



## TÍTULO

**ASSESSING GARCINIA AFZELII HARVEST AND TRADE  
CASE STUDY OF SOUTHEAST LIBERIA**

## AUTOR

**Ben B. Tally**

Tutores  
Instituciones  
Curso  
©  
©  
Fecha  
documento

**Esta edición electrónica ha sido realizada en 2023**

Dr. Johnson J. Geplý ; Dr. Seyni Abdoul-Aziz

Universidad Internacional de Andalucía

*Máster CITES (2021-2022)*

Ben B. Tally

De esta edición: Universidad Internacional de Andalucía

2023



**Atribución-NoComercial-SinDerivadas  
4.0 Internacional (CC BY-NC-ND 4.0)**

Para más información:

<https://creativecommons.org/licenses/by-nc-nd/4.0/deed.es>  
<https://creativecommons.org/licenses/by-nc-nd/4.0/deed.en>



**UNIVERSIDAD INTERNACIONAL DE ANDALUCÍA**  
**MANAGEMENT AND CONSERVATION OF SPECIES IN TRADE:**  
**THE INTERNATIONAL FRAMEWORK (14TH EDITION)**

**ACADEMIC YEAR 2021 – 2022**

**MASTER`S THESIS**

**ASSESSING *GARCINIA AFZELII* HARVEST AND TRADE: CASE STUDY  
OF SOUTHEAST LIBERIA**

**AUTHOR: BEN B. TALLY**

**SUPERVISOR: PROF. DR. JOHNSON J. GEPLY**

**CO-SUPERVISOR: DR. SEYNI ABDOUL-AZIZ**

**To obtain the UNIA Master Title in Management and Conservation of Species  
in Trade: The International Framework (14<sup>th</sup> edition)**

**Sede Antonio Machado, Baeza (Jaén), Spain**

**DATE: APRIL 1, 2023**

## **DEDICATION**

This thesis project is dedicated to the Almighty God without whose divine intervention I would not have been selected as Liberia's candidate for this prestigious master's degree program at the International University of Andalusia, Spain. I remain forever grateful to God the Almighty and Omnipresent.

## **ACKNOWLEDGMENT**

Let me take this opportunity to first acknowledge my beloved parents, Mr. Joseph J. Tally and Beatrice B. Tally, and all of my siblings for their encouragement and fullest support that gave me the self-confidence and determination to complete this master's course.

I owe a great debt of gratitude to the United States Agency for International Development (USAID)- funded West Africa Biodiversity and Low Emissions (WABiLED) program and the International Union for Conservation of Nature and Natural Resources (IUCN) for sponsoring this master's course on Management and Conservation of Species in Trade: The International Framework (14th edition). USAID-funded WABiLED program was very instrumental in providing me with a full scholarship which includes the costs of tuition, housing, and transportation.

Special recognition to Mr. Blamah S. Goll, Focal Point, Management Authority (MA), Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES) for approving my academic and career credentials for nomination. Mr. Goll was very supportive in making sure that all of my required documents were submitted on time and constantly checking on my progress.

I wish to wholeheartedly express my appreciation to the management of the Forestry Development Authority (FDA), especially the Managing Director, Hon. C Mike Doryen, who never hesitated to approve my nomination for the master's degree program.

I wish to thank my Supervisor, Dr. Johnson J. Geply, Assistant Professor of Forest Policy Law & Administration, University of Liberia, and Co-Supervisor, Dr. Seyi Addoul-Aziz, Nature Resource Management and Climate Change, Head of IUCN office, Niger Republic for their supervisory roles in making sure that my study becomes a success.

I am grateful to the faculty of Universidad Internacional de Andalucía (UNIA), headed by Professor Dr. Margarita África Clemente Muñoz, affectionately called 'Mama Africa and the Iron lady'. It was a great honor and privilege to enroll in the master's degree program where many highly qualified lecturers from different academic disciplines have the passion to teach students from different cultural backgrounds. This master's degree program is thus far the biggest pathway that I have taken in my professional career and academic life. It has given me a broader and more in-

depth knowledge of how CITES functions when it comes to understanding its major pillars- legality, sustainability, and traceability.

A big thank you to Michael Philippe Bessike Balinga, Lead on Combating Illegal Wildlife, WABiLED, and Stephen Kelleher, Chief of Party, WABiLED for their numerous supports in making this educational journey a success.

Special thanks to Mr. Burton M. Kawah, Chief Park Warden, Sapo National Park for his support, Milton Tarnewon, Clifford Spears, Robertson Saydee, Morris Qualay, and all of the many field assistants I had across the study sites.

## ABSTRACT

*Garcinia afzelii* is a polygamous evergreen tree species that belongs to the family Clusiaceae. Its geographic range extends across Central and West tropical Africa, mainly, in Nigeria, Cameroon, Central Africa Republic, Congo, Gabon, Ghana, Côte d'Ivoire, Liberia, Sierra Leone, and Guinea. There are special biotic chemicals contained in *Garcinia afzelii* for which it is highly desirable for trade. The tree species has been assessed by the IUCN Red List of Threatened Species in 2013 and is categorized as Vulnerable due to its decline in the wild as a result of extraction and overexploitation.

The study was carried out in Southeast Liberia with the general objective to analyze and map the areas of *Garcinia afzelii* harvest and trade. Four counties in Southeast Liberia, namely Grand Gedeh, Grand Kru, River Gee, and Sinoe were purposively selected for data collection based on important harvest sites, accessibility to towns, and the number of actors in the value chain of *Garcinia afzelii*. Participatory Rural Appraisal (PRA) tools were used to gather data from transporters, traditional leaders, Forestry Development Authority (FDA) staff, Police, immigration officers, and Liberia Revenue Authority (LRA) agents. Key questions were asked in the study that addressed the socio-economic and demographic characteristics of the major actors in the value chain, trade regulations, and the role played by local communities in the harvest of *Garcinia afzelii*. A total of 225 individuals (203 harvesters and 22 traders) were sampled in 17 communities across Southeast Liberia. For the majority of the harvesters, 115 (56.7%) age range was found between 18 to 35 years and followed by 81 (39.9%) who have an age range between 36 to 50 years. 7 (3.5%) of the harvesters have attained 50 years and above. 142 (70%) of the total harvesters interviewed are self-employed. The general overview of the harvesters' level of education from the results revealed 51.7% have attained elementary education, 30.5% with junior high education, 16.3% with senior high-level education, and 1.5% obtained no education. 14.8% of the harvesters generate their income from the sale of *Garcinia afzelii*. Key to addressing gender aspects in the value chain of *Garcinia afzelii*, women's involvement was addressed. Women's involvement comes at the town leadership level where they play a vital role in regulating the harvest and having opinions on the determination of the *Garcinia afzelii* round pole price. A total of 17 focus group discussions were held where women constituted 6% of the total 127 respondents. Income generated from *Garcinia afzelii* sale by both the harvesters and traders is used for health, feeding, small trade, and

education. Despite the FDA has promulgated the National Forestry Reform Law of 2006 which provides guidelines for the use, management, and protection of forest resources, there is increasing demand for *Garcinia afzelii* coupled with a lack of proper monitoring and enforcement of the harvest and trade regulations. Recommendations include more awareness raising for local communities on harvest and trade guidelines for Non-Timber Forest Products (NTFPs) and the FDA and the Community Forest Management Board need to coordinate to promote effective enforcement measures to regulate the harvest and trade of *Garcinia afzelii*.



## LIST OF ACRONYMS

|        |   |
|--------|---|
| CBD    | Conservation of Biological Diversity  |
| CDA    | County Development Agenda   |
| CFMB   | Community-Forest Management Bodies  |
| CIFOR  | Centre for International Forestry Research                                      |
| CITES  | Convention on International Trade in Endangered Species of Wild Fauna and Flora |
| DBH    | Diameter at Breast Height   |
| DCLs   | Diameter Cut Limits   |
| FAO    | Food and Agricultural Organization of the United Nations                        |
| FDA    | Forestry Development Authority  |
| FEF    | Forest Entry Fee  |
| FUP    | Forest Use Permit   |
| GKNP   | Grebo-Krahn National Park   |
| GPS    | Geographic positioning System   |
| ITTO   | International Tropical Timber Organization                                      |
| ITZC   | Inter-Tropical Convergence Zone   |
| IUCN   | International Union for the Conservation of Nature                              |
| LISGIS | Liberia Institute of Statistics and Geo-Information Services                    |
| LRA    | Liberia Revenue Authority   |
| NFRL   | National Forestry Reform Law  |
| NGO    | Non-Governmental Organizations  |
| NTFPS  | Non-Timber Forest Products  |
| PRA    | Participatory Rural Appraisal   |
| SNP    | Sapo National Park  |

UGFE Upper Guinean Rainforest Ecosystem  
UNIA Universidad Internacional de Andalucía  
USAID United States Agency for International Development  
WABiLED West Africa Biodiversity and Low Emissions Development Program

# TABLE OF CONTENTS

|   |          |
|---|----------|
| Dedication.....   | ii       |
| Acknowledgment.....   | iii      |
| Abstract.....   | v        |
| List of acronyms.....   | vii      |
| List of Figures.....  | xii      |
| List of maps.....   | xii      |
| List of plates.....   | xii      |
| List of tables.....   | xiii     |
| <b>Chapter I: Introduction.....</b>                               | <b>1</b> |
| 1.1 Background of the study.....                                  | 1        |
| 1. 2. Problem statement.....                                      | 2        |
| 1.3. General objective.....                                       | 2        |
| 1.3.1. Specific objectives.....                                   | 3        |
| 1.4. Research questions.....                                      | 3        |
| 1.5. Scope of the study.....                                      | 3        |
| 1.6. Justification of the study.....                              | 3        |
| 1.7 Limitations of the study.....                                 | 4        |
| <b>Chapter II: Literature review.....</b>                         | <b>5</b> |
| 2.1 Liberia’s forest cover ecology.....                           | 5        |
| 2.2 History of the trade and use of <i>Garcinia afzelii</i> ..... | 6        |
| 2.3 Species Characteristics.....                                  | 6        |
| 2.3.1 Geographical distribution and habitat .....                 | 6        |
| 2.3.2 Biological Characteristics.....                             | 7        |

|   |           |
|---|-----------|
| 2.3.3 Morphological characteristics.....        | 8         |
| 2.3.4 Role of the species in the ecosystem..... | 8         |
| 2.4 Conservation status and trends.....         | 8         |
| 2.5 Threats.....                                | 8         |
| <b>Chapter III: Research Methodology.....</b>   | <b>10</b> |
| 3.1 Study Area.....                             | 10        |
| 3.1.1 Description of the study area.....        | 10        |
| 3.2 Climate.....                                | 16        |
| 3.3 Rainfall and temperature.....               | 16        |
| 3.4 Relief and Drainage.....                    | 16        |
| 3.5 Geology and Soils.....                      | 17        |
| 3.6 Vegetation.....                             | 17        |
| 3.7 Population.....                             | 17        |
| 3.8 Sampling methods.....                       | 18        |
| 3.8.1 Sites selection.....                      | 18        |
| 3.8.2 Selection of respondents.....             | 20        |
| 3.8.3 Questionnaire design.....                 | 21        |
| 3.9 Data sources.....                           | 21        |
| 3.9.1 Preparation.....                          | 21        |
| 3.9.2 Secondary data collection.....            | 22        |
| 3.9.3 Rapid assessment.....                     | 22        |
| 3.9.4 Fieldwork.....                            | 22        |
| 3.9.5 Observation.....                          | 22        |
| 3.9.6 Interview.....                            | 22        |

|   |           |
|---|-----------|
| 3.9.7 Data Analysis.....  | 23        |
| <b>Chapter IV: Results and Discussion.....</b>                                | <b>24</b> |
| 4.1 <i>Garcinia afzelii</i> actors.....                                       | 24        |
| 4.1.1 Harvester characteristics .....   | 24        |
| 4.1.2 Harvester’s level of education.....                                     | 25        |
| 4.1.3 Household involvement in <i>Garcinia afzelii</i> harvest and trade..... | 27        |
| 4.1.4 Harvester income-generating activities.....                             | 26        |
| 4.1.5 Main uses of harvester income from <i>Garcinia afzelii</i> .....        | 27        |
| 4.1.6 <i>Garcinia afzelii</i> mode of transport.....                          | 29        |
| 4.1.7 Trader Characteristics.....   | 30        |
| 4.1.8 Trader income-generating activities.....                                | 34        |
| 4.1.9 Main uses of trader income from <i>Garcinia afzelii</i> .....           | 35        |
| 4.1.10 Gender aspects in <i>Garcinia</i> harvest and trade.....               | 35        |
| 4.2 Environmental sustainability.....   | 37        |
| 4.2.1 Harvest sites.....  | 37        |
| 4.2.2 Mode of <i>Garcinia afzelii</i> harvest.....                            | 38        |
| 4.3 Population management and trade control.....                              | 38        |
| 4.3.1 Access .....  | 38        |
| 4.3.2 Regulatory framework.....   | 39        |
| 4.3.3 Impact of harvesting and trade on the forest ecosystem.....             | 39        |
| 4.3.4 <i>Garcinia afzelii</i> trade routes and export channels.....           | 40        |
| <b>Chapter V: Conclusion and Recommendations.....</b>                         | <b>41</b> |
| 5.1 Conclusion.....   | 41        |
| 5.2 Recommendations.....  | 41        |

|                        |           |
|------------------------|-----------|
| <b>References.....</b> | <b>43</b> |
| <b>Appendix A.....</b> | <b>49</b> |
| <b>Appendix B.....</b> | <b>52</b> |
| <b>Appendix C.....</b> | <b>55</b> |

### **List of Figures**

|  |    |
|--|----|
| Figure 1. Sampled towns and the number of respondents.....                 | 21 |
| Figure 2. Position in the society of harvesters .....                      | 26 |
| Figure 3. Harvester level of education .....                               | 27 |
| Figure 4. Harvester income generating activities .....                     | 28 |
| Figure 5. Main uses of harvester income from <i>Garcinia afzelii</i> ..... | 29 |
| Figure 6. Trader marital status .....                                      | 32 |
| Figure 7. Trader occupation .....  | 33 |
| Figure 8. Trader age groups.....   | 33 |
| Figure 9. Trader level of education.....                                   | 34 |
| Figure 10. Trader income-generating activities.....                        | 34 |
| Figure 11. Main uses of trader income from <i>Garcinia afzelii</i> .....   | 35 |

### **List of Maps**

|  |    |
|--|----|
| Map 1. Map showing the Forest cover of Liberia ..... | 6. |
| Map 2. Sampled sites in Southeast Liberia .....      | 11 |
| Map 3. Sampled sites in Grand Kru County .....       | 12 |
| Map 4. Sampled sites in Grand Gedeh County .....     | 13 |
| Map 5. Sampled sites in River Gee County .....       | 14 |
| Map 6. Sampled sites in Sinoe County .....           | 15 |

### **List of Plates**

|   |    |
|---|----|
| Plate 1. <i>Garcinia afzelii</i> stockpile .....    | 30 |
| Plate 2. Focus group discussion .....               | 36 |
| Plate 3. <i>Garcinia afzelii</i> harvest site ..... | 37 |
| Plate 4. <i>Garcinia afzelii</i> leaves.....        | 38 |

### **List of Table**

|   |    |
|---|----|
| Table 1. Population statistics of the study area.....                 | 18 |
| Table 2. Sampled towns and the number of respondents.....             | 20 |
| Table 3. Demographic characteristics of harvesters in percentage..... | 27 |
| Table 4. Demographic characteristics of traders in percentage.....    | 31 |

# CHAPTER I: BACKGROUND AND INTRODUCTION

## 1.1 BACKGROUND

Since prehistoric times, human beings have deeply relied on forest products for survival and their well-being (Huckell and Toll, 2004; Maston and Coupland, 1995; Moerman, 1998; Scarry, 2003; Turner and Cocksedge, 2001). The forest acts as a vital source of food and revenue for the rural poor when times of unexpected scarcity occur or as a gap filler in times of regular seasonal shortfalls (Angelgen and Wunder, 2003; Shackleton and Shackleton, 2004; Paumgarten, 2005). It continues to contribute immensely today to the alleviation of poverty and food security of forest dwellers (Bahuchet, 2000). It is also estimated that about 60 million rural people all over the world depend on the forest ecosystem for their livelihood (World Bank, 2001). Globally, FAO (2004) states that 1.6 billion people depend on forest resources for living. The forest of Liberia has had a direct and indirect impact on the livelihoods of the people of whom an estimated 70% population lives in the rural areas (Lomax, 2008; Deshmukh *et al.*, 2009; Juliani *et al.*, 2013). Apart from timbers, the forests contain other recognized valuable biological resources classified as Non-Timber Forest Products (NTFPs) that contribute to the local economy. (Taplah, 2002; Kpadehyea *et al.*, 2015). In Liberian forestry, *Garcinia* species are categorized as Non-Timber Forest Products (NTFPs) (FDA, 2006). The term “Non-Timber Forest Product” includes “all biological materials other than timber which are extracted from forests for human use. These include foods, medicines, spices, essential oils, resins, gums, latexes, tannins, dyes, ornamental plants, wildlife (products and live animals), fuelwood, and raw materials, notably rattan, bamboo, small wood, and fibers” (De Beer and McDermott, 1996). Studies have shown that NTFPs can be of equal or even greater importance than timber and that these resources contribute to the overall economy of forest zones in many ways, such as through employment, values generated through the processing and marketing of the forest products, energy, and trade (FAO, 2007; De Beer and McDermott, 1996). NTFPs including *Garcinia afzelii* tree species have been defined as goods of biological origin other than wood, as well as services derived from forests and allied land uses (FAO, 1995). For this research thesis, NTFPs are defined as trees of biological origin other than industrial timber, which are or can be harvested for human use at the level of livelihood support or trade purposes. The stems, roots, and branches of over seventy (70) species of woody plants in West Africa are used to process chewing sticks (Isawumi, 1978; Abbiw, 1990). *Garcinia afzelii* and other notable species of the genera *Garcinia* such as *Garcinia kola*, and *Garcinia epunctata* are highly



commercialized in Liberia and the Mano River sub-region of West Africa (Adu-Tutu et al. 1979; Falconer, 1992; Tabi-Gyansah 2001). Few studies have been conducted to investigate the ethnobotanical, socio-economic importance, and usage of NTFPs by the rural communities in Liberia (Juliani *et al.*, 2003; Kpadehyea *et al.*, 2015). However, this study brings in more dynamic information on the recent development of the harvest and trade of *Garcinia afzelii* and relevant information on the harvest and trade regime of *Garcinia afzelii* in Southeast Liberia.

## **1.2 PROBLEM STATEMENT**

The rate of extraction of *Garcinia afzelii* in Southeast Liberia is alarming and has the propensity for irreversible consequences on the forest sector. The ignorance of the importance and appreciation of *Garcinia afzelii* and other relevant NTFPs by rural communities is leading to over-exploitation and this could trigger illegal trade. Although Liberia has regulations on the extraction of NTFPs, it is faced with challenges for constant monitoring of the harvest and trade of *Garcinia afzelii*. The influx of foreign nationalities and local community members in Southeast Liberia has placed huge pressure on the natural ecosystems.

Liberia is a signatory to many international organizations such as the International Tropical Timber Organization (ITTO), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and Conservation on Biological Diversity (CBD). Being a party to these international bodies, Liberia is obligated to promote the management and conservation of natural forest resources as well as periodically share statistical data on all forest products harvested and traded in and out of the country. Wildlife, and regulate trade in and out of its borders. The need for a holistic conservation approach to building a sustainable harvest regime of *Garcinia afzelii* is key to regulating and monitoring the harvest of the species. The illegal trade-offs are essential information for identifying the harvest sites, investigating the value chains, addressing the environmental impact of the harvest, and improving framework regulations to safeguard the species from a reduction in the wild.

## **1.3 GENERAL OBJECTIVE**

Given the above analogy, the overarching objective of the study is to analyze and map the areas of *Garcinia afzelii* harvest and trade in Southeast Liberia, suggest recommendations for a better improvement of the value chain, and the listing of the species in CITES Appendix II.

### **1.3.1 SPECIFIC OBJECTIVES**

Specifically, this study was meant to achieve the followings:

- I. To identify the main harvest and trade sites of *Garcinia afzelii* in Southeast Liberia.
- II. To investigate the actors in the value chain of *Garcinia afzelii*
- III. To evaluate the impact of *Garcinia afzelii* harvest on the ecosystem.

### **1.4 RESEARCH QUESTIONS**

This study seeks to answer the following questions:

- I. What are the characteristics of the harvesters and traders of *Garcinia afzelii* in Liberia?
- II. What roles do local communities play in the harvest and trade of *Garcinia afzelii* in southeast Liberia?
- III. What are the key harvesting site and trade channels of *Garcinia afzelii* in Southeast Liberia?

### **1.5 SCOPE OF THE STUDY**

The study area is limited to four counties in Southeast Liberia: Grand Gedeh, Grand Kru, River Gee, and Sinoe. In Grand Gedeh, River Gee, and Sinoe Counties, the study was conducted around towns and villages within the peripheral limits of the Tai-Grebo-Krahn and Sapo Forest Complex.

### **1.6 JUSTIFICATION OF THE STUDY**

A scientific survey on *Garcinia afzelii* is important to document the level of unsustainable harvest that is sporadically and exponentially increasing in Southeast Liberia. There is a need to establish baseline information which includes the impact of harvest, method of collection, harvesting sites, gender aspects, main uses of income, income-generating activities, harvester characteristics, trader characteristics, and households involvement in the value chain of *Garcinia afzelii* which can be used to mitigate the illegal trade, regulate the trade, and enhance the adaptive management of the population distribution of *Garcinia afzelii* and other *Garcinia* species being exploited in Southeast Liberia.

## **1.7 LIMITATIONS OF THE STUDY**

A few constraining issues were encountered while conducting the study. The first limitation of the study was my inability to sample more towns due to the deplorable road conditions in the southeast of Liberia. Reaching out to remote villages is either by walking long distances or riding motorbikes which are very expensive in transportation charges. Secondly, difficulties in gathering information from the interviewees due to fear of disclosing sensitive information on price and profits data. Many of the actors in the harvesters of *Garcinia afzelii* declined to be interviewed. Thirdly, it was impossible using cell phones and laptops in the field due to poor internet connection and electricity in many towns and villages in the southeast. Fourthly, secondary information on *Garcinia afzelii* harvest and trade in Southeast Liberia was limited. Lastly, financial constraints and unforeseen circumstances created some bottlenecks during the field data collection.

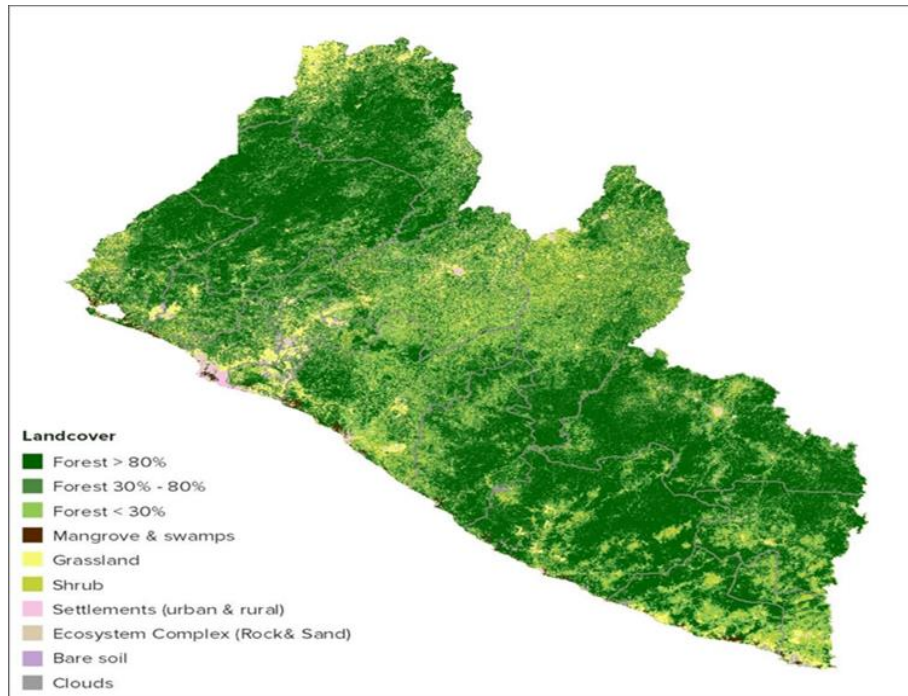
## CHAPTER II: LITERATURE REVIEW

### 2.1 Liberia`s forest cover ecology

Liberia`s forest is situated at the core of the Upper Guinean Rainforest Ecosystem (UGFE) thus making it one of the biologically richest and most endangered terrestrial ecoregions on the planet (Myers *et al.*, 2000; Mittermeier *et al.*, 2004). The forest of Liberia contains an exceptionally diverse ecologically rich biome and is home to many rare and endemic fauna and flora species (McCullough, 2004). The Upper Guinean Rainforest runs from southern Guinea into eastern Sierra Leone, through Liberia, Côte d'Ivoire, Ghana, and across the southwestern part of Togo. (Massalatchi, 2011). Recognized as a global biodiversity hotspot, the Upper Guinean Rainforest supports an unprecedented high-level richness of timber, Non-Timber Forest Products (NTFP) including *Garcinia afzelii*, and is a priority landscape for conservation (Junker *et al.*, 2015).

In the past, Liberia was completely covered with forest, having 9.6 million hectares (Bayol and Chevalier, 2004). Liberia`s land surface is 68% covered by forest making Liberia the most forested country in West Africa (Ampaire, 2020). However, it now has about 36% intact closed forest; 2.4 million hectares (Bayol and Chevalier, 2004). The forest of Liberia contains approximately 43% of the remaining intact blocks of the UGFE (CILSS, 2016), and boasts of having over 29,000 varieties of vascular plants (Taplah, 2002; Deshmukh *et al.*, 2009; Geoville & Metria, 2011). The forest sector contributes 10% to the Liberian national revenue generation and serves as an important of employment (Ampaire, 2020).

The forest is under severe threat and needs proper management. The rate of depletion of the forest has increased from 0.5% in 2005 to 32% in 2015. This depletion rate has put deforestation at an estimated rate of 0.46% per annum (Ampaire, 2020). Between 2009 and 2013, the government of Liberia illegally gave out more than 3 million hectares of the estimated 4 million hectares of the country`s forest to logging concessions (Chatham House Report, 2015).



**Map 1. Map showing the forest cover in Liberia. (Source: Geoville, Metria, and FDA, 2006)**

## **2.2 History of the harvest and trade and use of *Garcinia* species**

For centuries NTFPs including *Garcinia afzelii* have played a food and commercial role in Africa (Bahuchet, 2000). The early use of harvest and trade of *Garcinia* tree species especially *Garcinia afzelii* as chewing sticks dates back more than 7,000 years ago. The first group of ancient people to use chewing sticks (*Garcinia spp.*) were the Babylonians, followed by the Greeks and Romans. The Jews and the Egyptians followed later (Asadi and Asadi, 1997; Wu *et al.*, 2001; Al- Otaibi, 2004). There were different names for chewing sticks in ancient times. The Arabs called it ‘miswak’, the Romans used mastic, the Hebrews called it ‘qesam’, and the Japanese used koyoji (Gerrit 1993). The use of *Garcinia afzelii* and other *Garcinia* tree species as chewing sticks is also rooted in African history and has been a force to drive the economy during the conquest of North Africa by the Arabs (Townson, 1992).

## **2.3 Species Characteristics**

### **2.3.1 Geographical distribution and habitat**

Over 800 species of the genus *Garcinia* are geographically spread out in the pan-tropics, mainly Africa, Asia, and Polynesia (Awachare and Upreti, 2020). It is believed that the family Clusiaceae that *Garcinia afzelii* belongs to originated in Southeast Asia (Richard, 2003). *Garcinia* species’

central area of diversity is the Malaysian region, with some species extending to tropical Africa and Neotropics (Shameer *et al.*, 2016). *Garcinia afzelii* extends its range in West and Central tropical Africa, mainly, in Nigeria, Cameroon, Central Africa Republic, Congo, Gabon, Ghana, Côte d'Ivoire, Liberia, Sierra Leone, and Guinea (Sosef, 1996; Linder, 2001). These understory tree species are found in humid evergreen forests, dry and tropical rainforests, riverine forests, forest relicts, dense half-deciduous forests, swamps, and gallery forests at elevations from 450 – 1280 meters (Burkil, 2004).

### **2.3.2 Biological Characteristics**

Species of the genus *Garcinia* belong to the family Clusiaceae (the old concept of Guttiferae). The genus includes approximately 250 polygamous evergreen trees and shrubs. Taxonomically, *Garcinia* is considered complicated due to its complexity in floral characteristics (Mohanan *et al.* 1997; Sabu *et al.* 2013). The genus *Garcinia* was named by the Swedish naturalist, Carolus Linnaeus, in honor of the French naturalist and Dutch Army surgeon Laurent Garcin (1683-1752) for his contributions to plant science in the 18<sup>th</sup> century (Mohanan *et al.* 1997; Shameer *et al.*, 2016).

Most *Garcinia* species are dioecious in nature and well notable for their high level of sympatric species diversity (Lee *et al.*, 2002; Thomas *et al.*, 2003). *Garcinias* is also reported in other high diversity of sexual systems which include gynodioecious, androdieocious, monoecious, and andromonoecious species (Joseph and Murthy, 2015). In dioecism, plants bear either male or female flowers, whereas, in monoecism, plants bear both male and female flowers. In gynodioecious, plants bear either female or bisexual flowers whereas, in Androdieocism, plants bear either male or bisexual and male flowers. In andromonoecism, plants bear bisexual and male flowers both whereas, in gynomonoecism plants bear bisexual and female flowers (Bowa and Beach, 1981).

*Garcinia afzelii* is an evergreen tree that is characterized by a rounded, bushy crown that can grow up to 15 meters in height (occasionally to 18 meters). The tree species have brownish-yellow fruits which are 2.5 centimeters in diameter and contain 2 to 4 seeds embedded in an acidulous pulp (Burkil, 2004).

### **2.3.3 Morphological characteristics**

There is a texture and special biotic chemicals that make *Garcinia afzelii* highly desirable for trade. The sapwood is whitish, turning yellow in the air; the heartwood is pinkish to deep yellow or olive-brown at the center. The wood is liable to fungal attack and resistant to teredo worms (Burkil, 2004).

### **2.3.4 Role of the species in the ecosystem**

The stems and sometimes roots of *Garcinia afzelii* are widely harvested from the wild for various uses. The bioactive molecules in Garcinias contain phytochemicals that have pharmaceutical and therapeutic values and are widely used in the food and cosmetics industries (Hosakatte *et al.*, 2018; Hemshekhar *et al.*, 2011; Cunningham, 1993; Kpadehyea *et al.*, 2015; De Beer and McDermott, 1996; Facciola, 1998). Bundles of pencil-sized extracts from *Garcinia afzelii* are sold in local markets and regional markets in West Africa as a source of chewing sticks. (Hawthorne, 1995; Cunningham, 1993).

### **2.4 Conservation status and trends**

*Garcinia afzelii* is known to be in a decline as a result of the extraction of the species for its long-traditional use in promoting human health. The tree species have become vulnerable to illegal extraction and overexploitation in West Africa due to its high market value demand. The IUCN Red List of Threatened Species has assessed the genus *Garcinia* and classified *Garcinia afzelii* as Vulnerable since 2013 (IUCN, 2013). Its vulnerability is due to general habitat loss and the felling of the trees to provide chewing sticks for dental hygiene (Burkil, 2004). The Sub-Saharan Forest Genetic Resources Program listed *Garcinia afzelii* and *Garcinia Kola* as priority species for immediate conservation action (Ouedraogo and Boffa, 1999).

### **2.5 Threat**

About 10 million hectares of the original Upper Guinean tropical rainforest have been lost at an increasing rate through timber and NTFPs exploitation, conversion into agricultural lands, and infrastructural development activities (Christie *et al.* 2007; Norris *et al.* 2010; Mahli *et al.*, 2014). The decline of the resource base for *Garcinia afzelii* and other *Garcinia* species in Ghana has significantly resulted in considerable over-exploitation and excessive harvesting of *Garcinia afzelii* in Liberia and the Côte d'Ivoire (Holbech, 2000). Farming through the practices of shifting

cultivation which favors the introduction of invasive alien species has posed a serious threat to the natural regeneration of *Garcinia afzelii*. Expansion of logging concessions and mining have led to habitat destruction leading to *Garcinia afzelii* population being vulnerable to destruction in the wild. Infiltration of economic migrants from Ghana into villages in Southeast Liberia to harvest *Garcinia afzelii* to feed the unsustainable demand of Garcinia species as chewing sticks in Ghana and Côte d'Ivoire has posed a serious threat to the species population in the wild (Osei – Tutu *et al.*, 2012).

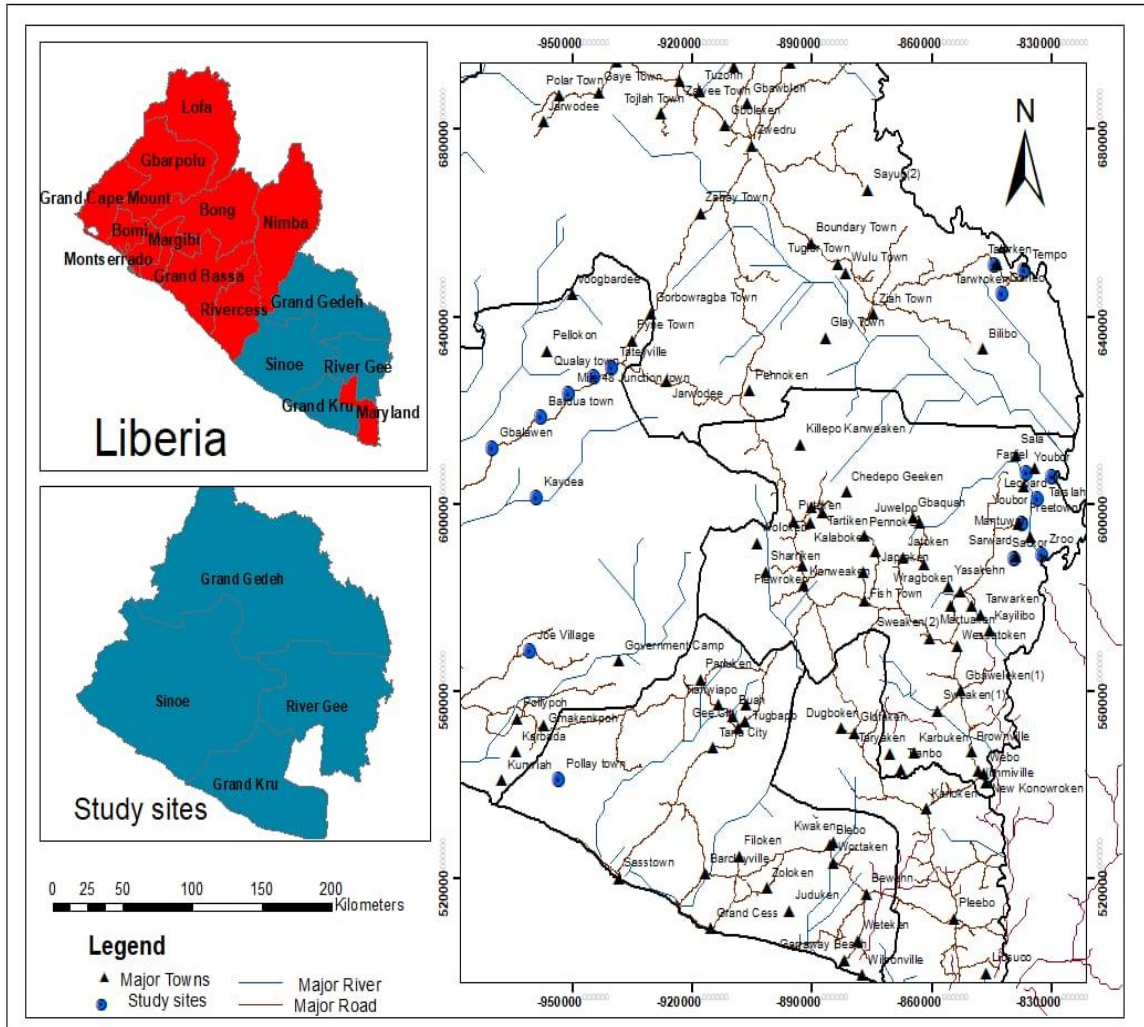


## CHAPTER III: RESEARCH METHODOLOGY

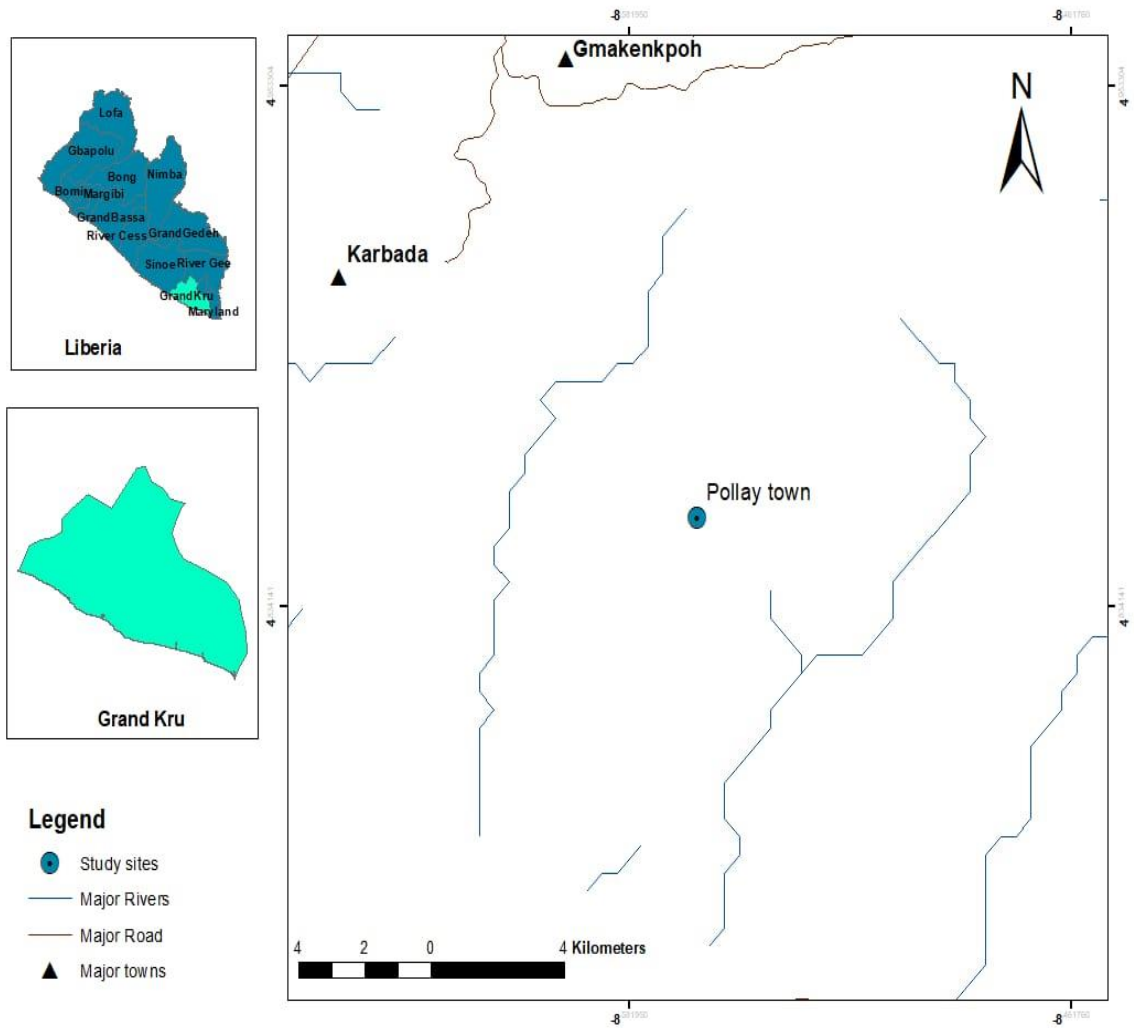
### 3.1 Study Area

#### 3.1.1 Description of the study area

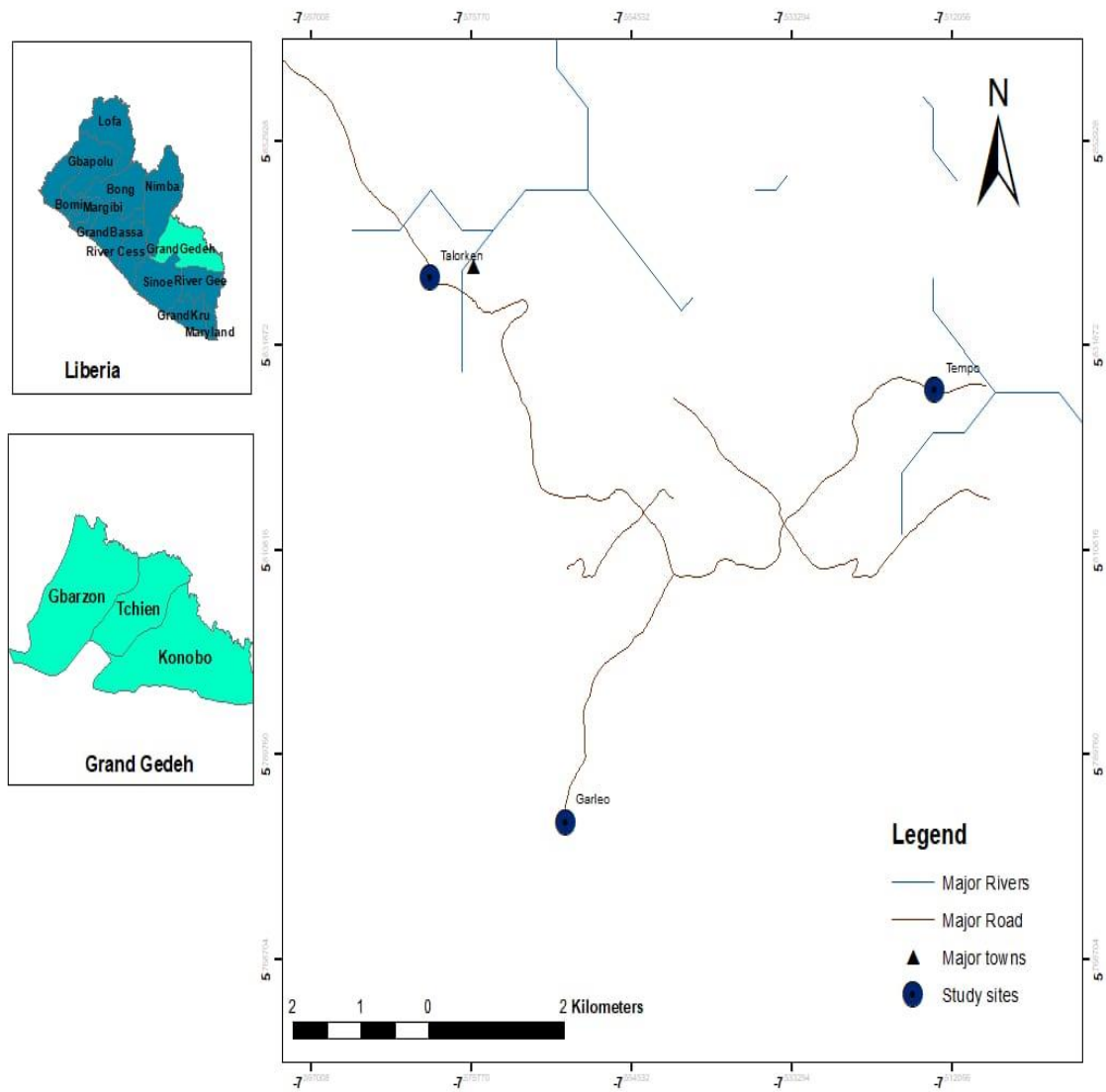
The research was carried out between the months of October 2022 to February 2023 in Southeast Liberia. Four counties Grand Gedeh ( $5.9222^{\circ}\text{N}$ ,  $8.2213^{\circ}\text{W}$ ), Grand Kru ( $4.7614^{\circ}\text{N}$ ,  $8.2213^{\circ}\text{W}$ ), River Gee ( $5.2605^{\circ}\text{N}$ ,  $7.8722^{\circ}\text{W}$ ), and Sinoe ( $5.4987^{\circ}\text{N}$ ,  $8.6601^{\circ}\text{W}$ ) were selected for sampling based on situation analysis and the rapid assessment carried out before the field data collection. Maryland County was not sampled because of the lack of *Garcinia afzelii* harvest and trade in that county. The total land surface of Southeast Liberia is 33,552 km<sup>2</sup>. Grand Gedeh county is the largest and most populous county in Southeast Liberia. Grand Gedeh has a total land surface area of 10,2766 km<sup>2</sup> and a population size of 125,258 inhabitants (LIGIS, 2009; CDA, 2012). One of the two forest blocks of Liberia, the Southeast Forest block (evergreen rainforest), is found in Southeast Liberia. Most of the intact primary forest is found in the Sapo National Park, Liberia's foremost protected area. The main economic activities of the southeasterners are agricultural farming (shifting cultivation), fishing, mining, hunting, timber extraction, and logging Mineral deposits (gold) are found in Sinoe County, Grand Gedeh, Grand Kru, and River Gee County. NTFP harvest and trade play an important role in the livelihood of the local people in generating household income. The main ethnic groups include the Krahn, Sapo, Grebo, and Kru. Other ethnic-speaking groups include the Gio and Mano tribes from Nimba county, Mandingo from Northern Liberia, and the Kpelleh tribes from Central Liberia (Bong County). Southeast Liberia is poorly developed and remote with deplorable roads and infrastructures.



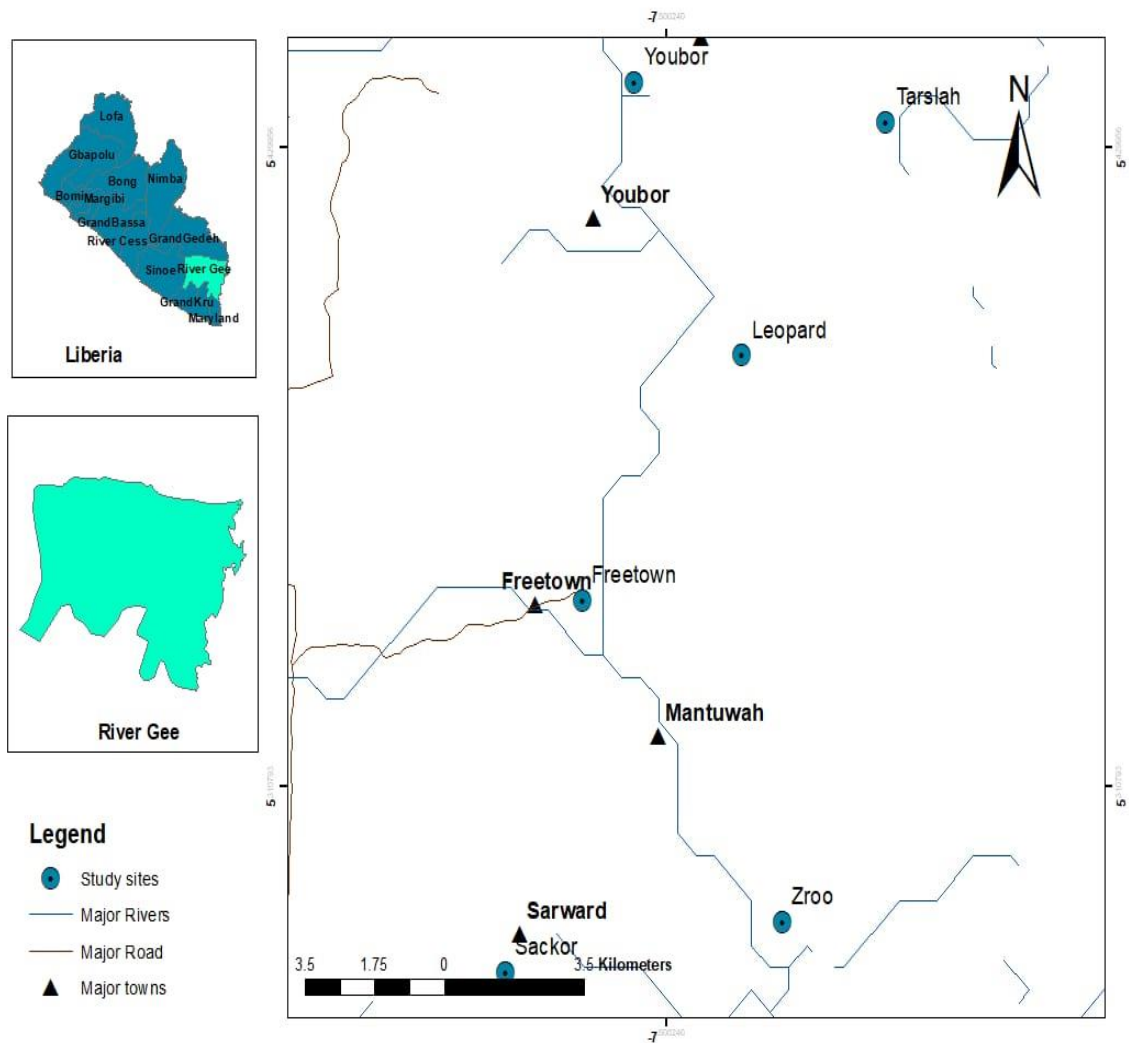
Map 2. Map showing *Garcinia afzelii* harvesting and trade sites in Southeast Liberia (Source: Tally, 2023)



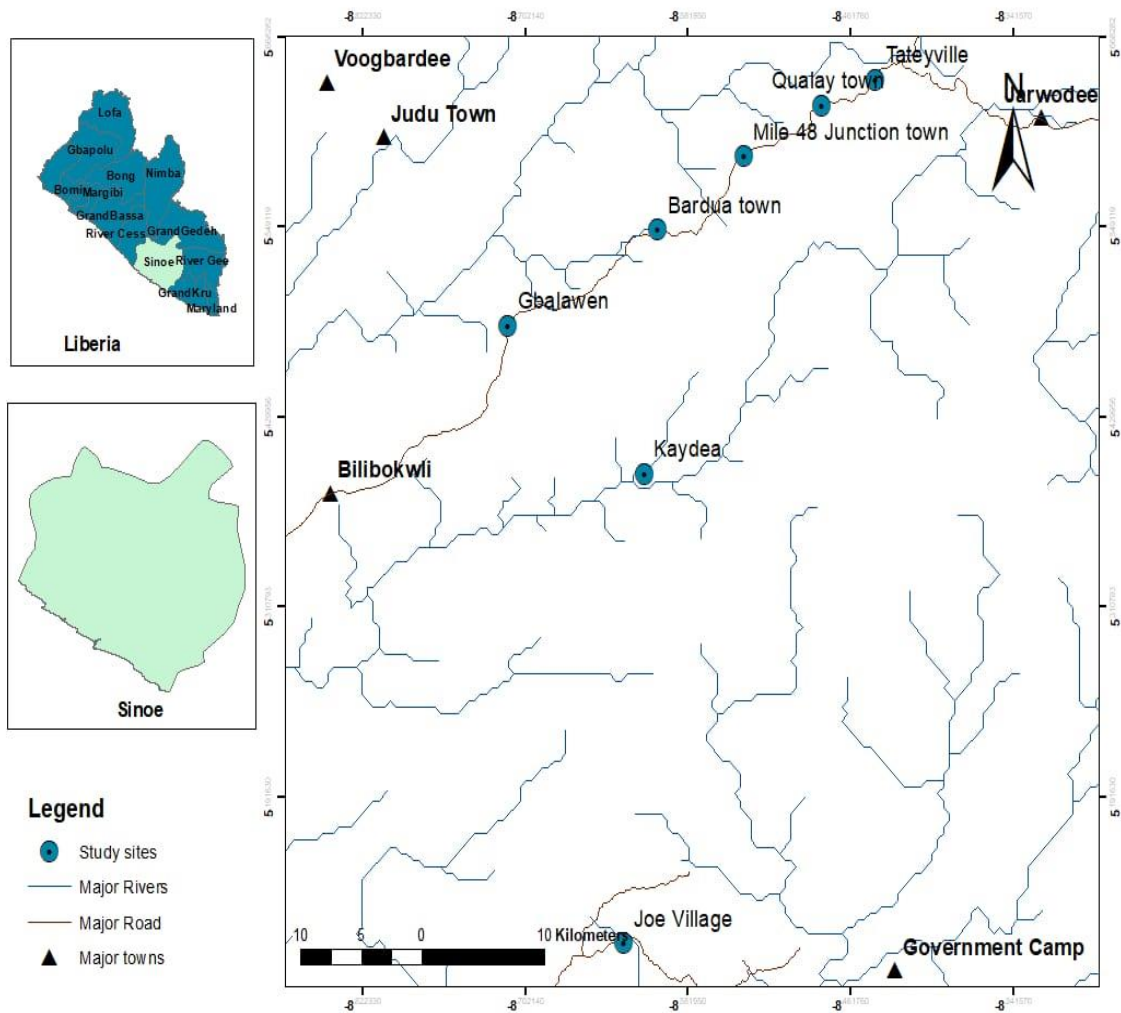
**Map 3. Map showing the *Garcinia afzелиi* harvest and trade sites in Grand Kru County (Source: Tally, 2023)**



Map 4. Map showing *Garcinia afzelii* harvesting and trade sites in Grand Gedeh County (Source: Tally, 2023)



**Map 5. Map showing *Garcinia afzelii* harvesting and trade sites in River Gee Gedeh County (Source: Tally, 2023)**



Map 6. Map showing *Garcinia afzelii* harvesting and trade sites in Sinoe County (Source: Tally, 2023)

### **3.3 Climate**

The climate of the southeast of Liberia, like many parts of Liberia, is determined by the country's geographic position near the Equator and Atlantic Ocean and experiences two main separate climate regimes (the equatorial and tropical). The equatorial climate regime occurs throughout the year (Stanturf et al., 2013). The growth and distribution of *Garcinia afzelii* are influenced by the climatic condition of Southeast Liberia. The tropical climate regime interacts with the Inter-Tropical Convergence Zone (ITZC) and the West African Monsoon. The southwesterly flow of the Monsoon maintains a thin layer of moist marine air in coastal regions of Liberia. The dust-laden Harmattan wind blows in from the Sahara (December-March). It is associated with the tropical climate regime and is typically introduced for a short period during the wintertime in the coastal regions of Liberia, especially in Grand Kru, Maryland, and Sinoe Counties. The summer wet season and winter dry season which are characteristic of a tropical climate are produced as the result of the interaction of the ITZC with the Monsoon flow (Stanturf *et al.*, 2013; Bongers *et al.* 1999).

### **3.4 Rainfall and Temperature**

Southeast Liberia experiences two distinct seasons: The wet season (April-October) and the dry season (November- May). The southeast of Liberia is marked by variations in precipitation. Average annual rainfall ranges between 107 inches in the north to 160 inches in the southern part of the southeast (CDA,2012). Southeast Liberia is characterized by warm temperatures and extremely high humidity. The average annual temperature is 25.5<sup>0</sup>C (77.5 <sup>0</sup>F). During daylight, the temperature ranges from 27<sup>0</sup>C to 32<sup>0</sup>C and from 21<sup>0</sup>C to 24<sup>0</sup>C at night. Relative air humidity is 90% throughout the country. This may drop below 20% during the Harmattan wind period. During the dry season, the relative air humidity decreases between 80% and 85%. Between the months of March and February (the driest period of the year), relative air humidity decreases as low as 65% (Bongers *et al.* 1999).

### **3.5 Relief and drainage**

Southeast Liberia's landscape is categorized under the highlands of Liberia, which are generally characterized by plateaus and mountain ranges. Important mountain ranges are Putu (247m) in Grand Gedeh County, Tiempo, and Killipo in River Gee County. The southeast region of Liberia is also hilly with gradients steep and irregular. Many creeks and rivers are flowing in the southeast.

Cavalla river flows through Grand Gedeh, River Gee, and Maryland Counties forming the boundary between Liberia and Cote D'Ivoire. Sinoe County alone contains three big rivers which are the Sinoe River flowing through the Sapo National Park, the Sanquin River, and the Dugbe River. Gee River is located in River Gee County. The rivers are V-shaped and narrow in the upper reaches (CDA, 2012)

### **3.6 Geology and Soils**

The geological structure of Southeast Liberia has similar features to those of the rest of the country. The soils are generally amenable to a variety of agricultural uses. Rocks of the Eburnean Age biotite rich are restricted to southeast Liberia, mainly in Grand Gedeh County where they extend into Côte d'Ivoire. A major tectonic feature, Dube Shear Zone, found in Grand Kru County has the potential for minerals (gold deposits). The rock structure of both Grand Gedeh and River Gee Counties forms part of the West African Croton which is recognizable for its stability and the general absence of tectonic activities over the past 2,500 million years. The soil types of Southeast Liberia are reddish-brown and gray to black comprising sedimentary rocks, clay, loam, and sand. These soils support the growth of tree crops such as rubber, oil palm, coffee, and other cash crops including maize and rice (LNBAP, 2008; CDA, 2012). The soil of Southeast Liberia also supports the growth of *Garcinia afzelii* and other NTFPs and timbers.

### **3.7 Vegetation**

The vegetation cover of Southeast Liberia falls within the Upper Guinean rainforest ecosystem which is characterized by evergreen and semi-deciduous rainforests (Massalatchi, 2011; CDA, 2012). Southeast Liberia consists of primary and secondary forests, mangroves, savannahs, and some grasslands. The coastal areas in Sinoe, Grand Kru, and Maryland, counties are noted for savannah, mangroves, and grasslands. The forest is exploited by shifting cultivation practices, mining, and logging concessions (CDA, 2012).

### **3.8 Population**

The population statistics of the study area are shown in table 1. The southeastern region of Liberia is comprised of five main counties which include Grand Gedeh, Grand Kru, Maryland, River Gee, and Sinoe counties. Southeast Liberia has a total population size of about 33,553 inhabitants.



Grand Gedeh county has the highest estimated population of 125,258 inhabitants followed by Sinoe county which has an estimated population of 102,391 inhabitants (LIGIS,2008).

**Table 1. Population statistics of the study area Source: LISGIS, 2009**

|             | Land area               | Population |         |         | Capital city | Ethnic group          |
|-------------|-------------------------|------------|---------|---------|--------------|-----------------------|
|             |                         | Male       | Female  | Total   |              |                       |
| Grand Gedeh | 10,276km <sup>2</sup>   | 64,994     | 60,264  | 125,258 | Zwedru       | Krahn and Grebo       |
| Grand Kru   | 2,298.78km <sup>2</sup> | 29,648     | 28,265  | 57,913  | Barclayville | Kru and Grebo         |
| Maryland    | 5,351km <sup>2</sup>    | 70,855     | 65,083  | 135,938 | Harper City  | Grebo and Kru         |
| River Gee   | 5,627km <sup>2</sup>    | 34,863     | 31,926  | 66,789  | Fish town    | Grebo                 |
| Sinoe       | 10,000km <sup>2</sup>   | 54,767     | 47,624  | 102,391 | Greenville   | Kru, Grebo, and Krahn |
| Total       | 33,553                  | 255,127    | 233,162 | 488,289 |              |                       |

### 3.9 Sampling methods

The study made use of socio-economic and geographic surveys. To collect empirical data for comprehensive data analysis, Random sampling, surveys, participatory rural appraisal (PRA) tools such as semi-structured interviews, income generation utilization raking, activity profiles, well-structured questionnaires for individuals and focus groups, visual assessments, and key-informants were used to collect data. Devices and materials such as Geographic Position System (GPS), excel sheets, notepads, pens, and digital cameras were also used for the data collection.

#### 3.9.1 Sites selection

A few rural communities were purposively selected for data collection in Southeast Liberia, based on important harvest sites, accessibility to towns, characteristics of distance to point, and the number of actors in the value chain for *Garcinia afzelii*. To determine areas that are important

production zones and people involved in the harvest and trade of *Garcinia afzelii*, focus group meetings targeting local leaders (town chief, youth chairs, women chairs, elders, paramount chiefs, and clan chiefs) were held. Individual interviews were conducted to ascertain information on the socio-economic, demographic image, and situation of *Garcinia afzelii* exploitation. In Grand Gedeh County, data was collected in three (3) communities; Garleo, Tarloken, and Tembo. In Grand Kru County, data was obtained in Pollay town. In River Gee County, data was gathered in six (6) key communities; Freetown, Leopard town, Sackor, Zroo, Tarlah, and Yubor. In Sinoe County, data was collected in seven (7) communities; Bardua town, Gbalawen, Tateyville, Kaydea, Mile 48 Junction town, Qualay town, and Joe village.

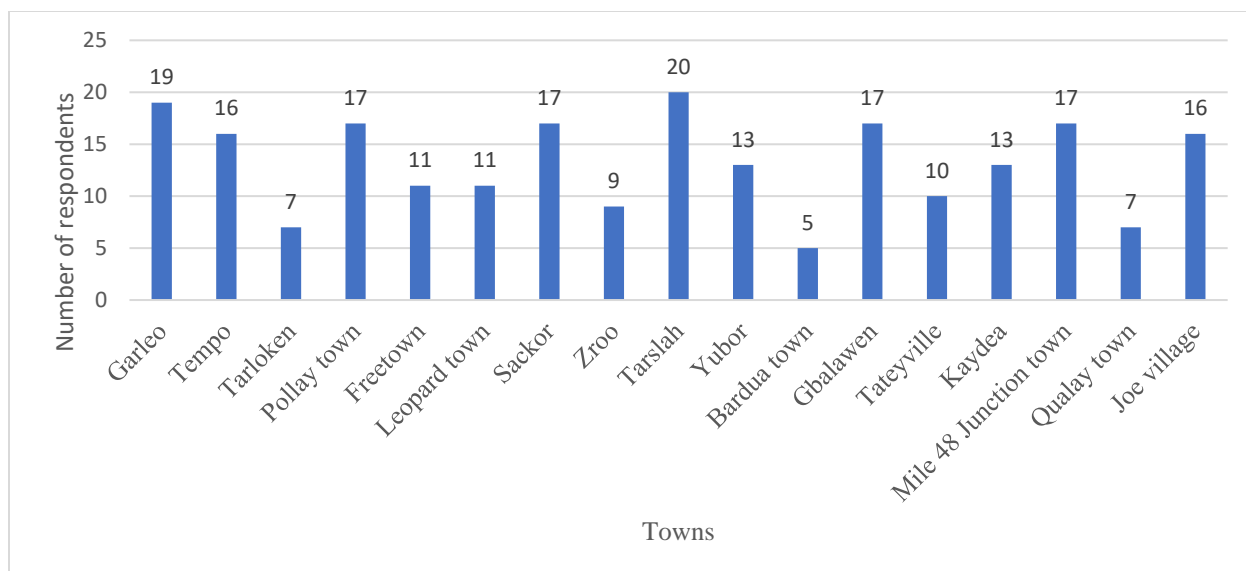
**Table 2. Sampled towns and number of respondents (Source: Tally, 2023)**

| <b>County</b>   | <b>Town</b>  | <b>Number interviewed</b> | <b>Percentage (%)</b> |
|-----------------|--------------|---------------------------|-----------------------|
| Grand Gedeh     | Garleo       | 19                        | 45.2                  |
|                 | Tempo        | 16                        | 38.1                  |
|                 | Tarloken     | 7                         | 16.7                  |
| <b>Subtotal</b> | <b>3</b>     | <b>42</b>                 | <b>100</b>            |
| Grand Kru       | Pollay town  | 17                        | 100                   |
| <b>Subtotal</b> | <b>1</b>     | <b>17</b>                 | <b>100</b>            |
| River Gee       | Freetown     | 11                        | 13.6                  |
|                 | Leopard town | 11                        | 13.6                  |
|                 | Sackor       | 17                        | 21                    |
|                 | Tarsla       | 20                        | 24.7                  |
|                 | Zroo         | 9                         | 11                    |
|                 | Yubor        | 13                        | 16                    |
| <b>Subtotal</b> | <b>6</b>     | <b>81</b>                 | <b>100</b>            |
|                 | Bardua town  | 5                         | 6                     |

|                 |                       |            |            |
|-----------------|-----------------------|------------|------------|
| Sinoe           | Gbalawen              | 17         | 20         |
|                 | Tateyville            | 10         | 11.8       |
|                 | Kaydea                | 13         | 15.3       |
|                 | Mile 48 Junction town | 17         | 20         |
|                 | Qualay town           | 7          | 8.2        |
|                 | Joe village           | 16         | 18.8       |
| <b>Subtotal</b> | <b>7</b>              | <b>85</b>  | <b>100</b> |
| <b>Total</b>    | <b>17</b>             | <b>225</b> | <b>100</b> |

### 3.9.2 Selection of respondents

Individuals and target groups who were identified as key stakeholders and actors in the harvest and trade of *Garcinia afzelii* were selected as respondents for the questionnaires. These respondents include local informants, town leaders, farmers, transporters, FDA staff, harvesters, and traders of *Garcinia afzelii*. To gather primary data, the researcher visited a total of 17 communities in Southeast Liberia: 3 communities in Grand Gedeh County (Garleo, Tarloken, and Tempo), 1 community in Grand Kru County (Pollay town), 6 communities in River Gee County (Leopard town, Freetown, Sackor, Zroo, Tarslah, and Yubor), and 7 in Sinoe County (Gbalawen, Tateyville, Bardua town, Qualay town, Mile 48 Junction town, Kaydea, and Joe village).



**Figure 1** Sampled towns and number of respondents (Source: Tally, 2023)

### 3.9.3 Questionnaire design

The questionnaires designed and adopted for this research were based on other NTFP market studies performed in the framework of the CIFOR-FAO project (Ingram *et al.*, 2009). The questionnaires were written out comprehensively and clearly to enable the different actors in the chain of *Garcinia afzeli* harvest and trade to easily respond in no longer than 30 minutes. The questions were fine-tuned to elicit theoretical accuracy, making them meaningful to the respondents. A set of three questionnaires were developed and administered in the field. They include questionnaires for focus groups, harvesters, and traders.

### 3.10 Data sources

#### 3.10.1 Preparation

Preparation started with defining the objectives, research questions, and problem statement, submission of a budget to IUCN for approval, and designing the questionnaires for field data collection. My Student Identification card from the International University of Andalucía (UNIA) was presented to local authorities for permission to obtain the necessary data during the field research data collection.

### **3.10.2 Secondary data collection**

Secondary data was obtained from many sources, such as previous research theses done on *Garcinia* species, NTFPs, scientific publications, NGO reports, government institution records, and the Internet.

### **3.10.3 Fieldwork**

Fieldwork was done physically by going into the study sites to collect primary data. Well-designed questionnaires were distributed, and interviews were administered directly to source first-hand information on the harvest and trade of *Garcinia afzelii* in Southeast Liberia between the months of October 2022 to February 2023.

### **3.10.4 Rapid assessment**

Before collecting data, a rapid assessment was conducted between September and October 2022 to identify the main harvesting towns, actors, and trading sites of *Garcinia afzelii* in Southeast Liberia as well as to pretest the questionnaires. The activities of the rapid assessment were made successful with key informants such as Forestry Development Authority rangers, harvesters, traders, town leadership, and community dwellers who provided an initial overview of the areas of harvest, key actors, and information on protocols for gaining access to the towns, forests, and to conduct individual interviews. The tested questionnaires provided information about the comprehensibility of the types of questions used, style, terms used, length of the questionnaires, and the actual information which will be gained that gave the possibility of improving the questionnaires which were eventually used. At the end of the rapid assessment, the pretest questionnaires were fine-tuned to obtain final versions that were used for field data collection from December 2022 to February 2023.

### **3.10.5 Observation**

To have the opportunity of getting first-hand information, the researcher did direct observations by going into the field to visit the various study sites to arrange for interviews, identify *Garcinia afzelii* harvesting sites, and evaluate the mode of harvest, and the trade channels.

### **3.10.6 Interview**

During the course of primary data collection, a situation analysis was conducted with different actors at the key stages of the chain in the harvest and trade of *Garcinia afzelii*. Before the conduct

of administering the questionnaires for interviews, initial focus group meetings were held with the town leadership to solicit the participation of the actors in the research, explain the research objectives, and how confidentially the data will be handled. 17 focus-group meetings were held in the various towns in which *Garcinia afzelii* is being harvested. A total of 203 harvesters (90.2%) and 22 traders (9.8%) were interviewed across four (4) counties in which the study was carried out in Southeast Liberia. The highest number of individuals interviewed, 85 (37.8%), came from Sinoe County and followed by River Gee County with 81 (36%). Grand Kru County has the lowest number of individuals, 17 (7.6%). During the conduct of the interview, when it was not possible to administer the interview on the scene, a rendezvous was scheduled for the convenience of the respondents.

### **3.10. 7 Data Analysis**

Quantitative data gathered from the field were analyzed using Statistical Package for the Social Sciences (SPSS) and Excel. The survey results were presented in maps, graphs, and tables to show an overview of data analysis performed to correlate variables in SPSS and Excel.

## CHAPTER IV: RESULTS AND DISCUSSION

### 4.1 *Garcinia afzelii* actors

The key actors recognized in the harvest and trade of *Garcinia afzelii* in Southeast Liberia include harvesters and traders. Data collected in Sinoe, and Grand Kru Counties showed that community leaderships play an important role in the harvest and trade of *Garcinia afzelii*. In Sinoe and Grand Kru counties, the trader (s) initially meet with the local authorities, especially the town chief, and present a permit from the FDA. The permit from the FDA gives authorization to the traders to harvest *Garcinia afzelii*. Upon the acceptance of the permit, the trader (s) pay the town leadership a Forest Entry Fee (FEF) between \$100.00 to \$150.00 Unites States Dollars, depending on the level of negotiation. Unlike Sinoe and Grand Kru counties, the harvesters and traders in Grand Gedeh and River counties most often do not seek permission from local authorities to harvest *Garcinia afzelii* and other NTFPS. Other actors were identified in the chain as indirect actors. They include laborers (roadside cleaners, loaders, and off-loaders), transporters, traditional leaders, FDA staff, Police, immigration officers, and Liberia Revenue Authority (LRA) agents.

#### 4.1.1 Harvester characteristics

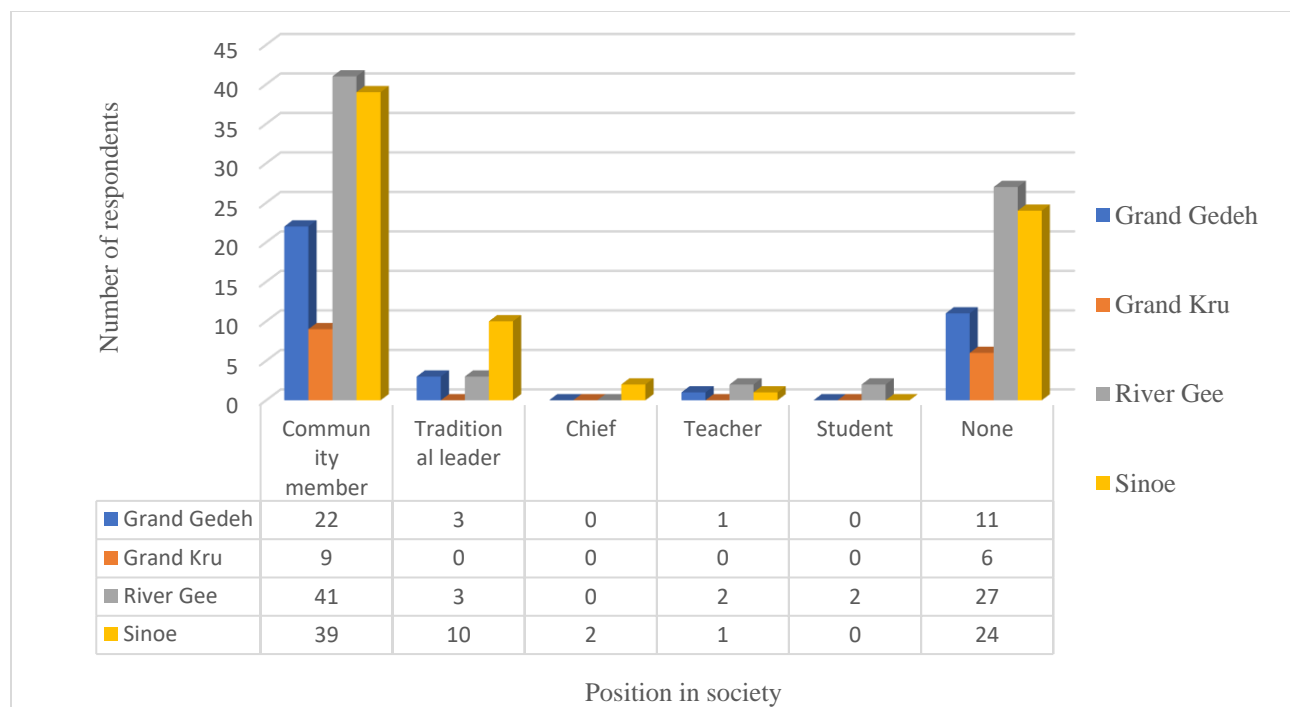
The first actors in the trade chain of *Garcinia afzelii* are the harvesters. The harvesters are also referred to as collectors. In Southeast Liberia, the harvesters of *Garcinia afzelii* tree species for trade are dominant males. The majority of the harvesters, 115 (56.7%) are between 18 to 35 years and followed by 81 (39.9%) who have an age range between 36 to 50 years. 7 (1.5%) harvesters have attained 50 years and above. Out of the 203 harvesters interviewed in the study, 142 (70%) are self-employed.

**Table 3. Demographic characteristics of harvesters in percentage**

| Demographics | Parameters   | Grand Gedeh | Grand Kru | River Gee  | Sinoe      |
|--------------|--------------|-------------|-----------|------------|------------|
| Number (N)   | Sampled size | 37          | 15        | 75         | 76         |
| Gender       | Male         | 37 (100%)   | 15 (100%) | 75 (100%)  | 76 (100%)  |
|              | Female       | 0           | 0         | 0          | 0          |
| Age group    | 18-35 years  | 20 (54.1%)  | 12 (80%)  | 45 (60%)   | 38 (50%)   |
|              | 36-50 years  | 16 (43.2%)  | 3 (20%)   | 28 (37.3%) | 34 (44.7%) |

|                |                |            |            |            |            |
|----------------|----------------|------------|------------|------------|------------|
|                | 50 years above | 1 (2.7%)   | 0          | 2 (2.7%)   | 4 (5.3%)   |
| Education      | None           | 0          | 1 (6.7%)   | 1 (1.3%)   | 1 (1.3%)   |
|                | Elementary     | 17 (45.9%) | 9 (60%)    | 38 (50.7%) | 41 (53.9%) |
|                | Junior high    | 13 (35.1%) | 5 (33.3%)  | 26 (34.7%) | 18 (23.7%) |
|                | Senior high    | 7 (18.9%)  | 0          | 10 (13.3%) | 16 (21.1%) |
|                | University     | 0          | 0          | 0          | 0          |
| Marital Status | Widower        | 0          | 0          | 0          | 0          |
|                | Single         | 21 (56.8%) | 13 (86.7%) | 55 (73.3%) | 49 (64.5%) |
|                | Married        | 16 (43.2%) | 2 (13.3%)  | 20 (26.7%) | 27 (35.5%) |
|                | Divorced       | 0          | 0          | 0          | 0          |
| Occupation     | Retired        | 0          | 0          | 0          | 0          |
|                | Employed       | 0          | 0          | 0          | 0          |
|                | Farmer         | 12 (32.4%) | 2 (13.3%)  | 19 (25.3%) | 28 (36.8%) |
|                | Self-employed  | 25 (67.6%) | 13 (86.7%) | 56 (74.7%) | 48 (63.2%) |

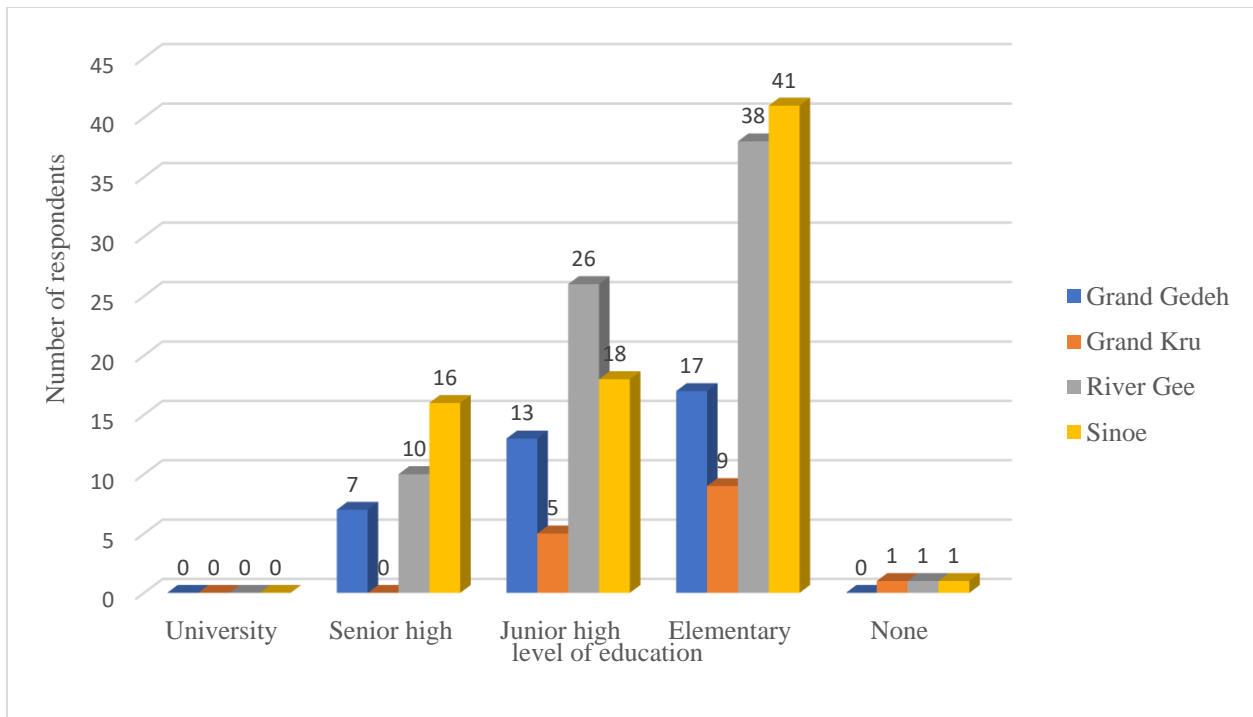




**Figure 2. Position in the society of harvesters (Source: Tally, 2023)**

#### **4.1.2 Harvester’s level of education**

Table 3 shows the general educational level of the harvesters across the study area. In Grand Gedeh County, the study shows that 45.9% of the harvesters have attained elementary education, 35.1% with junior high education, and 18.9% with senior high-level education. None with a university education. In Grand Kru County, 60% of the harvesters have attained elementary education and 33.3% have attained junior-level education. None attained senior high and university levels education. In River Gee, the survey showed that 50.7% of the harvesters attained elementary education, 34.7% attained junior high education and 13.3% with senior high education. In Sinoe County, elementary education attained by the harvesters is 53.9% followed by both junior high with 23.7%, and senior high levels education at 21.1%. The general overview of the education levels of the harvesters revealed that 51.7% have attained elementary education, 30.5% with junior high education, 16.3% with senior high-level education, and 1.5% obtained no education.



**Figure 3. Harvester level of education (Source: Tally, 2023)**

#### **4.1.3 Household involvement in *Garcinia afzelii* harvest and trade**

Rural families play a leading role in the harvest and trade of *Garcinia afzelii* in Southeast Liberia. Many young men from different households are hired by foreign contractors, especially Ghanaian migrants, who travel into the various towns to harvest and trade *Garcinia afzelii*.

#### **4.1.4 Harvesters' income generating activities**

There are different means by which harvesters in the study areas generate income. Harvester's sources of household income include subsistence agriculture activities, fishing, the sale of *Garcinia afzelii* and other NTFPs, motorbike riding, fishing, small trade, poaching, and artisanal gold mining. 31.0% of the harvesters generate income from subsistence farming followed by 15.8% whose source of income comes from small trade. 14.8% generate their income from the sale of *Garcinia afzelii*.

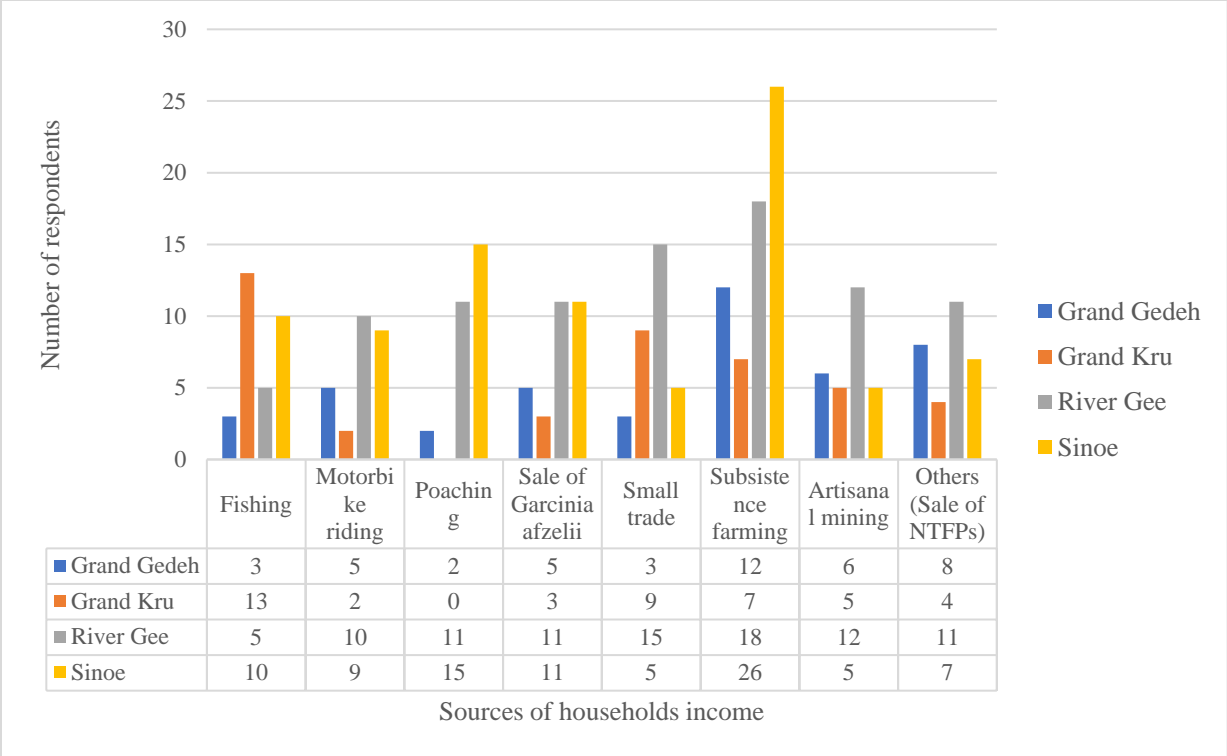


Figure 4. Harvesters’ income-generating activities (Source: Tally, 2023)

**4.1.5 Main uses of harvesters’ income from *Garcinia afzelii***

Income generated from the sale of *Garcinia afzelii* in the study area is primarily used to meet the following needs: education, health, food, purchase of equipment and materials for subsistence farming activities, building houses, and other basic needs. Health, food, and basic needs are ranked the highest main uses of the harvesters’ income from *Garcinia afzelii* sales.

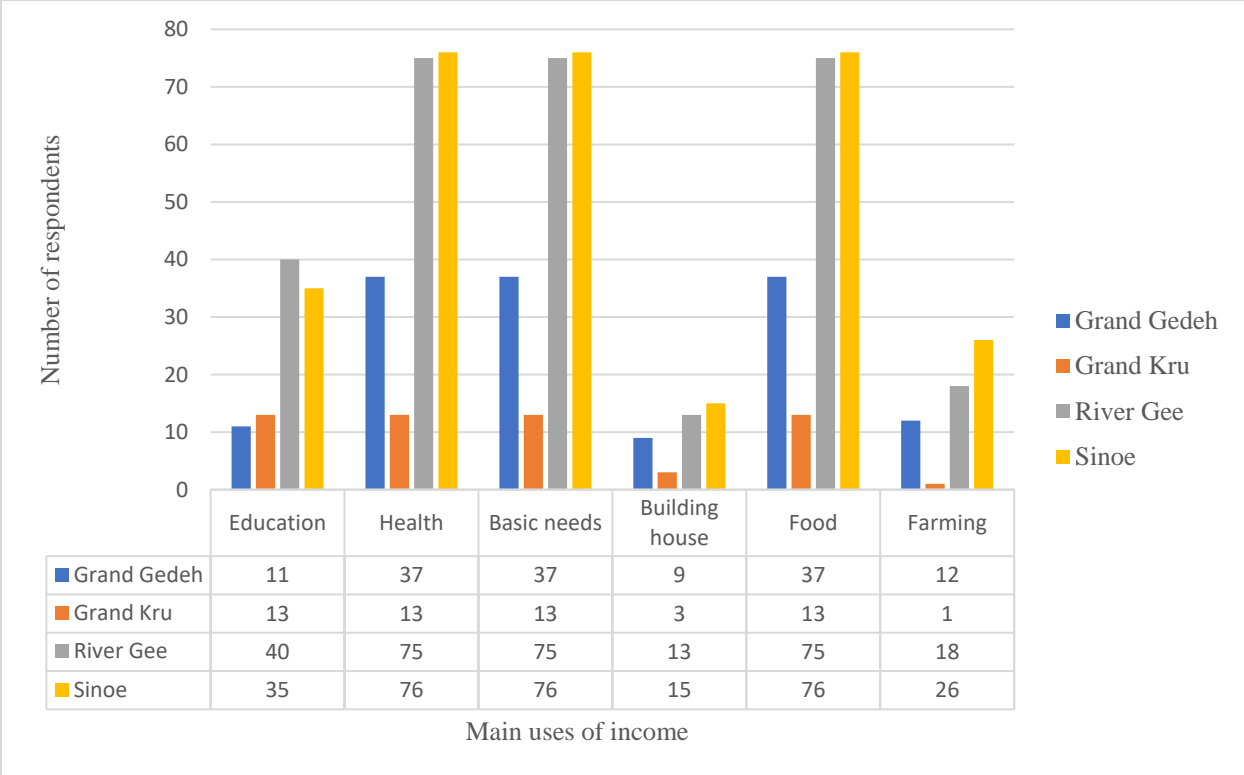


Figure 5. uses of harvesters’ income from *Garcinia afzelii* (Source: Tally, 2023)

4.1.6 *Garcinia afzelii* mode of transport

Mostly the mode of transport of harvested *Garcinia afzelii* from the forests to roadsides or towns is by the head. The *Garcinia afzelii* harvested in Sinoe and Grand Kru counties are transported on pickup trucks to the port city of Greenville, Sinoe County. From Greenville, the products are exported by engine boats to Ghana. *Garcinia afzelii* harvested from Grand Gedeh and River Gee counties around the borderline with Cote D`Ivoire are exported by canoes across the Cavally River to Côte d’Ivoire and put on vehicles to be transported to Ghana.



**Plate 1.** *Garcinia afzelii* stockpile (Source: Tally, 2023)

#### **4.1.7 Trader characteristics**

Traders in the value chain of *Garcinia afzelii* harvest in Southeast Liberia are foreigners, mainly Ghanaian migrants. The traders travel directly to the towns to purchase *Garcinia afzelii* from the rural dwellers of the forest communities. They play many different roles in the value chain of *Garcinia afzelii*. Some traders get in the physical harvest of *Garcinia afzelii* from the forest. The traders are responsible for hiring local harvesters and transporting the stems of the tree species from the harvesting sites to point of export.

**Table 4. Demographic characteristics of traders (in percentage) Source: Tally, 2023**

| Demographics   | Parameters       | Grand Gedeh | Grand Kru | River Gee | Sinoe     |
|----------------|------------------|-------------|-----------|-----------|-----------|
| Number (N)     | N (sampled size) | 5           | 2         | 6         | 9         |
| Gender         | Male             | 5 (100)     | 2 (100%)  | 6 (100%)  | 9 (100%)  |
|                | Female           | 0           | 0         | 0         | 0         |
| Age group      | 18-35            | 0           | 1(50%)    | 2 (33.3%) | 1(11.1%)  |
|                | 36-50 years      | 4 (80%)     | 1 (50%)   | 4 (66.7%) | 7 (77.8%) |
|                | Above 50 years   | 1 (20%)     | 0         | 0         | 1 (11.1%) |
| Education      | None             | 0           | 0         | 0         | 0         |
|                | Elementary       | 0           | 0         | 1 (16.7%) | 0         |
|                | Junior high      | 1 (20%)     | 2 (100%)  | 4 (66.7%) | 4 (44.4%) |
|                | Senior high      | 4 (80%)     | 0         | 1 (16.7%) | 5 (55.6%) |
|                | University       | 0           | 0         | 0         | 0         |
| Marital Status | Single           | 4 (80%)     | 1 (50%)   | 4 (66.7%) | 5 (55.6%) |
|                | Married          | 1 (20%)     | 1 (50%)   | 2 (33.7%) | 4 (44.4%) |
| Occupation     | Employed         | 0           | 0         | 0         | 0         |
|                | Self-employed    | 5 (100%)    | 2 (100%)  | 6 (100%)  | 9 (100%)  |
|                | Retired          | 0           | 0         | 0         | 0         |

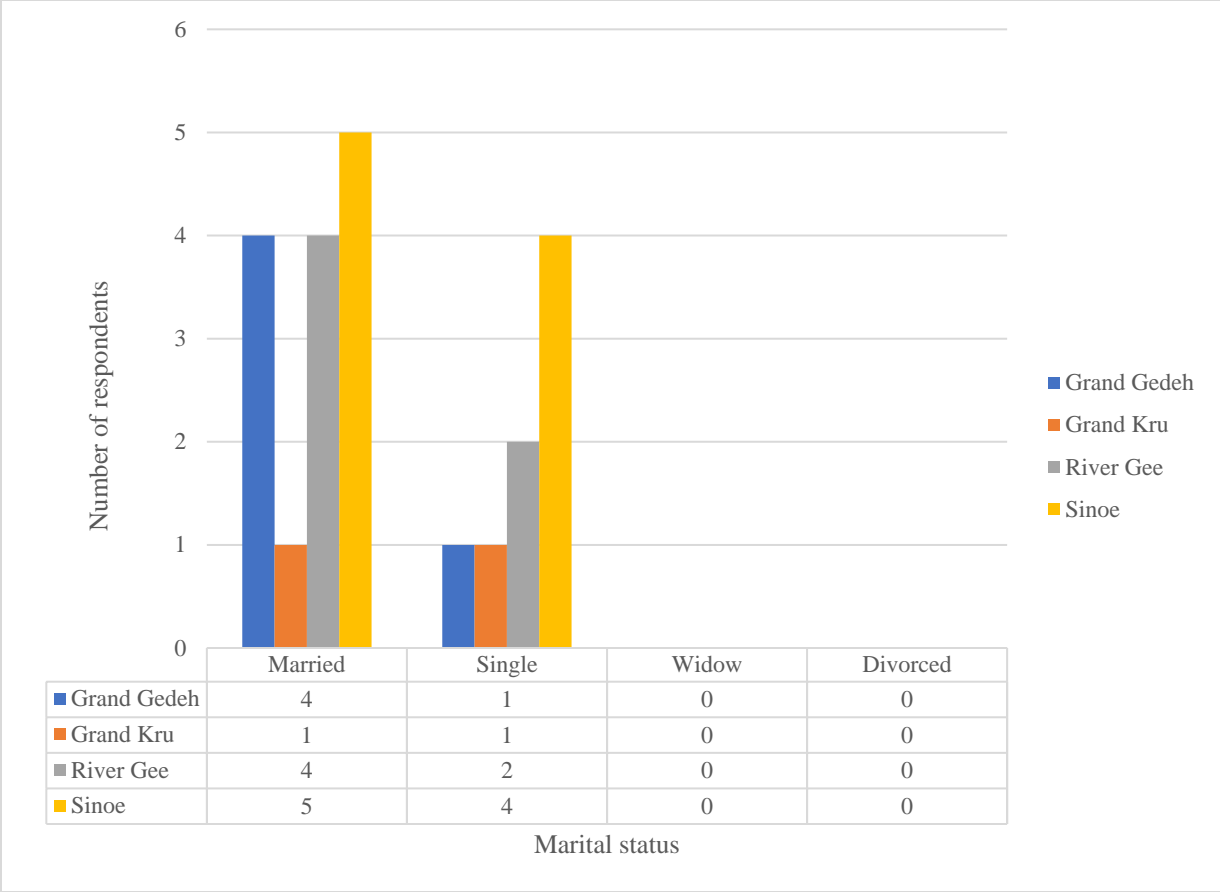


Figure 6. Traders’ marital status (Source: Tally, 2023)

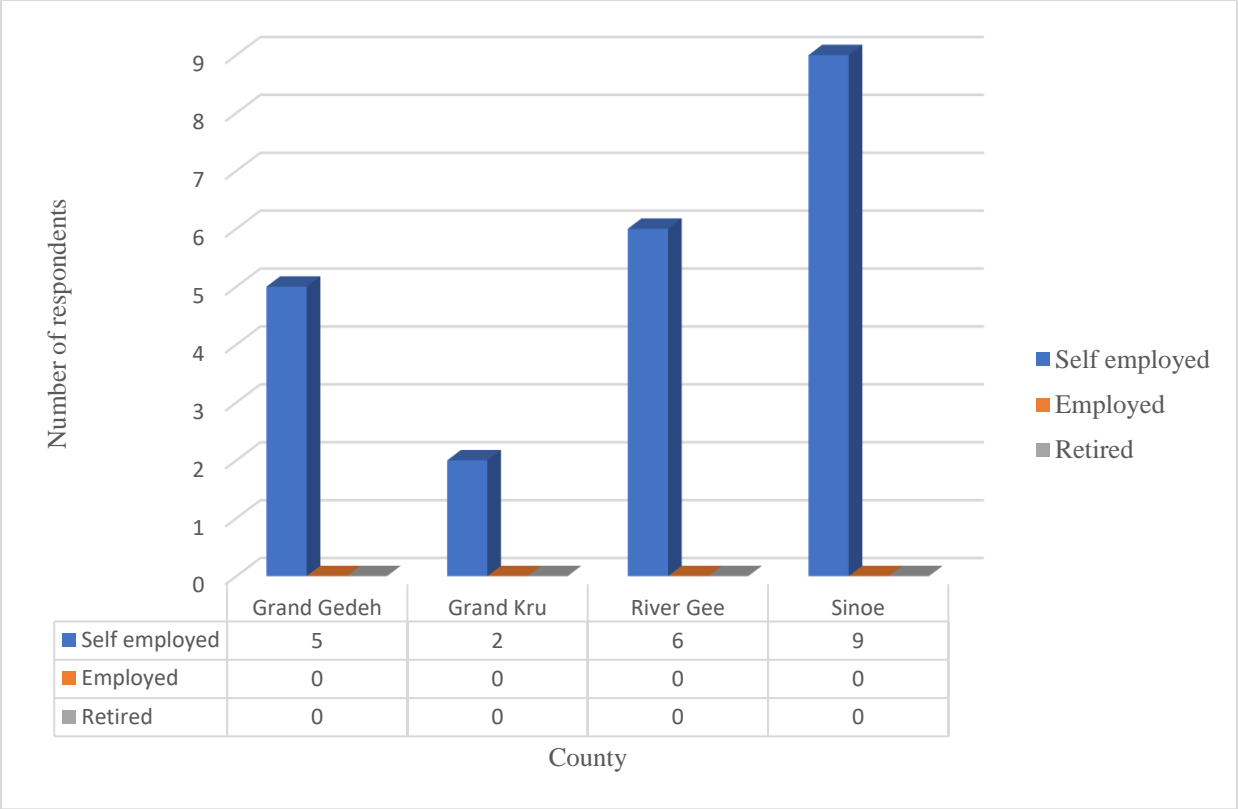


Figure 7. Traders' occupation (Source: Tally, 2023)

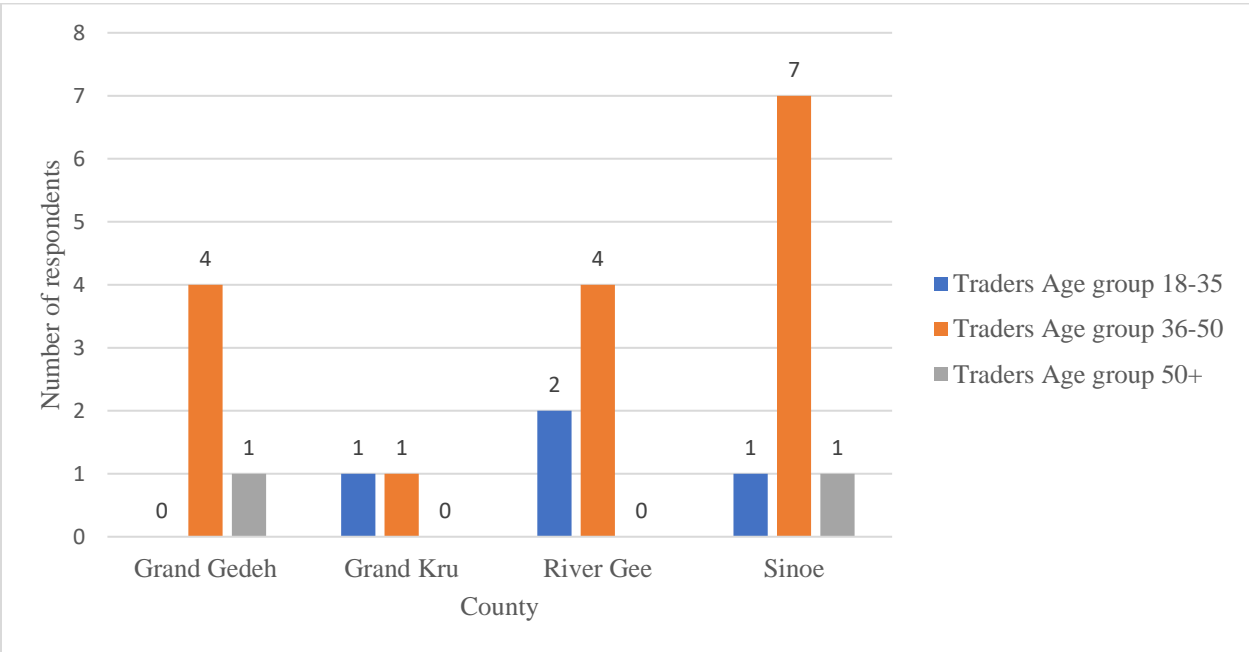


Figure 8. Traders' age group (Source: Tally, 2023)



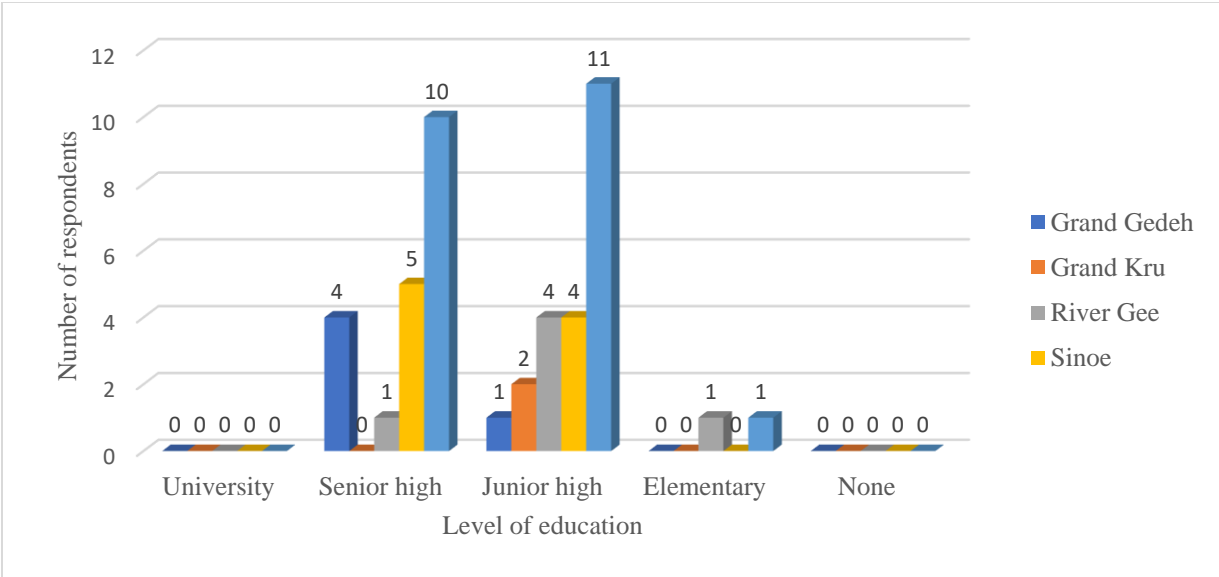


Figure 9. Traders' level of education (Source: Tally, 2023)

4.1.8 Traders' income-generating activities

*Garcinia afzelii* traders, as collectors, have different sources of income-generating means. Their sources of income generation include the sale of *Garcinia afzelii*, subsistence agriculture, small trade, mining, and the sale of other NTFPs. The majority of their sources of income are derived from the sale of *Garcinia afzelii* and other NTFPs. Small trade and subsistence farming also constitute the sources of the traders' income-generating activities.

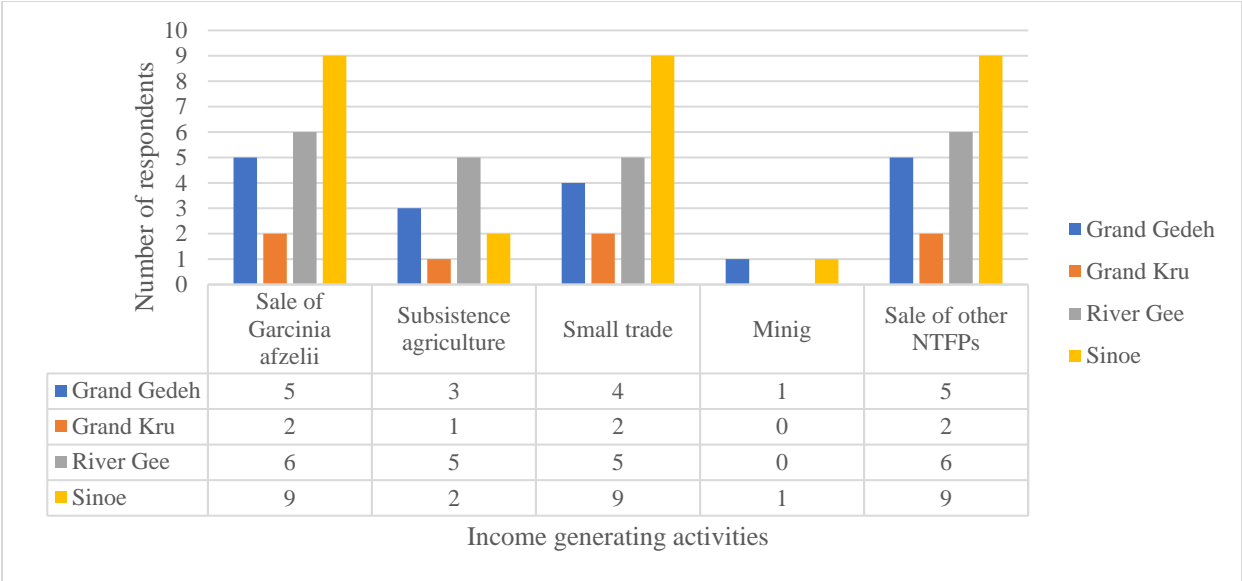


Figure 10. Traders' income-generating activities (Source: Tally, 2023)

#### 4.1.9 Main uses of traders' income from *Garcinia afzelii*

Income generated from the *Garcinia afzelii* trade is utilized for meeting up with various basic needs such as education, feeding, building houses, and health, and savings to invest in other businesses. However, income gained is also directed to the purchase of equipment and materials to enhance trade. The majority of the respondents used the income generated from *Garcinia afzelii* sales on health and feeding, and small.

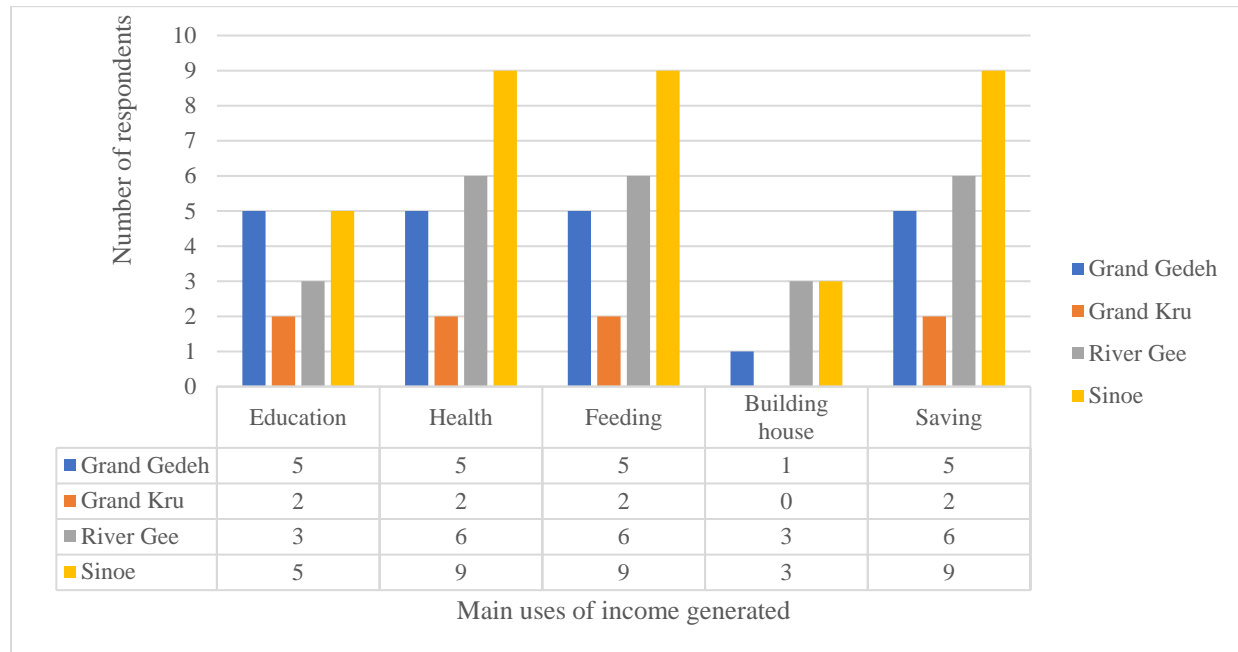


Figure 11. Main uses of traders' income from *Garcinia afzelii* (Source: Tally, 2023)

#### 4.1.10 Gender aspects in *Garcinia* harvest and trade

Males are more directly involved in the harvest and trade of *Garcinia afzelii* in Southeast Liberia than females. Most of the females sampled and interviewed during the focus group discussions across the research study sites have indirect roles in the value chain of *Garcinia afzelii*. Women's involvement comes in at the town leadership levels where they play a key role in regulating the harvest and having opinions on the determination of the *Garcinia afzelii* round pole price. A total of 17 focus group discussions were held in the 17 sampled towns. Information was gathered from 127 respondents of which 106 (83.5%) were males and 21 (16.5%) were females. On the overall scale of both the individuals interviewed and focus group discussions held across the study sites, a grand total of 352 respondents were encountered: 331 (94.0%) males and 21 (6%) females.

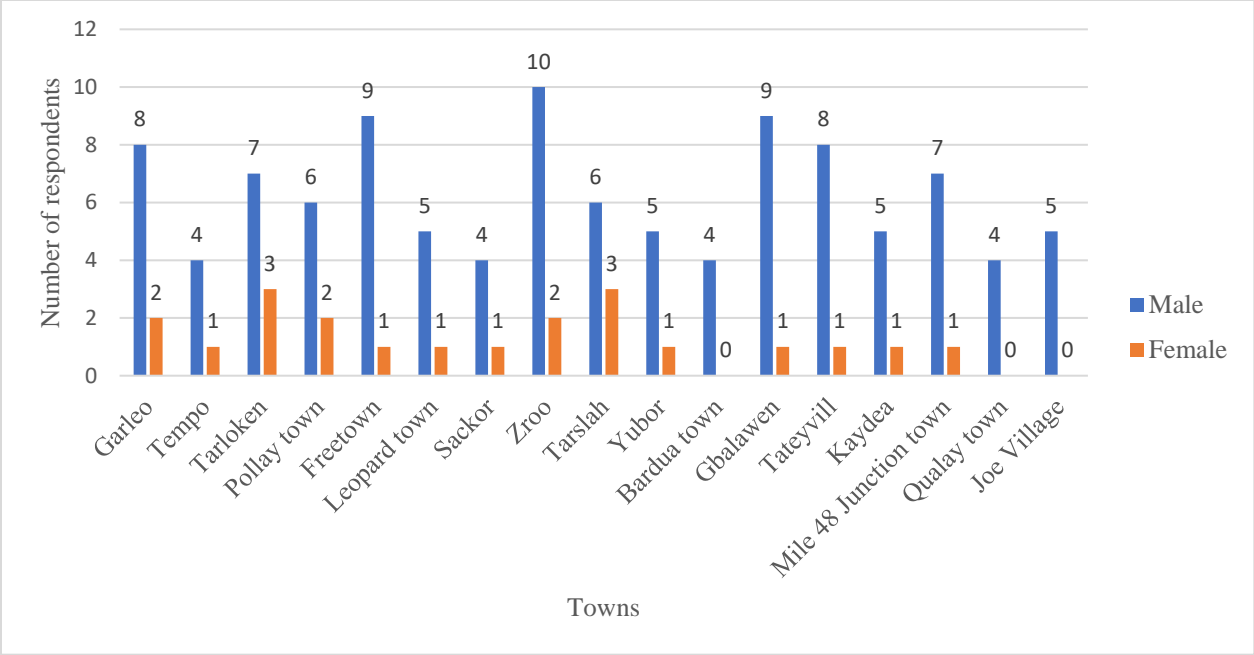


Figure 12. Sampled male and female respondents in focus group discussions (Source: Tally, 2023)



Plate 2. Focus group discussion (Source: Tally, 2023)

## 4.2 Environmental sustainability

### 4.2.1 Harvest sites

From all the areas surveyed within the four counties in Southeast Liberia, *Garcinia afzelii* is collected from the forest. It is collected from both primary and secondary forests. The highest density is harvested in secondary forests. Some harvesters in the fringe communities around the Grebo-Krahn National Park (GKNP) located in Grand Gedeh County and River Gee County enter the national park to harvest *Garcinia afzelii*.



**Plate 3.** *Garcinia afzelii* harvesting sites (Source: Tally, 2023)



**Plate 4. *Garcinia afzelii* leaves (Source: Tally, 2023)**

#### **4.2.2 Method of resource collection**

The methods that the harvesters used to collect *Garcinia afzelii* are highly considered crude and unsustainable. 100% of the respondents sampled use machetes to cut down the tree. The harvesters do not observe any regulations and guidelines concerning cutting trees above Diameter Cut Limits (DCLs) and Diameter at Breast Height (DBH). The stems are the main parts of the tree species that are extracted for trade.

#### **4.3 Population management and trade control**

##### **4.3.1 Access**

Access to *Garcinia afzelii* harvest in Southeast Liberia varies. Most respondents indicated that access is restricted to protected areas and sacred forests. Access is mainly regulated by the local community dwellers in Sinoe and Grand Kru counties who have rights to customary land tenure. In places in Grand Gedeh and River Gee counties bordering the Côte d'Ivoire, access to restricted areas is not fully observed as many harvesters enter the protected area (GKNP) to do illegal extraction of *Garcinia afzelii*.

### **4.3.2 Regulatory framework**

In Liberia, there is a transparent framework that establishes the use, management, and protection of forest resources that balances the commercial, community, and conservation aspects. This framework document requires that there should be a Forest Use Permit (FUP) given to harvesters and traders of NTFPs in any area where the species is naturally grown (FDA, 2006).

Recognizing the potential that NTFPs contribute to hunger eradication and poverty alleviation, protecting human health, the environment, and biodiversity resources, Regulation No.111-08 of the National Forestry Reform Law (NFRL) of 2006 provides the following guidelines for FUP:

1. A Non-refundable Annual Administrative Registration fee shall be levied on all Forest Use Permit holders engaging in the extraction/harvest of NTFPs.
2. Community-based NTFP producers are exempt from National Administration Fees
3. Community-Forest Management Bodies (CFMB) may levy fees on NTFP production by community members which be credited to a community Forest Fund used for community forest management or any other related development.

For NTFP exporters, the regulation also provides the following guidelines:

All NTFP exporters shall:

1. Write a letter of intent to the FDA Management
2. Present copies of articles of incorporation and Business Registration Certificate
3. Fill in the NTFP exporter's Annual Registration Form
4. Pay exporters' Annual Registration fees of \$USD 250.00 into Government Revenue

According to Regulation No.111-08 of The National Forestry Reform Law of 2006, the regulations provide that no traders shall transport any NTFPs without a valid waybill whereas no exporters shall export NTFPs from Liberia without a valid NTFPs export permit (FDA, 2006).

### **4.3.3 Impact of *Garcinia afzelii* harvest on the forest ecosystem.**

Based on direct observations of the various harvesting sites of *Garcinia afzelii* in Southeast Liberia, the impact of the harvest has adverse effects on the natural environment. The cutting of exploitable individuals of *Garcinia afzelii* trees in the forest is leading to loss of biodiversity, imbalance in the ecological structure of the ecosystems in which the trees are being harvested, and reduction in the presence of wild fauna species. The adverse impact on the ecosystem has been

exacerbated by the entry of Ghanaian migrants and local harvesters into the forest in search of *Garcinia afzelii* tree species causing huge disturbances in the ecosystem. The widespread unscrupulous harvesting method is threatening the sustainability of the species and also destroying the growth and regeneration of other understorey floras. This also leads to normal nutrient cycle disruption and soil leaching. Other plant genetic resources that could be used in the pharmaceutical industry and traditional remedies are depleted and lost as a result of the destruction of the forest through the unsustainable harvesting of *Garcinia afzelii*.

#### **4.3.4 *Garcinia afzelii* trade routes and export channels**

Four main trade channels for *Garcinia afzelii* were identified in the study: the port city of Greenville, Sinoe County, Tarloken and Tempo, cross-border towns in Grand Gedeh County, and Youbor, a cross-border town in River Gee County. Information gathered from the study shows that *Garcinia afzelii* harvested in Southeast Liberia are exported to Ghana. Traders interviewed in Grand Gedeh and River Gee Counties disclosed that *Garcinia afzelii* harvested are exported to Ghana via Tempo and Tarloken respectively. *Garcinia afzelii* harvested in Grand Kru and Sinoe counties is exported to Ghana through the port city of Greenville in Sinoe County.

## CHAPTER V: CONCLUSION AND RECOMMENDATIONS

### 5.1 Conclusion

*Garcinia afzelii* is an evergreen tree that is geographically spread out in Southeast Liberia. It grows in tropical rainforests, riverine forests, and gallery forests. *Garcinia afzelii* has a commercial and socio-economic potential that contributes to income generation and livelihood opportunities for rural communities in Southeast Liberia. Many young men are involved in the harvest of *Garcinia afzelii*. The study results show that out of the 352 respondents encountered and interviewed by the means of individual questionnaires and focus group discussions, 94.0% are men and just only 6% are women. Women's involvement is limited as many women see the harvest as a man's activity. 14.8% of the harvesters generate their income from the sale of *Garcinia afzelii*. 56.7% of the harvesters are between 18 to 35 years, 39.9%, are between 36 to 50 years, and 3.5% have attained 50 years and above. Income generated from the *Garcinia afzelii* by the traders is utilized for meeting up with various basic needs such as education, feeding, building houses, health, and savings to invest in other businesses.

*Garcinia spp* are due to be seriously threatened with extinction in Ghana due to overexploitation and to meet the demand in the Ashanti and Kumasi regions. To fill in the trade gap, Ghanaian traders and other foreign nationals have turned to the rich forest block of Southeast Liberia to harvest *Garcinia afzelii*. Cutlass is used to harvest the stems which are traded to feed the chewing stick markets in Ghana and other sub-regional West African countries. Harvesting generally takes place in the dry season between November to March to avoid the wet seasons at which time the roads are deplorable and impassable by vehicles. Although FDA has regulations on the trade, there are no basic rules on the method of harvesting thus leaving the species to be harvested unsustainably. *Garcinia afzelii* continues to be exploited in the wild because there is a lack of basic knowledge about the main usage and actual monetary value for which the species is being traded. The study only provides information on the main harvest and trade sites, the actors in the value chain, and the impact of *Garcinia afzelii* but no information on the final processing of the species.

### 5.2 Recommendations

The harvest and trade of *Garcinia afzelii* have been faced with many challenges and have remained marginalized from mainstream economic activity. In order to harness the effective management of the harvest and trade of *Garcinia afzelii* to fully realize the valuable potential *Garcinia afzelii* trade



has in contributing to the sustainable development of rural livelihoods, the study recommends that a moratorium be put on the trade of *Garcinia afzelii* until the following listed below are achieved:

1. Promote awareness on the value of sustainable harvest of *Garcinia afzelii*.
2. Train local communities on the most sustainable and non-destructive harvesting method of *Garcinia afzelii* and other NTFPs.
3. Conduct a Non-Detriment Finding (NDF) to gather more data on ecological adaptability, regeneration potential, biology, spatial distribution trends, abundance, dispersal efficiency, national population trends, illegal off-take, and national conservation status of *Garcinia afzelii*.
4. List *Garcinia afzelii* in CITES Appendix II for international trade regulation.
5. The FDA and CFMB should collaborate to create a framework regulation policy and an adaptive management scheme for enforcement and monitoring the harvest and trade to safeguard the species from the reduction in the wild.

## REFERENCE

- Adebisi, A.A.** (2004). A case study of *Garcinia kola* nut production-to-consumption system in J4 area of Omo Forest reserve, South-west Nigeria. In: Sunderland, T. and Ndoye, O. (eds): Forest Products, Livelihood and Conservation (Case study of Non-Timber Forest Product Systems), Volume 2 Africa, pp. 115-132
- Achoundong G.** (1995). Les formations submontagnardes du Nta-Ali au Cameroun. *Bois et Forêts des Tropiques* 243: 51-64.
- Adedara IA, Awogbindin IO, Anamelechi JP, Farombi EO.** (2015). *Garcinia kola* seed ameliorates renal, hepatic, and testicular oxidative damage in streptozotocin-induced diabetic rats. *Pharm Biol* 53:695-704.
- Ajebesone, P.E. and Aina, J.O.** (2004). Potential African Substances for Hops in Tropical Beer Brewing. *The Journal of Food Technology in Africa*, 9, 13-16.
- Abbiw, D. K.** (1990). *Useful Plants of Ghana, West African Use of Wild and Cultivated Plants.* Intermediate Technology Publications and Royal Botanical Gardens, Kew, London.
- Ali MY, Paul S, Tanvir EM, Hossen MS, Rumpa NN, Saha M, Bhoumik NC, Islam MA, Hossain MS, Alam N, Gan SH, Khalil MI.** (2017). Antihyperglycemic, antidiabetic, and antioxidant effects of *Garcinia pedunculata* in rats.;2979760. doi: 10.1155 /2017/ 2979760. Epub 2017 Oct 19.
- Al-Otaibi M.** (2004). The miswak (chewing stick) and oral health. *Studies on oral hygiene practices of urban Saudi Arabians.* *Swed Dent J Suppl*
- Ampaire, C.** (2020). *Inside Liberia Forest Sector*
- Angelsen, A., & Wunder, S.** (2003). Exploring the forest–poverty link: Key concepts, issues, and research implications. *Economist*, 40, 68.
- Arnold, J.E.M., & Perez, M.R.** (2001). Can non-timber forest products match tropical forest conservation and development objectives? *Ecological Economics*
- Arnold, J. E. M.; Ruiz-Perez, M. Can.** (2001). Non-Timber Forest Products Match Tropical Forest Conservation and Development Objectives? *Ecol. Econ.* 39, 437–447.

- Asadi SG, Asadi ZG. (1997).** Chewing sticks and the oral hygiene habits of the adult Pakistani population.
- Awachare, C.M., and K.K. Upreti. (2020).** Phenological growth stages in mangosteen (*Garcinia Mangostana* L.) according to the extended BBCH scale. *Ann. Appl. Biol.* 176(1):16–25. doi: 10.1111/aab.12552.
- Ayuk, E. T., Duguma, B., Franzel, S., Kengue, J., Mollet, M., Tiki-Manga, T. and Zenkeng, P. (1999).** Uses, management, and economic potentials of *Garcinia kola* and *Ricinodendron heudelotii* in the humid lowlands of Cameroon. *Journal of Trop. For. Sci.* 11(4): 746-761
- Bahuchet S. 2000.** Cinq ans en Afrique centrale: Une forêt, des peuples, des États. In: Bahuchet S. & Maret P. eds. *Les peuples des forêts tropicales*. Vol. 3, 5-21.
- Bawa, K.S., and J.H. Beach. (1981).** Evolution of sexual systems in flowering plants. *Ann. Mo. Bot. Gard.* 68(2):254. doi:10.2307/2398798.
- Bayol, N., and J.-F. Chevalier. (2004).** Current State of the Forest Cover in Liberia: Forest Information Critical to Decision Making. Final report to the World Bank. *Forêt Ressources Management*. Manguio, France.
- Burkill, H.M. (2004).** *The Useful Plants of West Tropical Africa*. Royal Botanic Gardens, Kew
- Belcher, B. and Schreckenberg, K. 2007.** "Commercialization of Non-timber Forest Products: A Reality Check." *Development Policy Review* 25(3): 355- 377.
- Chatham House Report. (2015).** Trading Illegal Logging and Related Trade: What Progress What Next?
- Cheng Tan, L., M. Ruiz Pérez & M. Ibach. (1996).** *Non-Timber Forest Product Databases*. CIFOR Special Publication, Jakarta, Indonesia.
- Dauby G. (2012).** Structuration spatiale de la diversité intra- et interspécifique en Afrique centrale - le cas des forêts gabonaises. PhD thesis, Université Libre de Bruxelles, Belgium.
- D. Dalziel, J.M. (1937).** The useful plants of west tropical Africa, being an appendix to the flora of West Africa by Hutchinson, J. and J. M. Dalziel. The Crown Agent for the Colonies
- Deshmukh, I.; Kanaan, R.; Flanagan, M.; Litz, V. N. (2009).** *Land Rights and Community*

- Forestry Program: Development of Non-Timber Forest in Sinoe and Nimba Counties.  
Liberia LRCFP: Non-Timber Forest Products. USAID/Liberia, Monrovia, Liberia.
- De Beer J, McDermott M.** (1996). The economic value of non-timber forest products in Southeast Asia, 2nd edition
- Espirito Santo BL , Santana LF , Kato Junior WH , de Araujo F , Bogo D , Freitas KC, Guimaraes RA , Hiane PA, Pott A , Oliveira Filiu WF , Asato MA , Figueiredo PO , Bastos PR.** (2020). Medicinal potential of *Garcinia* species and their compounds. *Molecules*. 25: 4513; doi:10.3390/ molecules 25194513
- Falconer, J.** (1992). Non-Timber Forest Products in Southern Ghana. ODA Series, No. 2. London.
- Falconer, J.** (1990). The local use and value of forests in the West African humid forest zone.
- Falconer, J.** (1991). Non-timber forest products In Southern Ghana. Main Report. Forestry Department of Ghana. Overseas Development Administration
- Food and Agriculture Organization (FAO).** (1998). Asia-Pacific Forestry Commission. Asia Pacific Forestry toward 2010. Report of the Asia-Pacific forestry sector outlook study. Rome
- FAO.** (1995) .Non-Wood Forest Products for Rural Income and Sustainable Development. – Non Wood Forest Products 7. Rome, Food and Agriculture Organization of the United Nations, Rome, Italy.
- FDA.** (2006). National Forestry Policy and Implementation Strategy: Forestry for Communities, Commerce and Conservation. Republic of Liberia, Forestry Development Authority, Monrovia, Liberia.
- Gerrit B.** (1993). The Miswak, an aspect of dental care in Islam Medical History
- Gonmadje C, Doumenge C, McKey D, Tchouto G, Sunderland T, Balinga M, Sonké B.** (2011). Tree diversity and conservation value of Ngovayang’s lowland forests, Cameroon. *Biodiversity and Conservation* 20 (12): 2627-2648. doi: [10.1007/s10531-011-0095-z](https://doi.org/10.1007/s10531-011-0095-z)
- Guedje NM, Fankap R.** (2001). Utilisations traditionnelles de *Garcinia lucida* et *Garcinia kola* (Clusiaceae) au Cameroun. *Systematics and Geography of Plants* 71: 747–758. <http://www.jstor.org/stable/3668714>

- Hosakatte N, Dandin V, Dalawai D, Park SY, Paek K.** (2018). Bioactive compounds from *Garcinia* fruits of high economic value for food and health. *Phytochem. Spr. Nature*; 1: 1-28
- Holbech, L.** (2000). Dental hygiene and livelihood: A case of chewing sticks in Ghana
- Huckell, L.W.; Toll, M.S.** (2004). Wild plant use in the North American Southwest. In: Minnis, P.E., ed. *People and plants in ancient western North America*. Washington, DC: Smithsonian Books: 37–114.
- Ingram, V., Bongers, G.** (2009). Valuation of Non-Timber Forest Product Chains in the Congo Basin. *A Valuation Methodology*.
- Jones, E.T.; McLain, R.J.; Lynch, K.A.** (2004). The relationship between nontimber forest product management and biodiversity in the United States. Report prepared for the Commission for Science on Sustainable Forestry.  
<http://www.ifcae.org/projects/ncssf1/index.html>.
- Joseph, K.S., and H.N. Murthy.** (2015). Sexual system of *Garcinia indica* Choisy: Geographic variation in trioecy and sexual dimorphism in floral traits. *Plant Syst. Evol.* 301(3):1065–1071. doi: 10.1007/s00606-014-1120-y
- Joseph GS, Jayaprakasha GK, Selvi AT, Jena BS, Sakariah KK.** (2005). Antiaflatoxic and antioxidant activities of *Garcinia* extracts. *Int J Food Microbiol*
- Juliani, H. R.; Amekuse, L.; Asante-Dartey, J.; Govindasamy, R.; Simon, J. E.** (2003). Non-Timber Forest Products: An Ethnobotanical Survey and Value Chain Study. *People, Rules and Organizations Supporting the Protection of Ecosystem Resources (PROSPER)*, USAID/Liberia, Monrovia, Liberia.
- Kpadehyea, J. T.; Fernando, E. S.; Tinio, C. E.; Buot, I. E.** (2015). Ethnobotany Survey of the Wonegizi, Ziama Clan-Lofa County, Liberia. *J. Biol.*, 11, 165–175.
- Lee, H.S., Ashton, P.S., Yamakura, T., Tan, S., Davies, S.J., Itoh, A., Chai, E.O.K., Ohkubo, T., LaFrankie, J.V.** (2002). The 52-hectare forest research plot at Lambir Hills, Sarawak, Malaysia: tree distribution maps, diameter tables, and species documentation. Forest Department Sarawak & The Arnold Arboretum-CTFS Asia Program.

- Lomax, T.** (2008). Forest Governance in Liberia: An NGO Perspective. SDI/FERN, Monrovia, Liberia.
- Manvell, A.** (2011). Use of Non-Timber Forest Products around Sapo National Park, Liberia. Technical Report. Fauna and Flora International. Monrovia, Liberia.
- Matson, R.G.; Coupland, G.C., eds.** (1995). The prehistory of the Northwest Coast. San Diego: Academic Press. 364 p
- Mbakwe, R. C.** (1983). A special form of wood utilization in Africa and its effects on the forest. `Forest Archives 54: 6- 228.
- McCullough, J. (ed.).** (2004). A Rapid Biological Assessment of the Forêt Classée du Pic de Fon, Simandou Range, Southeastern Republic of Guinea. RAP Bulletin of Biological Assessment 35. Conservation International. Washington, D.C.
- Methot, P. and Veit, P.** (2008). Community Forestry, Forestry Tax Redistribution, and Social Agreements – Lessons for Liberia, World Resources Institute; In Liberia Land Rights and Community Forestry Program: 11 Community Forestry in Liberia – Learning from Experience Elsewhere.
- Millennium Ecosystem Assessment, MEA.** (2005). Ecosystems and human well-being: Opportunities and challenges for business and industry. Washington, D.C.: World Resources Institute. Washington, DC, USA.
- Mittermeier, R.A., P. Robles Gil, M. Hoffmann, J. Pilgrom, T. Brooks, C.G. Mittermeier, J.**
- Murthy HN, Dalawai D, Dewir YH, Ibrahim A.** (2020). Phytochemicals and Biological Activities of *Garcinia morella* (Gaertn.) Desr.: A Review. *Molecules*. 25(23): 5690. doi: 10.3390/molecules25235690.
- Lamoreux and G.A.B. da Fonseca (eds.).** (2004). Hotspots Revisited. Earth’s Biologically Richest and Most Endangered Terrestrial Ecoregions. CEMEX/Agrupación Sierra Madre, Mexico City
- Moerman, D.** (1998). Native American ethnobotany. Portland, OR: Timber Press. 927 p.
- Mohanan N, Shaju T, Rajkumar G, Pandurangan AG.** (1997). Rediscovery of *Garcinia imberti* Bourd. (Clusiaceae), a little-known endemic species of Western Ghats. *Indian Journal Forestry* 20 (4): 383- 385

**Mshana, N. R., Abbiw, D. K., Addae-Mensah, I., Adjaouhoun, E., Ahyi, M. R. A., Ekpere, J. A., Enow-Orock, E. G., Gbile, Z. O., Noamesi, G. K., Odei, M. A., Odunlami, H., OtengYeboah, A. A., Sarpong, K., Ouédraogo, A. and Boffa, J.** (1999). Vers une approche régionale des ressources génétique forestières en Afrique sub-saharienne. Actes du premier atelier régional de formation sur la conservation et l'utilisation durable des ressources génétiques forestières en Afrique de l'Ouest, Afrique Centrale et Madagascar, 16-27 Mars 1998, Centre National de Semences Forestières CNSF, Ouagadougou, Burkina Faso. IPGRI, Rome, 299.

**Myers, N., R.A. Mittermeier, C.G. Mittermeier, G.A.B. da Fonseca and J. Kent.,** 2000.

Biodiversity hotspots for conservation priorities. *Nature* 403: 853–858.

**Sotowora A., and Tackie, A. N.** (2000) Traditional Medicine and Pharmacopoeia: Contribution to the Revision of Ethnobotanical and Floristic Studies in Ghana. OAU/STRC. Inst. For Scientific and Technological Information, Accra.

## APPENDIX A

### FOCUS GROUP QUESTIONNAIRE

#### I- SOCIAL ASPECT

Date: \_\_\_\_\_

District: \_\_\_\_\_

County: \_\_\_\_\_

Name of town: \_\_\_\_\_

Main activities of the participants: \_\_\_\_\_

#### Forest Importance and modes of Income

1. Why is the forest important to you? \_\_\_\_\_

2. What modes of income exist in the region and how important are they in percentages? (for example, fishing, mining, poaching, small trade, NTFPs collection, etc

| Mode of income |
|----------------|
|                |
|                |
|                |
|                |
|                |
|                |

3. What is the status of the place where people collect *Garcinia afzelii* (Please specify)?

1. Protected Area

2. Non-protected Area

1. a. Community forest

2. a. Open Forest

1. b Sacred area

1. c communal forest



**ENVIRONMENTAL**

- 1. Is there much *Garcinia afzelii* available in or around your town? [\_\_\_] 1=Yes, 0= No b.
- 2. Has this changed over the last three years? [\_\_\_] 1=Yes 0= No c. If yes, how? [\_\_\_] 1= decreased, 2 = increased 3= others (specify): \_\_\_\_\_
- 3. What techniques of storage for *Garcinia afzelii* do you use so that it stays good as long as possible? \_\_\_\_\_

**Garcinia afzelii SOCIAL**

- 1. a. What percentage of the people is involved in *Garcinia afzelii* exploitation and trade in your community? [%] \_\_\_\_\_
- b. What does the remaining percentage of the people? \_\_\_\_\_
- 2.a With whom do you trade mostly? (Specify): \_\_\_\_\_
- b. Are they mostly men or women? \_\_\_\_\_
- c. With whom do you prefer to trade (Specify): \_\_\_\_\_
- Why? \_\_\_\_\_
- 3. Do people have some restrictions as to where you collect *Garcinia afzelii* [\_\_\_] 1. Yes 2. No
- b. If yes, why \_\_\_\_\_
- 4. Do you people pay fees/taxes to enter the Forest? [\_\_\_] 1. Yes, 0. No
- b. If yes: How much? .....
- c. Do you know why you have to pay? [\_\_\_] 1. Yes, 0. No Please Explain \_\_\_\_\_
- 5. Are there any communal benefits resulting from *Garcinia afzelii* activity in your area? 1. Yes, 0. No [ ] Please specify if yes: \_\_\_\_\_ (for example Road construction; Town hall; hand pump, Construction of schools; Assistance to school pupils/students; etc)
- 6. What are the three main uses of income generated from *Garcinia afzelii*?

**IV- CONSTRAINTS IN THE *GARCINIA AFZELII* FIELD**

1. What are the main problems with *Garcinia afzelii*?

a. \_\_\_\_\_

b. \_\_\_\_\_

2. And what would you suggest as solutions?

a.....

b.....

2. Any other comments? \_\_\_\_\_

**THANK YOU VERY MUCH!**

## APPENDIX B

### QUESTIONNAIRE FOR HARVESTERS

I am **Ben B. Tally**, a master's student at the International University of Andalucía, Baeza, Spain. I am doing a master's degree research on "Assessing *Garcinia afzeli* Harvest and Trade: Case Study of Southeast Liberia". In other words, this questionnaire is solely for academic purposes. Therefore, please feel free to fill out the questionnaire or answer the questions because all information you provide will be kept secret. Do not write your name. Thank you very much.

#### I – General Information

1. Date of interview \_\_\_\_\_
2. County: \_\_\_\_\_ 3. District: \_\_\_\_\_ 4. Village /town \_\_\_\_\_
5. Age: 18-35 [ ]; 35-45 [ ]; 50+ [ ]
6. Sex Male [ ]; Female [ ]
7. Marital status: [ ] i. Divorced; ii. Widow; iii. Single; iv. Married
8. Number of household members: Boys [ ]; Girls [ ]; Women [ ]
9. Level of education: [ ] 0. None, 1. Elementary, 2. Junior high, 3. Senior high, 4. University
10. Position occupying in the community: Chief [ ]; Traditional leader [ ]; Youth member [ ]; Community forest member [ ]; Teacher [ ]; Community member [ ]; Others (specify) \_\_\_\_\_
11. Indicate 5 of your most important sources of income.

| Rank | Sources of revenue |
|------|--------------------|
| 1.   |                    |
| 2.   |                    |
| 3.   |                    |
| 4.   |                    |
| 5.   |                    |

\*1. Agriculture (Subsistence farming); 2 = Sale of NTFPs; 3 = Poaching; 4 = Artisanal gold mining; 5= Small trade; 6 = Fishing 7 = Motorbike riding; Others (to specify):\_\_\_\_\_

## **II – Access to Forest Resources**

1. Are there areas of the forest where you are not allowed to collect *Garcinia afzelii* from? Yes [ ] No [ ].

If yes, what type of area and why? \_\_\_\_\_

2. Have you ever paid any fee for entering the forest? Yes [ ] No [ ]

If yes, to whom? \_\_\_\_\_

How much and why? \_\_\_\_\_

3. Have there been changes in access/rights to the forest? Yes [ ] No [ ]

If yes, explain. \_\_\_\_\_

## **III – Harvesting**

1. For how long have you been harvesting *Garcinia afzelii*? \_\_\_\_\_

2. How do you harvest *Garcinia afzelii* (method)? \_\_\_\_\_

## **IV – Social capital (organization)**

1. What quantities of *Garcinia afzelii* tree did you gather during the last campaign or season?  
\_\_\_\_\_

2. If you gather *Garcinia afzelii*, where do you gather them? [ ]

i. Fallow farms

ii. Secondary Forest

iii. Primary Forest

iv Protected area

3. In the course of the last 12 months, what are the 3 main expenditures that you have undertaken with the money generated by *Garcinia afzelii* activities?

a. \_\_\_\_\_ b. \_\_\_\_\_ c. \_\_\_\_\_

**V – Transportation facilities, Distances, and Costs**

1. What transport means do you use during your activities related to *Garcinia afzelii*? [ ]

i. Motorbike; ii. Car; iii. Canoe; Other (specify)\_\_\_\_\_

**VI – Change of Forest Cover and Management practices**

1. Based on your observations from the last 3 years has the forest area removed around your village changed? [ ]

i) increased ii) diminished iii) Has not changed iv) Not sure. Why? \_\_\_\_\_

c. Can you give us some indicators that confirm your observation? \_\_\_\_\_

d. In case of reduction, according to you does there exist any relationship between reduction of the forest cover and the availability of *Garcinia afzelii* (State this relationship please)

\_\_\_\_\_

**THANK YOU VERY MUCH!**

## APPENDIX C

### QUESTIONNAIRE FOR TRADERS/EXPORTERS OF *GARCINIA AFZELII*

I am **Ben B. Tally**, a master's student at the International University of Andalucía, Baeza, Spain. I am doing a master's degree research on "Assessing *Garcinia afzeli* Harvest and Trade: Case Study of Southeast Liberia". In other words, this questionnaire is solely for academic purposes. Therefore, please feel free to fill out the questionnaire or answer the questions because all information you provide will be kept secret. Do not write your name. Thank you very much.

Date of interview: \_\_\_\_\_

#### I. General Information

1. Date of interview \_\_\_\_\_
2. Country of origin: \_\_\_\_\_
3. Nationality: i) Liberian [  ] ii Non-Liberian [  ] Other(Specify) \_\_\_\_\_
4. Age: 18-34 [  ]; 34-49 [  ]; 50+ [  ]
5. Sex Male [  ]; Female [  ]
6. Marital status: [  ] i. Divorced; ii. Widow; iii. Single; iv. Married
7. Number of household members: Boys [  ]; Girls [  ]; Women [  ]
8. Level of education: [  ] 0. None, 1. Elementary, 2. Junior high, 3. Senior high, 4. University

#### II. Household Sources of Income

1. Indicate 5 of your most important sources of income.

| Modes of income | Rank |
|-----------------|------|
|                 |      |
|                 |      |
|                 |      |
|                 |      |

|  |  |
|--|--|
|  |  |
|--|--|

2. How many people in your household benefit from the income generated from the *Garcinia afzelii* trade? \_\_

**III. Organizational Aspects and profit distribution**

1. Do you belong to any union of traders/exporters? 1. Yes [ ] No [ ]

2. Since you started trading/exporting *Garcinia afzelii*, what are the most important things you have used the money generated from *Garcinia afzelii*?

| Rank | Utilization |
|------|-------------|
| 1    |             |
| 2    |             |
| 3    |             |
| 4    |             |
| 5    |             |

**V – Access to forest resources**

1. Are there areas of the forest where you are not allowed to collect *Garcinia afzelii* from? Yes [ ] No [ ].

If yes, what type of area and why? \_\_\_\_\_

2. Have you ever paid any fee for entering the forest? Yes [ ] No [ ]

a. If yes, to whom? \_\_\_\_\_

b. How much and why? \_\_\_\_\_

3. From whom do you get your supplies of *Garcinia afzelii*? \_\_\_\_\_

4. What period of the year do you purchase *Garcinia afzelii*? \_\_\_\_\_

3. Have there been changes in access/rights to the forest? Yes [ ] No [ ]

If yes, explain. \_\_\_\_\_

**VI- Transportation means**

1. What modes of transport do you use to transport your harvested *Garcinia afzeli*?

i. Road transport [    ]; ii. River transport [    ]

**THANK YOU VERY MUCH!**