemporary problems related to food security and sustainability (Veen, 2018).

Ethnoarchaeological research into medicinal plants refers to the study of the use of plants by past and contemporary human societies for medicinal purposes. It adopts techniques from both ethnobotany and archaeology for a more rounded ecological, social, and cultural understanding of such plants. Ethnoarchaeologists study not only the plants themselves but also the relationships between people and plants that have changed through time. The ethnic knowledge related to harvested foods and medicinal plants is an important part of the traditions, knowledge, and beliefs documented here in. It has provided a deep understanding of the symbiotic relationships between humans and the environment. This is the data constituting a very important resource in archaeological studies (Smith, 2004).

1.4. Ethnoarchaeological Research

(Hildebrand, 2003) has conducted an ethnoarchaeological investigation of the cultivation and consumption of ensät and yams among the Shakko people in southwest Ethiopia. The study gives a fascinating insight into pre-domestication intensification and possible subsistence methods. Next to the practical contribution to subsistence, it deals with the social and cultural role of such a production. These findings detail valuable information on ancient Ethiopian domestication behavior and illustrate how the Shakko people cultivated and consumed yams and ensät differently from the global standard. This suggests a locally adapted food production system that most likely has been developed in line with specific environmental conditions and cultural preferences. More importantly, it points out the importance of local-level studies when conducting research on ancient agriculture and food systems, as these would bring a richer interpretation of human subsistence and survival strategies.

(Hareya Fassil, 2005) presented the medicinal plants utilized by the rural communities in the Northern Highlands of Ethiopia, which were noted to be implemented together with their related traditional medicinal knowledge and procedures, in his 2005 publication. Indeed, the results showed an interesting trend in health practices among the communities. First, the knowledge of the traditional medicinal plant use seemed to be confined only to specific individuals, mostly men who were traditional health leaders among the communities. This is indicative of a

specialized knowledge base and further emphasizes how important such individuals are for health provision in such communities. On the other hand, it also underlines a potential vulnerability, since the holders of its knowledge, once lost, would see this traditional wisdom lost. It emphasizes the need to give priority to efforts of documentation of this knowledge and expansion of its diffusion so that this resource will be preserved for future generations.

It describes and analyzes the tradition of growing coffee and its usages among the three communities Kafecho, Majangir, and Jimma Oromo inhabiting southwestern Ethiopia. Thus, this is targeted to explore the methods of traditional cultivation of coffee, socio-cultural contexts of its consumption, and related crafts before those traditions become transformed or lost due to modernization and urbanization. This work also attempts to draw some parallels between contemporary and past practices with the aim of gaining more insight into the cultural meaning of coffee. Outputs: Traditional practices documented: A number of practices of cultivating coffee and various tools that are used in the process were looked at closely and documented. Social Impact Analysis: How consumption of coffee has become a social impact, further reinforcing gender roles, and creating community bonding. Cultural Heritage Insights: These ranged from how coffee is combined into rituals and collective activities to how it becomes part of cultural heritage. Theoretical contributions: It developed some of the theoretical and methodological insights of the domestication and cultivation of the coffee plant, suggesting that the initial domestications may be because of religious needs, as its role in various rituals stated (Worku Derara, 2019).

1.5. Statement of the problem

Ethiopia is a country developed with traditional knowledge and is often a source, mostly acquired through communities living in close harmony with their natural environment. Traditional knowledge, being passed on to subsequent generations, shows how closely individuals are with nature. Valuable medicinal properties are carried by the rich flora of the country, offering a solution to most of the health concerns naturally.

In developing countries, plant resources play a vital role in fulfilling most of the basic needs of cattle-keeping communities. Basic needs refer not only to food but also to medicine, construction, fuel, and cultural practice. The Borana Pastoralists, located in southern Ethiopia,

numbering approximately 500,000 plants (Bassi, 2003), have developed their traditional ways and practical skills over the generations to maximize the use of plants available within their surroundings. The study area is inadequately explored and documented with respect to its medicinal plants and wild edible plants potential.

The Borana pastoralists are an integral part of the Oromo people and are located in the Borana Zone, a southern part of Ethiopia that is essentially arid and semi-arid. Livestock rearing is their livelihood, and they attach almost a spiritual connotation to the environment. Native plants have been used as food and medicine for centuries. Society is organized around the Gada system, recognized by UNESCO as an intangible world heritage site. They are resilient and show good potential for coexistence with the harsh environmental conditions. Their way of life, knowledge, and sustainable practices are one the indispensable keys in the study of wild edible and medicinal plants in the Borana zone (Abera Seyoum & Motuma Didita, 2022).

The Borana zone, particularly the Moyale woreda, has been affected by ongoing drought and lack of rain for about six consecutive years. In this study area, various types of wild edible and medicinal plants are still present, despite many environmental hazards. These important resources have been left with little research. The role and contribution of such marginal environments to the beginning of food production have not been explored. Edible and medicinal plants, though important, are not protected or conserved. The various techniques employed in the cultivation of these medicinal and edible plants by communities are poorly documented, and hence the documentation of such practices and technological advances is very limited. Thus, the present study tries to fill this gap by attempting to take part in the motivations that could quickly modernize the Borana residents to become dependent on wild edible and medicinal plants. By so doing, it also tries to provide information on the roots of ancient food production and other forms of plant use, which have valuable insights into human adaptation and resilience in the face of environmental challenges.

1.6. Research questions

- What is the diversity of medicinal plants and wild edible plants in the area, along with the associated indigenous and local botanical knowledge?

- How does the ethnoarchaeological evidence concerning medicinal plants and wild edible plants of the Borana zone contribute to an understanding of the origin and early development of food production in the region?
- Which parts of the plants are used to prepare food and medicine, and which materials are used during the preparation process?
- What are the major threats to and conservation practices of the medicinal plants and wild edible plants of the region?

1.7. Objective of the study

1.7.1. General Objective

The general objective of this research is to study the wild edible and medicinal plants found in the arid and semi-arid areas of the Borana zone, in the Moyale woreda, using ethnoarchaeological and ethnobotanical methodologies, for a better understanding of past human-plant interaction.

1.7.2. Specific Objective

- Documenting and identifying the diversity of wild edible and medicinal plants occurring in the area; record also the indigenous and local botanical knowledge of the local inhabitants and their interaction with plants.
- Describing how an ethnoarchaeological approach applied to such plants may contribute to understanding the origins and early development of food production systems.
- Identifying the material cultures and procedures associated with the culturing, processing, and utilization of these plants.
- Identifying the major threats to plant species and linked indigenous knowledge and discussing the conservational measures in place or needed to protect them.

1.8. Hypothesis

In a seminal work related to the origins of food production, (Neumann, 2005) advanced that plant cultivation started in what the author called marginal environments. These are areas in which resource availability is unpredictable and may force inhabitants to adopt novelty strategies

for survival in which the cultivation of plants features. Curiously, the environment of Moyale Woreda seems to match the characteristics of a marginal environment as those described by Neumann. Instability in this area may have led to the devising of special strategies for the cultivation of plants and resources, and it would therefore be a good region in which to test Neumann hypothesis.

Given the fact that the proposed study on ethnobotanical and ethnoarchaeological research in this region, with a particular emphasis on the interaction between humans and plants, would allow the application of this theory. This permits an in-depth analysis of the adaptation process of the local community to their natural habitat, the methods they have elaborated for the cultivation and usage of wild edible and medicinal flora, and the effects of such methods on the cultural and social life in question. This research might also bring to the fore the perseverance and self-sufficiency of the people just to survive in their peripheral environment. It considers the detailed interaction and relationship between the people and plants in facing the difficulties changing their immediate ecology. This constitutes not only a very good test of Neumann hypothesis but also generally advances the state of knowledge concerning man adaptability and resilience.

1.9. Significance of the Study

Borana is a region where one of the significant transformations in pastoral life to semi-pastoral is going on. This is part of a more extensive change in culture and adaptability. Thus, a deep study about traditional knowledge and utilization of wild edible and medicinal plants in this very region will be multidimensional. This will not only lead to deeper insight into the history of plant domestication and the evolution of food production but also shed light on the dynamics of such a cultural shift. This kind of research would most probably also show how these changes have been affecting the biodiversity in these regions and exactly how the Borana people are managing to modify their traditional ways in order to keep up their relationship with the environment.

The place is currently facing a decline in floral species and forest cover largely brought about by natural factors accompanied by human activities. Other factors include famine and drought, which have contributed to the extinction of various flora species in the Borana region. This led to the development of the necessity to conduct a critical study on the flora present in the area.

- This research will be very significant in terms of plant species documentation with their uses at the local level and will create a ground for further research.
- The research will add knowledge about the beginnings of food production and the process of domestication of plants and will provide insight into the survival strategies of humans in the past.
- The present research is going to contribute toward celebrating the local traditions by documenting culinary culture in the region.
- This is important research in that it illuminates human adaptability and resilience, rebuilds historical dietary and health behaviors, and informs conservation efforts.
- This wills also further our understanding of human-plant interactions and the various complex relationships between communities and their natural environments, emphasizing the importance of conservation efforts.

1.10. The scope of the study

The study was conducted in Moyale Woreda, which is found in the Borana zone of the Oromia Regional State. This region was unique in ecological diversity, but most importantly, it was really unique with respect to cultural identity. This is situated along the border with Kenya; the setting gave it an added layer of complexity within its cultural outline, as the influences across the border infused into the local traditions. The research was done across five kebeles, namely, Qabanawa, Lagsure, Arda Ola, Buladi, and Bokola, in order to ensure comprehensive understanding with regard to ethnobotanical practices of the region. Each of these kebeles, diverse in nature and practices, contributed toward a far richer, delicate understanding of the local knowledge and use of wild edible and medicinal plants.

Therefore, the ethnoarchaeological research of wild edible and medicinal flora in the Borana zone, Moyale woreda, in Ethiopia has focused on the selection with regard to geographical location of the kebeles, accessibility, biodiversity, willingness to participate, and ethical considerations. It had been designed to document Indigenous botanical knowledge, to document and identify a variety of plants, and to ensure the data collected would provide comprehensive insights into the region ethnoarchaeological aspects.

1.11. Limitation of the Study

This has been a quite comprehensive study, but it had some limitations because of the emergence of challenges during the investigation. The limitation was mainly brought about by the small number of people with knowledge of traditional medicine. The guidelines of the culture indicate that such specialized information is passed only to the older children and rarely to the second or third child under special conditions. This limits the number of people who can contribute to this share.

Another limitation was the unwillingness of people with knowledge of medicinal plants to provide information about such plants. This is founded on the very strong belief that the prevalent sharing of such information might dilute the value and efficiency of such medicinal plants; it thus led to an intentional withholding of information with regard to certain plants.

This study had a couple of methodological problems, including sampling bias and seasonal variations. Sampling was done in a diverse way to make sure that the plants and participants were representative of the regions variety, undertaking different areas from the region and taking into consideration different ranges of participants. The interviewed people were chosen from a cross-section of the community: different ages, genders, and roles. The research was conducted in a complete annual cycle about the seasonality of the availability and of the plant uses. In this way, these strategies allowed the reliability and validity of the results.

1.12. Ethical Considerations

The study followed ethical considerations by ensuring: informed consent for the participants; respect for autonomy, privacy, and confidentiality of information; transparency in information, source acknowledgment, cultural sensitivity, and beneficence in research. No personal data were required from the participants, save for what pertains to the purpose and nature of their involvement in this research. Transparency was ensured with the use of discussions. Any work and ideas not created by the author were cited correctly. The data was gathered in ways that helped add to the positive understanding of human-plant interaction, helping in the conservation effort in the region.

1.13. Organization of the Thesis

This thesis is structured into five distinct chapters. The first chapter provides a general background for the research, statement of the problem, research questions and objectives, significance of the study, and description of the study area. Chapter two presents a review of the literature on the theoretical and conceptual frame on ethnoarchaeology of wild edible and medicinal plants. The third section describes the materials and methods used in this study. In the fourth chapter data presentations are presented. The fifth chapter presents a discussion of the research findings and encompasses the conclusions and recommendations related to this study.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

This chapter contains a review of the theoretical literature on the theoretical basis and historical context of an ethnoarchaeological study of wild edible and medicinal plants. The study of food production in Ethiopia and the utilization of wild plants through ethnobotanical and archaeobotanical means are also summarized in this chapter.

2.1. Theoretical and Conceptual Frame on Ethnoarchaeology

Ethnoarchaeology is a sub-discipline in archaeology where the living cultures of modern communities are studied to draw a better understanding of ancient human societal behaviors. This methodology allows the researchers to trace links between the material culture of the past societies and the cultural activities of the groups in the present times (Schiffer, 2013).

Ethnoarchaeology was born in the mid-20th century partly as a response to the inadequacies of traditional archaeology regarding the interpretation of the cultural and social dimensions of prehistoric societies. As ethnoarchaeologists argue, they can understand the past through observation and making inferences from the traditions, customs, and artifact remains of living societies. This field of study makes determinations about the way a culture is currently interacting with material culture in order to provide insight into the structuring of communities, lifestyles, and ecosystems that may have occurred in ancient societies (Binford, 1968; Hodder, 1985).

The growth of ethnoarchaeology was due to the growing awareness of the need for a better contextual understanding of the human culture of the past. The traditional methods of archaeology, relying almost solely on the analyses of artifacts and excavation, suffered from serious inadequacies while attempting to portray the social, economic, and political backgrounds against which the various artifacts were produced and used. Ethnoarchaeology attempted to fill in the lacunae by considering inputs and knowledge gained from the study of living societies (Schiffer, 2013; Hamilakis, 2011).

American anthropologist Julian Steward is credited with founding this branch of study, and this book owes a great deal to his work. Steward did extensive fieldwork among Native American tribes during the 1930s and 1940s. He recognized the need to examine modern societies in order

to answer archaeological questions. He described a clear line of inquiry for ethnoarchaeological research that indeed has been considered and followed in the field (Schiffer, 2013).

British archaeologist Colin Renfrew also played an important role in the development of the discipline. Renfrew, an original proponent of the field, was concerned with placing archaeological finds into their broader cultural context. He believed that the modern societies that could be studied by ethnographers provided considerable insight into the processes leading to the material culture of past societies. Renfrew gave the basis upon which has since been called the "ethnoarchaeological method" that archaeologists throughout the world still use to this day (Binford, 1968; Hamilakis, 2011).

To this was added the enormous contribution of the American archaeologist Lewis Binford, who developed the area. The "New Archaeology" movement contributed by Binford during the 1960s and 1970s drew from the need for rigorous theoretical frameworks and empirical testing as necessary to apply the scientific method to archaeology. Thanks to Binford's work, today ethnoarchaeological methodologies are adopted in trying to solve specific research problems. His influence is also expressed through his contribution to the current practice of the field (Binford, 1968; Hamilakis, 2011).

Over time, ethnoarchaeology diversified into a myriad of research topics, including symbolic systems, settlement patterns, ceremonial behavior, and subsistence strategies. Throughout its history, it has embraced contributions from the neighboring social sciences, anthropology, sociology, and linguistics, as well as a wide scope of qualitative and quantitative research methods. Since its inception, the discipline has always sought to correlate findings from archaeology and ethnography (Schiffer, 2013).

Ethnoarchaeology emerged through the study of contemporary societies in the early 20th century because a need was felt for a more holistic understanding of ancient human cultures. Its growth has been facilitated through the progressive development of archaeological research interests, methodological progress, and the contributions of important figures such as Lewis Binford (1968) (Binford, 1968). During recent times, ethnoarchaeology continues to be one of the most vibrant and vital areas of research that helps to enhance our knowledge of the convoluted social, cultural, and environmental parameters that have influenced human history so far.

This development marked a significant milestone within the study of ethnoarchaeology with the publication of "Ethnoarchaeology: Implications of Ethnography for Archaeology" by Brian Hayden in 1979. Hayden argued for closer integration between the research methods of archaeological and ethnographic research, emphasizing the importance of taking into consideration the cultural context in which artifacts were created and used (Hamilakis, 2011).

Since its inception, the sub-discipline has enjoyed expanding resources. Ethnoarchaeology is a branch of archaeology used to study contemporary cultures to understand human behavior and cultural conservation in history. Since its inception, ethnoarchaeology has continued to shift and expand. The various methods of ethnoarchaeological study have been conducted on archaeological sites to understand the technology practiced in the past, building traditions, and social organization. The use of digital methods of recording and analyzing findings can be used to illustrate technological changes that enhance this specialization (Binford, 1968; Smith, 2004).

British archaeologist Renfrew supported ethnoarchaeology as a valid methodology to understand prehistoric societies. He considered that the study of contemporary cultures would enable the archaeologist to interpret the archaeological data by drawing analogies that allow inductive inferences about social organization, economic patterns, and technological development in the past. Lewis Binford counters that the limitations of ethnoarchaeology lie merely upon concentrating exclusively on modern analogies that will lead to mismodeling and simplification. Binford recommends that instead of ethnographic data accumulation, archaeological research should place more emphasis on establishing theoretical frameworks by painstakingly analyzing the material culture. Ethnoarchaeology, a technique different from the conventional excavation-based archaeological methods and their analysis of artifacts, enables a more integrated comprehension of human societies in times past since it furnishes certain parallels from contemporary cultures (Binford, 1968; Schiffer, 2013).

Using the excavation process and analysis of artifacts as primary sources, conventional archaeological methods have several key limitations to understanding ancient cultures. These include lack of context, incomplete representation, interpretive obstacles, biases, and assumptions. In fact, traditional approaches may focus on physical remains removed from social, political, or economic contexts within which perceptions of prehistoric practices may be influenced. They may also disregard significant parts of daily activities, social organization, and

symbolic systems. Ethnoarchaeology, on the other hand, overpasses such limitations since it integrates knowledge gained from research into modern cultures. It, therefore, represents a better understanding of past human societies (Binford, 1968; Hodder, 1985).

Ethnoarchaeological methodological analysis involves ways of data collection methodology, ethics, as well as the theory that are aimed at comprehensively judging the research for reliability. That is to say, the researcher has to respect cultural values and informed consent, ensure the confidentiality of information, and consider impacts on local community well-being. They will very often combine qualitative and quantitative research methods as a means of capturing the complexity of human behavior. Ethnoarchaeology requires methodological analysis to assure the validity, reliability, and relevance of the findings. By doing so, this gap between archaeology and anthropology will give insight into the cultural and social contexts that human behaviors prevailed within in the past, thus helping to increase our knowledge about civilization in the past while at the same time assisting modern-day archaeology studies (Binford, 1968; Hodder, 1985).

2.2. Ethnoarchaeological Study of Wild Edible Plants

These wild edible plants that exist in wetlands, grasslands, and forests and that were never domesticated have been one of the crucial foodstuffs in human nutrition from time to time. Most of the cultures depended on these plants for nutrition, medicine, and even other purposes (Hamilakis, 2011; Veen, 2018).

Ethnoarchaeological research into wild edible plants investigates the interdependence of past human groups and their use of plants in the wild. This integrative methodology weaves together ethnography, archaeology, and botany in understanding how various human societies of the past utilized wild edible plants for nutrition, medicine, and other cultural purposes. Researchers study current hunter-gatherer societies and traditional agricultural communities to gain insight into foraging behavior and plant knowledge prevalent in prehistoric and historic times. In Africa, ethnoarchaeological research focuses on the edible wild plants, often referred to as "wild foods" or "wild vegetables," which have been of utmost importance for the survival and good health of many African societies throughout the history of the continent. Ethnoarchaeological studies are carried out through the practical implementation of several approaches, which involve techniques

like direct observation, interviews with the members of the community and an examination of archaeological remains. Throughout recorded history, wild edible plants have played a vital role in the people of the world's strategy for subsistence by providing essential nutrition and diet diversity. Their survival and, to a large extent, that of their ecosystem depends highly on traditional ecological knowledge (Veen, 2018).

2.3. Ethnoarchaeological Study of Medicinal Plants

Medicinal plants have been acknowledged and applied for many years because of their pharmaceutical properties. The pharmaceutical value in plants arises because of pharmacologically active compounds that can be used in traditional and contemporary medicine. Plants can manage various health conditions (Hamilakis, 2011).

Ethnoarchaeology in medicinal plants forms an important way of understanding the uses of plants for medicinal purposes by ancient human cultures. This study explores modern human communities concerning their cultural practice and behavior. Ethnoarchaeologists study human-plant interactions in the ways that plants were used by humans in the past for medicinal purposes. The latter collect information through participant observation, interviews, and the collection of plant specimens, as well as artifacts, like the remains of plants unearthed on archaeological sites (Schiffer, 2013).

The ethnoarchaeology of medicinal plants focuses on one field of study that merges archaeology, anthropology, history, and ethnobotany. In ethnoarchaeological studies, the focus is to conceptualize past human behaviors and practices concerning specific themes, in this case, medicinal plants, through existing communities. By studying the existing communities, researchers are able to identify plants used for their medicinal properties, document traditional knowledge, and understand their use from a sociocultural perspective (Smith, 2004).

2.4. Archaeoethnobotanical and Ethnoarchaeological Research into Food Production in Ethiopia

This topic discusses the archaeoethnobotanical and ethnoarchaeological research on food production within an Ethiopian context. This sets the premise upon which practices, traditions, and knowledge systems have over time defined the agricultural landscapes and food habits of the

region. The rich biodiversity and varied cultural heritage in Ethiopia make this country a very special and unique place for such studies. These diverse climatic regimes and ecologies have promoted the practice of varied forms of agriculture as well as the utilization of a myriad of plant species for food production in the country. Merging the expertise of the authors in archaeoethnobotany and ethnoarchaeology, these work places them well to explore the cultivation, processing, and consumption of diverse plant species that have been practiced by various past societies in Ethiopia. This is also within the context where we get to understand the different roles these plants have played, whether in traditional medicine, cultural rituals, or socioeconomic structures (Marshall and Hildebrand, 2002).

Ethiopia has both rich crop diversity as well as a long history of farming. Agriculture is among the oldest practices in the history of the nation; it dates back over a couple of millennia. Plant cultivation in Ethiopia dates back several thousand years; the early farmers grew crops such as teff, barley, lentil, and chickpeas in regions such as Aksum and Lalibela. The sophisticated cultures of the region owe their developments to those early farming activities (Munro-hay, 1989).

Fuller et al. (2014) intend to explain the long-term food storage in northern Highland Ethiopia based on archaeobotanical analysis at Lalibela, Ethiopia. The study shall try to comprehend the agriculture and method of food storage used by prehistoric people in habitating Lalibela and the ways whereby it may have had an impact on the long-term food security in the region.

(Degsew Zerihun , 2015) discusses the ethnoarchaeology of wild edible and medicinal plants of Aba'ala Woreda, Afar. The existence of a pastoral way of life brings about full dependence on wild plants. This study highlights the role of traditional knowledge in the identification, collection, and use of such plant resources. It shows that ethnobotanical knowledge differs in different age categories and highlights the need for conservation and documentation necessary to conserve the traditional resources and the cultural heritage of the people.

Alemseged Beldados, (2017) reported in his 2017 article that archaeological contexts from Kassala, northeastern Sudan, contained desiccated and charred fruit stones and seeds. The study offered some ecological adaptations and subsistence strategies throughout the early 2 millennia BC among the Gash Groups. Identification of such plant species and preferred environment

enlightens the vegetation history and environmental conditions and thus contributes to the understanding of the paleoenvironment of the Late Holocene.

According to Alemseged Beldados, (2019) non-edible and edible plant species were available both in the Ethiopian highlands and in the Sudan lowlands. The study also enhances our knowledge of early agriculture in Sudan. Besides, the research explores the role of small-seeded millets, which has not been explored in any previous archaeological research. In addition, sorghum and small-seeded millets probably played a subsistence role as animal feed and the human food supply in settlement contexts at least as early as the middle of the fourth millennium BC. The study further reflects on questions of the origins of the crops cultivated and the crops significance to local economies. Generally, this is a good study that details how ancient Sudanese communities exploited agricultural practices and plant resources.

Archaeobotanical evidence for early plant use at Aksum by Anne et al., (2013) is a study that was designed to present the archaeological evidence of early plant use at the Aksum site. Authors research the plant remains at the site for an understanding of the importance of plants in the early Aksumite society lighting their environment, agriculture and diet. They also hope that the study will increase awareness about the Aksumite civilization and its interaction with flora.

(Alemseged Beldados & Hiruy Daniel, 2019) talk about the role of isolation in selecting domesticated crops and their morphological modification and query the importance of the pre-domestication culture as an evolutionary step towards domestication of food flora. It deals with the diversity, morphological changes, and selection pressures undergone in sorghum and noog domestication in Northern Ethiopia and northeastern Sudan. It is intended to add to our knowledge regarding different factors affecting plant domestication.

This study, therefore, seeks to throw light on the subsistence patterns and the ecology of the mid-late Holocene through archaeobotanical analysis. The results contribute to the reconstruction of the ancient economy and ecology at the site to enhance human-environment interactions (Alemseged Beldados and Medhanit Tamirat, 2020).

Ethnoarchaeological and archaeobotanical research was carried out in the Konso Zone in Amesias Alemu, (2022) on wild food plants. The production cycle, technological processes, customs, and social dynamics that characterize local use of such plants by the community were

the focus of study. Such findings develop the understanding of harvesting, processing, cooking, and consumption along with their ceremonial and cultural role in these plants. Her research also engages with the division of labor in the community and, through that, comes to unmask gender relations.

In this respect, the article by Ruiz-Giralt et al., (2023) attempts to shed light on the perceptions of agricultural history in the northern Horn of Africa by concentrating on the cultivation of sorghum and finger millet during the Aksumite Period, from approximately 50 BCE to 800 CE. The computer modeling tools allow these researchers to develop theories about historical agricultural systems in the region. Data such as altitude, precipitation distribution, and crop preferences are combined with information from ethnographic studies. Such models shall be tested against data from archaeology and ethnoarchaeological observations, which may give new insights about the importance of those staple crops in prehistoric societies.

2.5. Utilization of Wild Plant Species

The rich biodiversity and cultural heritage in Ethiopia make the utilization of wild plant species an important issue. Ethiopia has diverse flora, comprising many wild plants used by the local community for different purposes. Such plants are important in providing food, medicine, shelter, and other needs to the local people (Zemede Asfaw and Mesfin Tadesse, 2001).

This study assesses the ethnomedical knowledge in Ankober District, Ethiopia, in relation to the conservation of traditional understanding of herbal remedies. The study identified 135 species, 128 genera, and 71 plant families used as remedies against human ailments. It points out the importance of traditional knowledge and contributes to the conservation strategies for saving this resource (Ermias Lulekal et al., 2013).

Abebe Worku et al., (2020) have listed 31 therapeutic species of plants that have been given priority for long-term conservation at Midega & Fedis, Eastern Ethiopia. They noted those species that were threatened in their natural habitat and proffered strategies for the conservation of such plants. The study has once again shown the significance of traditional medicine and the protection of biodiversity.

Carried out research on use and management of traditional medicinal plants around Abeshige district, Gurage Zone, Ethiopia. The research identified 89 species used for treating human and livestock ailments, of which 84.26% were used specifically for human health. The study also emphasized the use of herbal remedies that usually came from fresh materials. It also mentioned that threats to these plants include expansion of agricultural lands, deforestation, and erosion of indigenous knowledge. In fact, the findings indicate that traditional healing practices play a very important role in the healthcare system among locals (Dagne Abebe and Belachew Garedew, 2020).

This 2021 study, by Mersha Eshete & Ermias Lulekal (2021), investigated the cultural importance of medicinal plants used to treat human ailments. Among the Guji semi-pastoralists in Ethiopia's Suro Barguda District. The research indicated a considerable diversity of medicinal plants important in traditional healing practices. The study calls for conservation efforts as a means of protecting such valuable plant resources and preserving traditional knowledge for future generations.

Aschalew Emire et al., (2022) identified, therefore, documented there are 54 edible plants in the Liben and Wadera Regions in Guji Zone, Southern Ethiopia, and investigated their ethnobotanical knowledge. The results indicated that trees were the most dominant growth form, followed by shrubs, herbaceous plants, and climbers. It also identified the preferred plants, age-related knowledge about these plants, and the threats to them.

Musa Abdella et al., (2023, in this research study, identified wild plant species from Oromia, East Hararghe Zone of Ethiopia. It discusses the role that edible plants may play in offsetting food insecurity with dietary diversity. The fruits were most consumed, followed by the bark, seeds, leaves, stems, and roots of the plants. This relatively small number of wild edible plants identified may be due to regional practices. The findings point to the potential importance these plants have for nutritional intervention related to food insecurity.

2.6. Previous Study on the Study Area

In their study "floral Variety and Borana Ethnobotany among Borana, Southern Ethiopia," Gemedo Dalle et al., (2005) investigate the connection between the knowledge and practices of southern Ethiopian Borana pastoralists and plant variety. The author explores the intricate

connections between biodiversity, traditional knowledge, and sustainable animal husbandry while highlighting the region's flora and its significance to the Borana. To ensure the sustainability of agricultural systems and the long-term well-being of local people, the research aims to increase public awareness of the critical role that plant biodiversity conservation and local knowledge play.

According to Garuma Gerbaba & Wendawek Abebe (2016), therefore seek to make an in-depth analysis of the diversity, variety, and form of tree and shrub in the designated area of forest. Their article "Diversity and Plant Pattern of "Tree and Shrubs" at Magada the Forest, Bule-Hora District, Borana Zone, and Oromia, which is Region, Southern Ethiopia," explains in detail the analysis. The study is targeted to capture all kinds of information on shrub and tree species of the Magada Forest regarding their pattern of distribution, ecological importance, and its conservation strategy. Besides this, the study will possibly discuss biological relationships among the different plant species concerning their contribution toward the maintenance of overall biodiversity and ecosystem stability in the forest.

In conclusion, these findings give relevance to our overall thesis. This research into the use of wild food and medicinal plants in the Borana zone provides us with a current understanding of the interrelationship between people and the environment, their adaptation strategies, and their resilience to a harsh climate area. The research also contributes to the general knowledge in the fields of sustainable practices, protection of biodiversity, and combining traditional knowledge into modern agricultural and health practices. These are the many insights that have guided and will continue to guide our exploration of human-plant interactions and their implications in our quest toward sustainable living in both arid and semi-arid regions.

CHAPTER THREE

3. MATERALS AND METHODS

This study adopted both qualitative and quantitative methods for the research design. This wide approach gave a wider understanding of the subject matter and ensured that such analysis was not unilateral but rather balanced, each contributing uniquely to the insights and perspectives brought into the study.

The study was conducted in all the five kebeles in the Moyale woreda, namely, Qabanawa, Lagsure, Arda Ola, Buladi, and Bokola. This involved an intensive field documentation of plant species in these areas, which included a detailed botanical information record. Therefore, all the various types of wild edibles and medicinal plants were documented one by one to bring inventory of tradition useful plant biodiversity in the region. The kind of research design adopted for this study was divided into three broad phases: pre-field stage, fieldwork stage, and post-field stage.

3.1. Pre-field Work

This stage consisted of gathering background information regarding the study area on which the research would have its foundation. This was done by going through a wide timescale of sources, such as searching and documenting scholarly works, articles, journals, various publications, historical accounts, and theses that relate to the research topic and its surroundings. A review of relevant publications became both a means for insight into the pool of existing knowledge on the subject and a starting point from which to realize what gaps existed in the current research that this study should aim to fill.

Considering the above, the following institutions were consulted, and reputed for their rich databases and resources:

- Ethiopian Heritage Authority: Maintains a vast pool of information relevant to the rich cultural and natural heritage of Ethiopia.
- French Centre for Ethiopian Studies: One of the organizations concerned with inter-disciplinary research on Ethiopia.
- Institute of Ethiopian Studies: one of the pioneering institutions for the study of Ethiopian Studies.

- Laboratory of the Department of Archaeology and Heritage Management at Addis Ababa University: It was one of the leading centers carrying on archaeological research.

3.2. Field Work

Data collection techniques were applied throughout the fieldwork phases as the second phase of the research procedure. Techniques used in collecting data for this study included ethnographic experimentation to identify the cultural practices concerning plants, such as the collection of wild edible and medicinal plants and plant mapping using the GPS coordinates.

The ethnoarchaeological methods included field observation and interviews. This was most relevant to the complex investigation of behavior among people and cultural materials in living communities. Lived among them in daily life, the researchers captured personal points of view on cultural practices and beliefs. All in all, the fieldwork was dynamic and intensive, developing an immense set of data that will serve as a basis for this research.

3.2.1. Field Observation

Ethnoarchaeology: According to Binford (1968), this approach should involve the direct observation of the existing societies or cultures, coupled with structured data recording. Ethnoarchaeologists investigate customs, traditions, and material culture among different modern groups, which has become a window into past human behavior and archaeological artifacts. This approach is important to provide the link between human activity and its consequences for both archaeological sites and fields, therefore allowing a dynamic view of the interactions between human beings and the environment.

During field observation photographic documentations were made to serve as visual records of the botanical diversity in the region and its uses within the community. Data obtained through keen observation and interaction with them provided a lot of information that described how this community relates to its environment and material culture in detail. Information on materials used for food and medicinal purposes was also gathered by using a semi-structured interview, reflecting knowledge and practices of the community concerning natural resources.

Figure 2: Observing wild edible and medicinal plants in Moyale Woreda and documenting their GPS locations and ecology (photo by Solomon Mulune, Jan 5, 2024)

3.2.2. Interviews

The purposive sampling method has been adapted for this ethnoarchaeological study on wild edible and medicinal plants. This strategy has enabled the researcher to select a participant with specialized knowledge in these particular plants, hence allowing the study to capture a rich and detailed understanding of the local practices and knowledge.

This corresponds to a sample size of informants of 31, considering the size of the population in the study area. It is large enough to cover a broad range of perspectives and experiences but not too large to make the qualitative interviews too time-consuming. The selection was done among knowledgeable, active community members. Elders consisted of eight pastoralists and semi-pastoralists who had a rich understanding of the traditional knowledge on wild plants. Other professionals from agricultural offices consisted of three informants, ten farmers, and ten traditional medicine experts based on their unique experience. The difference in age and gender

paved the way for a representative sample to be achieved from the informants. The oldest informant was 126 and the youngest informant was 22. The number of informants for male 22 and female 9.

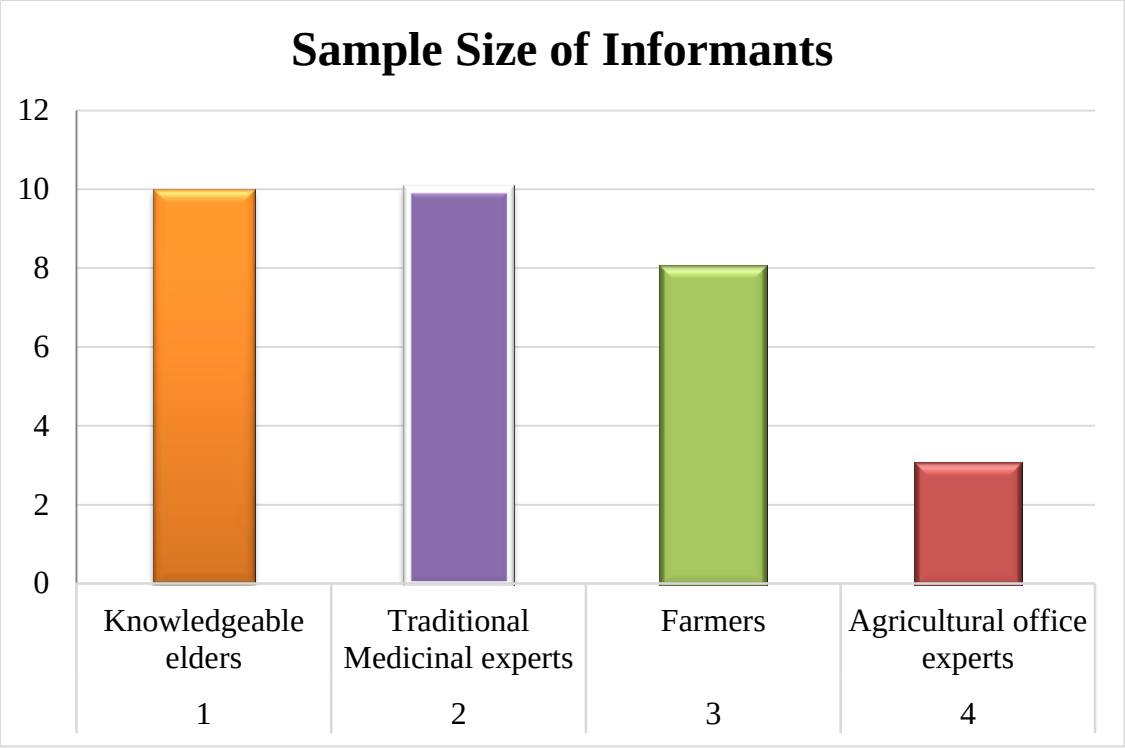


Figure 3: Sample of informants

Purposive sampling, though effective in the selection of knowledgeable informants, might have introduced selection bias in that this could have excluded other community members who actually had a good level of insight into the study area. This study was confined to just five kebeles within the Moyale woreda. The selection of kebeles with regard to geographical location of the kebeles, traditional knowledge, accessibility, biodiversity, willingness to participate, and ethical considerations. Although this allowed for an in-depth exploration of the selected areas, findings might not generalize to other areas. Therefore, it was important to research, keeping in mind all the biases that might incur into it. Transparency in researching would be ensured by gathering data from various sources as a means to cross-check information. In this way, the integrity and reliability of the study would be maintained accordingly.

Figure 4: Interviewing knowledgeable elders in the local community about wild edible and medicinal plants (photo by Seminew Asrat and Boru Galgalo, Jan 5 and 9, 2024)

3.2.3. Ethnographic Data Collection

In this phase, ethnographic data collection explored varied preparation methods of the three particular wild edible plants used as food. Ethnographic collection allowed the detailed observation of cultural variety in the whole course of food preparation, right from the selection and cleaning to the actual cooking of the selected plant foods. The study also documented other aspects of traditional knowledge related to food processing, including the use of any traditional material for preparing the food item. The information provided a great deal of insight into the cultural practices within the community and their relation to local flora. This built a rich, bright record in a multimedia format of the food preparation methods employed, hence allowing the comprehension of increasingly varied details about the culinary practices of the community involved and their relationships with local plant species.

Ethnographic data has interpreted the archaeological data with respect to knowledge of cultural practices, modes of preparation of food, and indigenous and local knowledge. This has therefore offered an opportunity to investigate past human behaviors, subsistence strategies, and resource

management. The documentation of techniques concerning food processing and allowing the delicate analysis of the past human-environment interactions. Integration of ethnographic data with the archaeological ones has allowed identification and full understanding of the cultural significance and use of wild plants in the past.

3.2.4. Photography

Other interesting methods of data collection during the study included photography. The ultimate purpose of photography in archaeology was the creation of accurate and enduring visual records for use as a resource for future research, interpretation, and conservation efforts. Most of the archaeological sites relied on photography to document the field and capture the spatial layout of the site, particular features at the site, and the artifacts that were discovered. In this respect, photography was a significant tool for recording the various processes of fruit preparation during fieldwork (Schlitz, 2018).

Besides the capture of the preparation modes, photography was used to record the physical characteristics of the chosen plant species as a way of providing a visual record in detail of the morphology of the plants. This helped in identifying the plant and helped to identify what role it played in the local food ways. In addition, photography was complemented by recording the GPS coordinates of the area, contributing to the spatial knowledge of plants over their distribution and relationship with the local environment. In combination, the above set of photographs and data tended towards a nearly complete visual spatial record of the study and improved the richness of the map's final output by providing a rich resource for further research.

3.3. Post Fields Work

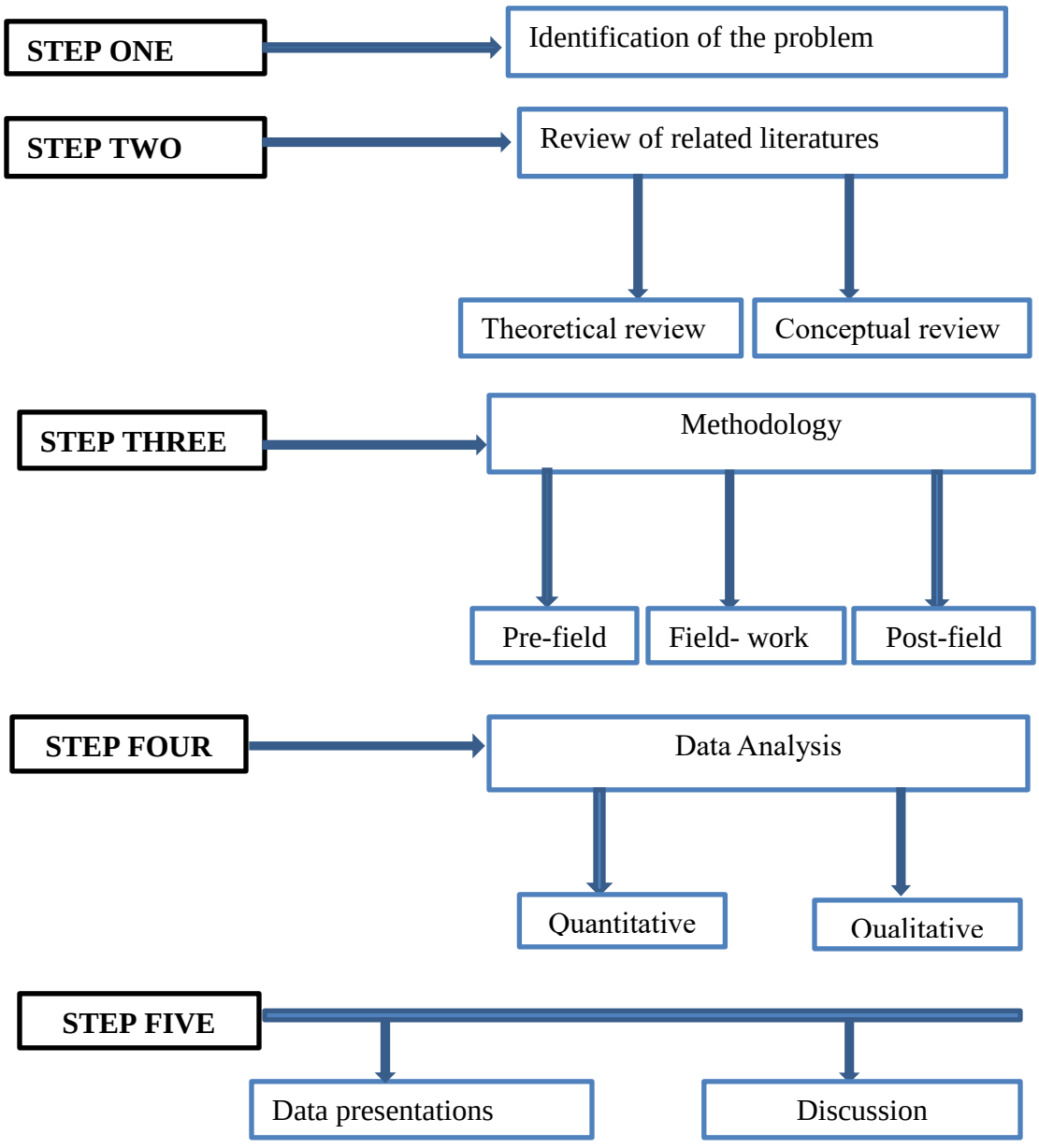
3.3.1. Authentication of the Collected Plant Specimens

The post-fieldwork phase was an important part of the research in the validation of the data collected in the field, especially the authentication of plant specimens collected. Authentication was done by comparing field-collected plant specimens with herbarium collections kept at the National Herbarium of Ethiopia in the Department of Plant Biology and Biodiversity Management, Addis Ababa University. This allowed a proper understanding of their taxonomy and naming for proper identification and classification.

Authentication of plants in the present ethnoarchaeological study of wild edible and medicinal plants involved correct identification and documentation of all the plant species put into use by the local community. The authentication of plants involves specimen collection from the study area of sustainable, edible, and medicinal plants, their preservation onto herbarium sheets, consulting a botanist or taxonomic expert when there are particularly challenging identifications, and further comparing the identified specimens against authenticated voucher specimens from botanical collections or herbaria for accuracy to validate the presence of the plant species in the area under study. Each identified specimen has got expert confirmation, and later deposited at the National Herbarium of Ethiopia for future reference.

Figure 5: Shows pictures of (A) the sample taken from the study site, (B) identification work, (C) a drying cabinet, which we used to dry the plants for a week, and (D) a deep freezer at the Addis Ababa University Herbarium, where we killed the insects for three days (Photo by Wege Abebe and Morketa Befikadu, April 15, 2024)

3.4. Research Design



CHAPTER FOUR

4. RESLUTS

This chapter discusses the results of the study including the Taxonomic Classification of medicinal and wild edible Plants and associated Indigenous and local knowledge. It encompasses in-depth results on Medicinal plants and the process of use for medicine, Wild edible plants in the study area, Direct Observation of Food Processing and Preparations, Materials Cultures used for Wild edible and Medicinal plants and Labour Division of wild plants.

4.1. Classification of Wild Plant Species and their Utilization

As a result of this study, 44 species were reported as medicinal plants, 43 as wild edible plants, and some plants are used for both food and medicinal purposes and also for building, charcoal, firewood, incense, decoration, and household. Four plants used for both food and medicinal purposes are also categorized as both under wild edible and medicinal plants. N.B. One plant has different uses

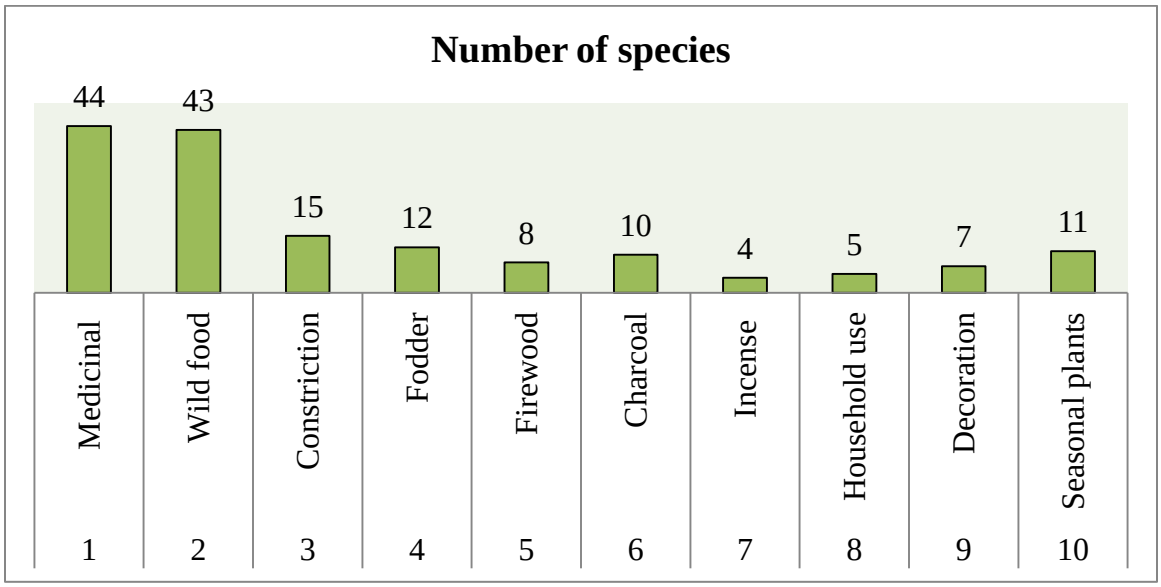


Figure 6: The use category and species number

4.2. Medicinal plants of Moyale and the corresponding uses and processing

1. *Senegalia nilotica* (L.) Willd. ex Del.

Local name: *Burquqqee*; Amharic: *Girar*. This is a tree up to 6 m high. It is found in semi-desert to almost pure desert. It is an adapted species in arid environments, resistant to drought and high temperatures. The growth period of this plant is spring, ranging between March and May. The family to which this plant belongs is Fabaceae.

According to traditional medicinal expert Mr. Haro Dida, *Senegalia nilotica* has diverse medicinal uses: the most commonly reported usages of it are that this can be consumed in powdered form by drying and grinding its bark. It is taken orally with water, juice and honey for the treatment of conditions such as diarrhea and sore throats. The leaves are boiled in water to make a decoction that can be taken as a tonic or used topically to treat skin conditions. The roots are mixed with water to a pasty consistency for the treatment of cow mange and ringworm. In addition to this medicinal value, the plant is highly valued for furniture, tools, and construction materials, as it is very hard and durable. The fruits are a source of fodder for animals. It can also be converted into charcoal.

2. *Senegalia tortilis* (Forssk.) Hayne

This tree is locally known as *Dhaddacha,* and it is a small to evergreen tree of moderate size that ranges from 3 to 5 meters in height. It is well adapted to arid and semi-arid conditions typical in savannas and deserts. The active growth season of this plant is in spring, from March to May. The species belongs to the family Fabaceae.

According to Mr. Boru Galgalo, a traditional medicinal expert, *Senegalia tortilis* is highly known for its various medicinal values and has been administered in folk medicine to cure several ailments. Here are some of the reported uses when the species is traditionally used for medicinal purposes: Its bark can be soaked in hot water to make tea, which is believed to alleviate digestive disorders, reducing fever. It boils in water to produce a decoction, which is taken by mouth for the treatment of diarrhea and indigestion.

This plant is not used only for medicinal purposes. Leaves and pods are nutritious; hence, they are used as fodder for animals. It is also a strong wood that is durable for construction, fencing,

fuel wood, furniture, and handcraft making. It is also one of the highly essential plants since it provides a venue for many different meetings. While one Oromo group uses the Odaa for their meetings, the other one depends on it. For example, during a meeting in *Gummi Gayyoo,* the *Abba Gada* and other participants sit on this plant.

Figure 7: Picture of *Senegalia tortilis* from the study region (photo by Morketa Befikadu, Jan 10, 2024)

3. *Actiniopteris radiata* (L) P. Beauv

It is a seasonal plant that develops during the rainy season and is commonly referred to as *Filaa tarrii.* It is generally 30 cm long. It usually grows in forests, waterways, and rocky outcrops. The growth period of this plant is autumn, attaining growth from September to November. The plant is a member of the Pteridaceae family. This plant has been used over time by the local community for medicinal purposes. The plant is crushed or ground into a paste and used as a treatment for the skin problem.

4. *Albuca abyssinica* Jacq

It is locally known as *Qorsa bofaa*. Grasslands, savannas, and rocky areas are its natural habitats. It normally reaches approximately 30–60 cm in height. September through November is when the active growing phase takes place. The family name of this plant is Hyacinthaceae. Informants

claim that this herb has the following therapeutic uses: Snake bites can be treated topically with the bulb's extracted juice. Leaves can be applied topically to cattle to treat fever and coughing.

5. *Caralluma apriogonium* K. Schum

This plant is locally known as *Matabuttoo,* and it reaches up to 40 cm in height. This plant thrives in arid regions with dry weather and can survive with very little water. This plant grows most actively in the fall, from September to November. The family name of this plant is Apocynaceae. This plant, according to Ms. Loko Duba, a traditional medicinal practitioner, can be medicinally used through its decoction or extract. The fresh parts of the plant, like the stems, must be cleaned very well to remove any dirt. After that, the plant parts should be chopped into smaller pieces and placed into a pot with water. The water should be boiled with the steam of the plant for ten to fifteen minutes, then, after allowing the decoction to cool and strain out the plant material, consumed as tea or used topically for skin conditions.

6. *Commiphora erythraea* (Ehrenb.) Engl.

This is locally called *Agarsuu.* It is a tiny to moderately sized shrub that may attain a height of up to 4 meters. This plant is seen to begin its growth in the spring season, which ranges from March to May. This plant is a member of the Burseraceae family. In the region, the plant finds its application in medicine. Traditionally, it was used as a wound healer and was topically applied on cuts, wounds, and also on insect bites to promote healing. Besides medicinal uses, the wood is also highly used in carvings and construction because it is very hard with high-quality grain patterns. It is also used in various cultural instruments. It is also a source of charcoal.

7. ***Commiphora kua* (R. Br. ex Royle) Vollesen**

This tree is locally known as *Callaanqaa*; it is an evergreen tree that ranges in size from small to medium, growing up to 8 meters in height. Its growth form is a bushy plant with a multi-stemmed trunk and branches. This plant grows on rocky, dry, and sandy soils. This plant grows from March to May throughout the spring season. The family name of the plant is Burseraceae. According to different informants, it is used in folk medicine in the following ways: The plant has often been used in herbal medicine for weight loss and bloating. It can be internally taken as a supplement or added to teas and tinctures.

This plant is used only by men, besides medicinal purposes. In order to remember the deceased, each of the father's five sons would place five of these plants in their father's grave when he passed away. The plant is considered to be the deceased abode and is also employed for washing clothes and as soap.

8. *Commiphora habessinica* (Berg) Engl

It is locally named *Hoomachoo*. The shrub is small to medium in size and rises to 5 meters high. This plant grows during the spring season, starting from March up to May. The Burseraceae family includes this plant. Various informants have reported that this plant has been used in traditional medicine among the Borana for years for a variety of purposes in medicine. The leaves of this plant help in wound healing by preventing infection and thus reducing the recovery time because it is applied topically in the form of a salve or ointment. The leaves are traditionally chewed to avoid oral health problems.

9. *Crabbea velutina* S. Moore

Qorsa garaa, known locally, is an upright succulent with elongated stems. The plants are normally around 80 cm tall, growing on rocks and dry highland forest floors. Its growth begins in the autumn season, which starts from September up to November. The family name of this plant is Acanthaceae. Traditionally, this plant has been used by Borana communities for medicinal purposes. Boiling the plant's roots in water in order to make tea or infusion is one of the medicinal preparation methods. This can be drunk to cure stomach problems.

10. *Delonix elata (L.)* Gamble

Locally named *Sukeellaa*, this is a medium- to large-sized tree, growing up to 10 meters. The plant usually grows in semi-arid areas of Moyale woreda. March through May is when this plant-growing season occurs. The Fabaceae family includes it. The plant is used for different medicinal purposes by the Borana community, as reported by different informants. The bark of the tree is made into a poultice or paste for skin ailments such as wounds and insect bites. The bark of the tree is used for medicine. It is boiled in water to a decoction, which is drink to help lower fever and relieve stomach disorders. Leaves of the plant are used to treat respiratory and skin conditions in cows and goats.

11. *Dodonea angustifolia* L. f

Locally known as *Dhitacha*, this plant grows up to 6 meters high. This plant's active growing season occurs in the spring, from March through May. The plant is a member of the Sapindaceae family.In traditional ways; it has been used for the following medicinal purposes: The leaves can be dried out and soaked in hot water to make a medicinal tea. This is used to cure diseases that include coughs and colds. The bark is used as a digestive remedy for diarrhea, indigestion, and stomach aches. A decoction of the bark may be orally taken for digestion.

Figure 8: A photo of *Dodonea angustifolia* taken in the research region (photo by Morketa Befikadu, Jan 10, 2024)

12. *Euphorbia crotonoides* Boiss

This small shrub, locally known as *uuroo*, usually grows up to a height of 60 cm. This plant is drought-tolerant and resilient. The active growing season of this plant is in autumn, in September, October, and November. Its family name is Euphorbiaceae. Traditionally, it has been used as a medicinal plant. Here is how the plant is used as medication, according to local informants: The leaves are crushed to get sap from them. The sap obtained is applied topically to skin diseases, burns, wounds, and insect bites. The leaves are boiled to get tea, which relieves stomach pain and diarrhea conditions.

13. *Euphorbia cuneata* ssp. spinescens (Pax) S. Carter

It is commonly known as *Bursa*, growing to about one meter in height. It thrives in dry conditions and can survive with minimum water. It is an autumn-growing plant, growing between September and November. Its family name is Euphorbiaceae. Traditional uses in medicine by Borana communities. Some of the traditional uses of the plant are as follows: Leaves can be dried, and then a decoction prepared from these dried leaves successfully treats colds and coughs. Roots of the plant can be used for treating indigestion, stomach ulcers, and diarrhea. Oral decoction prepared from the roots relieves these symptoms. The roots are administered to goats to improve digestion and reduce inflammation. The plant is not used only medicinally but also as a supply of fodder and charcoal.

14. *Euphorbia schizacantha* Pax.

Harkeena, in the local language, normally develops into a small or medium-sized shrub, let reaching 1 meter high. It commonly occurs on dry savannas with abundant sunshine. It is a drought-resistant plant and may require only small amounts of water. This plant grows during the autumn seasons: September to November. The Euphorbiaceae family includes it. Traditionally, this plant has been used for medicinal reasons. The leaves can be applied to open wounds for better healing and to avoid the chances of infection. In traditional usages, stomach disorders like diarrhea have been treated using the roots of the plant. It is taken orally in small quantities.

15. *Gnidia stenophylla* Gilg

The local name for this shrub as *Aarsaa.* It can reach heights of up to 3 meters and thrives primarily on savannas and rocky areas in hot, dry lands. This plant grows during spring, that is, from March to May. The family name of this plant is Thymelaeaceae. Here is the guide on ways to utilize it in medication in the Borana community: First, roots are the most frequently utilized components of a plant for medicinal purposes. Dig up its root. For drying, let the roots be completely dried out in a shaded place with proper air flow. This may take several days to up to a week to ten days, depending on the weather conditions. The plant will now be ready for further processing into medicine after the complete drying of the roots. The roots can be ground Use a pestle and mortar to make a finely ground powder. The roots, powdered, are taken with water or honey for headache and fever, and the tea is taken daily for diarrhea.

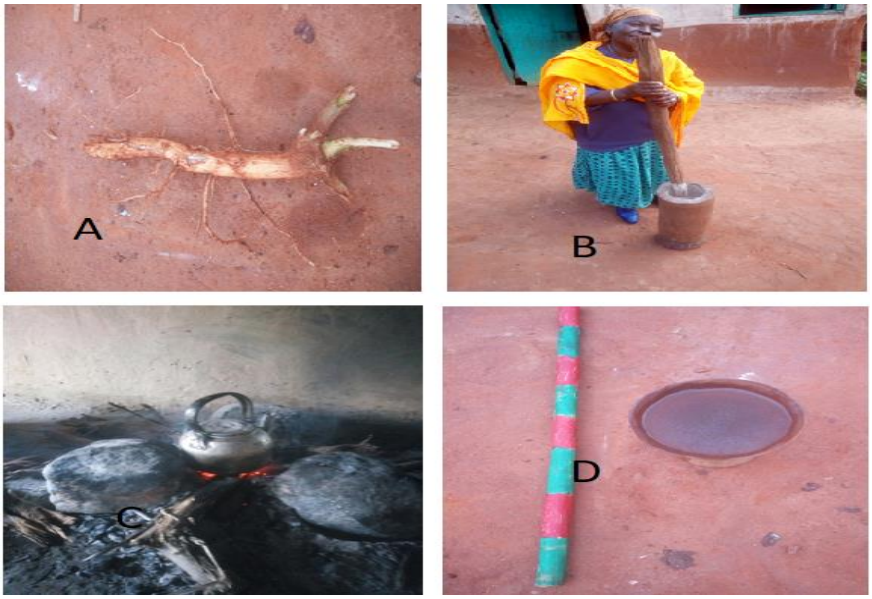


Figure 9: Photos of (A) the medicinal root, (B) the root being ground in a mortar and pestle, and (C) medicinal tea made with roots, (photo taken by Morketa Befikadu, March, 2, 2024)

16. *Gomphocarpus fruticosus* (L.) Ait. F

This plant, in the local setup, is referred to as *Dhuufiftuu*, and it is a shrub that grows up to 2 meters in height. Traditional uses in the Borana community include medical reasons. The growth season of the plant is during the autumn from September to November. Its family name is Apocynaceae. This is the usage according to the informants: Latex from the leaf applied topically enhances wound healing. It is directly on the wound to help in the closing and the healing process. A paste made from the roots and water applied topically to goat's cures skin ailments like scabies.

17. *Kalanchoe mamorata* Baker

This plant, variously known locally as *Qorsa haxisoo*, is found in the wild and is transplanted into gardens for ornamental uses. The typical height ranges from 30 to 60 cm tall, with a shrub growth form. The active growth period for this plant falls in the months of spring: March to May. The family name given to this plant is Cassiaceae. Here are some of the traditional ways it is used medicinally with this plant: The juice of its leaf can be applied to the wounds to make them heal sooner and also avoid infection. Crush the leaves and extract the juice; apply to the injured

site. A poultice of the crushed leaves was applied for swelling and inflammation to help in the reduction of pain and swelling.

18. *Sansevieria ehrenbergii* Schweinf. ex Baker

Known locally as *Cakkee*, this small succulent plant grows to a height of approximately 60 cm. The species belongs to the family Dracaenaceae. This species grows in disturbed areas, roadsides, and open fields. It has been used for many years in traditional medication for: the roots are dried and soaked in hot water to form an infusion that is used as tea. It treats respiratory problems such as coughs and colds.

19. *Terminalia brownie* Fresen

This tree grows up to 5 meters in height. It is also locally known as *Birresa*, which largely grows in dry woodland areas, its natural habitat. The growing season of this plant is spring, from March to May. Combretaceae is the family name of this plant. Medicinal uses of the plant by a traditional medicinal practitioner, Mr. Haro Dida, are as follows: The plant was used to heal diarrhea and to make tea by steeping the dried bark of the plant in hot water and drinking it before meals. It was applied topically for wound healing and to prevent infection; it can be made into a poultice by crushing the leaves of the plant and applying it directly onto the wounds. Leaves are fed to goats to improve health and enhance the condition of their coats. The bark of this plant is also burned as incense, apart from its medicinal uses.

20. *Dalbergia melanoxylon* Guill. & Perr

Locally known as *Debobesa.* This is a medium-sized hardwood tree, and it attains an elevation of 5 meters. The fruits of the plant are used as a source of food by the people. It develops nicely in an open forest and woodlands. The growing season of this plant is the spring season. The time is from September to November. The species belongs to the family Fabaceae. Following are the traditional medicinal uses of the plant: An infusion made by boiling a handful of its bark in water for 10 to 15 minutes, letting the liquid cool, then straining and drinking as tea to address coughs and colds. Boil its leaves in water and use the cooled liquid as a mouthwash to treat toothache, gum infection, and bad breath. The fruit is administered to cattle to cure stomach ailments, including constipation.

21. *Senegalia brevispica* Harms

This plant is locally known as *Hamarasa.* This is mostly a small to medium-sized tree heights of up to 7 meters, and it mostly grows in dry areas with sandy soils. The best season for growth of this flora falls within spring, starting from March up to May. This plant belongs to the Mimosoideae family. Ms. Ware Galgalo adds that this plant is used in the following medicinal and other uses: The bark is usually prepared as a decoction or tea to cure stomach illnesses and infections. The root is crushed and applied as a poultice to heal wounds faster. It is also said to be used as animal feed and in charcoal production.

22. *Belia schimperi*

This plant is locally known as *Hanqu*. Height attains about 1 meter in grasslands, rocky slopes, and open woodlands at variable altitudes. It is best during the autumn season, i.e., September to November. The family name of this plant is Myrsinaceae. According to Ms. Jilo Malicha, a traditional medicinal expert, the following are the uses of the plant for various ailments: The bark of the plant is used in traditional medicine to treat stomach issues and skin conditions. The bark is usually prepared as tea. The plant is used for curing stomach disorders and increasing appetite.

23. *Aloe Yavellana* Reynolds

Locally known as *Hargesa*, the plant reaches about 70 cm in height. It is resistant to hot and dry conditions and this area receive full sun, which is particularly important for plants that thrive in dry, well-lit conditions. The season of growth is autumn. Family name: Aloeaceae. The local community uses the plant for treating malaria, bleeding from accidents, and eye diseases while also discouraging children from breastfeeding. When applied topically, the gel made from leaves can be used to treat and soothe burns, wounds of skin and insect bites. The remedy for camel related digestive problems, including diarrhea, is derived from this plant.

24. *Grewia evolute* Juss

This plant is known by the local name *Haroresa*; it is a shrub that usually attains a height of 6 meters. It is found in dry areas like the savannas or woodlands of the Borana community. The active growth of this plant is during the spring season, from March to May. Its family name is Ebenaceae. It has different medicinal uses, according to Mr. Boru Haro, a traditional medicine

practitioner. The procedure for the preparation of the plant is as follows: Harvest: Observe and select carefully mature plants with healthy leaves. Drying: It is usually dried in the shade after harvesting to avoid losing any medicinal properties. Leaves, after drying, are used in herbal medication preparation. Infusions or Teas: Dried leaves, when steeped for a few minutes in hot water, yield a medicinal tea that can be taken as medication against any particular ailment. Externally applied: crushed leaves are applied as a poultice. This relieves inflammation, pain, skin conditions, and headaches.

However, *Haroresa* is not only used for medicine; it is also used as a source of food, and the bark is utilized in construction. Its wood is used in making wonderful sticks that are of great importance to Borana males. In addition to all these uses, *Haroresa* is used as fodder and in charcoal production.

25. *Solanum incanum* L

The locals know it as *Hiddi*; it is a shrub that can reach a height of one meter in height. It grows on roadsides, fields, and disturbed areas. It has been used as medicine traditionally. Autumn is considered its active growth season, which starts in September and ends at the start of November. Its family name is Solanaceae. The roots, particularly, are the most used in topical applications for various skin ailments, such as insect bites. The affected area can also be anointed with a treatment of crushed leaves. Traditionally, it is employed to treat digestive problems, including bloating and diarrhea. The decoction prepared from the roots of the plant is taken. It is used topically in skin conditions such as ringworm and scabies of camels.

Figure 10: A photo of *Solanum incanum* taken in the study region (photo by Morketa Befikadu, Jan 10, 2024)

26. *Euclea divinorum* Hiern

Known in this region as *Mie'sa*, It is a tree that usually has a height of 5 meters. The fruits obtained from this tree are edible and raw consumable. It is normally found in grasslands and woodlands. This plant grows in spring, between March and May. This plant belongs to the family Eberaceae. The bark from this tree is used to make a poultice, which is applied to cuts and wounds, especially snake bites. The roots of this plant are boiled to make tea; it has both medicinal and salt-adding properties; it is used when dogs bite people or other animals.

The plant is culturally important to the Borana people, who perform naming ceremonies known as *maqaa baasa.* A few participants hold a stick from this plant during ceremonies, especially the one being named and his parents. It also serves as fodder for animals and in charcoal production.

Figure 11: Photos of (A) the therapeutic root, (B) the root being ground in a little mortar and pestle and (C) medicinal tea made with roots, (photo taken by Morketa Befikadu, March 2, 2024)

27. *Barleria anthemoides* R.Br.ex C.B.Clarke

Qiltipe is what the Natives call for this plant. It thrives in sunny open grasslands, savannas, and woodlands. This plant grows during the autumn period, from September to November. The classification of this plant lies within the Acanthaceae family. In order to extract the decoction,

the leaves of this plant are first dried and then boiled in water. The decoction is taken by one who is suffering from coughs and colds. The dried flowers are soaked in a stream of hot water to prepare an infusion that is drunk as medicine for digestion problems such as indigestion and bloating.

28. *Withania somnifera* (L.) Dunal

The local name of the plant is *Hiddi xirooftu.* It is a seasonal plant that attains a height of 50 cm. It can grow in most habitats, ranging from woods to scrublands to deserts. It prefers dry, rocky localities. In the Borana zone, including Moyale woreda, there is the famous medicinal shrub, which is traditionally used for its diverse health benefits. The growing time of the plant is in autumn, from September to November. Family: Acanthaceae. Traditional herbalist Ms. Loko Duba describes the following stages, which were traditionally involved in the practice of using this plant medicinally: Harvesting: The plant is to be carefully harvested for its medical purposes; the roots of the plant are mainly used in traditional practices. Drying: After harvesting, the roots are thoroughly cleaned and dried. According to conventional practices, drying the roots in the sun preserves their medicinal action and facilitates increasing their effectiveness. Grinding: Once the roots are totally dry, they are reduced to a fine powder. The drug is used in its powdered form in traditional medicine. Formulation: The powdered plant can be used in various formulations, decoctions, teas, and herbal supplements; the preparation of these formulae follows traditional techniques as passed on from generation to generation. Traditional medical professionals locally consider this plant helps alleviate tension and anxiety, enhances energy, gives a boost to immunity, and is generally good for well-being.

29. *Datura stramonium* L.

Locally known as *Qoboo.* It grows to one meter tall and prefers fields with disturbed or heavy soils, roadsides, and waste areas. This plant flowers in spring, particularly from September to November. The family name is Solanaceae. According to Mr. Boru Dida, a medicinal expert, the plant was used traditionally as medicine by the Borana community long before his time. In this plant, the leaves are used in the traditional treatment of diabetes through the preparation of a decoction by boiling the leaves in water and taking the liquid orally. The roots of the plant are used for treating pains like toothaches and headaches by making decoctions and boiling the roots

in water to result in a liquid that is topically applied or ingested orally. For headaches, the head is washed with hot water containing this plant. The leaves are also used in the treatment of menstrual pain and labor pains. The leaves are taken as a decoction in which leaves are boiled in water, and the resulting water is drunk.

30. *Cucumis ficifolius* A.Rich

The local name of this plant is *Dergo*. It grows into a climber with a height of up to five meters. This plant grows in savannas and open woodlands. It is normally a spring-growing plant, starting from March up to May. The family name of this plant is Cucurbitaceae. The plant has been used traditionally by the Borana community. Leaves are used as traditional remedies for malaria and fever; the leaves are boiled in water and consumed as tea.

31. *Euphorbia tirucalli* L.

Known locally as *Anno worebessa*, this is a succulent shrub. It stands 3 to 2 meters high. Rocky areas, scrub, and dry woodlands are common areas to find it in. The period of growth is spring; thus, it starts its growing activities between March and May. The family name of this plant is Euphorbiaceae.

For ages, the plant has been in use by the Borana community through traditional medicine. It was taught to Mr. Boru Dida by ancestors, and he gave the following instructions on how to process the plant to make medicine out of it: The first phase is harvesting: the most appropriate time to harvest the plant is at its flowering season. Cut the stems but leave a small part so this plant can grow anew. The second phase is cleaning. Wash the collected stems in water to remove dirt or debris. Third phase drying: It should be done in a warm, dry area or under the shade to avoid mold growth. The fourth step is crushing. The air-dried stems are crushed into small pieces with the help of a mortar and pestle to liberate the latex from them. Medicinal uses traditionally applied: The topically applied latex extract on cuts and wounds heals them rapidly with less inflammation. Leaves are also used in the treatment of cough and bronchitis issues in camels and donkeys.

Figure 12: A photo of *Euphorbia tirucalli* taken in the research region (photo by Morketa Befikadu, Jan 8, 2024)

32. *Vernonia amygdalina* Delile

This is *Grewa* in the local language. It is a shrub, growing up to three meters in height. Its growing season is in the spring, between March and May. It belongs to the family Asteraceae. Ms. Loko Duba recommends this plant, which has been used in traditional medicine by the Borana community for a long period of time. Traditional medicine normally pertains to knowledge that is passed down through generations based on experience. Here are some traditional uses most commonly practiced: Boil the leaves in milk to prepare a medicinal concoction. It is applied to various sicknesses like fever, cough, and diarrhea.

33. *Croton macrostachyus* Hochst. Ex Delile

The local name of this plant is *Makanisa.* This is a perennial plant that grows up to six meters tall. The plant inhabits moist to dry forests, savannas, and grasslands. This plant has a growing season in the spring, ranging from March to May. The family name of this plant is Ebenaceae. According to the traditional medicinal expert, Mr. Boru Dida, this plant has been traditionally used for a long period of time in regions of the Borana population. Boil the dried plant roots in hot water to get a liquid extract that is commonly used for fever and cough. Crush the dried roots and mix with oil to form a paste for application on wounds and other skin diseases. The plant

also serves many purposes in local homes, apart from being an ornament and providing firewood.

Figure 13: A photo of *Croton macrostachys* taken in the research region (Morketa Befikadu, Jan 8, 2024)

34. *Malva verticillate* L.

Locally known as *Turii*, it is grown one to three meters high. It grows in dry, open areas like fields and waste grounds and also on rock outcrops with poor soil. Its growth season is through autumn, between the months of September and November. Its family name is Malvaceae. According to various informants, this plant has over the years been used to cure different health conditions. It is used directly on the wound; a poultice with this plant's crushed leaves and flowers heals them faster and reduces irritation. This plant is also taken as an infusion to avoid indigestion, diarrhea, and constipation.

35. *Galinsoga parviflora* Cav.

Local name as *Arado.* It is a seasonal plant, upright, growing from 40 to 60 cm tall. Growth for this particular plant takes place during the autumn months: September, October, and November. The family name for this plant is Asteraceae. Traditionally, medical experts known as Galgalo Jatan have recommended it in traditional medicine for hundreds of years. Here is the outline of

the traditional way it is prepared as medicine: the dried stems steep in boiling water to make a tea. Drinking this tea helps reduce body temperature and alleviates the symptoms of flu and cold.

36. *Gardioserium helicacabum* L.

It is popularly known to the people of Borana in their mother tongue as *Rerto*. It is 10 meters long. Traditional medicine has used this flowering plant for many years. This plant flowers from spring, that is, from March to May. The Sapindaceae is its family name. More importantly are the multiple medicinal uses for this plant, which have been passed down through generations from one generation of healers to the next, according to information the informants have provided. Its roots are used as medicine to treat wound healing or skin disorders by decoction, in the form of direct application to the skin, or as a poultice. The steam of this plant is also used medicinally; decoctions are burned as incense or inhaled by steam to cure respiratory problems. It is also utilized as a treatment for camels and sheep, as well as for indigestion and constipation.

37. *Calpurnia aurea* (Ait.) Benth.

Ceekata is the local name of this shrub-like plant that grows up to 4 meters tall. This plant grows in dry washes, rocky outcrops, and desert grasslands. Traditionally, the plant was used by the local community for medicinal purposes. The active growth period for this plant is during the spring months, that is, from March to May. This plant is a member of the Fabaceae family. The roots are decocted, and the decoction is used to treat fever, headaches, and other body aches. Dried or fresh leaves, crushed fruit, and seeds are mixed with food and given to dogs to help with their behavior.

Figure 14: A photo of *Calcinaria aurea* taken in the research region (photo by Morketa Befikadu, Jan 8, 2024)

38. J*uniperus procera* Hochst. Ex Endl.

Indhessa is another plant in Amharic called *Tid*, a medium-sized to large evergreen tree, reaching a height of up to 5 meters. It grows in dry forests, scrublands, and mountainous areas at high altitudes. Spring, during the months of March to May, is the growing season of this plant. The family name of this plant is Cupressaceae. It has also been used in traditional medicine by the Borana community: the bark is prepared in water and combined with salt to treat skin problems of sheep, goats, and cows. The young twigs and buds are used to treat stomach worms; for wounds, crushed fresh leaves are applied topically. Apart from its medicinal value, this plant plays an essential part in construction.

Figure 15: A photo of *Juniperus procera* taken in the study area (photo by Morketa Befikadu, Jan 8, 2024)

39. *Tagetes minuta* L.

Ajjoftu is the local name of this herbaceous plant. Its height can be up to 80 cm. It is a seasonal plant. It grows along with other plants in trees, shrubs, and grasses. Its autumnal growth season begins in September and concludes in November. Asteraceae is the family name of this plant. This particular plant is traditionally used by members of the Borana community. Boil dried roots in one cup of water that has come to a boil for five to ten minutes. Strain the mixture and use it as a tea to treat illnesses such as colds, fever, and stomach problems.

40. *Tamarindus indica* L.

Roqaa is the native name for this tree, which is a member of the Fabaceae family. It can reach as high as about 4 meters. It is best grown from March until May because it is a spring growing season about four meters. It is best grown from March until May because this is a spring growing season. The plant is part of the Fabaceae family. A particular kind of tree has long been used in the village of Borana for its therapeutic properties. The tree's traditional medical applications include treating fever, cough, and sore throat using fresh bark. It is consumed internally as an infusion or paste. It is planted in food production, and fruits are sold in local markets. Fruits are

eaten by the community during desert time. It can be found both in the gardens and wild, and the community has domesticated it.

41. *Laggera stelleraria* Sch.B.P. ex Benth & Hook.f.

The local name for this plant is *Buqee*. This plant can reach a height of three meters. Autumn is the growing season of this plant, during the months of September, October, and November. This plant is classified within the Asteraceae family. The root is highly valued in the Borana community because of its medicinal properties. Coughs and fevers can be cured with its infusion, which is prepared in water like tea. After being dried, the leaves are cooked in water for a long time to concentrate the liquid. This infusion treats stomachache and diarrhea.

42. *Cucumis dipsaceus* Ehrenb. ex Spach

The local name is *Sarete*; it's a climbing vine, 3-5 meters long. The active growing season for this plant starts from March to May. It is a member of the Cucurbitaceae family. In traditional medicine, the Borana community uses this plant. The leaves are used to cure toothaches, joint problems, and headaches after being boiled in water. The fruit is combined with honey and consumed as a drink in the treatment of diarrhea.

43. *Ocimum gratissimum* L

Urgoo harree: This is a local name of the following plant, which stands at 60 cm in height. This plant is utilized in traditional medical practices among the Borana community to treat different types of illnesses. The growing season for this plant is during the autumn period from September to November. The family name for this plant is Lamiaceae. Diarrhea is among the digestive diseases for which this plant is used medicinally; the leaves are steeped in water.

44. *Cyathula uncinulata* (Schrad.) Schinz

Local name: *Gurbii*. This plant grows as an annual herb, which attains a height of up to one meter. It is frequently encountered in disturbed environments such as poor soil areas, roadside ditches, and abandoned fields. It is an autumn-growing crop that grows between September and November. The family name of the plant is Amaranthaceae. There are several traditional medicinal uses of this plant among the Borana community. In some cases, it treats fever and

cough; a decoction from the roots and leaves can be administered orally or by inhalation. A poultice made from the leaves is applied topically for the relief of pain and, especially, for joints and headaches.

Summary of the Medicinal plants Collected in the Study Area

Table 1: List of medicinal plant species with their scientific names, common names, and local names (Sample number of species collected from Moyale, MB. M=Morketa B=Befikadu.).

NO	Scientific names	common names	Local names	Sample NO
1	*Senegalia nilotica* (L.) Willd. ex Del	thorn mimosa,	Burquqqee.	MB 1
2	*Senegalia tortilis* (Forssk.) Hayne	umbrella thorn	Dhaddacha.	MB 2
3	*Actiniopteris radiata* (L.) P. Beauv	ray fern	Filaa tarrii	MB 3
4	*Albuca abyssinica* Jacq	Koyosa	Qorsa bofaa	MB 4
5	*Caralluma apriogonium* K. Schum	Caralluma cactus	Matabuttoo	MB 5
6	*Commiphora erythraea* (Ehrenb.) Engl.	Sweet myrrh	Agarsuu	MB 6
7	*Commiphora kua* (R. Br. ex Royle) Vollesen	Indian myrrh	Callaanqaa	MB 7
8	*Commiphora habessinica* (Berg) Engl	Abyssinian myrrh	Hoomachoo	MB 8
9	*Crabbea velutina* S. Moore	Velvet Crabbea	Qorsa garaa	MB 9
10	*Delonix elata* (L.) Gamble	white gul mohur	Sukeellaa	MB 10
11	*Dodonea angustifolia* L. f	Sand olive	Dhitacha	MB 11
12	*Euphorbia crotonoides* Boiss	Spurge	Uuroo	MB 12
13	*Euphorbia cuneata* ssp. spinescens (Pax)	Spiny Spurge.	Bursa	MB 13

	S. Carter			
14	*Euphorbia schizacantha* Pax.	Nodding Spurge	Harkeena	MB 14
15	*Gnidia stenophylla* Gilg	bitter bush	Aarsaa	MB 15
16	*Gomphocarpus fruticosus* (L.) Ait. F	Swan plant	Dhuufiftuu	MB 16
17	*Kalanchoe mamorata* Baker	Penwiper Plant	Qorsa haxisoo	MB 17
18	*Sansevieria ehrenbergii* Schweinf. ex Baker	Sword Sansevieria.	Cakkee	MB 18
19	*Ocimum gratissimum* L	Alfavaca	Urgoo harree	MB 19
20	*Terminalia brownie* Guill. &Perr	Brown Terminalia.	Birresa	MB 20
21	*Rhus natalensis* Engl	Natal rhus	Debobesa	MB 21
22	*Senegalia brevispica* Harms	Hortspike acacia	Hamarasa	MB 22
23	*Belia schimperi*	Ethiopian Olivelike	Hanqu	MB 23
24	*Aloe Yavellana* Reynolds	Yavel Aloe	Hargesa	MB 24
25	*Grewia evolute* Juss	Indian Crossberry	Haroresa	MB 25
26	S*olanum incanum* L	Bitter apple	Hiddi	MB 26
27	*Euclea divinorum* Hiern	Magic guarri	Mi'eessaa	MB 27
28	*Barleriaer anthemoides* R.Br.ex C.B. Clarke	Lesser yellowthroat	Qiltipe	MB 28

29	*Withania somnifer (*L.) Dunal	Ashwagandha	Hiddi xirooftu	MB 29
30	*Datura stramonium* L.	Jimsonweed	Qoboo	MB 30
31	*Cucumis ficifolius* A.Rich	Cucumis	Dergo	MB 31
32	*Euphorbia tirucalli* L.	Pencil cactus	Anno worebessa	MB 32
33	*Vernonia amygdalin* Delile	Bitter Leaf	Grewa	MB 33
34	*Cyathula uncinulata* (Schrad.) Schinz	Bohome	Gurbii	MB 34
35	*Croton macrostachys* Hochst. Ex Delile	Broad leaved croton	Makanisa	MB 35
36	*Malva verticillate* L.	Chinese mellow	Turii	M B 36
37	*Galinsoga parviflora* Cav	Gallant soldier	Aradoo	MB 37
38	*Gardiosperimum helicacabum* L.	Balloon vine	Rerto	MB 38
39	*Calpurnia aurea* (Ait.) Benth.	Common Calpurnia	Ceekata	MB 39
40	*Juniperus procera* Hochst. Ex Endl.	East African Juniper	Endhessa	MB 40
41	*Tagetes minuta* L.	Tagetes minuta	Ajjoftu	MB 41
42	*Tamarindus indicus* L	Tamarind	Roqaa	MB 42
43	*Laggera stelleraria* Sch.B.P. ex Benth & Hook.f.	Laggera siceraria	Buqee	MB 43
44	*Cucumis dipsaceus* Ehrenb. ex Spach	thorny gourd	Sarete	MB 44

4.3. Wild Edible Plants in the Study Area

Wild edible plants are composed of extreme importance and are mainly consumed fresh. Man has been collecting these wild foods from the nearby available resources since time immemorial, even after agriculture came into being. People of different nations have preserved this knowledge for centuries. Most of them are extremely healing and enhanced.

There are various types wild edible plants in the Borana Zone in Moyale woreda; some plants eaten directly or fresh are listed below, while others that are not eaten directly are discussed in the next topic.

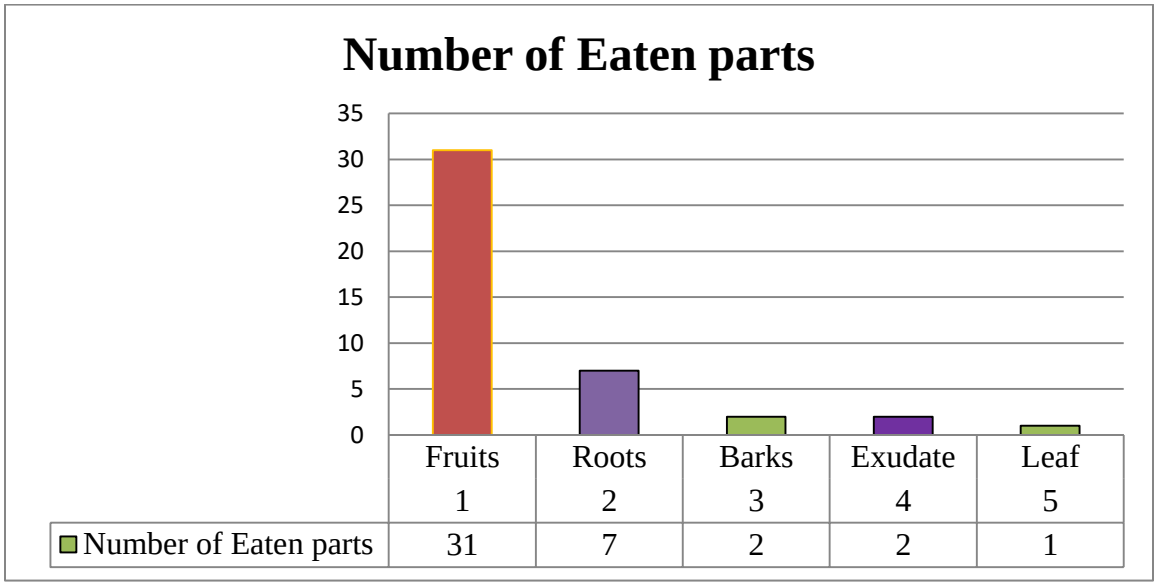


Figure 16: Number of eaten parts of plants

Summary of Wild Edible Plants

Table 2: List of scientific names, common names, local names, and parts eaten of directly consumed wild edible plants in the study area**,** (Sample number of species collected from Moyale, MB. M=Morketa B=Befikadu).

NO	Scientific names	Common names	Local names	parts of eaten	Sample NO
1	*Senegalia hockii* De Willd	African Fever tree	Dabbasoo	Bark	MB 45
2	*Grewia villosa* Willd	Mallow-leaved cross-berry	Ogomdii	Fruit	MB 46
3	*Lanea rivae* (Chiov.) sacl	Rivae's Lenea	Handaraku	Fruit	MB 47
4	*Physalis peruviana* L.	Ground Cherry	Nyanyiti Ferenji	Fruit	MB 48
5	*Senegalia Senegal* (L.) Willd.	Gum acacia	Hidhaadhoo	Exudate	MB 49
6	*Merendera* sp	Corn Lily	Godaree	Root	MB 50
7	*Opuntia ficus-indica* (L.)miller	Prickly pear	Adaamii	Fruit	MB 51
8	*Senegalia seyal* De	white-galled acacia	Waacuu	Exudate	MB 52
9	*Amaranthus thunbergii* Moq	Thunberg's amaranthus	Raafuu	Leaf	MB 53
10	*Pappea capensis* Ekel and zeyh	Jacket plum	Biiqqaa	Fruit	MB 54
11	*Balanites aegyptiaca* (L.) Del	Desert date	Baddana lu'oo.	Fruit	MB 55
12	*Rumex abyssinicus*	Red sorrel,	Dhaangagoo	Root	MB 56

	Jacq				
13	*Balanites rotundifolia* (Van Tiegh.) Blatter	Blatter is Indian Date Palm	Baddana okolee	Fruit	MB 57
14	*Olea europaea* subsp. *Cuspidate*	Common olive	Ejersa	Fruit	MB 58
15	*Carissa spinarum* Vahl	Natal plum	Dhagamsa	Fruit	MB 59
16	*Capparis tomentosa* Lam	Woolly caper bush	Gora	Fruit	MB 60
17	*Chasmanthera dependens* Hochst	Ethiopian Sneeze-Wood	Umbaraara.	Root	MB 61
18	*Teclea simplicitolia* (Engl.) Lam.	Simplified Teelea	Hadheesa	Fruit	MB 62
19	*Grewia revoluta* Juss	Indian Crossberry	Harooressa	Fruit	MB 63
20	*Cordia gharaf* (Forssk.) Ehrenb	Grey-leaved saucer berry	Madheera Raphachoo	Fruit	MB 64
21	*Cordia ovalis* R. Br.	Satin-bark Saucer-berry	Madheera Hoffee	Fruit	MB 65
22	*Tamarindus indica*	Tamarind	Roqaa	Fruit	MB 66
23	*Commiphora africana* (A. Rich.) Engl	African myrrh	Hammesa	Bark	MB 67
24	*Dioscorea quartiniana* A. Rich	Spiny Yam	Gumbo	Root	MB 68

25	*Dobera glabra* (Forssk.) Juss. ex Poir	Garas	Garsee	Fruit	MB 69
26	*Dorstenia barnimiana* Schweinf. E	Barnim plate plant	Rarii	Root	MB 70
27	*Euclea divinorum* Hiern	Magic guarri	Mi'eessaa	Fruit	MB 71
28	*Ficus glumosa* Del	Mountain fig	Qilxaa	Fruit	MB 72
29	*Ficus sycomorus* L	Ycamore fig	Odaa	Fruit	MB 73
30	*Grewia arborea* (Forssk) Lam	African starbush	Qurquraa	Fruit	MB 74
31	*Grewia tembensis* Fresen	Tembesi Wild Plum	Dheekkaa	Fruit	MB 75
32	*Grewia tenax* (Forssk.) Fiori	Phalsa cherry	Saarkama	Fruit	MB 76
33	*Haplocephalum foliolosum* (Hiern.)	Northern galla-plum	Canaa	Fruit	MB 77
34	*Lantana rhodesiensis* Moldenke	Hodesian lantana	Midhaan Dubraa	Fruit	MB 78
35	*Peucedanum harmsianum* Wolf	Harmel's hogweed	Michuu	Root	MB 79
36	*Pollichia campestris* Ait	Waxberry	Guunguma korbeessaa	Fruit	MB 80
37	*Premna schimperi* Engl	African sandalwood	Xaaxessaa	Fruit	MB 81

38	*Pyrostria phyllantheoidea* (Baill.) Brids	Firebush	Ladhana	Fruit	MB 82
39	*Rhus natalensis* Engl	Natal rhus	Daboobessa.	Fruit	MB 83
40	*Sclerocarya birrea* (A. Rich.) Hochst	Marula	Hudha	Fruit	MB 84
41	*Sterculia stencarpa* H. Winkler	Red Silk Cotton Tree	Qararru	Fruit	MB 85
42	*Vigna friesiorum* Harms	Summer redwood bean	Camee Hoolaa	Root	MB 86
43	*Ziziphus mucronata* Willd	Buffalo-thorn	Qurquraa	Fruit	MB 87

4.4. Direct Observation of Food Processing and Preparation

Food processing, according to Hastorf, is a labor-intensive process where people prepare, store, and cook both edible and inedible plant parts. Unfortunately, archaeobotanical evidence is usually not enough to solely sustain food production research. Ideally, ethnobotanical documentation of the entire food processing sequence should accompany the archaeobotanical evidence. During the data collection period, it was observed that three plants were not directly consumed by the local people but rather collected and brought home. The plants bear edible fruits and leaves, but locals preferred to employ them in various processing methods before eating. They are as follows:

1. *Carissa spinarum* Vahl

Carissa spinarum Vahl (locally known as *Dhagamsa)* is a tree-like growth that can reach a height of 6 meters. It is usually found in open forests, savannas, and drier areas with well-draining soil. This plant is drought-tolerant.

Both children and women participate in the food preparation of *Carissa spinarum* Vahl. Children mainly gather the fruit and prepare firewood, while women are the principal actors in the whole process. The woman's duties include producing palatable food. This food processing is a result of the harmonious work of both children and women, each utilizing their skills. A grinding stone is used as special equipment in the process of preparing *Carissa spinarum* Vahl fruit for home consumption. The food preparation takes approximately 40 minutes to become palatable.

There are two ways in which people consume the fruits of this plant. First, they consume the plant fresh or when the fruit is ready to be eaten. Additionally, the nearby community purchases these fruits from the market. In the second way fruit cannot be consumed directly. Instead, people pick it, season it with salt, and cook it, especially during periods of drought. Women of the Borana community prepare these fruits for food by breaking them down on a grinding stone. During my fieldwork, I had the opportunity to eat this fruit, and it was delicious.

Figure 17: Using a grindstone, Borana women prepare food from *Carissa spinarum* Vahl (photo by Morketa Befikadu, March 2, 2024)

3. *Grewia villosa* Willd

Grewia villosa Willd: This plant is locally known as *Ogomdii*. It is a deciduous shrub, which attains a height of 3 meters with beautifully shaped leaves. The plant normally grows in rocky places, meadows, and open forests.

Food is obtained from thisplant through its fruits. Fruits obtained from these plants are used for food and medicine. I tasted the fruits obtained from this plant during the fieldwork, and they tasted sweet. This plant is widely consumed during the dry season. In addition, the local people export this plant to the next woreda and sell it in the markets. These fruits are not harvested using any special tools among the local community, though I have seen some people using the tools when gathering plants in the field. My informant, Mr. Galgalo Dida, told me these fruits are normally not collected with tools, even though some people do occasionally use them.

Figure 18: The local children collect this plant from the forest and bring it to the home (this can be a very good example to extrapolate to past realities (domestication), i.e., bringing wild plants to home and the possibility of planting in home gardens) (photo by Morketa Befikadu, Jan 19, 2024)

3. *Amaranthus thunbergii* Moq.

The locals call this plant *Raafuu.* It grows for a short period of time during the rainy season, reaching a height of up to 50 cm. It is commonly found in disturbed areas such as fields, roadsides, and agricultural sites.

For many years, the Borana community has used the leaves of this plant as a food source. Although the leaves are not eaten directly, they are used as a substitute for cabbage. I had the opportunity to taste this food during my fieldwork, and it was quite delicious. The leaves are cooked with maize and are locally known as the food fiikke. According to the informant, Ms. Xume Liban, preparation of food is carried out in a special pot made of clay called "Ookkote

Faara," unique and very delicious. Besides cooking in clay pots, local people do food preparation in metal utensils.

Figure 19: Photos that shows (A) the leaf of the plant, (B) the food prepared from this leaf and other crops, and (C) the food ready to consume (photo by Morketa Befikadu, March 4, 2024)

4.5. Materials Cultures Used for Wild Edible and Medicinal Plants

1. Pottery (*Okoote*)

In Afaan Oromo *Okoote* is the local term used for pottery. According to the traditional medicine experts, Mr. Jatani Galgalo and Ms. Loko Wako, the pottery is used for the three purposes, i.e., preservation, drying, and preparation of medicinal plants. These are a few instances: First up is the preservation of plant specimens. This can be contained in pottery. By doing this, the integrity of the plant material is preserved. The second is the drying and processing of usable plant materials, such as bark, roots, and herbs. This maintains the medicinal properties of the plant. The third is the preparation of plant extracts: steeping the plant materials in water or other solvent, pottery can use to prepare plant extracts, such as teas, tinctures, and infusions. This enhances the release of the medicinal constituents from the plant.

Figure 20: Pottery used to treat medicinal plants (photo by Morketa Befikadu, March 5, 2024)

2. Axe (*Dhagaara*)

An axe is known locally in Afaan Oromo as *dhagaara*. In this regard, axe has long been used by the local people in Borana, particularly in Moyale woreda, for preparing the wild edible and medicinal plants. Some instances of axes in use for this purpose include the following: Harvesting: Using an axe, one can cut and collect the plants from the wild flora for food, medicine, and shelter. Processing: Axes are used in processing plant products: seeds crushed roots and tubers cut, and barks pounded into powder. Axes are used for the processing of the plant materials so as to make them edible or be applied medicinally. A good example includes axes used to cut and shape medicinal herbs into pieces for infusion or taken with tea.

Figure 21: An axe used to cut wild edible and medicinal plants (photo by Morketa Befikadu, March 5, 2024)

3. Wooden Mortar and Wooden Pestle (*Mooyye* and *Tumaa*)

Mooyye and *Tumaa* are the local names for wooden mortar and pestle, respectively. The various traditional medical uses of the Borana people include wood mortar and wood pestle to prepare medicines from roots, barks, leaves, and seeds. Powder, crush, and mix these plant components into various forms, including Powders: The ground plant material, with the help of a pestle and mortar, is reduced to a fine powder and is used as medicine. Decoctions: To prepare the decoction, one plant part is grounded with the help of a pestle and mortar into small bits that are then taken in boiling water. The wooden mortar and pestle also play a very vital role in herbal medicine and traditional medicine, where medicinal herbs are prepared at the facility in various forms. This old method of processing, using a wooden mortar and pestle, has been widely applied in many traditional medical practices. There are two types of wooden mortars and pestles made of wood. Large wood mortar for huge plants and small wood mortar for small plants are displayed in the picture below.

Figure 22: shows a wooden mortar and pestle used for grinding medicinal herbs (photo by Morketa Befikadu, March 5, 2024)

4. Grinding Stone (*Dhakaa dakuu*)

The Afaan Oromo local term for grinding stones is *dhakaa dakuu*. Grinding stones over the years have been used in traditional medicine, mainly by the Borana community. Grinding stone is

among the most important steps of preparation that medicinal plants undergo in order to be utilized. Medicinal plants can be fresh or dried, depending on the preference of the one using them. Both can be crushed on grinding stones into powder form. These includes the root, bark, leaves, and seeds. These powders are often used in making liquids, capsules, or topical salves quite often.

According to Mr. Haro Dida, a traditional medicinal, grinding stone gives a variety of benefits when preparing medicinal plants. Effective extraction: Grinding stones help extract the maximum amount of the required components by releasing the active chemicals of the plant material. Increased accessibility: Grinding stones break up the cell walls of the plants; therefore, active ingredients have more chances of easily being absorbed by the body. Improved Potency: At the time of use, some grinding stones increase the potency of a medicinal plant, which means releasing more active chemicals and improving their bioavailability.

Figure 23: A grinding stone for wild edible and medicinal herbs (photo by Morketa Befikadu, March 6, 2024).

5. Small pottery cup (*Elee qayya*)

This small pottery is known by its local name, Afaan Oromo *Elee qayya.* This pottery, being smaller than the previously discussed pottery, is produced differently. According to Mr. Boje

Konte, in traditional Borana community medicine, pottery is used for preparing and using medicinal plants; thus, they consider them as the fundamental instruments for use. It is used in the traditional Borana community medicine as follows: This substance is worked on the head to cure headaches and to burn the plant roots and leaves in the pottery. The sick person is allowed to inhale the smoke/vapour of the fire in the materials burned roots and leaves. Because of this, the Borana community appreciates this instrument very much. It is also used for other purposes: to burn incense and to obtain fire from the people next door.

Figure 24: Small pottery cup used for burning medicinal herbs (photo by Morketa Befikadu, March 6, 2024)

6. Basket and Bucket (*Maannoo*)

This basket is locally known as *maannoo* in Afaan Oromo. This tool is a basket used by the Borana community to gather wild edible and medicinal plants. Some of the methods for gathering and gathering medicinal and delicious wild plants using baskets or buckets are as follows: Gathering of plants. Gathering leaves and roots of plants in a basket or bucket. Used to collect roots for food or medicinal purposes. It can also be used for carrying, which involves relocating harvested plants back to the house or storage area; storing, which is keeping harvested plants in a cool and dry location; and preserving, which involves the storage of preserved plants. The Borana people use this basket for other purposes other than gathering and medicinal wild

plants. It also helps in the collection of various materials in this basket during pastoral movements.

Figure 25: Basket (*Maannoo*) used in harvesting and transporting wild edible and medicinal plants (photo by Morketa Befikadu, March 6, 2024)

7. CUP (*Kookii*)

Locally, this cup is known in Afaan Oromo as *kookii*. Traditional practices in the Borana community involve the use of wood and metal cups for the preparation and intake of traditional medicinal plants. The following are some uses of wooden cups made from traditional medicinal plants: Decoctions, or liquid extracts of medicinal plants, are prepared in wood cups. It is filled with water or any liquid after the placement of the plants to make a mixture of tea. Infusion, just like decoction, means placing the medicinal plants in a hot beverage, whether it's a form of tea or water, into a wooded cup. So, this cup is necessary for use, just like the intake of medically prepared tea.

Figure 26: Photo cups used for drinking medicinal plants (photo by Morketa Befikadu, March 7, 2024)

8. Pick Mattock (*Sururu*)

This pick mattock is locally known in Afaan Oromo as *Sururu*. In this area of Borana, many Indigenous cultures and traditional societies have used pick mattock over hundreds of years for gathering medicinal and wild edible plants, referred to as digging plant roots. Many of the Indigenous societies make use of the pick mattocks to collect the wild plants, forming one of the key sources of subsistence. The pick mattocks are also used for the harvesting of wild roots, which are used either as food or for healing. Pick mattocks have also been important in the traditional practice of the Borana community for many years in the gathering of wild plants that are edible or used for medicine.

Figure 27: A pick mattock used to dig the roots of wild edible and medicinal plants (photo by Morketa Befikadu, March 7, 2024)

9. Hoe (*Qotoo*)

This hoe is known locally in the Afaan Oromo as *qotoo*. In the majority of these cultures surrounding the Borana community, hoes are commonly used for digging up and preparing edible and medicinal plants in the wild. The community medicinal healers of the Borana community use hoes in the manufacture of medicinal plants due to their ability to heal diseases.

In addition, many villagers of the surrounding community dig up wild edible plants with hoes, including roots.

Figure 28: A hoe is used to dig the roots of wild edible medicinal plants (Photo by Morketa Befikadu, March 7, 2024)

10. KNIFE (*Banga* or *Sholee*)

It is locally known in Afaan Oromo as a *banga* or *sholee*. Various techniques are employed in the Borana to prepare and process medicinal plants for use in traditional medicine. These are the chopping and gathering of medicinal plants from the wild or their gardens and forests, like herbs, leaves, roots, or bark, which can be chopped and harvested using a knife. Furthermore, herbal remedies are prepared with the use of a knife: herbs can be chopped and then mixed with fat or oil to prepare ointments or salves. A knife may serve to get resin from a traditional medicine plant. The knife is made of a wooden handle and a long cutting iron part.

Figure 29: A knife (*Banga/shole*) used to cut wild edible and medicinal plants (photo by Morketa Befikadu, March 8, 2024)

11. TeaPot (*Ibrikaa*)

Locally, it is known as *ibrikaa* in Afaan Oromo. The teapot is one of the tools used in the preparation and serving of the traditional medicine of the Borana community, especially when it relates to tea. Traditional Borana medicine makes extensive use of teapots in the preparation of herbal remedies. Usage: Preparation: medicinal teas are prepared using a teapot and form a necessary part of the traditional Borana treatment. Boiling or steaming the herbs, plants, and spices extracts their medical components using the teapot. This tool is quite vital at the time of making medicinal tea for sick patients using traditional medicinal plants.

Figure 30: A teapot is used to infuse medicinal tea (photo by Morketa Befikadu, March 8, 2024)

12. Wood instrument (*Hoko*)

This wooden instrument is locally known in Afaan Oromo as *hoko*. In the traditional cultures of the Borana community, some wild edible and medicinal plants that grow in tall trees are collected and processed by using wood instruments. Here are a few examples: Locals use ladders to access the top of the trees for fruits, nuts, and leaves. This is a wooden tool with a hook, whereby the fruit is caught, and with the pole, it is pulled down. Methods used by people to gather delicious and medicinal wild plants from long trees using wooden tools. Every culture has

its methods and customs of gathering these plants, which are frequently passed to generations in the Borana community.

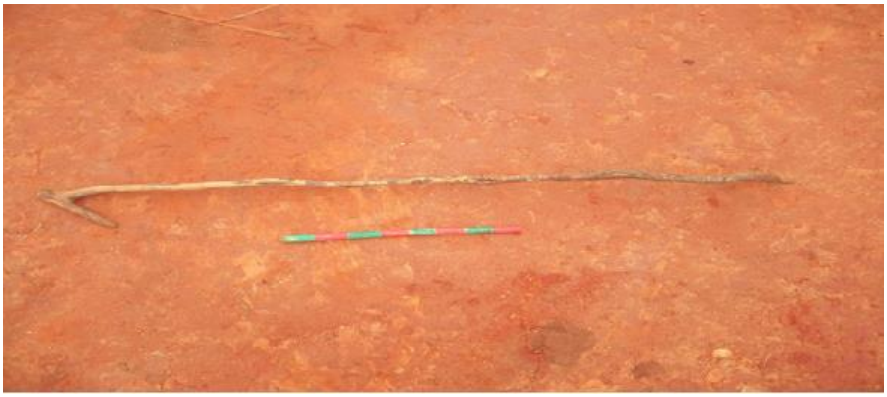


Figure 31: *Hoko*, a wooden implement used to slash wild edible and medicinal plants (photo by Morketa Befikadu, March 8, 2024)

4.6. Division of Labour Work division in wild plants

4.6.1. Division of Labour in Wild Edible Plants Gathering and Consumption

Division of labor in the collection and exploration of wild edible plants refers to a method in which tasks and responsibilities are allocated among the members. This means that there is a structured approach that can be done to collect and utilize such resources with efficiency. The elaboration of elements comprising this type of division of labor is described below.

Collecting Responsibility:

Children: Among indigenous communities, such as the Borana, they are important in gathering wild edible plants. Collecting fruits and other plant parts that are within easy reach is an ordinary job conducted by children their age between 5 and 13. They are quite helpful because children spend most of their time playing in natural environments like forests and fields where they can learn about and collect these wild foods.

Women: They usually collect wild edible plants, especially when they are out to fulfill other daily activities like fetching water or firewood. While on their way to such activities, they collect some wild edible fruits; hence, collecting fits into the daily routine.

Men: Although men also forage the wild foods, they usually have other jobs, such as hunting or even working outside the community. They may also involve themselves in the foraging activity during the food-scarcity periods.

Generally, the division of labor in gathering wild edible plants is done cooperatively by people within the community: children, women, and men all play their roles. It will ensure that there is effective foraging, preparation, and sharing of foods obtained from the wild. Moreover, it allows cultural practices and knowledge within the community to be depicted and passed on.

4.6.2. Division of Labour in Medicinal Plants Gathering and Preparation

The work division in gathering and preparing medicinal plants includes identification, selecting, sorting, cleaning, preparing for use, formulation, and packaging, all in an organized manner. It is normally managed by elders and healers, although the gathering of the actual plants is usually done by women and children. Division of labor also functions as a way to pass knowledge on to younger community members, including about plants and their uses and proper methods of harvesting and preparation to avoid harming the plants. This transfer of knowledge is vital for continuity in traditional healing practices and is, as a matter of fact, related to community survival.

4.7. The use of medicinal and wild edible plants in the study area is influenced by a complex interplay of cultural practices, environmental factors, and socio-economic conditions.

how medicinal and wild edible plants uses in Moyale district has been shaped by past cultural practices, environmental factors, and socio-economic conditions

4.7.1. Cultural Practices

Traditional Knowledge Systems: The Borana people have a rich oral tradition that conveys knowledge about the identification, preparation, and medicinal uses of local plants. Elders play a crucial role in passing down this knowledge, ensuring that younger generations understand the significance and applications of various species.

Rituals and Beliefs: Certain plants are embedded in cultural rituals and healing practices. For example, specific herbs used in ceremonies for healing or protection, reflecting the community's spiritual beliefs and reinforcing the cultural significance of these plants.

Dietary Customs: Historical dietary practices emphasize the importance of wild edibles. Traditional recipes often incorporate foraged plants, which not only provide nutrition but also strengthen cultural identity and community cohesion.

Social Roles: The division of labor within the community often determines who gathers and uses these plants. Women and children may traditionally be responsible for collecting wild edibles, while men might focus on livestock. This division influences the transmission of knowledge regarding plant use.

4.7.2. Environmental Factors

Biodiversity: The diverse ecosystems in Moyale District provide a rich array of medicinal and edible plants. The availability of species is influenced by factors such as climate, soil type, and altitude, which shape local plant communities.

Seasonality: The timing of plant growth and availability is critical. Traditional practices often involve seasonal foraging, where knowledge about when specific plants are ripe or most potent is essential for sustainable harvesting.

Environmental Change: Changes in climate and land use can impact the availability of certain plants. Historical experiences with droughts or shifts in vegetation have led to adaptations in foraging practices and the prioritization of certain species that are more resilient.

4.7.3. Socio-Economic Conditions

Livelihood Strategies: The socio-economic context influences how communities interact with their environment. In Moyale District, pastoralism is a primary livelihood, and the reliance on livestock affects the availability and use of plant resources. During times of drought or livestock loss, communities may turn to wild edibles for sustenance.

Market Dynamics: Economic factors also play a role in how medicinal and wild edible plants are valued. Increased market access can lead to the commercialization of certain plants, changing traditional practices.

Health Systems: The integration of traditional medicine with modern healthcare systems can influence the use of medicinal plants. As access to formal healthcare improves, some individuals may rely less on traditional remedies, while others continue to value them for their cultural significance or efficacy.

In conclusion the utilization of medicinal and wild edible plants in Moyale District is deeply rooted in the interplay between past cultural practices, environmental factors, and socio-economic conditions. Understanding this dynamic is essential for promoting sustainable practices that honor traditional knowledge while adapting to contemporary challenges. As communities navigate changes in their environment and economy, preserving this rich heritage becomes increasingly important for both cultural identity and ecological sustainability.

4.8. The historical, cultural, and ecological significance of medicinal and wild edible plants in Moyale Woreda

4.8.1. Historical Significance

Traditional Medicine: The use of medicinal plants has been a cornerstone of healthcare for generations. Through oral traditions document the healing properties of various plants, which were often the primary source of medicine before the advent of modern pharmaceuticals. This knowledge has been passed down through generations, forming a vital part of community identity.

Food Security: Wild edible plants have historically provided essential nutrition, especially during periods of food scarcity or drought. The ability to forage for these plants has been critical for survival in harsh environments, particularly in Borana pastoralist communities where livestock may fail.

Cultural Heritage: Many plants are intertwined with cultural practices, rituals, and beliefs. They feature prominently in ceremonies, storytelling, and local customs, reflecting the community's relationship with nature and their environment.

4.8.2. Cultural Significance

Identity and Tradition: The use of local plants contributes to cultural identity. Traditional knowledge about plant uses fosters a sense of belonging and continuity within communities. Elders often serve as custodians of this knowledge, reinforcing social structures.

Social Practices: The gathering and preparation of wild edibles often involve communal activities that strengthen social bonds. These practices not only promote cooperation but also facilitate the sharing of knowledge across generations.

Spiritual Connections: Certain plants hold spiritual significance and are used in rituals for healing, protection, or connection to ancestors. This spiritual dimension underscores the intrinsic value that these plants hold beyond their practical uses.

4.8.3. Ecological Significance

Biodiversity: Medicinal and wild edible plants in the study area contribute significantly to local biodiversity. Their preservation is essential for maintaining ecosystem health and resilience. Diverse plant species support various ecological functions, including soil stabilization, water retention, and habitat provision for wildlife.

Ecosystem Services: Many of these plants provide vital ecosystem services such as pollination, pest control, and nutrient cycling. Their presence enhances ecosystem stability and productivity, which is crucial for both human livelihoods and environmental health.

Adaptation to Climate Change: Indigenous knowledge regarding plant use can inform strategies for adapting to climate change. Certain species may be more resilient to changing conditions, making them valuable for future food security and medicinal needs.

In general the historical, cultural, and ecological significance of medicinal and wild edible plants in Moyale Woreda and across Ethiopia underscores their vital role in community health, identity, and biodiversity. As environmental changes pose challenges to these resources, a concerted effort towards conservation rooted in traditional knowledge and supported by scientific research will be essential for ensuring their continued existence and the well-being of future generations. By valuing and protecting these plants, communities can maintain their cultural heritage while promoting ecological sustainability in a changing world.

CHAPTER FIVE

5. DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

5.1. Ethnoarchaeology of Wild Edible and Medicinal Plants

The present investigation into the Wild Edible and Medicinal plants of the Moyale woreda in the Oromia Region covered five Kebeles across the whole Woreda. Medicinal and wild edible plant distribution, habitat where they grow, vernacular names, scientific names, and utilization of the species were discussed in Chapter 4. Identification of the wild and edible medicinal plants was addressed with the support and guidance of expert botanists from the National Herbarium of Ethiopia, the Department of Plant Biology and Biodiversity Management.

5.1.1. Procedures for Using Medicinal Plants

Traditional medicinal plants are very important for effective and safe use. They include identification, harvesting, preparation, and administration at appropriate dosages in the forms of tea, tincture, poultices, or powder. Their dosage will depend on the plant's nature and various individual factors. The method of administration shall depend on the plant and condition. It is very important that one observes the effect of the plant in question for future use. Involvement of and interaction with traditional healers of an indigenous community offers a source of sound information on what is safe (Debela Hundie et al., 2015).

Traditional medicine specialists recommend the following practices to be followed when administering medicinal plants in the study area: The first procedure is cleanliness. Before preparing any medicine, the person who will take the medicine must be free from activities that make them unclean. This involves people abstaining from sexual intercourse and, in the case of female medicine, avoiding the menstrual cycle. The second procedure is abstention from taking alcohol and water during the treatment; the milk can represent the necessary nutritional values to enforce recovery, while meat-based foods can also be taken without any addition of salt to maintain the normal nutrition cycle within the body.

The third procedure involves some specific recommendations considering the different diseases. In the case of a dog bite, the wound should not be washed properly. Also, the food items that contain salt must be avoided, as it increases the illness. There is a medicated program developed

that needs to be followed with due care. Also to consider is the fact that patients with broken limbs may not have the opportunity to engage in sexual intercourse during the treatment period. They are supposed to be extra careful so as not to press the respective limbs due to their injury status. Those breastfeeding mothers may be unable to give milk to their babies during their treatment schedule, hence making them incapable of breastfeeding their babies during this period. All in all, the traditional preparation of medicinal plants by indigenous healers in the area usually involves such steps as powdering, pounding, smashing, chewing, crushing, dry baths, and steam baths.

5.1.2. Transmission of Indigenous and Local Knowledge of Wild Edible Plants

The study among settled communities of Borana has identified that the transmission of original indigenous and local knowledge is the responsibility of the whole community. Conversely, it is the primary responsibility of fathers and mothers to provide indigenous and local knowledge on the gathering and consumption of wild edible plants, as they are the ones who are more exposed to external environments. There was a high dependence on wild edible plants before the Borana settled. Families were supposed to pass knowledge on to their young ones on which are edible plants and which ones were not. In fact, the entire community was supposed to be involved in the passing of indigenous and local knowledge to the next generation. The Borana people also practiced communal living, whereby they migrated as a community in search of survival products such as food and water for themselves and their cattle. This communal existence further cemented the practice of sharing and preserving ancestral knowledge.

5.1.3. Transmission of Indigenous and local Knowledge of Medicinal Plants

According to the two Borana elders, Mr. Haro Boru and Mr. Nuguse Dirge, there are various approaches or methods through which indigenous and local knowledge on traditional medicinal plants has been passed down through generations: through oral traditions, through apprenticeships with healers and family and community both discussed as follows.

Family and Community Roles: In the case of medicinal plants, the transmission of knowledge usually begins within the family. Parents, especially those with traditional healing experiences, teach their children about the therapeutic properties of different plants. Members of the wider community, such as healers and elders, also often share this knowledge.

Traditional oral and storytelling: The passing on knowledge concerning medicinal plants happens through oral traditions. Elders use the telling of stories to relay facts about the actual plant healing properties, ways of preparation, and cultural significance.

Apprenticeship to Healers: The young interested in traditional medicine may apprentice themselves to experienced healers. Under such mentorship, they will work out in the fields, identifying, harvesting, and preparing medicinal plants. They learn by direct observation and participation about dosage and preparation techniques.

Traditional knowledge transmission concerning wild edible and medicinal plants is carried out in general by a mixture of family teaching, oral traditions, and apprenticeships. Each one of these single aspects bears great importance as to making this value worthy knowledge last in the pass of time and across generations.

5.1.4. The Ethnoarchaeological and Insights into the Origins and Evolution of Early Food Production Systems

The research area does not have an entire desert climate, nor does it have a continuous supply of water. Due to the absence of predictable resources like water and pasture, the host community becomes dependent on both pastoral and agro-pastoral livelihoods. The Moyale Woreda environmental arrangement is consistent with the origins of food production, particularly when viewed from the perspective of the marginal environmental theory of food production, where there is an ideal setting to document transition to food production employing ethnoarchaeological methods. This gives support to the argument that plant cultivation took place in a marginal environment. As explained by Neumann, (2005) a marginal environment refers to an area where there are inconsistent accesses to resources.

Half of the population in each of the five Kebeles in the study area depends on an agro-pastoral way of life. They have planted a few specific fruits and grains. They also depend on a pastoral lifestyle with regard to their food, which is inconsistent and scanty. Agro-pastoralists in relation to Moyale Woreda are those who own a permanent residence, a family, and agricultural land. They also are pastoralists, having moved their animals seeking grass and water. However, they retire to their permanent residence, from where they engage in social activities and cultivate their property. Therefore, they encourage farming and the pastoralist lifestyle through the sale of cattle

and related livestock products. According to the ethnoarchaeological study, local people consume the wild food plants in that area, such as *Carissa spinarum* Vahl *(Dhagamsa), Grewia villosa* Willd *(Ogomdii),* and *Amaranthus thunbergii* Moq *(Raafuu*), as a substitute for their unpredictable resource availability.

The interaction between wild plants and humans in the research area appears to indicate the early stages of food production. The locals are familiar with every detail of the flora that grows in the area. Their knowledge towards the wild edible is not as expected. The native knowledge gathered in this Kebele is the least extensive of the five in terms of information regarding the use of wild food and medicinal plants. There are also attempts to transplant wild edible plants to home gardens, as seen in wild edible crops like *Grewia villosa* Willd, *Olea europaea* subsp. *Cuppidata, Tamarindus* indica, and *Premna schimperi* Engl. Documentation of such transitional knowledge can provide a good insight into pre-historic transitions from cultivation to domestication (Hildebrand, 2003).

Moreover, knowledge about the plants within the research area varies among various age groups. Elderly people typically know more about indigenous wisdom than younger people do. This observation is also supported by most of my informants. For example, while younger community members may know plants, they lack the extensive understanding possessed by the elders. They can tell when flowers and fruits appear, when fruits should be collected, and which plant parts are useful for medicine, construction, consumption, or fodder. More importantly, they can classify different species of plants of the same genus, which the younger generation cannot do at all. The actual cause of such variation in knowledge is manifold. First, modern education decreases time spent on acquiring floral knowledge. Secondly, through modernization, the younger people in the community increasingly rely on modern medicine as opposed to traditional medicine made from wild flora. Thus, the younger generation has little knowledge concerning these plants. It is worth noting that all young people do not lack indigenous flora knowledge. There are so many young people, especially among herders, who have much experience in this field.

Moreover, the modern inhabitants of Moyale still depend on the wild plants in the area both for medicine and nutritional purposes. There are three reasons for this: First, because of their pastoralist mode of subsistence, they are related to the environment and dependent on flora in

various aspects of their daily routine. For instance, when their cattle get sick, they need to look for ways to treat them, and this is what can be at their disposal from the plants around them. They are normally very far away from the modern health facilities. Their main source of use is therefore traditional remedies. Equally, the same thing happens whenever the pastoralists feel unwell while tending their cattle to health. Additionally, when it comes to personal hygiene, cleaning, and even clothing, they depend on the flora in their close. Similarly, agro-pastoralists, drawing on their knowledge from herding, apply the same methods when they are at home to address their own health issues.

Their location provides the second reason for their dependence on Flora. To explain, Moyale has been in a position where modern healthcare, education, or any other need was out of reach for them because of their isolated position. Still today, things are not improving. Because of this fact, local flora had been utilized by the local indigenous people as their main source for many decades to solve all of their problems and handle all of their concerns.

Thirdly, because the Moyale population depends on flora, this environment faces huge impact. The use of ethnobotanical methods made it possible to see how *Grewia villosa* Willd, *Carissa spinarum* Vahl, and other plants are processed as food. This shows how the community uses these wild edible plants as food when the local environment changes and there is a drought. It is evident how much the Moyale community has depended on the plants over the years, and this is still the case now. Informants indicate that they show that they are prepared to eat this evergreen tree if a drought occurs.

5.1.5. Bridging Traditional and Modern Medicine through Ethnoarchaeological Findings

Ethnoarchaeological findings related to wild edible and medicinal plants in arid and semi-arid regions, such as those to be found in Moyale Woreda, might give reason to new insights for connecting traditional medicine with its modern counterpart. This integration could be realized through the steps identified below, besides working in close collaboration with traditional healers and medical professionals.

Traditional knowledge documentation: It involves the proper documentation of the knowledge concerning the use of wild edible and wild medicinal flora by local healers. This should carry information on which plant species is used, how it is prepared, its dosage, and the ailment it is

normally used for. Ethnobotanical surveys can be carried out for this purpose in a systematic manner. It creates a comprehensive database of such remedies, thereby allowing scientific analysis of their potential efficacy (Arthur, 2023).

Scientific validation: Traditional knowledge, after being documented, has to be verified by science. Such collaboration between ethnobotanists, pharmacologists, and traditional healers has resulted in controlled studies that have assessed the pharmacological characteristics of such plants (Arthur, 2014). These plants can have bioactive compounds isolated and tested against various health conditions in vitro or in clinical trials. The step helps in the validation not only of traditional practices but also of enhancing the credibility of traditional treatment in modern healthcare frameworks.

Integration into Modern Healthcare Practice: On validation, efficacious remedies of wider use can then be integrated into modern healthcare practice. This would range from the formulation of herbs in standard dosage forms to stringent quality control that must comply with the safety regulations laid down by health authorities. The medical professionals will then use the remedies as a complement during treatment together with conventional medicines, especially for diseases where the modern treatment lacks efficacy or has major side effects (Arthur, 2023; Debela Hundie et al., 2015).

Training and Education: These should be organized for both traditional healers and medical professionals to effectively integrate and work together. Traditional healers will have a better insight into modern medical practices, and they will also be able to share their extensive knowledge about local flora with healthcare providers (Arthur, 2014). Medical professionals can get to understand holistic approaches toward health, considering cultural beliefs and practices.

Community Engagement: In this respect, the process will involve community engagement in every step of the way so that communities can accept and adhere to integrated health practices. Workshops may be utilized at community levels as tools for changing perspectives on how traditional remedies and modern medicine can be integrated in a manner that does not violate cultural heritage (Debela Hundie et al., 2015).

Policy Development: Advocating for policy development that recognizes the importance of integrating traditional medicine into national health systems is required. This may include setting

up a framework by governments that secures funding for research into ethnobotanical studies and encourages collaboration among various practitioners (Debela Hundie et al., 2015). Traditional and modern medicine can be bridged through findings from ethnoarchaeological studies by a systematic approach: documentation, validation through scientific research, integration into healthcare practices, education for practitioners, community engagement, and supportive policies.

5.1.6. Areas for Further Research in Ethnobotany and Pharmacology

Ethnobotanical studies have a great significance in understanding the ways that indigenous cultures make use of plants for food, medication, and even other purposes (Mirutse Giday et al., 2009). Traditional wisdom regarding the utilization and protection of wild edible and therapeutic plants is immense in arid and semi-arid areas of Moyale Woreda. However, most of these kinds of plants. Have still been under-researched for their pharmacological properties. Aspects that have to be further researched concern the documentation of traditional wisdom, its pharmacological evaluation, and emphasizing sustainable methods for harvesting for its conservation. Interdisciplinary research techniques combine ethnobotany with pharmacology in the quest to discover new therapeutic agents with thoughtfulness toward environmental science (Fisseha Mesfin, 2014). Research where the participation of local people is involved, could, therefore, be a way of strengthening the capacities of these communities and simultaneously help decisions on policy about strategies related to conservation, methodologies related to sustainable development, and rights concerning intellectual property regarding Indigenous knowledge.

5.1.7. Challenges of Wild Edible and Medicinal Plants

Wild edible and medicinal plants of Moyale Woreda are within the circle of conservation challenges. The following shows some of the key issues:

Biodiversity Loss and Fragmentation: These two factors provide the biggest threats to the natural flora in the research area that are both edible and therapeutic. The region is heavily utilized for agriculture and animal grazing due to its distinct biodiversity. Plant populations get fragmented consequently of habitat degradation, which lowers genetic diversity.

Overexploitation: Overexploitation is the term used to describe the unsustainable harvesting of wild plants for their food and other uses. The indigenous populations in the study area used to depend heavily on wild edible and medicinal plants for their daily sustenance. However, overharvesting has occurred in recent decades due to increased demand brought on by population expansion. The majority of many plant species are in danger due to population increase and occasionally even local extinction because they are being harvested more quickly than they can be replaced. Due to a culture's dependence on plant use, its loss also poses a threat to cultural activities; therefore, it is not just a biodiversity concern.

Lack of Data and Knowledge: One of the major challenges toward addressing the impacts on wild edible and medicinal plants includes the general lack of comprehensive data and knowledge of the species found within the study region. Most local communities have traditional ecological knowledge of plant uses; however, most of this knowledge has not been documented. Where adequate scientific research documenting distribution of plants, population trends, and their ecological roles is lacking.

Lack of Awareness: The lack of knowledge among the local communities on the significance of protecting wild edible and medicinal plants is further accelerating their decline in species. Education that may point out their ecological value for biodiversity conservation and for human health is basically lacking.

Urbanization: Urbanization has been contributing much to habitat loss in the study area through the expansion of the city into surroundings that are mostly natural. The expansion directly destroys habitats of wild edible and medicinal plants while increasing levels of pollution that may pose adverse effects on plant health.

5.1.8. Conclusion and Recommendations

5.1.8.1. Conclusion

This work aimed to explore the diverse biodiversity of wild edible and medicinal plants of the arid and semi-arid parts of the Borana zone in Moyale woreda using ethnoarchaeological methods. The research identified and documented 83 plant species and captured the ecological knowledge that has been traditionally the indigenous and local communities in order to highlight the past relationships that have existed between communities and these plants. The research has also revealed how humans were interacting with the environment over time, and the exploration of material cultures and practices related to the preparation and use of these plants has provided insight into the cultural significance and technological expertise associated with these resources. The study of cultural tools that the local people use to cultivate and process wild edible and medical plants is documented to understand their archaeological implications. Archaeologists studying in the region should be able to look for pot shreds, pot cups, composite tools, long knives, axes, wooden mortar and wooden pestles, grinding stones, small pottery cups, buckets, pick-mattocks, hoes, and wooden instruments in understanding the beginning of the food production process in the region. The challenges for the conservation of this category of plant species were underlined, and effective conservation measures were called for to preserve biodiversity and ensuring indigenous and local knowledge is passed across the present and future generations. Such a holistic approach calls for due attention to academic research and practical conservation efforts in the region.

5.1.8.2. Recommendations

- Plant Conservation Strategy: The plant conservation strategy in the Borana Zone will focus on the maintenance of genetic diversity, sustainable utilization of wild edible and medicinal plants, and ecological knowledge concerning the participation of local communities in plant conservation. This would involve the carrying out of surveys, protected areas, methodology for sustainable harvesting, and integration of ecological knowledge. Benefits include increased access to medicinal plants.

- Taxonomic and Ecological Research Importance: Research in taxonomy, the classification of organisms, and ecology, the study of interactions between organisms and their environment, is a very crucial part of effective strategies for conservation. Understanding plant species relationships, distributions, and ecological roles informs selecting the areas of focus for conservation. The knowledge also ensures that there is local capacity building through training community members in scientific methodologies that enable them to take part in the monitoring of biodiversity changes over time.

- Sustainable Practices: Conserve these plant species by adopting their use sustainably within the local communities. Community-led workshops and training sessions will help to show conservation strategies.

- Collaboration with Researchers: Encourage the collaboration of local communities, ethnobotanists, ethnoarchaeologists, and conservation organizations to continue research and deliberations on the use and conservation of wild plants.

- Policy Support: Promote integration of traditional ecological knowledge into local or national policy frameworks concerning biodiversity conservation and sustainable development.

These recommendations open ways in which stakeholders can contribute to the long-term utilization of wild edible and medicinal plants, while at the same time empowering the local communities and conserving their cultural heritage.

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Appendices

Appendix 1: List of Multipurpose Plants in the Study Area

No	Scientific name	Family	Use	Elevation	Longitude	Latitudes
1	*Senegalia nilotica* (L.) Willd. ex Del	Fabaceae	Medicinal	1166M	5º.051.111'N	39º.046.389'E
2	*Senegalia tortilis* (Forssk.) Hayne	Fabaceae	Medicinal	1150M	5º.051.122'N	39º.046.498'E
3	*Actiniopteris radiata* (L.) P. Beauv	Pteridaceae	Medicinal	1265M	5º.070.243'N	39º.043.290'E
4	*Albuca abyssinica* Jacq	Hyacinthaceae	Medicinal	1170M	5º.053.211'N	39º.043.287'E
5	*Becium filamentosum* (Forssk.) Chiov	Apocynaceae	Medicinal	1190M	5º.056.212'N	39º.044.213'E
6	*Commiphora erythraea* (Ehrenb.) Engl.	Burseraceae	Medicinal	1350M	5º.051.112'N	39º.046.390'E
7	*Commiphora kua (*R. Br. ex Royle) Vollesen	Burseraceae	Medicinal	1322M	5º.051.632'N	39º.046.842'E
8	*Commiphora habessinica* (Berg) Engl	Burseraceae	Medicinal	1230M	5º051.423'N	39º.043.896'E
9	*Crabbea velutina* S. Moore	*Acanthaceae*	Medicinal	1150M	5º051.132'N	39º.048.733'E
10	*Delonix elata* (L.)	*Fabaceae*	Medicinal	1320M	5º.052.314'N	39º.043.618'E

	Gamble					
11	*Dodonea angustifolia* L. f	*Sapindaceae*	Medicinal	1158M	5º.04.044'N	39º.5.811'E
12	*Euphorbia crotonoides* Boiss	*Euphorbiaceae*	Medicinal	1157M	5º.04.042'N	5º.04.042'E
13	*Euphorbia cuneata* ssp. spinescens (Pax) S. Carter	*Euphorbiaceae*	Medicinal	1160M	5º.03.970'N	39º.5.878'E
14	*Euphorbia schizacantha* Pax.	*Euphorbiaceae*	Medicinal	1152M	5º.03.854'N	39º.5.825'E
15	*Gnidia stenophylla* Gilg	*Thymelaeaceae*	Medicinal	1155M	5º03.841'N	39º5.818'E
16	*Gomphocarpus fruticosus* (L.) Ait. F	*Apocynaceae*	Medicinal	1155M	5º.03.885'N	39º5.771'E
17	*Kalanchoe mamorata* Baker	*Crassulaceae*	Medicinal	1160M	5º.04.045'N	39º.5.809'E
18	*Sansevieria ehrenbergii* Schweinf. ex Baker	*Dracaenaceae*	Medicinal	1160M	5º.04.058'N	39º.5.808'E
19	*Datura stramonium*	*Solanaceae*	Medicinal	1158M	5º.04.168'N	39º.5.837'E
20	*Terminalia brownie* Guill. &Perr	*Combretaceae*	Medicinal	1160M	5º.04.176'N	39º.5.823'E
21	*Senegalia brevispica* Harms	*Mimosoideae*	Medicinal	1168M	5º.04.488'N	39º.5.528'E
22	*Belia schimperi*	*Myrsinaceae*	Medicinal	1175M	5º.04.204'N	39º.5.831'E
23	*Aloe Yavellana* Reynolds	*Aloeaceae*	Medicinal	1340M	5º067.543'N	39º056.983'E
24	S*olanum incanum* L	*Solanaceae*	Medicinal	1350M	5º067.543'N	39º056.984'E
25	*Euclea divinorum* Hiern	*Ebenaceae*	Medicinal	1336M	5º067.543'N	39º056.983'E

26	*Barleriaer anthemoides* R.Br.ex C.B. Clarke	*Acanthaceae*	Both	1230M	5º051.423'N	39º.043.897'E
27	*Withania somnifer* (L.) Dunal	*Acanthaceae*	Medicinal	1240M	5º051.423'N	39º.043.896'E
28	*Datura stramonium* L	Solanaceae	Medicinal	1230M	5º051.423'N	39º.043.896'E
29	*Cucumis ficifolius* A.Rich	*Cucurbitaceae*	Medicinal	1157M	5º.04.042'N	5º.04.039'E
30	*Euphorbia tirucalli* L	*Euphorbiaceae*	Medicinal	1157M	5º.04.042'N	5º.04.040'E
31	*Vernonia amygdalin* Delile	*Asteraceae*	Medicinal	1157M	5º.04.042'N	5º.04.043'E
32	*Achyranthes aspera*	*Solanaceae*	Medicinal	1157M	5º.04.042'N	5º.04.042'E
33	*Croton macrostachys* Hochst. Ex Delile	*Ebenaceae*	Medicinal	1160M	5º.03.078'N	39º.5.578'E
34	*Malva verticillate* L	*Malvaceae*	Medicinal	1170M	5º.03.078'N	5º.03.076'N
35	*Galinsoga parviflora* Cav	*Asteraceae*	Medicinal	1170M	5º.03.078'N	5º.03.078'N
36	*Gardiosperimum helicacabum* L	*Sapindaceae*	Medicinal	1160M	5º.03.078'N	5º.03.079'N
37	*Calcinaria aurea* (Ait.) Benth.	*Fabaceae*	Medicinal	1150M	5º.03.078'N	5º.03.077'N
38	*Juniperus procera* Hochst. Ex Endl.	*Cupressaceae*	Medicinal	1166M	5º.051.111'N	39º.046.389'E
39	*Tagetes minuta* L	*Asteraceae*	Medicinal	1166M	5º.051.111'N	39º.046.387'E
40	*Tamarindus indicus* L	*Fabaceae*	Both	1166M	5º.051.111'N	39º.046.389'E
41	*Laggera stelleraria* Sch.B.P. ex Benth & Hook.f.	*Asteraceae*	Medicinal	1166M	5º.051.111'N	39º.046.390'E
42	*Cucumis dipsaceus* Ehrenb. ex Spach	*Cucurbitaceae*	Medicinal	1166M	5º.051.111'N	39º.046.389'E

43	*Senegalia hockii* De Willd	*Fabaceae*	Edible	1170M	5º.051.122'N	39º.046.498'E
44	*Grewia villosa* Willd	Malvaceae	Edible	1170M	5º.053.211'N	39º.043.287'E
45	*Lenea rivae* (Chiov.) sacl	Anacardiacea	Both	1322M	5º.051.632'N	39º.046.842'E
46	*Physalis peruviana* L.	Solanaceae	Edible	1260M	5º.052.314'N	39º.043.618'E
47	*Acacia senegal* (L.) Willd.	Leguminosae	Edible	1260M	5º.052.314'N	39º.043.618'E
48	*Merendera* sp	Colchicaceae	Edible	1260M	5º.052.314'N	39º.043.618'E
49	*Opuntia ficus-indica* (L.)miller	Cactaceae	Edible	1180M	5º.03.078'N	39º.5.579'E
50	*Senegalia seyal* De	Fabaceae	Edible	1180M	5º.03.078'N	39º.5.578'E
51	*Amaranthus thunbergii* Moq	Amaranthaceae	Edible	1190M	5º.051.122'N	39º.046.497'E
52	Pappea capensis Ekel and zeyh	Sapindaceae	Edible	1190M	5º.051.122'N	39º.046.498'E
53	*Balanites aegyptiaca* (L.) Del	*Balanitaceae*	Edible	1190M	5º.04.488'N	39º.5.528'E
54	*Rumex abyssinicus* Jacq	*Polygonaceae*	Edible	1157M	5º.04.042'N	5º.04.042'E
55	*Balanites rotundifolia* (Van Tiegh.) Blatter	*Balanitaceae*	Edible	1166M	5º.051.122'N	39º.046.498'E
56	*Olea europaea* subsp. Cuspidate	*Oleaceae*	Edible	1170M	5º.053.211'N	39º.043.287'E
57	*Carissa spinarum Vahl* Vahl	Apocynaceae	Edible	1322M	5º.051.632'N	39º.046.842'E
58	*Capparis tomentosa* Lam	Capparaceae	Edible	1160M	5º.052.314'N	39º.043.618'E
59	*Chasmanthera dependens* Hochst	Menispermaceae	Edible	1270M	5º.03.078'N	39º.5.578'E

60	*Teclea simplicitolia* (Engl.) Lam.	*Solanaceae*	Edible	1180M	5º.051.122'N	39º.046.498'E
61	*Grewia revoluta* Juss	*Ebenaceae*	Edible	1180M	5º.04.488'N	39º.5.528'E
62	*Cordia gharaf* (Forssk.) Ehrenb	Boraginaceae	Edible	1180M	5º.051.122'N	39º.046.498'E
63	*Cordia ovalis* R. Br.	Boraginaceae	Edible	1170M	5º.053.211'N	39º.043.287'E
64	*Commiphora africana* (A. Rich.) Engl	Burseraceae	Edible	1322M	5º.051.632'N	39º.046.840'E
65	*Dioscorea quartiniana* A. Rich	Dioscoreaceae	Edible	1322M	5º.051.632'N	39º.046.842'E
66	*Dobera glabra* (Forssk.) Juss. ex Poir	Salvadoraceae	Edible	1322M	5º.051.632'N	39º.046.841'E
67	*Dorstenia barnimiana* Schweinf. E	Moraceae	Edible	1160M	5º.052.314'N	39º.043.618'E
68	*Ficus glumosa* Del	Moraceae	Edible	1180M	5º.03.078'N	39º.5.578'E
69	*Ficus syomorus* L	Moraceae	Edible	1180M	5º.051.122'N	39º.046.498'E
70	*Grewia arborea* (Forssk) Lam	Moraceae	Edible	1168M	5º.04.488'N	39º.5.528'E
71	*Grewia tembensis* Fresen	Moraceae	Edible	1157M	5º.04.042'N	5º.04.042'E
72	*Grewia tenax* (Forssk.) Fiori	Moraceae	Edible	1157M	5º.051.122'N	39º.046.498'E
73	*Haplocephalum foliolosum* (Hiern.) Bullock	Sapindaceae	Edible	1170M	5º.053.211'N	39º.043.287'E
74	*Lantana rhodesiensis* Moldenke	Verbenaceae	Edible	1260M	5º.052.314'N	39º.043.618'E
75	*Peucedanum harmsianum* Wolf	Apiaceae	Edible	1340M	5º.03.078'N	39º.5.578'E
76	*Pollichia campestris*	Caryophyllaceae	Edible	1182M	5º.051.122'N	39º.046.498'E

	Ait					
77	*Premna schimperi* Engl	Lamiaceae	Edible	1168M	5º.04.488'N	39º.5.528'E
78	*Pyrostria phyllantheoidea* (Baill.) Brids	*Rubiaceae*	Edible	1157M	5º.04.042'N	5º.04.042'E
79	*Rhus natalensis* Engl	Anacardiaceae	Edible	1322M	5º.051.632'N	39º.046.841'E
80	*Sclerocarya birrea* (A. Rich.) Hochst	Anacardiaceae	Both	1260M	5º.051.122'N	39º.046.498'E
81	*Sterculia stencarpa* H. Winkler	Malvaceae	Edible	1170M	5º.053.211'N	39º.043.287'E
82	*Vigna friesiorum* Harms	Fabaceae	Edible	1322M	5º.051.632'N	39º.046.842'E
83	*Ziziphus mucronata* Willd	Rhamnaceae	Edible	1260M	5º.052.314'N	39º.043.618'E

Appendix 2: List of Informants

No	Name of Informants	Occupation	Marital	Sex	Age	Place of Interviews	Date of Interviews
1	Haro Dida	Traditional Medicinal experts	Married	M	90	Qabanawa	07/05/2024
2	Boru Galgalo	knowledgeable elder	Married	M	126	Lagsure	09/05/2024
3	Loko Duba	Traditional Medicinal experts	Married	F	70	Bokola	11/05/2024
4	Jilo Malicha	Traditional Medicinal experts	Married	F	70	Arda Ola	13/05/2024
5	Haro Boru	knowledgeable elder	Married	M	80	Buladi	15/05/2024
6	Boru Dida	Farmer	Married	M	50	Bokola	11/05/2024
7	Loko Wako	Traditional Medicinal experts	Married	F	62	Qabanawa	07/05/2024
8	Galgalo Dida	knowledgeable elder	Married	M	80	Lagsure	09/05/2024
9	Xume Liban	Traditional Medicinal experts	Married	M	79	Arda Ola	13/05/2024
10	Nuguse Dirge	knowledgeable elder	Married	M	93	Qabanawa	07/05/2024
11	Halake Duba	Farmer	Married	M	36	Bokola	11/05/2024
12	Guyo Wako	knowledgeable elder	Married	M	82	Bokola	11/05/2024
13	Hirbo Guyo	Farmer	Married	M	45	Bokola	11/05/2024
14	Bojee Konte	knowledgeable elder	Married	M	79	Qabanawa	07/05/2024
15	Ebise Qilxa	Traditional Medicinal experts	Married	F	76	Qabanawa	07/05/2024
16	Mamo Kare	knowledgeable elder	Married	M	96	Lagsure	20/07/2024
17	Wako Guyo	Farmer	Married	M	53	Lagsure	20/07/2024
18	Malicha Halake	Farmer	Married	M	42	Lagsure	20/07/2024
19	Jaldesa Huka	Farmer	Married	M	32	Buladi	22/07/2024

20	Ali Guyo	Traditional Medicinal experts	Married	M	56	Buladi	22/07/2024
21	Guyatu Garse	Traditional Medicinal experts	Married	F	62	Buladi	22/07/2024
22	Tiyaa Kare	Farmer	Married	F	29	Arda Ola	24/07/2024
23	Molu Barchi	Traditional Medicinal experts	Married	M	52	Arda Ola	24/07/2024
24	Daki Godo	Government worker	Unmarried	F	22	Qabanawa	26/07/2024
25	Bokayo Dida	Farmer	Married	F	34	Qabanawa	26/07/2024
26	Wariyo Racho	Traditional Medicinal experts	Married	M	56	Buladi	22/07/2024
27	Roba Godo	knowledgeable elder	Married	M	83	Lagsure	20/07/2024
28	Dima Abduba	Farmer	Married	M	39	Bokola	28/07/2024
29	Kunu Dima	Government worker	Unmarried	M	26	Bokola	28/07/2024
30	Bati Guyo	Government worker	Married	F	34	Bokola	28/07/2024
31	Guyo Golicha	Farmer	Married	M	42	Buladi	22/07/2024

Appendix 3: Questions for Interviews

The purpose of this questionnaire was to collect data for a research project titled **"Ethnoarchaeological Study of Wild Edible and Medicinal Plants in Arid and Semi-Arid Areas: The Case of Moyale Woreda, Borana Zone of Oromia Regional State, Ethiopia"** for an MA degree in Archaeology and Heritage Management at Addis Ababa University. Your honest response to the following question is critical to the successful completion of this paper, and the information you provide will be used for academic purposes and kept confidential:

Instructions;

No need to write your name

Write in the blanks for your comment.

Thanks in advice.

1. What purposes do plants in the Moyale woreda have? (More than one option is possible).

List some important plant species for each use: Fire woods, Construction material, Charcoal, Timber, Farm implements, Wild food (famine, normal), Medicines (human, livestock), Fodder, and Bee forage, fence, Spices.

2. Which plant parts do you use for the above purpose? a. Root/bark b. Stem/bark c. Leaf d. Seed/fruit e. flower/nectar g. latex.

3. Mention plants that can serve with multiple purposes for the locals.

4. What are the plant species utilized to treat diseases in people and animals?

5. What are plants that have other uses in addition to food and medicinal uses in your areas?

6. Who process the depth of medicinal knowledge concerning these plants? Is that from elders, traditional hillers, religious leaders or others?

7. List the various ways that wild plants can be consumed.

8. Where do these traditional useful plants grow and what are their growth seasons?

9. How do you diagnose health problem (for each disease)?

10. How do you process medicinal plants? Used alone or combined with additional components or water, fresh, dried, crushed, or powdered; decoction, concoction.

11. Does the amount taken of traditional medicine vary depending on the user age and gender? If ‘’yes’’, why?

12. Do the use of medicinal and wild food plants during the period of collection, the technique of collecting, sex, age, storage, and other factors carry any taboos?

13. List any observable negative effects or side effects of commonly used and wild plants food plants.

14. Does wild edible fall under the categories of wild food, famine food, children food, elderly food, or other?

15. What is transplanting? Does your area have any transplants? Or do you replant them in your home garden?

16. Why you choose these wild edible plants to replant in your home garden?

17. What kinds of wild edible plants you eat directly or indirectly in your area?

18. What types of wild edible plants grow during high rainfall and low rainfall season?

19. Does the use of wild plants vary within the Borana zone? Is there a uniform standard for the use of plants?

20. Why is the rite of passage only open to a select few experts?

21. Is the utilization of wild medicinal and edible plants being impacted by modernization? How?

22. Do domesticated medicinal and wild edible plants exist?

23. How are family members and the next generation are being educated about medicinal and wild food plants? Are there knowledge gaps resulting from pastoral activities?

24. What is your observation on the current status of useful plants in comparing with the past history? 1) Still intact 2) Slightly disturbed 3) Heavily disturbed

25. List the main threats to these traditional useful plants

26. What are the major constraints/problems in the conservation and management of plants?

27. What recommendations do you suggest for conservation, management and sustainable utilization of the forests?

27. How was the usage of wild and medicinal plants during your grandfather's time (50/60 years ago)? During your father's time (40/30 years ago)?

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