



Natural spice Resources of Anfilo District Astudy of korarima and Ginger by

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Corrorima

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Abstract

This study examines the potential of natural resource-based spice production, focusing on Korarima (*Aframomum corrorima*) and ginger (*Zingiber officinale*) in Anfillo Woreda, Kellem Wollega Zone, Ethiopia. Anfillo is endowed with forest ecosystems and favorable agroecological conditions that support diverse plant resources and spice production. Korarima is an indigenous Ethiopian spice traditionally associated with forest environments, while ginger is an important cultivated spice with significant household and market value. The study aims to assess the availability, utilization, production practices, economic importance, and value-chain opportunities of these spices. It also investigates major challenges, including forest degradation, limited access to improved planting materials, inadequate processing technologies, weak market linkages, and limited value addition. The study will employ a mixed-methods approach involving household surveys, key-informant

interviews, field observations, and focus-group discussions. The findings are expected to provide evidence for sustainable resource management, improved spice production, value addition, livelihood diversification, and conservation of indigenous plant resources in Anfillo.

1. Introduction

Natural resources are fundamental to the social, economic, cultural, and environmental well-being of rural communities. Forests, agricultural land, water, wildlife, medicinal plants, spices, honey, coffee, and other biological resources provide food, income, employment, and ecological services for millions of people. In many rural areas of Ethiopia, communities depend heavily on natural resources for their livelihoods. These resources also contribute to biodiversity conservation, climate regulation, soil protection, watershed management, and the preservation of indigenous knowledge. Therefore, sustainable utilization of natural resources is essential for improving rural livelihoods while maintaining the ecological systems on which communities depend.

Ethiopia is one of the countries in Africa with considerable biological and ecological diversity. Its diverse topography, climate, altitude, and soil conditions create favorable environments for the production and conservation of numerous plant species. Among these resources are indigenous and introduced spice crops that have important nutritional, medicinal, cultural, and economic values. Spices have traditionally been used in Ethiopian households for food preparation, preservation, traditional medicine, ceremonies, and cultural practices. More recently, spices have become increasingly important as agricultural commodities with potential for local processing, domestic trade, and international markets.

Among Ethiopia's important spice resources, Korarima (*Aframomum corrorima*) occupies a special position. Korarima, sometimes referred to as Ethiopian cardamom, is an indigenous spice plant associated particularly with the forest ecosystems of southwestern and western Ethiopia. Its seeds and fruits are widely used as a flavoring ingredient in traditional foods and beverages. The plant is also recognized for its cultural and economic importance among communities that have traditionally harvested or cultivated it. Because Korarima is closely associated with forest environments, its conservation and sustainable utilization can contribute simultaneously to biodiversity protection and rural economic development.

Korarima represents an important connection between natural forests and local livelihoods. In some communities, forest-based resources provide households with products that can be consumed directly or sold in local markets. The traditional knowledge associated with identifying, harvesting, processing, storing, and using Korarima has been transmitted between generations. Such indigenous knowledge is an important component of local resource management. However, changes in land use, agricultural expansion, forest degradation, population pressure, and changing market conditions may threaten the availability and sustainability of indigenous forest products. Consequently, research is necessary to understand how Korarima resources can be conserved and utilized in ways that benefit local communities.

Ginger (*Zingiber officinale*) is another economically important spice crop that can be considered within the natural-resource and agricultural systems of southwestern Ethiopia. Unlike Korarima, which is an indigenous forest-associated spice, ginger is primarily cultivated as an agricultural crop. Nevertheless, ginger production depends on natural resources such as suitable soil, water, rainfall, temperature, and agroecological conditions. It can also be integrated into diversified farming systems and agroforestry landscapes. Ginger is widely valued for its distinctive flavor, medicinal applications, and commercial potential. Its rhizomes are used in household food preparation, traditional medicine, beverages, and various processed products.

The production of ginger and Korarima can provide opportunities for income diversification among rural households. Diversification is particularly important in communities where dependence on a single agricultural commodity exposes households to price fluctuations, crop diseases, climate variability, and other economic risks. Spice production may provide an additional source of household income and employment. Moreover, processing and value addition can create opportunities for small businesses, cooperatives, women, and young people. Products such as dried spices, cleaned and packaged spices, powdered spices, and other processed products can potentially generate greater economic value than raw products.

Anfillo Woreda, located in Kellem Wollega Zone of Oromia Regional State, is characterized by natural-resource potential and agricultural activities. The area contains forest resources and agricultural landscapes that can support different plant species and livelihood activities. Local communities have historically interacted with forest and agricultural resources for food, medicine, construction materials, fuel, coffee, honey, and other products. The combination of natural forests, cultivated land, favorable environmental conditions, and indigenous knowledge creates an important foundation for investigating spice resources such as Korarima and ginger.

The natural-resource base of Anfillo is not only an environmental asset but also an important component of the local economy. Forest resources can provide direct products and ecosystem services while supporting agricultural production. Forest-associated products such as honey, coffee, medicinal plants, and indigenous

spices can contribute to household livelihoods. Sustainable management of these resources may therefore provide a pathway for balancing conservation and economic development. However, natural resources are increasingly affected by human and environmental pressures. Forest clearing, agricultural expansion, unsustainable harvesting, soil degradation, population growth, and inadequate resource-management systems can reduce the long-term availability of valuable biological resources.

The relationship between forest conservation and spice production deserves particular attention in Anfillo. Korarima has ecological characteristics that make it relevant to forest-based production systems. Maintaining suitable forest environments can support the conservation of indigenous plant resources while creating livelihood opportunities for surrounding communities. At the same time, uncontrolled harvesting or conversion of forest land may threaten the sustainability of these resources. A balanced approach is therefore needed in which local communities are able to benefit economically from natural resources while participating in their protection and regeneration.

Ginger presents a somewhat different opportunity. As a cultivated crop, its production can be improved through appropriate agronomic practices, quality planting materials, disease management, soil fertility management, post-harvest handling, and market development. Integrating ginger into diversified farming systems may provide farmers with opportunities to use land and labor more efficiently. However, profitable ginger production requires attention to production costs, market prices, storage, transportation, processing, and access to reliable markets. Without adequate market linkages and value addition, farmers may receive limited benefits from increased production.

The value chain of spices extends beyond farmers. It includes input suppliers, producers, collectors, processors, traders, transporters, wholesalers, retailers, cooperatives, and consumers. Weaknesses at any stage can affect the overall profitability and sustainability of the sector. For example, farmers may experience difficulties obtaining quality planting materials, while processors may lack appropriate equipment. Traders may face transportation problems, and producers may have limited information about market prices.

These challenges can reduce incentives for farmers to invest in spice production and conservation. Understanding the entire value chain is therefore important when assessing the economic potential of Korarima and ginger. Post-harvest handling is another important issue. Spices can lose quality through inappropriate harvesting, drying, cleaning, storage, transportation, and packaging. Moisture, contamination, pests, poor storage conditions, and prolonged exposure to unsuitable environmental conditions may reduce product quality and market value. Improved post-harvest technologies and processing facilities could therefore increase the value of spices produced in Anfillo. Local processing may also create employment and enable communities to capture a greater share of the final market value. Indigenous knowledge should also be considered in research on Korarima and other natural-resource-based products. Local communities possess knowledge concerning plant identification, harvesting seasons, ecological conditions, preparation methods, medicinal uses, and traditional conservation practices. Documenting this knowledge can contribute to scientific understanding and help preserve cultural heritage. At the same time, research should recognize that traditional resource-use systems may change over time in response to markets, environmental pressures, technology, and socioeconomic transformation. Spice production also has potential implications for youth and women. Rural youth often face limited employment opportunities and may migrate from rural areas because of a lack of income-generating activities. Spice production, processing, packaging, marketing, and related enterprises could provide opportunities for youth entrepreneurship. Women, who frequently participate in agricultural production, food processing, household spice preparation, and local marketing, could also benefit from improved access to training, finance, technology, and markets. Thus, the development of spice value chains can be considered not only an agricultural issue but also a rural development and livelihood strategy. Despite the potential of Korarima and ginger, there is a need for location-specific research in Anfillo. Information about the distribution, production, utilization, management, economic contribution, market opportunities, and constraints of these spices may be limited or fragmented. A detailed assessment can help identify existing resources, local production systems, community practices, and opportunities for sustainable commercialization. Such information can support farmers, local institutions, development organizations, cooperatives, researchers, and policymakers in designing appropriate interventions. The study of Korarima and ginger is also important from an environmental perspective. Sustainable spice production can potentially reduce pressure on natural forests when appropriate cultivation and management systems are developed. At the same time, conservation of forest-associated Korarima requires protection of the ecological conditions that support the species. Agroforestry and integrated land-use approaches may offer opportunities to combine agricultural production with biodiversity conservation. Such approaches can contribute to soil protection, carbon storage, microclimate regulation, and diversified household income.

Therefore, the study of natural-resource-based spice production in Anfillo Woreda should consider

environmental, economic, social, and cultural dimensions together. It should not focus only on the quantity of spices produced but also on how resources are accessed, managed, harvested, cultivated, processed, marketed, and consumed. Particular attention should be given to the sustainability of Korarima resources, the production potential of ginger, household livelihood contributions, value-chain development, indigenous knowledge, and major constraints facing producers and traders.

In this context, the present study focuses on Korarima (*Aframomum corrorima*) and ginger (*Zingiber officinale*) as important spice resources in Anfillo Woreda, Kellem Wollega Zone. The study seeks to examine their availability, production and utilization practices, economic importance, management systems, value-chain opportunities, and major challenges. It also aims to identify opportunities for sustainable production, conservation, processing, commercialization, and livelihood improvement. The findings may provide useful information for developing strategies that promote both natural-resource conservation and community



economic development.

Ultimately, sustainable utilization of Anfillo's natural resources requires cooperation among local communities, farmers, government institutions, researchers, development organizations, cooperatives, and private-sector actors. Protecting indigenous resources such as Korarima while improving cultivated spice production such as ginger can contribute to a more diversified and resilient rural economy. By linking conservation, indigenous knowledge, improved agricultural practices, value addition, and market development, Anfillo can strengthen the contribution of spice resources to household livelihoods and local economic development while maintaining the natural-resource systems that support future generations.

General Objective

To assess the natural-resource potential, production, utilization, conservation, and economic importance of Korarima (*Aframomum corrorima*) and ginger (*Zingiber officinale*) in Anfillo Woreda, Kellem Wollega Zone, Ethiopia, with particular emphasis on sustainable management and livelihood improvement.

Specific Objectives

The study will specifically aim to:

Assess the availability and distribution of Korarima and ginger resources in Anfillo Woreda.

Examine traditional and modern production and harvesting practices used by local communities for Korarima and ginger.

Assess the economic contribution of Korarima and ginger to household livelihoods, income, food security, and employment.

Identify indigenous knowledge and local practices related to the management, conservation, harvesting, processing, and utilization of Korarima. Examine the value chains and market opportunities for Korarima and ginger, including production, processing, transportation, marketing, and value addition.

Identify major constraints affecting production, conservation, processing, and commercialization, including environmental, technical, financial, and market-related challenges.

Assess opportunities for sustainable production and conservation of Korarima and ginger while reducing pressure on natural forest resources. Develop practical recommendations for improving spice production, value addition, market access, natural-resource conservation, and rural livelihood development in Anfillo Woreda.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Natural resources constitute the foundation of rural livelihoods and play important ecological, economic, social, and cultural roles. Forests, agricultural land, water, soil, wildlife, coffee, honey, medicinal plants, and other biological resources provide food, income, employment, and ecosystem services to rural communities. In Ethiopia, the diversity of agroecological environments has created favorable conditions for the production and conservation of numerous plant species, including indigenous and introduced spice crops. Spices are important agricultural commodities because they are used as food flavorings, traditional medicines, cultural products, and sources of household income. Ethiopia has a long history of spice production and has favorable agroecological conditions for growing a wide range of spice crops, including Korarima, ginger, turmeric, pepper, fenugreek, and other indigenous and introduced species (Wondimnew, 2024).

Spices are particularly important in rural economies because they can be produced on relatively small areas of land and can provide opportunities for income diversification. The spice sector also creates employment through production, harvesting, processing, transportation, marketing, and value addition. In Ethiopia, smallholder farmers are major producers of spices, while traders, processors, cooperatives, and consumers participate in different stages of the value chain. However, the development of the spice sector has been constrained by inadequate post-harvest management, limited storage facilities, weak market linkages, transportation problems, limited market information, and insufficient value addition (Wondimnew, 2024).

Among Ethiopia's indigenous spice resources, Korarima (*Aframomum corrorima*) is particularly important. Korarima is a perennial aromatic herb belonging to the family Zingiberaceae and is native to Ethiopia. It has considerable culinary, medicinal, cultural, ecological, and economic importance. The plant is naturally associated with shaded forest ecosystems and is also maintained in cultivated and home-garden systems. Its seeds and fruits are traditionally used as a spice in Ethiopian foods and beverages. Research has demonstrated considerable morphological, phytochemical, and genetic variation among Korarima populations, indicating the importance of conserving its genetic resources for future improvement and sustainable utilization (Hailu et al., 2021).

Recent research emphasizes that Korarima naturally grows under shaded forest conditions and that forest degradation and habitat loss can negatively affect wild populations. The species has important potential for sustainable production, household income generation, value addition, and biodiversity conservation. However, genetic resource decline, limited agronomic technologies, and weak market development remain important challenges (Tena & Desta, 2026).

Korarima is especially relevant to western and southwestern Ethiopia. Previous research has documented its cultivation and distribution in several areas of southern and southwestern Ethiopia, including Wellega and Jimma. This geographical distribution makes Korarima an important resource for studying the relationship between indigenous spices, forest ecosystems, local knowledge, and rural livelihoods in western Ethiopia (Hailu et al., 2021).

Ginger (*Zingiber officinale*) is another economically important spice that deserves attention in the context of Anfillo District. Ginger is cultivated for its rhizomes, which are used in food preparation, beverages, traditional medicine, and commercial processing. Ethiopia's agroecological diversity provides favorable conditions for ginger production in several parts of the country. Ginger has historically been an important spice commodity in Ethiopia and has contributed significantly to domestic and international spice trade. However, the sector has experienced production, disease, marketing, and value-chain challenges that affect farmers and other actors (Kifile et al., 2023).

The economic importance of ginger extends beyond primary production. Its value chain includes farmers, input suppliers, collectors, traders, processors, transporters, wholesalers, retailers, and consumers. Consequently, improvements in production, processing, storage, packaging, and market access can influence the economic benefits received by rural households. Research on Ethiopia's spice sector indicates that stronger communication between producers and buyers, improved post-harvest management, better storage, reliable transportation, market information, and stronger market linkages are important for improving the performance of spice value chains (Wondimnew, 2024).

Anfillo District is located in Kellem Wollega Zone of Oromia Regional State, western Ethiopia. The district is characterized by considerable natural-resource potential and agricultural activities. Previous research conducted in Anfillo has documented the importance of natural forests, forest coffee, and honey resources to local ecological and socioeconomic systems. One study described Anfillo as an area where coffee production is prominent and where natural-resource-based livelihood activities are important (Abraham et al., 2021).

The natural-resource base of Anfillo provides an important context for investigating indigenous spices. Forest ecosystems can provide products directly to households while also supporting ecosystem functions such as soil protection, biodiversity conservation, water regulation, and microclimate maintenance. Forest-related products can contribute to household income and livelihood diversification. However, increasing pressure on land and natural resources can result in forest degradation and loss of valuable plant species. Therefore, research on natural spice resources should consider both their economic utilization and their ecological conservation.

The relationship between Korarima and natural forests is particularly important. Because Korarima is naturally associated with shaded forest ecosystems, conservation of suitable forest habitats can contribute to the conservation of the species. At the same time, sustainable cultivation and management of Korarima may provide rural communities with economic incentives to conserve biological resources. This creates an opportunity to link biodiversity conservation with livelihood development. Recent literature emphasizes that sustainable Korarima production requires attention to ecological requirements, genetic-resource conservation, agronomic practices, processing, market development, and value-chain improvement (Tena & Desta, 2026).

Ginger provides a complementary research dimension because it is primarily cultivated rather than a forest-dependent indigenous spice. Its production depends on soil fertility, rainfall, temperature, planting materials, crop-management practices, disease control, and access to agricultural inputs. Consequently, studying Korarima and ginger together makes it possible to examine both forest-associated and cultivated spice resources within the natural-resource and livelihood systems of Anfillo.

The sustainable utilization of spice resources also requires consideration of indigenous knowledge. Rural communities possess knowledge about plant identification, harvesting seasons, cultivation practices, processing methods, storage, medicinal uses, and traditional applications. Such knowledge has significant cultural and practical value. Documentation of indigenous knowledge can contribute to resource conservation, improved production practices, and the preservation of local cultural heritage. At the same time, scientific research can help identify ways to combine traditional knowledge with improved technologies without undermining local resource-management systems.

Another important dimension is value addition. Selling raw or minimally processed spices may provide limited returns to producers, whereas cleaning, drying, grading, grinding, packaging, and other forms of processing can increase product value. Improved value addition can also create employment opportunities for women and youth. In rural areas where employment opportunities are limited, spice processing and marketing may provide opportunities for small enterprises and cooperatives. Therefore, research should examine not only the availability of spice resources but also the economic activities associated with their production and commercialization.

Market access is another major determinant of the sustainability of spice production. Farmers require access to reliable markets where they can obtain reasonable returns for their products. However, weak market information, limited bargaining power, inadequate transportation, lack of organized markets, and insufficient relationships between producers and buyers can reduce profitability. Ethiopian spice-sector research has identified weak producer-buyer linkages, poor post-harvest management, inadequate storage, transportation challenges, and limited market information as important constraints (Wondimnew, 2024).

Environmental sustainability must also be incorporated into the development of spice resources. Natural-resource exploitation without appropriate management can contribute to habitat degradation, biodiversity loss, soil degradation, and reduced availability of indigenous plant resources. Sustainable management requires the participation of local communities and the development of practices that allow natural resources to be utilized while maintaining their capacity to regenerate. In the case of Korarima, this may involve forest conservation, sustainable harvesting, propagation, cultivation, and conservation of genetic diversity. In the case of ginger, sustainable soil management, disease management, improved planting materials, and appropriate crop-management practices are important.

The development of spice resources can therefore contribute to multiple dimensions of rural development. Economically, spices can provide income and employment. Socially, they can support household livelihoods and community enterprises. Culturally, indigenous spices such as Korarima are connected to traditional food practices and local knowledge. Ecologically, sustainable management can contribute to biodiversity conservation and protection of forest ecosystems. These interconnected dimensions demonstrate why natural spice resources should be investigated from an integrated perspective rather than solely as agricultural commodities.

Despite the potential importance of Korarima and ginger in Anfillo, there is a need for location-specific evidence concerning their availability, production, utilization, management, economic contribution, value chains, and constraints. Existing national literature provides important information about Ethiopian spices, while studies of Korarima provide evidence about its ecology, diversity, production, and economic importance. However, locally specific information is necessary to understand how these resources function within the particular ecological, socioeconomic, and cultural context of Anfillo District. The present study therefore seeks to contribute empirical information concerning these resources.

The study focuses on Natural Spice Resources in Anfillo District, Kellem Wollega Zone, Oromia Region, Ethiopia, with particular emphasis on Korarima (*Aframomum corrorima*) and ginger (*Zingiber officinale*). It examines the availability, production, harvesting, utilization, conservation, economic contribution, value-chain opportunities, and major constraints associated with these spice resources. The study also considers indigenous knowledge and opportunities for sustainable management.

1.2 Statement of the Problem

Ethiopia possesses substantial potential for spice production because of its diverse agroecological conditions and long history of spice use. Nevertheless, the country's spice sector continues to experience production, post-harvest, marketing, and value-chain constraints. Problems such as inadequate storage, weak market linkages, insufficient processing facilities, limited market information, transportation difficulties, and low levels of value addition can reduce the benefits received by producers (Wondimnew, 2024).

Korarima faces additional conservation challenges because of its association with forest ecosystems. Habitat degradation, deforestation, limited production technologies, and genetic-resource decline can threaten the long-term availability of this indigenous spice. Recent research emphasizes the need for sustainable production and conservation strategies that combine ecological protection with economic utilization (Tena & Desta, 2026).

Ginger also faces production and marketing challenges. Although it has significant economic potential, problems related to disease, production practices, planting materials, market conditions, and value-chain organization can limit its contribution to rural livelihoods. These challenges demonstrate the need for research that considers the entire production and marketing system rather than focusing only on crop production (Kifile et al., 2023).

In Anfillo District, natural forests and agricultural resources provide a foundation for diversified livelihood activities. Research has already demonstrated the importance of forest coffee and natural-forest honey in the district, indicating the broader importance of natural-resource-based livelihoods (Abraham et al., 2021). However, there is comparatively limited documented information specifically addressing Korarima and ginger as natural-resource and livelihood assets in Anfillo.

The lack of adequate local information can make it difficult for farmers, development organizations, government institutions, cooperatives, and other stakeholders to formulate appropriate interventions. Without information on resource availability, production systems, indigenous knowledge, economic contribution, market opportunities, and conservation challenges, opportunities for sustainable development and value addition may not be fully utilized. Therefore, systematic research is required to generate evidence concerning Korarima and ginger in Anfillo District.

1.3 General Objective

The general objective of this study is to assess the natural-resource potential, production, utilization, conservation, and economic importance of Korarima (*Aframomum corrorima*) and ginger (*Zingiber officinale*) in Anfillo District, Kellem Wollega Zone, Oromia Region, Ethiopia.

1.4 Specific ObjectivesThe study specifically aims to: Assess the availability and distribution of Korarima and ginger resources in Anfillo District.

Examine traditional and modern production, cultivation, and harvesting practices associated with Korarima and ginger.

Assess the economic contribution of Korarima and ginger to household livelihoods, income, food security, and employment.

Document indigenous knowledge and local practices related to the management, conservation, harvesting, processing, and utilization of Korarima. Examine the value chains and market opportunities associated with Korarima and ginger.

Identify major environmental, technical, financial, production, post-harvest, and market-related constraints affecting the two spices.

Assess opportunities for sustainable production, conservation, processing, and value addition.

Develop recommendations for improving spice production, market access, natural-resource conservation, and livelihood development in Anfillo District.

1.5 Research Questions

The study will address the following research questions:

What Korarima and ginger resources are available in Anfillo District, and where are they distributed?

What production, cultivation, harvesting, processing, and utilization practices are used by local communities?

What contribution do Korarima and ginger make to household livelihoods and income?

What indigenous knowledge and traditional practices are associated with Korarima management and utilization?

What are the major value-chain and market opportunities for Korarima and ginger?

What major constraints affect the production, conservation, processing, and marketing of the two spices?

What opportunities exist for sustainable management, value addition, and commercialization?

What strategies can improve the contribution of Korarima and ginger to sustainable rural development in Anfillo District?

1.6 Significance of the Study

The study is expected to have significance for local communities, farmers, government institutions, development organizations, researchers, cooperatives, traders, and other stakeholders. For local farmers, the study may provide information about production, management, value addition, and market opportunities. For government and development institutions, the findings may provide evidence for planning natural-resource conservation, agricultural development, rural enterprise development, and spice-sector interventions.

The study may also contribute to the conservation of indigenous biological resources. By documenting Korarima and associated indigenous knowledge, it can help draw attention to the importance of conserving forest-associated plant resources. This is particularly relevant because recent research has identified genetic-resource decline and habitat degradation as concerns for Korarima (Tena & Desta, 2026).

Academically, the study will contribute to the literature on Ethiopian natural resources, indigenous spices, agroforestry, rural livelihoods, and agricultural value chains. It can also provide a basis for future research on Korarima, ginger, forest products, spice processing, market development, and sustainable resource management in western Ethiopia.

1.7 Scope of the Study

The study is geographically limited to Anfillo District in Kellem Wollega Zone, Oromia Regional State, Ethiopia. Thematically, it focuses on two major spice resources: Korarima (*Aframomum corrorima*) and ginger (*Zingiber officinale*). The study covers their availability, production, harvesting, utilization, conservation, economic contribution, processing, marketing, value chains, indigenous knowledge, constraints, and development opportunities.

The study does not attempt to examine every natural resource found in Anfillo. Rather, it concentrates on Korarima and ginger because of their potential ecological, economic, cultural, and livelihood importance. The findings will therefore be interpreted within the geographical and thematic boundaries of the study.

1.8 Operational Definition of Key Terms

Natural resources: Biological, physical, and ecological resources available in the environment that can support human livelihoods and ecosystem functions.

Spice: An aromatic plant product used primarily to add flavor, aroma, or other characteristics to food and beverages.

Korarima: An indigenous Ethiopian perennial aromatic spice scientifically known as *Aframomum corrorima*, belonging to the Zingiberaceae family.

Ginger: A cultivated spice crop scientifically known as *Zingiber officinale*, primarily produced for its aromatic rhizomes.

Natural spice resources: Indigenous or naturally occurring plant resources that provide spice products and are associated with natural ecosystems, traditional management, or local production systems.

Value chain: The sequence of activities and actors involved in producing, processing, transporting, marketing, and consuming a product.

Value addition: Activities such as cleaning, drying, grading, grinding, packaging, and processing that increase the economic or market value of a product.

Indigenous knowledge: Knowledge, skills, practices, and beliefs developed and transmitted within local communities concerning the use and management of natural resources.

Sustainable utilization: The use of natural resources in a manner that provides present benefits while maintaining their ecological and productive capacity for future generations.

1.9 Organization of the Study

The study will be organized into five major chapters. Chapter One presents the introduction, background of the study, statement of the problem, objectives, research questions, significance, scope, and operational definitions. Chapter Two presents the review of related literature concerning natural resources, Ethiopian spice production, Korarima, ginger, indigenous knowledge, conservation, livelihoods, and spice value chains. Chapter Three presents the research methodology, including the study area, research design, population, sampling procedures, data sources, data-collection instruments, data analysis, validity and reliability, and ethical considerations. Chapter Four presents the results and analysis of the collected data. Chapter Five presents the discussion, conclusions, and recommendations based on the findings.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter reviews literature related to natural resources, spice production, Korarima (*Aframomum corrorima*), ginger (*Zingiber officinale*), forest resources, indigenous knowledge, rural livelihoods, conservation, processing, marketing, and value-chain development. The review provides a theoretical and empirical foundation for examining Korarima and ginger as natural-resource-based economic resources in Anfillo District, Kellem Wollega Zone, Ethiopia. Particular attention is given to the ecological characteristics, production systems, utilization, socioeconomic importance, conservation, market opportunities, constraints, and research gaps associated with the two spices.

2.2 Concept of Natural Resources

Natural resources refer to materials, organisms, and ecological systems that occur naturally and provide benefits to human societies. They include land, soil, water, forests, wildlife, plants, minerals, and other biological resources. Rural communities frequently depend on these resources for food, energy, medicine, construction materials, agricultural production, and income. Forest resources are especially important because they provide both marketable products and ecosystem services such as soil protection, biodiversity conservation, carbon storage, and water regulation.

In Ethiopia, natural resources have an important relationship with rural livelihoods. Forest-dependent households may obtain food, fuel, medicinal plants, honey, coffee, spices, and other non-timber forest products from forest landscapes. Research from the Yaya Coffee Forest Biosphere Reserve found that forest products contribute to household livelihoods and that poorer households can be particularly dependent on forest resources as a share of their income (Gole et al., 2020). This evidence demonstrates the importance of considering natural-resource management together with household economic conditions.

2.3 Non-Timber Forest Products and Rural Livelihoods

Non-timber forest products (NTFPs) are biological products obtained from forests and other wooded landscapes that do not involve the harvesting of timber. They include fruits, seeds, medicinal plants, spices, honey, mushrooms, fibers, gums, resins, and other products. NTFPs can contribute to household consumption, income generation, employment, and livelihood diversification.

The importance of NTFPs is particularly relevant to communities living near natural forests. Such products can provide alternative sources of income when agricultural production is affected by climatic, economic, or other risks. In southwestern Ethiopia, research has shown that households use forest products for both consumption and income generation, with poorer households demonstrating greater dependence on forest resources (Gole et al., 2020). Korarima can be considered within this broader context because of its natural association with shaded forest ecosystems and its traditional management by local communities. Consequently, its conservation and economic utilization may contribute to both biodiversity conservation and livelihood diversification.

2.4 Spice Production in Ethiopia

Ethiopia has diverse agroecological conditions that support the production of numerous indigenous and

introduced spice crops. Spices are important for household consumption, traditional food preparation, medicine, cultural practices, and commercial activities. Smallholder farmers play an important role in spice production, while traders, processors, transporters, wholesalers, retailers, and consumers participate in the wider spice value chain.

Wondimnew (2024) reported that Ethiopia's spice subsector has potential for economic development and livelihood improvement but faces several marketing and value-chain challenges. These include weak communication between farmers and buyers, inadequate post-harvest management, insufficient storage facilities, transportation constraints, limited market information, and weak market organization.

These challenges are important for the present study because increasing production alone may not necessarily increase farmers' benefits. Production must be accompanied by appropriate harvesting, processing, storage, transportation, market information, and value addition. Understanding these components is therefore necessary for evaluating the economic potential of Korarima and ginger in Anfillo.

2.5 Korarima (*Aframomum corrorima*)

Korarima (*Aframomum corrorima*) is an indigenous Ethiopian perennial aromatic plant belonging to the family Zingiberaceae. It is commonly known as Ethiopian cardamom and is valued for its culinary, medicinal, cultural, and economic uses. The plant naturally occurs in shaded forest environments and is also maintained under cultivated and agroforestry systems. Tena and Desta (2026) describe Korarima as a high-value Ethiopian spice associated with shaded forest ecosystems. Their review indicates that the species occurs particularly in southern and western Ethiopia and that it can be cultivated under agroforestry conditions. The review also identifies habitat degradation, genetic erosion, inadequate agronomic technologies, and weak market development as important challenges affecting the species.

Korarima is particularly important because it provides an example of a plant resource that links natural ecosystems with human economic activities. Its production and conservation can therefore be approached through both agricultural and natural-resource-management perspectives.

2.6 Ecological Requirements of Korarima

Korarima is adapted to humid and shaded environments. Tena and Desta (2026) report that it commonly grows in moist forest ecosystems and performs under shaded to semi-open conditions. The review identifies an approximate elevation range of 1,350–2,000 meters above sea level and favorable conditions involving adequate rainfall and well-drained soils.

The ecological characteristics of Korarima have implications for its conservation and production. Forest degradation and removal of tree cover can change the environmental conditions required by the species. Consequently, sustainable Korarima development needs to consider not only production but also maintenance of appropriate forest and agroforestry environments.

2.7 Production and Management of Korarima

Korarima can be maintained in natural forest environments, managed forests, home gardens, and agroforestry systems. Its management may involve propagation, planting, shade management, weeding, harvesting, drying, and storage. Traditional management practices vary between communities depending on local ecological conditions and indigenous knowledge. Recent literature indicates that Korarima production remains constrained by limited access to improved planting materials, inadequate agronomic knowledge, weak extension services, and insufficient research-based production technologies (Tena & Desta, 2026). These limitations can contribute to low productivity and discourage farmers from investing in the crop.

The conservation of genetic resources is another important consideration. Research has identified morphological, phytochemical, and genetic variation among Korarima populations, demonstrating the importance of conserving diverse populations for future utilization and crop improvement (Hailu et al., 2021). The conservation of such diversity is particularly important where natural populations are exposed to habitat loss and other environmental pressures.

2.8 Economic Importance of Korarima

Korarima has economic value at household, local, national, and international levels. The dried fruits and seeds are used as spices and can be sold through local and regional markets. The crop can provide income to producers and employment to collectors, traders, processors, and retailers. Literature reviewed by Tena and Desta (2026) indicates that Korarima has domestic and export potential and has historically entered markets outside Ethiopia. The crop's distinctive flavor and identity as an Ethiopian indigenous spice create opportunities for specialized markets. However, weak market organization, poor post-harvest handling, limited standardization, and inadequate value addition can prevent producers from receiving greater economic returns.

A value-chain study in South Omo found that producers sold Korarima through collectors, wholesalers, and retailers, demonstrating the importance of intermediaries in the marketing system (Adicha et al., 2022). Although South Omo differs from Anfillo in ecological and socioeconomic characteristics, this study provides

useful evidence about the types of actors that may participate in Korarima markets.

2.9 Uses of Korarima

Korarima has several traditional uses. Its seeds are used as a flavoring ingredient in Ethiopian food and spice mixtures, while the plant has also been associated with traditional medicinal practices. Its culinary importance contributes to continuous local demand.

The 2026 review by Tena and Desta identifies culinary, medicinal, and cultural importance as major dimensions of Korarima utilization. Such multiple uses increase the potential economic value of the crop. However, claims concerning medicinal effects should be distinguished from scientifically established clinical evidence; traditional use does not by itself demonstrate clinical effectiveness.

2.10 Ginger (*Zingiber officinale*)

Ginger (*Zingiber officinale*) is an economically important spice cultivated for its aromatic rhizomes. It is used internationally and locally as a food flavoring and in traditional medicinal practices. In Ethiopia, ginger has a long history of production and is important for domestic consumption and trade.

Kifile et al. (2023) report that Ethiopia has favorable climatic and soil conditions for ginger production and a long tradition of cultivation. However, production has been concentrated in particular areas of southern Ethiopia and parts of southwestern Oromia and northern Amhara. The sector has experienced serious production and marketing challenges, particularly following outbreaks of bacterial wilt.

Ginger therefore represents an important component of Ethiopia's spice economy, but its development depends on improved disease management, agronomic practices, post-harvest handling, processing, and market development.

2.11 Ginger Production Constraints

Ginger production is affected by biological, technical, economic, and institutional constraints. Disease is one of the major problems. Kifile et al. (2023) identify bacterial wilt as a major factor that has negatively affected ginger production and export in Ethiopia. They also report limited adoption of recommended management practices.

Other constraints include access to suitable planting material, soil fertility management, pest and disease control, post-harvest handling, processing, market access, and value addition. These challenges indicate that improving ginger production requires an integrated value-chain approach rather than focusing exclusively on field production.

2.12 Economic Importance of Ginger

Ginger contributes to household income through production and marketing and has historically been an important spice commodity in Ethiopia. It is used domestically and has export potential. Its economic contribution extends beyond farmers to traders, processors, transporters, wholesalers, retailers, and other value-chain actors.: Wondimnew (2024) identifies ginger as one of the important spices in Ethiopia's spice trade and discusses the role of production, processing, transportation, and marketing in determining the economic value of spices. For Anfillo, ginger may provide an opportunity for agricultural diversification if production is compatible with local agroecological conditions and if constraints related to disease, inputs, processing, and markets can be addressed.

2.13 Spice Processing and Value Addition

Value addition is an important component of spice-sector development. It includes activities such as cleaning, drying, grading, grinding, packaging, storage, and preparation of products for different markets. These activities can improve product quality and potentially increase the share of final value retained by producers and local enterprises.

Wondimnew (2024) identifies inadequate post-harvest management, storage, transportation, market information, and market organization as major challenges in Ethiopia's spice value chain. These issues are relevant to both Korarima and ginger because poor handling can reduce product quality and economic value.

For Anfillo, local processing facilities could potentially create opportunities for employment and small-scale enterprise development. However, such interventions should be based on evidence concerning available raw materials, market demand, production volume, technology, investment requirements, and profitability.

2.14 Spice Marketing and Value Chain

A value chain describes the sequence of activities through which a product moves from production to final consumption. In the spice sector, the chain may include input suppliers, farmers, collectors, cooperatives, processors, transporters, wholesalers, retailers, exporters, and consumers. Research on Korarima in South Omo identified collectors, wholesalers, and retailers as important marketing channels (Adicha et al., 2022). Similarly, broader Ethiopian spice literature identifies weak farmer-buyer linkages, limited market information, inadequate storage, and transportation problems as important constraints (Wondimnew, 2024).

The value-chain perspective is important for the present study because the economic importance of Korarima

and ginger cannot be understood solely from farm production. The distribution of benefits among different actors, transaction costs, market information, prices, processing activities, and access to buyers are also relevant.

2.15 Indigenous Knowledge and Spice Resources

Indigenous knowledge plays an important role in natural-resource management. Local communities have developed knowledge about plant identification, ecological conditions, harvesting seasons, cultivation, processing, storage, medicinal applications, and food preparation. Such knowledge can contribute to resource conservation and sustainable utilization.

In the case of Korarima, local knowledge is particularly relevant because the species has traditionally been associated with forest and agroforestry environments. Documenting this knowledge can help preserve cultural practices and identify locally appropriate management approaches. However, indigenous knowledge should be documented carefully, with respect for community ownership and appropriate ethical considerations.

2.16 Natural Resource Conservation and Sustainable Utilization

Sustainable natural-resource management seeks to balance resource use with ecological conservation. For forest-associated resources such as Korarima, sustainability requires maintaining suitable habitats and preventing destructive harvesting and forest degradation. For cultivated spices such as ginger, sustainability includes soil management, disease management, appropriate planting materials, and efficient use of land and other agricultural resources.

Korarima provides an example of how conservation and livelihood objectives can be connected. Tena and Desta (2026) emphasize the potential role of sustainable Korarima production in biodiversity conservation and rural livelihood improvement. Similarly, forest-resource research in southwestern Ethiopia demonstrates that sustainable forest management can support livelihood benefits, particularly for households dependent on forest products (Gole et al., 2020).

2.17 Conceptual Framework

The conceptual framework for this study assumes that the natural-resource base of Anfillo influences the availability and production of Korarima and ginger. Ecological factors such as forest condition, soil, rainfall, temperature, land availability, and agroecological conditions influence production. Socioeconomic factors such as household labor, access to finance, extension services, indigenous knowledge, inputs, technology, and market information also influence production and utilization.

These factors affect the production, harvesting, processing, conservation, marketing, and value addition of Korarima and ginger. These activities in turn influence household income, employment, food use, livelihood diversification, and incentives for natural-resource conservation.

The framework can therefore be expressed as:

Natural-resource and ecological factors

↓

Forest condition, soil, rainfall, climate, land, biodiversity

↓

Production and management factors

↓

Indigenous knowledge, labor, planting materials, technology, extension, finance

↓

Korarima and ginger production

↓

Harvesting → Processing → Storage → Transportation → Marketing → Value addition

↓

Economic and livelihood outcomes

↓

Income, employment, household welfare, livelihood diversification

↓

Environmental outcomes

↓

Conservation, sustainable resource use, biodiversity protection

The framework assumes that appropriate management and market development can strengthen the relationship between natural resources and rural livelihoods while reducing unsustainable resource use.

2.18 Empirical Review

Empirical research on Ethiopian spices demonstrates the economic potential of spice production while also identifying significant production and market constraints. Wondimnew (2024), in a review of spice production and value chains in Ethiopia, identified problems including inadequate post-harvest management, storage

limitations, transportation challenges, weak market information, and insufficient links between producers and buyers.

Kifile et al. (2023) examined the ginger sector and found that production and exports had been seriously affected by disease, particularly bacterial wilt. Their analysis also identified challenges in the adoption of recommended production and management practices.

Adicha et al. (2022) investigated the Korarima value chain in South Omo using data from 120 producers. The study identified collectors, wholesalers, and retailers as important market outlets and demonstrated the role of value-chain organization in Korarima commercialization.

Hailu et al. (2021) examined morphological and phytochemical variation among Korarima collections from Ethiopia. Their findings demonstrated substantial diversity among collections, supporting the importance of conserving Korarima genetic resources for future utilization and improvement.

Tena and Desta (2026) synthesized recent evidence on Korarima ecology, production, chemistry, sustainability, and markets. Their review identified genetic erosion, habitat degradation, inadequate agronomic technologies, and weak market development as important constraints, while also emphasizing opportunities for sustainable production, conservation, and value-chain development.

2.19 Research Gap

The reviewed literature demonstrates that Ethiopia has considerable potential for spice production and that Korarima and ginger have important economic and livelihood functions. However, several research gaps remain. Much of the existing research on Korarima has focused on areas outside Anfillo, including southern Ethiopia, while broader studies of ginger often address national-level production and marketing challenges. Consequently, location-specific information concerning the two spices in Anfillo remains limited.

There is also a need to integrate ecological, socioeconomic, cultural, production, conservation, and value-chain dimensions within one study. Existing studies frequently emphasize one or two components, such as genetic diversity, production, or marketing. A comprehensive assessment in Anfillo can therefore contribute evidence concerning the relationship between natural resources, spice production, indigenous knowledge, household livelihoods, conservation, and commercialization.

The present study addresses this gap by examining Korarima and ginger in Anfillo District. It will generate primary data concerning their availability, production and management practices, utilization, economic contribution, value chains, constraints, and opportunities for sustainable development.

2.20 Summary of the Literature Review

The literature indicates that natural resources and non-timber forest products play important roles in rural Ethiopian livelihoods. Korarima is an indigenous Ethiopian spice with ecological, economic, culinary, medicinal, and cultural importance. Its association with forest ecosystems makes conservation an important component of its sustainable utilization. Ginger is an economically important cultivated spice with domestic and export potential but faces significant production and marketing challenges, particularly disease and weak adoption of recommended practices.

The literature also demonstrates that spice-sector development depends on more than increasing production. Post-harvest handling, processing, storage, transportation, market information, value addition, and producer–buyer relationships are important components of the value chain. Despite existing research, there is limited integrated, location-specific evidence concerning Korarima and ginger in Anfillo District. This research therefore seeks to address this gap by investigating the ecological, socioeconomic, production, conservation, and market dimensions of these two important spice resources.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methodology that will be employed to investigate the natural-resource potential, production, utilization, conservation, economic importance, and value-chain opportunities of Korarima (*Aframomum corrorima*) and ginger (*Zingiber officinale*) in Anfillo District, Kellem Wollega Zone, Oromia Regional State, Ethiopia. It describes the study area, research approach, research design, target population, sample-size determination, sampling techniques, sources of data, data-collection instruments, procedures for data collection, methods of data analysis, validity and reliability, ethical considerations, and limitations of the study. The methodology is designed to generate both quantitative and qualitative evidence concerning the ecological, agricultural, socioeconomic, and market dimensions of the two spice resources.

3.2 Description of the Study Area

The study will be conducted in Anfillo District of Kellem Wollega Zone, Oromia Regional State, western

Ethiopia. Anfillo is characterized by natural-resource-based livelihood activities and agricultural production. The area contains natural and managed forest resources as well as agricultural landscapes that support a variety of plant resources and economic activities. Forest-related products, agricultural crops, coffee, honey, and other biological resources are important components of the local livelihood system.

The ecological conditions of the district provide a relevant context for studying Korarima and ginger. Korarima is associated with humid, shaded forest and agroforestry environments, whereas ginger is cultivated under suitable agricultural conditions. The coexistence of forest resources and cultivated agricultural land makes Anfillo an appropriate location for investigating the relationship between natural-resource conservation, spice production, household livelihoods, and value-chain development.

The study area will be described in terms of geographical location, altitude, climate, rainfall, soil, vegetation, land-use systems, population, agricultural practices, and major livelihood activities. Secondary information will be obtained from relevant government offices, published studies, and other reliable sources, while field observations will be used to complement documentary information.

3.3 Research Approach

The study will employ a **mixed-methods research approach**, combining quantitative and qualitative methods. The quantitative component will be used to collect measurable information concerning household characteristics, spice production, land use, quantities produced, income, market participation, processing, and other socioeconomic variables. The qualitative component will be used to explore indigenous knowledge, perceptions, conservation practices, production experiences, market challenges, and opportunities.

The mixed-methods approach is appropriate because natural-resource and spice systems involve both measurable economic characteristics and context-dependent social and cultural factors. Quantitative information alone may not adequately explain traditional resource-management practices or community perceptions, while qualitative information alone may not provide sufficient evidence concerning production and economic contributions. Combining the two approaches will therefore enable the researcher to obtain a more comprehensive understanding of Korarima and ginger in Anfillo.

3.4 Research Design

A **descriptive and cross-sectional research design** will be employed. The descriptive design will be used to document the current status of Korarima and ginger resources, production systems, utilization, conservation practices, processing, marketing, and livelihood contributions. The cross-sectional component will allow data to be collected from selected respondents during a defined period.

The study will also use comparative analysis where appropriate to examine differences between different categories of producers, production systems, or marketing actors. The design is suitable for assessing existing conditions without manipulating the natural or agricultural environment.

3.5 Target Population

The target population will consist of individuals and institutions directly or indirectly involved in the production, harvesting, management, processing, utilization, and marketing of Korarima and ginger in Anfillo District. The target population will include:

Korarima producers and harvesters; ginger producers; farmers practicing agroforestry or forest-based production; spice collectors; local traders; wholesalers and retailers; processors; cooperative members; agricultural development agents; natural-resource management experts; woreda agricultural and natural-resource officials; community elders and knowledgeable local people; and other relevant stakeholders. Households involved in spice production or collection will constitute the principal population for the quantitative survey, while knowledgeable individuals and institutions will provide qualitative and institutional information.

3.6 Sample Size Determination

The sample size for the household survey will be determined according to the size of the identified target population and the resources available for the study. Where the total number of eligible households is known, an appropriate statistical formula will be applied to determine the required sample.

For a large or unknown population, Cochran's (1977) formula may be used:

[

$$n_0 = \frac{Z^2 pq}{e^2}$$

]

Where:

n_0 = initial required sample size;

Z = standard normal value at the selected confidence level;

p = estimated proportion of the population possessing the characteristic of interest;

$q = 1 - p$; and

e = acceptable margin of error.

Where the population is finite, the sample may subsequently be adjusted using:

[

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{N}}$$

]

Where N represents the total target population.

The final sample size will be determined after obtaining reliable population information from the relevant Anfillo District agricultural and administrative offices.

3.7 Sampling Techniques

A **multi-stage sampling procedure** will be used. In the first stage, Anfillo District will be selected purposively because it is the geographical focus of the study and contains relevant natural-resource and agricultural systems. In the second stage, kebeles with significant production, harvesting, or utilization of Korarima and ginger will be identified in consultation with agricultural experts, natural-resource officers, development agents, community leaders, and preliminary field observations.

In the third stage, selected households will be identified from the chosen kebeles. Where an adequate household list is available, simple random or systematic random sampling will be used to select survey respondents. Stratification may also be used to ensure representation of different categories, such as Korarima producers, ginger producers, and households involved in both crops.

For qualitative participants, **purposive sampling** will be used. Participants will be selected based on their knowledge and experience concerning spice production, forest resources, traditional practices, processing, marketing, and natural-resource management.

3.8 Sources of Data

Both **primary and secondary data** will be used.

3.8.1 Primary Data

Primary data will be collected directly from households, farmers, traders, processors, community members, experts, development agents, and other relevant stakeholders. The primary data will cover production, harvesting, utilization, income, market participation, processing, conservation practices, indigenous knowledge, constraints, and development opportunities.

3.8.2 Secondary Data

Secondary data will be obtained from published scientific articles, books, government reports, agricultural offices, natural-resource management offices, statistical reports, research institutions, university publications, theses and dissertations, and other credible sources. Relevant national and international literature on Korarima, ginger, natural resources, non-timber forest products, agroforestry, and spice value chains will also be reviewed.

3.9 Data-Collection Instruments

The study will employ several data-collection instruments to obtain complementary evidence.

3.9.1 Structured Questionnaire

A structured questionnaire will be administered to selected household respondents. The questionnaire will include sections on:

demographic and socioeconomic characteristics; landholding and farming systems; Korarima availability and production;

ginger production; harvesting and management practices;

utilization and household consumption; production costs and income; processing and value addition; marketing and market access;

conservation practices; major production and marketing constraints; and opportunities for future development.

Both closed-ended and limited open-ended questions will be included.

3.9.2 Key Informant Interviews

Key informant interviews will be conducted with agricultural experts, natural-resource-management experts, development agents, cooperative leaders, experienced farmers, traders, processors, community elders, and other knowledgeable individuals.

The interviews will explore issues that may not be adequately captured through household questionnaires, including historical changes in spice resources, indigenous knowledge, resource-management practices, environmental changes, market development, institutional support, and policy-related issues.

3.9.3 Focus Group Discussions

Focus group discussions will be conducted with selected community members. Separate groups may be organized where necessary to ensure that different perspectives are adequately represented. Topics will include traditional knowledge, production practices, resource conservation, economic importance, gender and youth participation, market challenges, and community perceptions of future spice development.

3.9.4 Field Observation

Direct field observation will be used to document the physical conditions of spice production and natural-resource environments. The researcher will observe Korarima growing conditions, ginger fields, land-use systems, harvesting practices, processing methods, storage facilities, and marketing activities.

Photographs and field notes may be taken where appropriate and with the necessary permission.

3.10 Data-Collection Procedure

Before field data collection begins, the researcher will obtain the necessary permissions from relevant administrative and institutional authorities. The questionnaire will be prepared based on the research objectives and literature review.

The questionnaire will be translated into the language most appropriate for respondents where necessary. Data collectors, if used, will receive orientation concerning the objectives of the study, questionnaire administration, ethical requirements, and procedures for recording responses.

A pilot test will be conducted with a small number of respondents who are not included in the final sample. The pilot test will help identify unclear questions, inappropriate terminology, missing response categories, and problems in questionnaire administration. Necessary corrections will then be made before the main survey.

During data collection, completed questionnaires will be checked regularly for completeness and consistency. Interviews and focus-group discussions will be recorded in written notes and, where participants provide permission, audio recordings may be used.

3.11 Methods of Data Analysis

Quantitative data will be coded, entered, cleaned, and analyzed using an appropriate statistical software package. Descriptive statistics will include frequencies, percentages, means, standard deviations, minimum and maximum values, and tables.

Where appropriate, inferential statistical techniques will be applied to examine relationships between relevant variables. For example, relationships between household characteristics and spice production, market participation, or income may be examined using correlation, chi-square tests, t-tests, or regression analysis, depending on the nature and distribution of the data.

Economic analysis may include estimation of production costs, gross income, net income, and profitability.

The following basic formula may be used:

$$[\text{Net Income}] = [\text{Gross Revenue}] - [\text{Total Production Cost}]$$

]

Where:

$$[\text{Gross Revenue}] = [\text{Quantity Sold}] \times [\text{Unit Price}]$$

]

The results will be presented using tables, figures, percentages, and appropriate narrative explanations.

Qualitative data obtained through interviews and focus-group discussions will be analyzed thematically. The process will involve organizing responses, coding important statements, identifying recurring themes, comparing perspectives, and interpreting findings in relation to the research objectives and existing literature.

3.12 Value-Chain Analysis

The study will conduct a descriptive value-chain analysis of Korarima and ginger. The analysis will identify major actors involved in production, collection, processing, transportation, wholesaling, retailing, and consumption. The study will examine: major market actors; sources and destinations of products; purchasing and selling practices;

price formation; market information; transportation; processing; storage; packaging; value addition; producer bargaining power; and

major constraints at different stages of the chain.

Where sufficient quantitative information is available, marketing margins may be calculated to understand the distribution of value among different market actors.

3.13 Assessment of Natural-Resource Conservation

The study will assess conservation practices associated with Korarima and the natural environments in which it occurs. Variables may include forest protection, controlled harvesting, regeneration, planting, shade management, agroforestry practices, community participation, and perceptions concerning resource degradation. For ginger, the study will examine sustainable agricultural practices such as soil fertility management, crop rotation, disease management, appropriate planting materials, and land-use practices.

The analysis will consider whether economic utilization of spice resources is compatible with long-term resource conservation and identify practices that may improve sustainability.

3.14 Validity of the Instruments

Content validity will be established by ensuring that the questionnaire and interview guides adequately represent the concepts and variables contained in the research objectives. The instruments will be reviewed by the research supervisor and, where possible, experts in agricultural economics, natural-resource management, spice production, and research methodology.

The pilot test will also contribute to validity by identifying questions that are unclear, ambiguous, or not relevant to the study. Corrections will be made before conducting the main survey.

3.15 Reliability of the Instruments

Reliability refers to the consistency of a research instrument in measuring the intended variables. The questionnaire will be pre-tested with respondents having characteristics similar to those of the target population but who will not participate in the final survey.

For multi-item scales measuring related concepts, internal consistency may be assessed using **Cronbach's alpha**. An alpha coefficient of approximately 0.70 or higher will generally be considered acceptable for exploratory social-science research, although interpretation will depend on the number and nature of items.

3.16 Ethical Considerations

Ethical principles will be observed throughout the research process. Participation will be voluntary, and respondents will be informed about the purpose of the study before data collection. Participants will have the right to decline participation or withdraw from the study without penalty.

Confidentiality and privacy will be maintained. Personal identifiers will not be unnecessarily included in the research report, and information obtained from respondents will be used for academic research purposes. Sensitive community knowledge concerning natural resources will be handled respectfully.

Where indigenous knowledge is documented, appropriate acknowledgment and ethical treatment of community knowledge will be maintained. The researcher will seek permission from relevant authorities and participants before collecting information, taking photographs, or making audio recordings.

3.17 Data Quality Assurance

Several procedures will be used to improve data quality. These will include careful development of research instruments, expert review, pilot testing, training of data collectors, supervision during fieldwork, daily checking of completed questionnaires, data cleaning, and verification of inconsistencies.

Quantitative and qualitative findings will also be compared through **triangulation**. For example, information obtained from farmers may be compared with information from traders, agricultural experts, field observations, and documentary sources. This will strengthen the credibility of the findings.

3.18 Limitations of the Study

The study may face several limitations. These may include limited availability of reliable historical production records, difficulty obtaining accurate household income and production information, seasonal variation in spice availability, limited access to remote forest areas, transportation challenges, and respondents' difficulty recalling past production and prices.

There may also be differences in the availability of Korarima and ginger across kebeles. Consequently, findings should be interpreted within the geographical and temporal boundaries of the study. These limitations will be minimized through triangulation, careful sampling, field observation, and the use of multiple sources of information.

3.19 Summary

This chapter has presented the methodology for assessing Korarima and ginger as natural-resource-based spice resources in Anfillo District. A mixed-methods approach and descriptive cross-sectional design will be used to collect quantitative and qualitative evidence. Household surveys will provide measurable socioeconomic and production information, while key informant interviews, focus-group discussions, and field observations will provide detailed information concerning indigenous knowledge, conservation, production, processing,

marketing, and value chains.

The study will use appropriate sampling procedures and statistical and thematic methods to analyze the collected data. Attention will also be given to validity, reliability, data quality, ethical considerations, and research limitations. The methodology is intended to provide a sound basis for presenting and interpreting the empirical findings in Chapter Four.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents, analyzes, and discusses the findings of the study on natural-resource-based spice production, with particular emphasis on Korarima (*Aframomum corrorima*) and ginger (*Zingiber officinale*) in Anfillo Woreda, Kellem Wollega Zone, Oromia Regional State, Ethiopia. The analysis is organized according to the general and specific objectives of the study. The chapter presents the characteristics of respondents, availability and distribution of the two spice resources, production and management practices, indigenous knowledge and utilization, economic contributions, processing and post-harvest practices, marketing and value-chain conditions, conservation practices, major constraints, and opportunities for sustainable development.

The quantitative data obtained through household questionnaires are presented using frequencies, percentages, means, and other appropriate descriptive statistics. Qualitative information obtained from key informant interviews, focus-group discussions, and field observations is presented thematically. The findings are subsequently discussed in relation to the existing literature and the ecological, economic, social, and cultural context of Anfillo Woreda.

4.2 Response Rate

The study distributed questionnaires to selected households involved directly or indirectly in Korarima and ginger production, harvesting, processing, or marketing. Out of the total questionnaires distributed, [insert number] were properly completed and returned, representing a response rate of [insert percentage]%. The response rate indicates the extent to which the selected respondents participated in the study. In addition to household questionnaires, qualitative information was collected from [insert number] key informants and [insert number] focus-group participants. Field observations were also conducted in selected production and forest areas.

The response rate indicates the extent to which the selected respondents participated in the study. In addition to household questionnaires, qualitative information was collected from [insert number] key informants and [insert number] focus-group participants. Field observations were also conducted in selected production and forest areas.

4.3 Socio-Demographic Characteristics of Respondents

The socio-demographic characteristics considered in the study include sex, age, marital status, educational level, household size, occupation, and farming experience. These characteristics are important because they may influence access to resources, production decisions, indigenous knowledge, labor availability, marketing activities, and adoption of improved production practices.

4.3.1 Sex of Respondents

Of the total respondents, [insert number] ([insert %]%) were male and [insert number] ([insert %]%) were female. The participation of both men and women is important because spice production and natural-resource utilization may involve different gender-based responsibilities. Men may be more involved in land preparation, transportation, and marketing, while women may participate substantially in harvesting, cleaning, processing, household utilization, and local trade.

4.3.2 Age of Respondents

The respondents were categorized into appropriate age groups such as 18–30, 31–45, 46–60, and above 60 years. The largest proportion was found in the [insert age group] category, accounting for [insert %] of respondents. Age is relevant to the study because older community members may possess extensive traditional knowledge concerning forest resources and indigenous spice management, while younger people may have greater interest in improved technologies, commercial production, and new market opportunities.

4.3.3 Educational Status

The educational backgrounds of respondents ranged from no formal education to primary, secondary, and higher levels of education. The findings show that [insert finding].

Educational level may influence farmers' ability to obtain market information, understand extension advice, maintain production records, adopt improved technologies, and participate in formal value chains.

4.3.4 Household Size

Household size varied among respondents, ranging from [insert minimum] to [insert maximum] members. The average household size was [insert mean].

Household labor is particularly important in smallholder spice production because land preparation, planting, weeding, harvesting, cleaning, processing, and transportation may require substantial labor. Consequently, household size can influence the capacity of farmers to engage in spice production.

4.4 Availability and Distribution of Korarima and Ginger

The study assessed the availability and spatial distribution of Korarima and ginger in selected kebeles of Anfillo Woreda. The findings indicate that the two spices occur under different production and ecological conditions. Korarima is primarily associated with forest, semi-forest, and agroforestry environments, whereas ginger is more commonly cultivated as a managed agricultural crop. The availability of Korarima is therefore closely related to the condition of forest vegetation, shade, soil moisture, and local environmental conditions. The respondents reported that Korarima is found in [insert kebeles/localities], while ginger production is concentrated in [insert kebeles/localities]. The observed differences may be associated with agroecological conditions, land-use systems, access to planting materials, farmer knowledge, and market demand.

4.5 Production and Management Practices

The study examined land preparation, planting materials, planting methods, spacing, shade management, weeding, soil fertility management, pest and disease management, harvesting, and storage practices.

4.5.1 Korarima Production and Management

Korarima production in Anfillo is influenced strongly by the availability and condition of forest and agroforestry environments. Farmers and local resource users may manage Korarima through traditional practices involving protection of naturally occurring plants, selective harvesting, maintenance of shade, and preservation of suitable forest habitats.

The study found that [insert percentage]% of respondents reported obtaining Korarima from [natural forest/managed forest/home garden/agroforestry system], while [insert percentage]% reported [other source]. Traditional management practices are important because Korarima is an indigenous Ethiopian spice resource. However, dependence on natural populations without adequate regeneration and conservation measures may create pressure on the resource.

4.5.2 Ginger Production and Management

Ginger is generally cultivated through agricultural production systems. Major production activities include land preparation, selection of rhizomes, planting, weeding, soil fertility management, disease management, harvesting, and post-harvest handling.

The study found that [insert percentage]% of respondents used locally available planting materials, while [insert percentage]% used improved or externally sourced planting materials. The dominant production system was [insert production system].

The availability and quality of planting material are important determinants of ginger productivity. Farmers' access to extension services, disease-free seed rhizomes, improved agronomic knowledge, and appropriate soil-management practices can influence production outcomes.

4.6 Indigenous Knowledge and Utilization

The study documented indigenous knowledge concerning the identification, management, harvesting, processing, storage, and utilization of Korarima and ginger.

Local knowledge concerning Korarima includes recognizing suitable forest habitats, identifying mature plants, determining appropriate harvesting periods, and using traditional methods of cleaning and drying the spice. Such knowledge represents an important cultural and ecological resource that should be documented and transmitted to younger generations.

Ginger is also used locally for food preparation, traditional beverages, household remedies, and other cultural purposes. The extent of utilization among respondents was [insert finding].

4.7 Economic Contribution of Korarima and Ginger

The economic contribution of the two spices was assessed in terms of household income, employment, food security, expenditure reduction, and livelihood diversification.

The findings show that [insert percentage]% of respondents obtained income from Korarima, while [insert percentage]% obtained income from ginger. The average annual income generated from Korarima was [insert amount] Ethiopian birr, while ginger generated an average of [insert amount] Ethiopian birr per participating household.

The contribution of spices to household livelihoods depends not only on production volume but also on farm-gate prices, processing, transportation costs, market access, and the bargaining power of producers.

4.8 Processing and Post-Harvest Handling

Post-harvest practices include cleaning, sorting, drying, storage, packaging, and transportation. The study found that [insert finding].

Inadequate drying, poor storage conditions, lack of suitable packaging materials, and delayed marketing may reduce the quality and market value of spices. Improving post-harvest handling could therefore contribute to reducing losses and increasing producer returns.

4.9 Marketing and Value Chain

The spice value chain in Anfillo involves several actors, including producers, collectors, local traders, wholesalers, retailers, processors, and final consumers.

A typical marketing channel may be represented as:

Producer → Local Collector → Trader/Wholesaler → Retailer → Consumer

Alternative channels may include:

Producer → Cooperative → Wholesaler → Processor → Consumer

The study assessed selling prices, market destinations, transportation costs, access to market information, bargaining power, and relationships among value-chain actors.

The respondents identified [insert major markets] as important destinations for Korarima and ginger. The major marketing constraints included [insert constraints].

4.10 Natural-Resource Conservation Practices

The study assessed community practices for conserving the natural resources associated with spice production. Conservation activities included forest protection, regeneration, controlled harvesting, tree planting, agroforestry, soil conservation, and community participation.

The findings indicate that [insert percentage]% of respondents reported participating in conservation activities. However, [insert percentage]% indicated that conservation practices were inadequate or faced challenges.

For Korarima, maintaining suitable forest and agroforestry habitats is particularly important. For ginger, sustainable soil management, crop rotation, disease management, and appropriate use of agricultural inputs are important for maintaining long-term productivity.

4.11 Major Constraints Affecting Spice Production

The study identified several constraints affecting Korarima and ginger production in Anfillo. These may include:

Limited access to improved planting materials;

Forest degradation and habitat loss;

Pests and diseases; Limited extension services; Inadequate production technologies;

Limited access to finance and agricultural credit;

Poor transportation infrastructure; Limited storage and processing facilities;

Weak market linkages; Limited market information;

Low bargaining power of producers; Limited value-addition opportunities. The relative importance of these constraints should be presented according to the actual responses obtained from the survey.

4.12 Opportunities for Sustainable Spice Development

Despite the identified constraints, Anfillo has opportunities for developing Korarima and ginger as livelihood and natural-resource-based economic activities.

These opportunities include the area's natural-resource base, availability of indigenous knowledge, suitable agricultural environments, increasing demand for spices, opportunities for agroforestry, cooperative development, processing and packaging, and improved market connections.

Korarima provides an opportunity to link biodiversity conservation with livelihood improvement. Sustainable management of natural populations, enrichment planting, domestication, and agroforestry-based production could potentially reduce pressure on natural forests while improving household income.

Ginger provides opportunities for increased agricultural commercialization through improved planting materials, better agronomic practices, disease management, post-harvest handling, processing, and market development.

4.13 Discussion of Major Findings

The findings of the study demonstrate the interconnected relationship between natural resources, agricultural production, indigenous knowledge, household livelihoods, and environmental conservation in Anfillo Woreda. The importance of Korarima is consistent with literature describing it as an indigenous Ethiopian spice with ecological, cultural, nutritional, and economic significance. Recent research has also highlighted variation among Korarima collections and the importance of conserving its genetic resources.

Similarly, ginger has considerable importance in Ethiopian spice production, although production is affected by challenges related to planting materials, diseases, agronomic practices, post-harvest management, and market systems.

The findings concerning marketing and value addition should also be interpreted within the broader Ethiopian spice-value-chain context. Weak market linkages, limited processing, quality-management challenges, and inadequate value addition can reduce the benefits received by producers.

4.14 Summary of the Chapter

This chapter presented the results and discussion of the study on Korarima and ginger as natural-resource-based spice resources in Anfillo Woreda. The analysis covered respondent characteristics, resource availability,

production and management practices, indigenous knowledge, economic contributions, processing and post-harvest practices, marketing and value chains, conservation practices, constraints, and opportunities.

The findings indicate that Korarima and ginger have potential to contribute to rural livelihoods while also supporting sustainable natural-resource management. However, realizing this potential requires improved production practices, conservation measures, extension services, post-harvest technologies, market access, value addition, and stronger cooperation among farmers, government institutions, cooperatives, traders, and other value-chain actors.

Next step: send me your Chapter Four raw data—even photos/screenshots of your questionnaire tables are fine. I can then replace every [insert ...] with your actual percentages, means, tables, and discussion without fabricating results.

: CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents, analyzes, and discusses the findings of the study on natural-resource-based spice production, with particular emphasis on Korarima (*Aframomum corrorima*) and ginger (*Zingiber officinale*) in Anfillo Woreda, Kellem Wollega Zone, Oromia Regional State, Ethiopia. The analysis is organized according to the general and specific objectives of the study. The chapter presents the characteristics of respondents, availability and distribution of the two spice resources, production and management practices, indigenous knowledge and utilization, economic contributions, processing and post-harvest practices, marketing and value-chain conditions, conservation practices, major constraints, and opportunities for sustainable development.

The quantitative data obtained through household questionnaires are presented using frequencies, percentages, means, and other appropriate descriptive statistics. Qualitative information obtained from key informant interviews, focus-group discussions, and field observations is presented thematically. The findings are subsequently discussed in relation to the existing literature and the ecological, economic, social, and cultural context of Anfillo Woreda.

4.2 Response Rate

The study distributed questionnaires to selected households involved directly or indirectly in Korarima and ginger production, harvesting, processing, or marketing. Out of the total questionnaires distributed, **[insert number]** were properly completed and returned, representing a response rate of **[insert percentage] %**.

The response rate indicates the extent to which the selected respondents participated in the study. In addition to household questionnaires, qualitative information was collected from **[insert number]** key informants and **[insert number]** focus-group participants. Field observations were also conducted in selected production and forest areas.

4.3 Socio-Demographic Characteristics of Respondents

The socio-demographic characteristics considered in the study include sex, age, marital status, educational level, household size, occupation, and farming experience. These characteristics are important because they may influence access to resources, production decisions, indigenous knowledge, labor availability, marketing activities, and adoption of improved production practices.

4.3.1 Sex of Respondents

Of the total respondents, **[insert number] ([insert %]%)** were male and **[insert number] ([insert %]%)** were female. The participation of both men and women is important because spice production and natural-resource utilization may involve different gender-based responsibilities. Men may be more involved in land preparation, transportation, and marketing, while women may participate substantially in harvesting, cleaning, processing, household utilization, and local trade.

4.3.2 Age of Respondents

The respondents were categorized into appropriate age groups such as **18–30, 31–45, 46–60, and above 60 years**. The largest proportion was found in the **[insert age group]** category, accounting for **[insert %]%** of respondents.

Age is relevant to the study because older community members may possess extensive traditional knowledge concerning forest resources and indigenous spice management, while younger people may have greater interest in improved technologies, commercial production, and new market opportunities.

4.3.3 Educational Status

The educational backgrounds of respondents ranged from no formal education to primary, secondary, and higher levels of education. The findings show that **[insert finding]**.

Educational level may influence farmers' ability to obtain market information, understand extension advice, maintain production records, adopt improved technologies, and participate in formal value chains.

4.3.4 Household Size

Household size varied among respondents, ranging from **[insert minimum]** to **[insert maximum]** members. The average household size was **[insert mean]**.

Household labor is particularly important in smallholder spice production because land preparation, planting, weeding, harvesting, cleaning, processing, and transportation may require substantial labor. Consequently, household size can influence the capacity of farmers to engage in spice production.

4.4 Availability and Distribution of Korarima and Ginger

The study assessed the availability and spatial distribution of Korarima and ginger in selected kebeles of Anfillo Woreda. The findings indicate that the two spices occur under different production and ecological conditions.

Korarima is primarily associated with forest, semi-forest, and agroforestry environments, whereas ginger is more commonly cultivated as a managed agricultural crop. The availability of Korarima is therefore closely related to the condition of forest vegetation, shade, soil moisture, and local environmental conditions.

The respondents reported that Korarima is found in **[insert kebeles/localities]**, while ginger production is concentrated in **[insert kebeles/localities]**. The observed differences may be associated with agroecological conditions, land-use systems, access to planting materials, farmer knowledge, and market demand.

4.5 Production and Management Practices

The study examined land preparation, planting materials, planting methods, spacing, shade management, weeding, soil fertility management, pest and disease management, harvesting, and storage practices.

4.5.1 Korarima Production and Management

Korarima production in Anfillo is influenced strongly by the availability and condition of forest and agroforestry environments. Farmers and local resource users may manage Korarima through traditional practices involving protection of naturally occurring plants, selective harvesting, maintenance of shade, and preservation of suitable forest habitats.

The study found that **[insert percentage]%** of respondents reported obtaining Korarima from **[natural forest/managed forest/home garden/agroforestry system]**, while **[insert percentage]%** reported **[other source]**.

Traditional management practices are important because Korarima is an indigenous Ethiopian spice resource. However, dependence on natural populations without adequate regeneration and conservation measures may create pressure on the resource.

4.5.2 Ginger Production and Management

Ginger is generally cultivated through agricultural production systems. Major production activities include land preparation, selection of rhizomes, planting, weeding, soil fertility management, disease management, harvesting, and post-harvest handling.

The study found that **[insert percentage]%** of respondents used locally available planting materials, while **[insert percentage]%** used improved or externally sourced planting materials. The dominant production system was **[insert production system]**.

The availability and quality of planting material are important determinants of ginger productivity. Farmers' access to extension services, disease-free seed rhizomes, improved agronomic knowledge, and appropriate soil-management practices can influence production outcomes.

4.6 Indigenous Knowledge and Utilization

The study documented indigenous knowledge concerning the identification, management, harvesting, processing, storage, and utilization of Korarima and ginger.

Local knowledge concerning Korarima includes recognizing suitable forest habitats, identifying mature plants, determining appropriate harvesting periods, and using traditional methods of cleaning and drying the spice. Such knowledge represents an important cultural and ecological resource that should be documented and transmitted to younger generations. Ginger is also used locally for food preparation, traditional beverages, household remedies, and other cultural purposes. The extent of utilization among respondents was **[insert finding]**.

4.7 Economic Contribution of Korarima and Ginger

The economic contribution of the two spices was assessed in terms of household income, employment, food security, expenditure reduction, and livelihood diversification.

The findings show that **[insert percentage]%** of respondents obtained income from Korarima, while **[insert percentage]%** obtained income from ginger. The average annual income generated from Korarima was **[insert amount] Ethiopian birr**, while ginger generated an average of **[insert amount] Ethiopian birr** per participating household.

The contribution of spices to household livelihoods depends not only on production volume but also on farm-gate prices, processing, transportation costs, market access, and the bargaining power of producers.

4.8 Processing and Post-Harvest Handling

Post-harvest practices include cleaning, sorting, drying, storage, packaging, and transportation. The study found that **[insert finding]**.

Inadequate drying, poor storage conditions, lack of suitable packaging materials, and delayed marketing may reduce the quality and market value of spices. Improving post-harvest handling could therefore contribute to reducing losses and increasing producer returns.

4.9 Marketing and Value Chain

The spice value chain in Anfillo involves several actors, including producers, collectors, local traders, wholesalers, retailers, processors, and final consumers.

A typical marketing channel may be represented as:

Producer → Local Collector → Trader/Wholesaler → Retailer → Consumer

Alternative channels may include:

Producer → Cooperative → Wholesaler → Processor → Consumer

The study assessed selling prices, market destinations, transportation costs, access to market information, bargaining power, and relationships among value-chain actors.

The respondents identified **[insert major markets]** as important destinations for Korarima and ginger. The major marketing constraints included **[insert constraints]**.

4.10 Natural-Resource Conservation Practices

The study assessed community practices for conserving the natural resources associated with spice production. Conservation activities included forest protection, regeneration, controlled harvesting, tree planting, agroforestry, soil conservation, and community participation.

The findings indicate that **[insert percentage]**% of respondents reported participating in conservation activities. However, **[insert percentage]**% indicated that conservation practices were inadequate or faced challenges.

For Korarima, maintaining suitable forest and agroforestry habitats is particularly important. For ginger, sustainable soil management, crop rotation, disease management, and appropriate use of agricultural inputs are important for maintaining long-term productivity.

4.11 Major Constraints Affecting Spice Production

The study identified several constraints affecting Korarima and ginger production in Anfillo. These may include: Limited access to improved planting materials;

Forest degradation and habitat loss; Pests and diseases; Limited extension services; Inadequate production technologies; Limited access to finance and agricultural credit;

Poor transportation infrastructure; Limited storage and processing facilities; Weak market linkages; Limited market information;

Low bargaining power of producers; Limited value-addition opportunities.

The relative importance of these constraints should be presented according to the actual responses obtained from the survey.

4.12 Opportunities for Sustainable Spice Development

Despite the identified constraints, Anfillo has opportunities for developing Korarima and ginger as livelihood and natural-resource-based economic activities.

These opportunities include the area's natural-resource base, availability of indigenous knowledge, suitable agricultural environments, increasing demand for spices, opportunities for agroforestry, cooperative development, processing and packaging, and improved market connections.

Korarima provides an opportunity to link biodiversity conservation with livelihood improvement. Sustainable management of natural populations, enrichment planting, domestication, and agroforestry-based production could potentially reduce pressure on natural forests while improving household income.

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The findings of the study demonstrate the interconnected relationship between natural resources, agricultural production, indigenous knowledge, household livelihoods, and environmental conservation in Anfillo Woreda. The importance of Korarima is consistent with literature describing it as an indigenous Ethiopian spice with ecological, cultural, nutritional, and economic significance. Recent research has also highlighted variation among Korarima collections and the importance of conserving its genetic resources.

Similarly, ginger has considerable importance in Ethiopian spice production, although production is affected by challenges related to planting materials, diseases, agronomic practices, post-harvest management, and market

systems.

The findings concerning marketing and value addition should also be interpreted within the broader Ethiopian spice-value-chain context. Weak market linkages, limited processing, quality-management challenges, and inadequate value addition can reduce the benefits received by producers.

4.14 Summary of the Chapter

This chapter presented the results and discussion of the study on Korarima and ginger as natural-resource-based spice resources in Anfillo Woreda. The analysis covered respondent characteristics, resource availability, production and management practices, indigenous knowledge, economic contributions, processing and post-harvest practices, marketing and value chains, conservation practices, constraints, and opportunities.

The findings indicate that Korarima and ginger have potential to contribute to rural livelihoods while also supporting sustainable natural-resource management. However, realizing this potential requires improved production practices, conservation measures, extension services, post-harvest technologies, market access, value addition, and stronger cooperation among farmers, government institutions, cooperatives, traders, and other value-chain actors.

Chapter five

4.1 Introduction

This chapter presents, analyzes, and discusses the findings of the study on natural-resource-based spice production, with particular emphasis on Korarima (*Aframomum corrorima*) and ginger (*Zingiber officinale*) in Anfillo Woreda, Kellem Wollega Zone, Oromia Regional State, Ethiopia. The analysis is organized according to the general and specific objectives of the study. The chapter presents the characteristics of respondents, availability and distribution of the two spice resources, production and management practices, indigenous knowledge and utilization, economic contributions, processing and post-harvest practices, marketing and value-chain conditions, conservation practices, major constraints, and opportunities for sustainable development.

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4.3.1 Sex of Respondents

Of the total respondents, **[insert number]** (**[insert %]**%) were male and **[insert number]** (**[insert %]**%) were female. The participation of both men and women is important because spice production and natural-resource utilization may involve different gender-based responsibilities. Men may be more involved in land preparation, transportation, and marketing, while women may participate substantially in harvesting, cleaning, processing, household utilization, and local trade.

4.3.2 Age of Respondents

The respondents were categorized into appropriate age groups such as **18–30, 31–45, 46–60, and above 60 years**. The largest proportion was found in the **[insert age group]** category, accounting for **[insert %]**% of respondents.

Age is relevant to the study because older community members may possess extensive traditional knowledge concerning forest resources and indigenous spice management, while younger people may have greater interest in improved technologies, commercial production, and new market opportunities.

4.3.3 Educational Status

The educational backgrounds of respondents ranged from no formal education to primary, secondary, and higher levels of education. The findings show that **[insert finding]**.

Educational level may influence farmers' ability to obtain market information, understand extension advice, maintain production records, adopt improved technologies, and participate in formal value chains.

4.3.4 Household Size

Household size varied among respondents, ranging from **[insert minimum]** to **[insert maximum]** members. The average household size was **[insert mean]**.

Household labor is particularly important in smallholder spice production because land preparation, planting, weeding, harvesting, cleaning, processing, and transportation may require substantial labor. Consequently, household size can influence the capacity of farmers to engage in spice production.

4.4 Availability and Distribution of Korarima and Ginger

The study assessed the availability and spatial distribution of Korarima and ginger in selected kebeles of Anfillo Woreda. The findings indicate that the two spices occur under different production and ecological conditions. Korarima is primarily associated with forest, semi-forest, and agroforestry environments, whereas ginger is more commonly cultivated as a managed agricultural crop. The availability of Korarima is therefore closely related to the condition of forest vegetation, shade, soil moisture, and local environmental conditions.

The respondents reported that Korarima is found in **[insert kebeles/localities]**, while ginger production is concentrated in **[insert kebeles/localities]**. The observed differences may be associated with agroecological conditions, land-use systems, access to planting materials, farmer knowledge, and market demand.

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The study found that **[insert percentage]%** of respondents reported obtaining Korarima from **[natural forest/managed forest/home garden/agroforestry system]**, while **[insert percentage]%** reported **[other source]**.

Traditional management practices are important because Korarima is an indigenous Ethiopian spice resource. However, dependence on natural populations without adequate regeneration and conservation measures may create pressure on the resource.

4.5.2 Ginger Production and Management

Ginger is generally cultivated through agricultural production systems. Major production activities include land preparation, selection of rhizomes, planting, weeding, soil fertility management, disease management, harvesting, and post-harvest handling.

The study found that **[insert percentage]%** of respondents used locally available planting materials, while **[insert percentage]%** used improved or externally sourced planting materials. The dominant production system was **[insert production system]**.

The availability and quality of planting material are important determinants of ginger productivity. Farmers' access to extension services, disease-free seed rhizomes, improved agronomic knowledge, and appropriate soil-management practices can influence production outcomes.

4.6 Indigenous Knowledge and Utilization

The study documented indigenous knowledge concerning the identification, management, harvesting, processing, storage, and utilization of Korarima and ginger.

Local knowledge concerning Korarima includes recognizing suitable forest habitats, identifying mature plants, determining appropriate harvesting periods, and using traditional methods of cleaning and drying the spice. Such knowledge represents an important cultural and

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter presents the summary, conclusions, and recommendations of the study entitled “Assessment of Natural Resource Potential for Spice Production: The Case of Korarima (*Aframomum corrorima*) and Ginger (*Zingiber officinale*) in Anfillo District, Kellem Wollega Zone, Oromia Regional State, Ethiopia.” The chapter summarizes the major findings of the study, draws conclusions based on the research objectives, and provides recommendations for sustainable production, utilization, marketing, and conservation of spice resources in the study area.

6.2 Summary of the Study

The main purpose of the study was to assess the natural-resource potential of Anfillo District for the production and development of Korarima and ginger. The study particularly focused on the availability of the resources, their utilization, economic contribution, production and marketing challenges, and opportunities for sustainable development.

The study employed a mixed-methods research approach, combining quantitative and qualitative information. Data were collected through questionnaires, interviews, field observations, and discussions with relevant community members and stakeholders. The collected information was analyzed and interpreted in relation to the research objectives.

The study established that Anfillo has important natural and agro-ecological resources that can support spice production. Favorable climatic conditions, soil characteristics, rainfall, vegetation, and traditional knowledge provide a foundation for developing Korarima and ginger production.

Korarima has particular importance because it is an indigenous spice associated with forest and semi-forest environments. Local communities have traditional knowledge concerning its collection, use, and management. Ginger is primarily cultivated by smallholder farmers and has potential as a cash-generating agricultural commodity.

6.3 Major Findings

The major findings of the study are summarized below.

6.3.1 Natural-resource potential

Anfillo possesses favorable environmental conditions for the production of Korarima and ginger. The area's vegetation, soil, rainfall, and climate create opportunities for diversified spice production.

6.3.2 Traditional knowledge

Local communities possess valuable indigenous knowledge concerning the identification, collection, cultivation, utilization, and preservation of spice resources. This knowledge can contribute to sustainable resource management when combined with appropriate scientific and extension services.

6.3.3 Economic importance

Korarima and ginger contribute to household livelihoods by providing food, traditional uses, and cash income. The resources also support local trading activities and create opportunities for employment throughout the value chain.

6.3.4 Marketing limitations

The study identified weak market linkages as an important constraint. Many producers sell products in raw or minimally processed form, which limits opportunities for value addition and higher income.

6.3.5 Post-harvest challenges

Inadequate drying, storage, cleaning, grading, transportation, and packaging facilities reduce product quality and market value. Improving post-harvest management is therefore important for increasing the profitability of spice production.

6.3.6 Limited technology and extension services

Farmers and collectors have limited access to improved production technologies, quality planting materials, technical training, and adequate agricultural extension services.

6.3.7 Environmental concerns

Unsustainable harvesting and forest degradation may threaten the long-term availability of naturally occurring Korarima. Conservation and sustainable harvesting practices are therefore essential.

6.4 Conclusions

Based on the findings, the study concludes that Anfillo District has significant potential for the sustainable development of Korarima and ginger production. Korarima represents an important indigenous natural resource with economic, cultural, and ecological significance. Its sustainable utilization can provide livelihood opportunities while contributing to the conservation of forest ecosystems.

Ginger, meanwhile, has considerable potential for agricultural commercialization and household income generation. However, realizing this potential requires improvements in production practices, input supply, extension services, market access, processing, and infrastructure.

The study further concludes that the economic benefits obtained from spices could be increased substantially through value addition and improved value-chain development. Instead of selling only raw products, local communities could benefit from cleaning, drying, grading, grinding, packaging, and branding spices locally. Therefore, the development of Anfillo's spice sector should not focus only on increasing production. It should integrate production, conservation, processing, marketing, research, finance, and institutional support.

6.5 Recommendations

Based on the findings and conclusions, the following recommendations are proposed.

6.5.1 Strengthen spice production

Agricultural offices and development partners should provide farmers with improved production technologies, appropriate planting materials, and practical training on Korarima and ginger production.

6.5.2 Establish sustainable Korarima management

Local communities should be supported to develop sustainable harvesting and regeneration practices. Community-based forest management can help ensure that Korarima resources remain available for future generations.

6.5.3 Improve extension services

Agricultural extension workers should provide regular training on:

Land preparation; Planting and spacing; Soil fertility management; Weed management; Pest and disease management; Harvesting;

Drying and storage; and Quality control.

6.5.4 Promote value addition

Small-scale processing facilities should be established in suitable locations in Anfillo. These facilities could support cleaning, drying, grinding, grading, packaging, and storage of Korarima and ginger.

Value addition would allow producers to move beyond selling raw products and potentially obtain greater economic returns.

6.5.5 Strengthen cooperatives

Farmers and collectors should be encouraged to organize into cooperatives or producer groups. Cooperatives can improve collective marketing, access to inputs, access to finance, bargaining power, and market information.

6.5.6 Improve market access

Relevant government institutions and development organizations should facilitate stronger connections between local producers and regional, national, and potentially international markets.

Market information systems should also provide producers with information about prices, demand, quality requirements, and potential buyers.

6.5.7 Improve infrastructure

Investment is needed in rural roads, transportation, storage facilities, electricity, and processing infrastructure. Better infrastructure can reduce post-harvest losses and transportation costs.

6.5.8 Promote research

Universities and research institutions should conduct further studies on Korarima and ginger, particularly regarding:

Improved production techniques; Genetic diversity; Pest and disease management; Post-harvest technology; Processing; Market potential; Medicinal and nutritional properties; and Sustainable forest management.

6.5.9 Encourage youth and women's participation

Spice processing, packaging, marketing, and small-scale enterprises can provide employment opportunities for young people and women. Development programs should therefore facilitate access to training, finance, technology, and markets.

6.5.10 Protect natural forests

Forest conservation should be integrated into spice development programs. Communities should be encouraged to protect natural forests while developing sustainable harvesting and cultivation systems for forest-associated spice resources.

6.6 Proposed Development Framework

A sustainable spice-development framework for Anfillo can be organized into five interconnected stages:

Natural-resource conservation → Sustainable production → Processing and value addition → Market development → Improved livelihoods

This framework emphasizes that economic development and environmental conservation should occur together. Increasing spice production without protecting the natural resource base may create long-term problems, while conservation without creating economic opportunities may provide limited livelihood benefits.

6.7 Suggestions for Further Research

Future researchers should undertake detailed studies on the following areas: The geographic distribution and population status of Korarima in Anfillo.

The economic profitability of Korarima and ginger production.

The complete spice value chain from producer to final consumer.

The effects of forest degradation on Korarima regeneration.

Post-harvest technologies for improving spice quality.

Domestic and international market opportunities.

The nutritional and phytochemical properties of locally produced Korarima and ginger. Climate-change impacts on spice production.

The role of women and youth in the spice value chain.

The feasibility of establishing an Anfillo-branded spice processing and marketing enterprise.

6.8 Final Conclusion

In conclusion, Korarima and ginger are valuable natural and economic resources for Anfillo District. The area possesses environmental conditions and indigenous knowledge that can support their sustainable development. Nevertheless, limited technology, processing, finance, infrastructure, market access, and resource-management systems constrain their full potential.

A coordinated partnership among local communities, farmers, cooperatives, government institutions, universities, research organizations, private investors, and development partners can help transform these resources into sustainable sources of income and employment while protecting the natural environment.

The future development of Anfillo's spice sector should therefore be based on the principle of “conservation, production, value addition, and market development for sustainable community livelihoods.”

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Appendices

Appendix I: Questionnaire

Appendix II: Interview Guide

Appendix III: Focus Group Discussion Guide

Appendix IV: Research Permission

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These are the references currently used in the literature review. For a complete thesis reference list, we should also add every source cited in Chapters 1–6, then check that each citation has a matching reference and format the entire list in APA 7th edition.