MANAGEMENT STRATEGIES OF *ELAEIS GUINEENSIS* (OIL PALM) IN
RESPONSE TO LOCALIZED MARKETS IN SOUTH EASTERN GHANA, WEST
AFRICA

By

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submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN FORESTRY

MICHIGAN TECHNOLOGICAL UNIVERSITY

2000
The thesis, “Management Strategies of *Elaeis guineensis* (Oil Palm) in Response to localized markets in south eastern Ghana, West Africa,” is hereby approved in partial fulfillment of the requirements for the Degree of MASTER OF SCIENCE IN FORESTRY.

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PREFACE

This study was developed and conducted in Peace Corps service from 1997-1999. My primary assignment was the management of a tree nursery and agroforestry extension.

Ghana has a literacy rate of about 40% (presumably lower in rural areas), and consequently, many people do not understand the official language, English. Therefore, in order to disseminate agroforestry information, either one must use an interpreter, which can partially sacrifice a personal relationship an extension agent should have with the farmers, or learn the local language.

For this reason, I made a considerable effort in acquisition of the E£e language. This is the reason that many E£e words are found throughout this document. Some items and ideas in the E£e language can take an entire phrase to represent the concept. In this cases the E£e word is described once, then used exclusively.

Use of E£e words also reflects subtle differences not recognized in English. For example, dzomi and amidze would both be called palm oil in English, although the differences in processing render these oils edible or inedible in E£e culture.

To facilitate the reading, a glossary has been included at the end of the text.
# TABLE OF CONTENTS

LIST OF FIGURES AND ILLUSTRATIONS………………………………………. v
ABSTRACT……………………………………………………………………… vi

 CHAPTER 1 INTRODUCTION………………………………………………… 1
   STUDY AREA…………………………………………………………….. 2

 CHAPTER 2 BACKGROUND……………………………………………….. 8
   DESCRIPTION OF OIL PALM………………………………………. 8
   HISTORY OF OIL PALM IN GHANA……………………………. 17
   USES OF PALMS…………………………………………………….. 21
   CULTURAL ASPECTS……………………………………………… 32
   THE FARMING SYSTEM………………………………………… 34
   COOPERATIVES………………………………………………………… 45

 CHAPTER 3 METHODS…………………………………………………….. 47
   EXPERIMENTAL PROCESSING……………………………………… 49
   INTERVIEWS…………………………………………………………… 58
   YIELD REGRESSION………………………………………………… 59

 CHAPTER 4 RESULTS & DISCUSSION……………………………………. 60
   PROCESSING RESULTS……………………………………………… 60
   LOCAL PERCEPTIONS……………………………………………… 81
   TYPES OF PALM MANAGEMENT………………………………… 88
   REGRESSION ANALYSIS………………………………………….. 96

 CONCLUSION……………………………………………………………… 98

 LITERATURE CITED…………………………………………………………… 101

 APPENDIX 1 - GLOSSARY…………………………………………………. 104

 APPENDIX 2 – LIST OF KEY INFORMANTS ……………………………. 107

 APPENDIX 3 – TREE TAPPING DATA …………………………………… 109
LIST OF FIGURES AND TABLES

FIGURE 1. AFRICA MAP................................................................. 4
FIGURE 2. GHANA MAP............................................................... 4
FIGURE 3. HISTORICAL OIL PALM BELT...................................... 10
FIGURE 4. NEW OIL PALM BELT.................................................. 10
FIGURE 5. THE PALM NUT........................................................... 14
FIGURE 6. PALM FRUITING.......................................................... 14
FIGURE 7. THE LEAF................................................................. 16
FIGURE 8. PALM OIL................................................................. 24
FIGURE 9. PALM KERNEL OIL..................................................... 24
FIGURE 10. MARKET USES OF FRONDS...................................... 27
FIGURE 11. HOUSEHOLD USES OF FRONDS................................. 27
FIGURE 12. PALM WINE............................................................. 29
FIGURE 13. DISTILLATION.......................................................... 30
FIGURE 14. PALM FELLING.......................................................... 31
FIGURE 15. PREPARATION FOR TAPPING..................................... 31
FIGURE 16. FALLOW SYSTEM..................................................... 36
FIGURE 17. TREES IN FARM SYSTEM.......................................... 39
FIGURE 18. PALM OIL PROCESSING............................................. 52
FIGURE 19. PALM KERNEL PROCESSING...................................... 52
FIGURE 20. LEAF PROCESSING.................................................... 54
FIGURE 21. BURNING PALMS FOR TAPPING.................................. 57
FIGURE 22. TAPPING OF PALMS.................................................. 57
FIGURE 23. PALM NUTS FOR SALE............................................. 61
FIGURE 24. REFINED PALM OIL.................................................. 64
FIGURE 25. PALM KERNEL CRACKING MACHINE........................... 66
FIGURE 26. PALM KERNEL HAND CRACKER.................................. 66
FIGURE 27. RETAILING OF PALM KERNEL OIL............................. 69
FIGURE 28. FRONDS FOR SALE.................................................. 71
FIGURE 29. F/JPolo FOR SALE AS FUEL........................................ 74
FIGURE 30. F/JPolo AS FUEL IN DISTILLATION............................. 78
FIGURE 31. OIL PALM PLANTATION MANAGEMENT......................... 91
FIGURE 32. MULTIPLE USE MANAGEMENT.................................... 92
FIGURE 33. MULTIPLE USE MANAGEMENT.................................... 93
FIGURE 34. DENSE GROVE MANAGEMENT..................................... 95

TABLE 1. SUCCESSION OF PALM GROVES................................. 12
TABLE 2. PALM OIL COST/BENEFIT........................................... 64
TABLE 3. PALM KERNEL OIL COST/BENEFIT................................ 69
TABLE 4. FROND PRODUCT COST/BENEFIT.................................. 73
TABLE 5. PALM WINE TAPPING COST/BENEFIT............................... 79
TABLE 6. DISTILLING COST/BENEFIT........................................... 79
TABLE 7. REGRESSION VARIABLES............................................. 97
TABLE 8. REGRESSION ANALYSIS............................................... 97
ACKNOWLEDGEMENTS

First and foremost I have to thank my advisor Blair Orr, for everything he has taught me about development, for checking me when I thought I knew everything about development, and for completely exhausting the phrase “write frantically”. I must also thank the remainder of my committee: Glen Mroz, Susan Martin, and Ann Maclean, for encouragement and praise, both warranted and otherwise.

Across the Atlantic, primary appreciation goes to Lawrence Kofitse Dzidza, for his help in the execution of this study, as well as for teaching me the E¿e language and culture, and also for being an enlightened individual in a place where many things don’t make sense. Nye bro, novinye, gb]gb] desiade na yrawo. Other key inspirations in the development of my E¿e persona were W]lasî E.K. Datey, Sista Comfort, Yayra Agbozu, and the staff of the Dekpor CCFI Tree Nursery.

Among Peace Corps staff, I would like to thank Eloise Parker, without whom I would probably still be bogged in the bureaucracy of the application process to this day. In Peace Corps Ghana I would like to thank both of my APCD’s, Ben Baah and Aba Sey, for being there just enough.

Last and most definitely not least, I, and every other Peace Corps Ghana volunteer, have Joe Goodwin Jr. to thank for his contribution to sanity maintenance. His generosity is paralleled only by his wit and good nature.
ABSTRACT

West Africa was the leading producer of palm oil in the world at the turn of the century. The palm oil market was based on naturally regenerated groves of *Elaeis guineensis* (oil palms). An increase in population growth created more demands for land for subsistence crops, limiting the space available for oil palm cultivation. There has also been an increase in the demand for palm wine for the distillation of local alcohol (*akpeteshi*). Collection of palm wine necessitates felling of the tree. Both of these factors led to a decrease in the number of harvestable palms. The areas of palm production for export have shifted north in Ghana from where the natural palm groves once existed. The palm plantations in this new oil palm area now supply Ghana’s contribution to world markets.

In the former areas of palm production, local demands of oil palm products remain. These products include two types of palm oils, leaf fibers, as well as palm wine and *akpeteshi*. The disappearance of natural groves limits the supply of raw materials to processors, and ultimately caused a shift in management strategies for the people of southeastern Ghana. The objective of this study is to describe the role oil palm in southeastern Ghana. This includes identifying the palm products, conducting a cost-benefit analysis of each, and describing the ways farmers manage oil palm. It is found that farmers prefer to manage local varieties of oil palm for palm wine and alcohol production instead of investing more resources into improving cultivation for oils.
Aha me k] na wua tre o.

Eğegbe Ludodo

Palm wine cannot be taller than its calabash.

Ewe Proverb
Detumakpali be yetu `o `o na de.

Eğegbe Ludodo

The emerging palm flower says that it arrived before the ripe palm nut.

Ewe Proverb
Chapter 1 Introduction

*Elaeis guineensis* (Jacq.) is an important oil producing crop throughout the world. Oil palm has a high oil content and the highest potential of oil yield per acre when compared to other vegetable oils (Anyane 1961). At the turn of the century, West Africa was the center of palm oil production. Palm oil and, later, palm kernel oil were used in soap, candles, and early margarine production. Today, oil palm is cultivated around the world, with large plantations in both the East Indies and Central America.

In West Africa, palm oil is the main source for filling the fat and oil requirements in the diet. Non-edible products are made from palm kernel oil. There are other oil palm products which are of cultural, domestic, and local economic value. These are referred to as by-products in the plantation industry.

The most noted of these products is palm wine. Palm wine is tapped from the xylem flow of the meristem. An alcoholic spirit is distilled from tapped palm wine. In certain places of Africa, a method called standing tapping exists. Standing tapping does not kill the tree. The tapping method in Ghana, fell tapping, requires the felling of the tree which kills the tree, ceasing production of the palm fruits. In Ghana, Togo, and Benin, the fell tapping method is preferred. Ideally, this tapping is done well after the 15-year peak period of production of nuts, when the tree is fully mature. In the southern Volta Region of Ghana, however, it was observed that the trees are harvested much earlier, before the palm is taller than the person who taps it. This is in the first few years of peak nut production, or shortly after fruiting has begun.
Products made with the leaves of the palm use the fibrous leaf stalk. Baskets and
other household items are the most common. These products have generally been
neglected as oil palm products. In areas where palm management fells immature trees,
the palm fronds have now become more scarce than in the past. The leaves themselves
have thus become a commodity sold to basket weavers. Leaves are also pruned to make
room for annual cereal crops. Leaf pruning is locally reported to adversely affect palm
nut production.

While palm oil is the main commodity of oil palm worldwide, farmers in the
southeast Ghana seem to manage against palm nut production. By continually pruning
leaves and felling at an early age, the farmers not only choose to forego a steady annual
income which could come from the seasonal harvest of palm nuts, but sacrifice
continuous increasing value of the standing tree for wine. The purpose of this study is to
examine what causes the local people to manage palms in ways which seem to decrease
the value of the tree for its fruit. In doing this, management strategies for the oil palm
will be defined.

Study Area

This study was centered in the town of Dzodze, Volta Region, in the southeast
corner of the Republic of Ghana. Ghana was the first African country to achieve
independence from colonial administration in 1957. “Ghana” replaced the name of the
former British Protectorate ‘The Gold Coast’. This name was chosen to signify the
emulation of the great Empire of Ghana, which is actually quite removed geographically
from modern day Ghana. Because of its promising economic situation at the time of independence, it was known as the Black Star of Africa. Because of the failure of the cocoa industry after independence and a series of political coups, Ghana has failed to live up to this expectation.

Ghana is located in the center of West Africa, bordered by Togo, Burkina Faso, and Côte d’Ivoire, with 529 km of coastline on the Gulf of Guinea (Figures 1 and 2). Natural resources are dominated by gold, hence the colonial name the Gold Coast. Today, Ghana has the only West African company- a gold mining company- on the New York Stock Exchange. It is also a notable producer of electricity generated by the Akosombo Dam, which has created the largest man made lake in the world, Lake Volta.

Agricultural production includes cocoa (35% of exports), timber (9.4%), cassava, peanuts, maize, shea nuts, and bananas. Sixty-one percent of the population is employed in the agricultural sector. While Ghana has twice the gross domestic product of other West African countries, over 30% of the population remains under the poverty line. Per capita annual income is $ 462.80 (CIA, 1999).

Ghana is populated by over 75 linguistically and culturally separate groups, the southern majority being Akans (Ashantis, Brongs, Ahafos, Fantis and Twi-speaking people), followed by Gas, Adangmes, Nzimas, and Ewes. This cultural mishmash is indicative of modern day Africa’s political boundaries, a direct result of haphazard colonial fragmentation.

The cultural group which inhabits the study area, Ewe, is said to have migrated across modern Togo and Benin from Nigeria. Consequently, the Ewes are spread across
the southern portions of neighboring Togo, Benin, and parts of southwestern Nigeria. During the time of voting for independence, Ghanaian Ewes were undecided whether

Figure 1 – Africa  (http://www.lib.utexas.edu)
they should be a part of the newly forming Ghana, or join French controlled Togo. It was decided by popular national vote that the Volta Region would become part of Ghana.

The subject matter of this study was chosen partially because of the indigenous knowledge attributed to the culture. E‡e knowledge of oil palms dates back to the E‡e migration from modern day Nigeria, where E‡e oral tradition traces their roots. The Niger River delta could be argued to be the major oil palm producing area in all of West Africa. Given their historical management and manipulation of palms, the E‡es are renowned as the expert palm wine tappers and distillers in Ghana. The area in which they inhabit also has a history as a major palm oil and kernel producing area, and at one time served as a major source of palm oil for export to European markets.
Ghana has a diverse climate, from tropical rainforest in the southwestern corner to a Sahelian climate in the northeastern corner. Rainfall ranges from over 2500 mm/year in the former to under 600 mm per year in the latter. Rainfall across West Africa generally falls into four seasons. The major rainy season lasts from March to June. This is when the bulk of farm activities take place. This period is followed by a hot dry season lasting until about August. A minor rainy season occurs from October to early December, when supplementary cultivation takes place. The period from December to February is called the Harmattan. This is a southwesterly wind which brings dry air and dust down from the Sahara Desert.

The bi-modal rainfall pattern ranges in precipitation resulting in 1000 mm to 1800 mm per year along the coast. The Harmattan blocks sunlight and cools temperatures from December to February, although it is not as severe in the study area as in Northern Ghana (Agbodeka, 1997).

Ecotypes can be delineated in lateral striations running parallel with the coast. A coastal savanna runs along the coast, ranging in breadth from 0 to 50 miles. North of this savanna is the forest region, which in times of low population pressure was high tropical forest. This forest zone reaches the coast in the Southwest corner of the country. Continuing north, average annual rainfall decreases, from sub-Sahelian to Sahelian climates (Berry 1994).

Dzodze, the center of the study area, is in the coastal savanna, although oral tradition tells of heavily forested areas which once occurred in the area. Less then five miles north of Dzodze, the names of the villages indicate that the area was once considered forest (*Ave Afidenyiga, Ave Dakpa*; where *Ave* = forest). A better term used
to describe the cover type would be “medium productivity West African cultivation and forest mosaic” (Millington et al. 1994). This area developed from the cropping and fallowing system of agriculture in a “semi-deciduous Guineo-Congolian rain forest” (Millington et al. 1994), as is common throughout West Africa.

This study is an examination of the oil palm in Southeastern Ghana. The study is broken into two parts. The first half of the study examines how the people in the Dzodze traditional area make use of the oil palm plant to supply needs in their diet, households, and culture. The remainder of the study will deal with how palm individuals and populations are managed in order to fill these needs.

The next chapter will provide a background of palms in the study area. First, the phenology of the palm will be described in order to understand the structure of palms, how they appear in the landscape, and how they are used. Then the oil palm in the local situation will be explained. This will include an overview of the palm industry and trade in Ghana, as well as describe the non-industrial use and the role of oil palm products in the local economy. In this, a description of the development of the social influences surrounding the distillation of palm wine is included. The remainder of background information defines the farming and land tenure system in the study area, and the role of oil palm in each.

Chapter 3 describes the methods employed in gathering data for this study, both quantitative and qualitative. In describing how data was collected, the indigenous processing of palm products are described. These are based on observations by the author. The method employed in understanding the processors’ perceptions of the market
is also explained. Finally descriptions of the interviews with local farmers in response to palm markets are described.

Chapter 4 shows the results and discussion of the study. The first section is a financial cost-benefit analysis of palm processing. This includes the perceptions of the palm markets by palm processors gleaned from interviews. The results of the farmers’ perceptions of how to manage palm populations on the farm are then explained. The discussion of the study focuses on this aspect, and three different palm management strategies are defined.
Chapter 2 Background

This chapter provides background for the species *Elaeis guineensis*, and its use in Ghana. This begins with a description of the parts of the oil palm which have economic relevance. The next section describes how the indigenous people use these individual parts of the plant. This is followed by a brief history of the oil palm economy in the study area, including changes in Ghanaian culture in this century which has changed the way in which palms are managed. Finally, the farming system and land tenure system in the area are described as they apply to oil palm.

Description of Oil Palm

Palms appear tree like, but grow differently than hardwoods and conifers. Palms are classified in the family Palmae, lacking the aboreal characteristic of wood, bark and cambium, though they are still frequently referred to as trees (Thomas 2000). The oil palm is a monocotyledon, which grows from the center. It produces one leaf at a time, emerging from the apex, with the leaflets folded against each other. It then spreads its leaflets as photosynthetic ability of the individual leaf develops. A palm can live up to sixty-five years and reach a height of 20 meters (Hartley 1988). In Ghana, it begins to fruit in the fourth year of growth, though genetic manipulation has reduced this in plantation areas (Blaak 1972).
There have been claims for the origin of the oil palm in both Africa and the Americas. The discovery of deposited fossil *Elaeis* pollen grains deep in the Niger River Delta, however, seem to point towards a West African origin (Zeven 1964, Schultes 1990).

In West Africa, oil palm ranges from Senegal along the coast of West Africa to the modern day Congo. In the Congo river valley, the range extends inland almost reaching Lake Tanganyika. Pockets of intentional cultivation have also been developed farther south of the original range, reaching as far as Madagascar (Hartley 1988).

A belt of oil palm areas originally existed along the coast of Ghana ranging 8 to 60 km wide, between the latitudes of 5 and 7 degrees N. There were four main centers of production (Anyane 1961). From west to east these were centered around Sekondi, Winneaba, Krobo, and Dzodze. Today, however the concentration of oil palm production has shifted to a different area, located to the north of the old belt because of the environmental demands of the oil palm (Figures 3 & 4 from Gyasi 1992).

For oil palm production, the ideal climate includes over 2,000 mm of evenly distributed rainfall per year, and with no marked dry seasons. With a mean annual rainfall of less that 1800 mm per year, the Dzodze area has less than the optimal precipitation for oil palm fruit production.

The palm was able to flourish in a non-optimal area because of the successional regime to which oil palm has adapted. The palm is an early successional plant, which grows in climates which are suitable for high tropical forest. Therefore, oil palms are only able to establish in the forest climate either on river banks or where an opening is created to allow sufficient sunlight.
Figure 3 – Historical Oil Palm Belt  (Gyasi 1992)

Figure 4 - New Oil Palm Belt  (Gyasi 1992)
In forested areas, oil palm cannot occur in the shade of the larger trees. A disturbance must occur to open the canopy for germination. In West Africa, a common disturbance is the clearing of vegetation for cultivation. The palms then thrive in the opening as the farmer moves to cultivate other plots. Old fields and associated palms are eventually succeeded by the high forest. In this manner, man develops a symbiotic relationship with the palm. As human population pressure grows, the periods between cultivation are shortened, initially insuring the survival of palms because the high forest cannot regenerate. As population continues to increase, however, fallow periods shorten so that eventually the palms which are filling the forest canopy gaps need to be felled for cultivation of food crops. This process is summarized in Table 1.
Table 1 – Composition of Palm Groves in response to Population Pressure.
Adapted from Zeven, 1937.

<table>
<thead>
<tr>
<th>Pop/ km²</th>
<th>Palms/ha</th>
<th>Grove Type</th>
<th>Cropping system</th>
<th>Characteristics</th>
<th>Palm regeneration</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>1-75</td>
<td>Secondary Forest with oil palms</td>
<td>Shifting Cultivation 20&gt;100 year fallow.</td>
<td>Rotational clearing of 20-30 year old secondary forest is preferred to clearing of old growth. Soil fertility is regenerated. Considered underfarmed.</td>
<td>Oil palms can generate from seed abandoned in abandoned, and are left to stand during next clearing. Palms are at risk of being overtopped by forest growth.</td>
</tr>
<tr>
<td>15-90</td>
<td>25</td>
<td>Palm Bush</td>
<td>Shifting Cultivation 8-25 year fallow.</td>
<td>Multiple years farming on one plot Under- to moderately farmed.</td>
<td>Generated on abandoned compounds. Longer period of cultivation means less chance of competition from competing forest.</td>
</tr>
<tr>
<td>80-220</td>
<td>125-150</td>
<td>Dense grove/ farmland with or without palms</td>
<td>Bush fallow rotation 5-10 year fallow</td>
<td>1 ½ year cultivation. Fallow is to short to completely restore fertility to original, although land is still fertile. Some construction of permanent homesteads.</td>
<td>Generated in abandoned compounds or newly built homesteads. Dense even age groves with self competition. Little regeneration.</td>
</tr>
<tr>
<td>200-325</td>
<td>No more than 100</td>
<td>Thinned grove</td>
<td>Bush fallow rotation. 3-8 year fallow</td>
<td>1 ½ year cultivation. Continued shorting of fallow continues to decrease fertility. More or less settled into permanent homesteads</td>
<td>Some generation and/or planting in homesteads. May begin to clear palm groves for cultivation.</td>
</tr>
<tr>
<td>200-325</td>
<td>No more than 100</td>
<td>Sparse grove</td>
<td>Bush fallow rotation. 3-8 year fallow</td>
<td>1 ½ year cultivation. Continued shorting of fallow continues to decrease fertility</td>
<td>Felling and dying are counteracted by self sowing and some natural regeneration in grove gaps and homesteads.</td>
</tr>
<tr>
<td>&gt;300</td>
<td>No more than 100</td>
<td>Village grove</td>
<td>Bush fallow rotation. 3-8 year fallow</td>
<td>1 ½ year cultivation. Very low fertility “derived savanna”. Often swept by fire. Multiple homesteads make up villages.</td>
<td>Fire regime retards palm germination. Palms generally only germinate or are planted in proximity of village.</td>
</tr>
<tr>
<td>&gt;300</td>
<td>Up to individual spacing.</td>
<td>Peasant plantation</td>
<td>Bush fallow rotation with planted palms integrated</td>
<td>Can be established in any of the grove stages</td>
<td>Can be planted with stemless palms transplanted from other groves, nursery raised palms, and some naturally germinated.</td>
</tr>
</tbody>
</table>
The Fruit

The fruit (referred to as palm nut) is a drupe which number in the hundreds. These occur in bunches that develop from a node at the base of the petiole of the leaf. The fruit consists of two main parts, the pericarp and the endocarp. The pericarp, which surrounds the seed, consists of exocarp (skin or shell) and mesocarp (pulp or fiber). The endocarp is the viable seed, which is planted for germination. It is composed of a whitish kernel and its shell (Figure 5). The pericarp produces the more palatable palm oil (dzomi). From the endocarpic kernel, kernel oil (ne fimi) is processed.

The oil palm is monoecious. There is no economic use for the male flower of the plant, although it is said to be an indicator of wine production. A palm with a large number of male inflorescences is said to contain relatively little wine (Konkogbui personal communication). The female inflorescence is where fruiting occurs (Figure 6). A fertilized female flower becomes a bunch (know as eta [head] in Ewe, probably because of it’s comparable size to a human head). A bunch has several spikletes to which the individual fruits are attached. Individual fruit shapes vary from spherical to ovoid, often seemingly adjusting to the shape of the adjacent fruit. It ranges in size from 2 to 5 cm, and weighs from 3 to 30 grams and varies in color from bright red to a deep purple on the exposed section of the ripe fruit, with a lighter shade of red, orange, or yellow on the encased portion of the fruit. There are also fruits that appear green during development, E. guineensis var. virescens, of which one bunch was found in the study area. These are considered inedible by local standards.
Figure 5 – The palm nut. (Drawing by C. Olmsted)

Figure 6 – Palm Fruiting - Emerging palm nut bunch surrounded by dry male inflorescences
Of the palm nuts which edible palm oil is extractable, three main varieties occurring in Ghana have been identified. *Elaeis guineensis* var. *dura* has a shell that is 2–5 mm thick. *E. guineensis* var. *macrocarpa* has a very thick shell (4–8.5 mm) and little pulp. *E. guineensis* var. *tenera* has a thinner shell of about 2.5 mm. Other varieties which are less common in the area, and consequently not relegated to use, are: *E. guineensis* var. *pisifera* (very small fruits developing late in palm’s life cycle), *E. guineensis* var. *idolatrica* (rare and taboo to use), and *E. guineensis* var. *nigrescens* (dominant variety in Congo)(Anyane 1966).

Fruiting of the oil palm is highest in the rainy season, with a smaller but notable harvest in the minor season. Fruit production is low throughout the rest of the year. An individual palm will peak in fruit production from about age 15 to 30 years (Hartley 1988).

The Leaf

The leaf, or frond (*fJ*) is simply pinnate and can reach lengths of over 8 meters, although lengths of 2-4 meters are more common in the Volta Region of Ghana. One palm can ideally carry 45-50 leaves. The stalk is hard and fibrous. The leaflets are attached laterally to and supported by a stiff midrib. This leaflet carrying section of the
plant is referred to as rachis, which in cross sections proves to be asymmetrical, with the abaxial face, (the underside of the leaf) being much more curved than the adaxial (Figure 7). The petiole is shorter and thicker than the rachis, and bears short spines instead of leaflets.

The leaflets can number up to 300. They point laterally from the stalk and are supported by a bristle-like spine, to which the leaf material is attached. In early leaf development the leaflets are not separated, but folded at the point where separation will occur.

Figure 7 – The Leaf (Drawing by C. Olmsted)
The Stem

Palms, unlike woody tree species, have one growing point, the apex, where individual leaves emerge. This is located at the center of the crown and consists of soft undeveloped leaves, or ‘cabbage’ (Hartley, 1988). Young, unopened leaves, ‘spears’ emerge from this point. The spear rapidly emerges vertically from the plant, at a rate of 30 to 40 per annum in mature individuals. An individual leaf can remain on the plant for 2 years, through which time the tip slowly bends back to below the horizontal as new leaves emerge from the apex, until it dies and dries on the plant.

The dead leaves can remain attached to the stem for some time, snapping at the base of the rachis long before the petiole is shed. Thus, it appears that the stem of the plant is structured from the leaf bases of leaves that had been shed. The dry petioles can remain on the plant for over 12 years. Palms which have begun to shed these leaf bases are called ‘smooth-stemmed palms’ (Zeven 1937), although palms of these type were rare in the study area. The width of the stem after the leaf bases are shed can be from 20 – 75 centimeters. This part of the tree is of no economic importance as timber, although the individual leaf bases (f]kp]lo) that make up the stem are used as fuel wood.

History of Oil Palm in Ghana

There are various local uses for the different parts of the oil palm. The most important world wide is the palm oils derived from the fruits. Palm oil was the major
international trade item from Ghana in the 19th century. What follows is a brief history of Ghana’s role in international trade.

Early trade from modern day Ghana with Europe dates to the 15th century, when the Portuguese established the first European fort in West Africa at El Mina. However, it is noted that Ashanti-mined gold was probably reaching Europe during the middle ages in a complex trans-Sahara-Mediterranean trade route (Lynn 1991).

Palm oil trade began to flourish as an alternative to the slave trade after abolition by the British in 1807. Palm oil trade was a major source of revenue concurrent with slaving. Abolition of the slave trade only served to elevate its importance, making it “far and away the major item traded from West Africa after abolition” (Lynn 1991). The demand for palm oils was driven by the European industrial revolution need for oils used in soaps and candle production, as well as lubricants. Initially, these were filled by palm oil. Palm kernels and their oil were virtually neglected both domestically and in markets abroad.

Uses for kernel oil were discovered in the new product margarine, and the residue from the oil extraction was discovered to make good livestock feed (Wilson 1954). By the middle of the 19th century both palm oil and palm kernels were being exported from West Africa (Lynn, 1991).

World palm oil prices rose throughout the first half of the 19th century, and as the kernel market began to emerge, its price rose as well. Around 1850, these oil palm products became the principal agricultural trade items in British West Africa.

The success of the oil palm market was due to the small initial investment necessary for production. Unlike the slave trade, which required large capital
investments, palm products could be produced by individual households with limited resources. This allowed for the general population to enter into international markets, giving them purchasing power and access to manufactured goods. Contrary to previous thinking, it was this commercial activity which began the propulsion into “modernity”, not the imposition of colonial rule (Hopkins 1973).

The peak of the trade was 1884, when 20,000 tons of palm oil and 40,000 tons of kernels were exported from Ghana. With slight, gradual decline, the industry remained the most important of Ghana’s cash crops through the turn of the century (Gyasi 1992). The source of this localized industry was dependent on ‘natural’ (not planted) palm groves.

In the early 1900’s, imported cocoa began to flourish and quickly surpassed oil palm as the primary agricultural cash crop (Anyane 1966). Because more farmers began devoting resources to cocoa, which is less labor intensive and was bringing higher returns than palm oil, natural oil palm groves were often left underharvested. The year 1905 showed a record cocoa crop, as well as an increase in all other agricultural exports except palm oil and kernels, causing the Gold Coast Department of Agriculture to accurately predict that ‘it is a matter of time…[barring mechanization]…before this industry dies out’ (from Government Report 1906, in Anyane, 1961).

Anyane (1961) explored the decline of the oil palm industry in Ghana. In examining how to boost the industry, he weighed the positive and negative aspects of encouraging large scale plantations or nurturing of the existent peasant industry. Although plantations offer higher production and more efficient oil extraction, initial
investment is high, thus limiting individual quality of life improvements among the general population.

Some attempts were made to modernize the oil palm industry in peasant production in the first half of the 20th century (Anyane, 1963). These attempts met with little success. Plans for communal palm oil processing factories to be developed in high palm density areas never materialized for lack of enthusiasm. Larger privately financed and/or subsidized factories failed to operate at capacity. The processing factories, with large start-up costs, could not offer a price which would compare to what the farmers could make from processing the oil themselves (Kaniki 1980). Exports of palm oil and kernels ceased altogether in 1955, and Ghana became an importer of palm oil (Gyasi 1992).

These problems with low development of production were compounded by the decrease in acreage of wild oil palms. Decrease in palm numbers was largely attributed to the felling of the palms for tapping (Gyasi 1992).

The change in oil palm use was exacerbated by the creation of plantations in other parts of the world, namely Malaysia and Indonesia, which have produced higher palm nut yields and efficiency in extraction. Plantation establishment has also taken place in West Africa, including Ghana, marked by the establishment of the West African Institute of Oil Palm research, WAIFOR, and an oil palm research station in Kade. Plantations are in areas where rainfall is closer to the ideal moisture demand for the species. Consequently, there is neglect of areas which were historically the main oil palm producers.
Today, wild oil palm groves are still the source of the largest portion of palm oil production throughout West Africa (Gyasi 1992). This produces the palm oil which is consumed locally. Exports of palm oil are rebounding from the stagnation in the 50’s and 60’s, although this palm oil is almost exclusively the product of plantation palms in the new oil palm belt (Lynam 1972).

The oil palm industry is unique in Dzodze, in that no alternative cash crops exist which could replace the oil palm industry (Anyane 1961). Other areas of the oil palm belt were able to choose an alternative cash crop in response to oil palm losses. Since Dzodze is not considered prime habitat for oil palm, it has been neglected in industry development efforts. Though not ideal habitat for oil palm, the existence of the local market indicates that the Dzodze area is still able to be an oil palm producing area. What is lacking for the area is reasonable incentive to produce oil palm. The startup costs for oil palm production, along with the period of loss of investment capital without return, was shown to be the leading inhibitor of palm production. Although Anyane (1961) suggested subsidizing the farmers for these five years to encourage planting, no government sponsored efforts exist to revive the Dzodze oil palm industry.

Uses of Palms

The Ewes, in their migration across West Africa, have developed many uses for the oil palm. Some of these have become important to European markets, while Europeans introduced others. Many have remained utilized strictly in the household. The products derived from the oil palm can be divided into three main categories: the
oils derived from the fruit and seeds of the oil palm, the drinks from the ‘sap’ of the palm; and products that utilize the leaf stem and foliage of the plant.

In oil palm literature, non-oil produce of oil palm is only mentioned parenthetically, as of “less economic value” (Anyane 1966), or described, in the case of palm wine, “entirely destructive to the crop” (Hartley 1988). But Gerritsma and Wessel (1997) noticed that palm alcohol production is “becoming of increasing importance in Ghana”. This has been quantified by Meikle et al. (1996), who conducted a study in Benin which modeled decision making of the time when farmers will sacrifice potential annual yield of palm fruit to fell the tree for extraction of palm wine. This study indicated that there is a balance of values of palm products, but fails to give a complete picture of local level valuation of palms. This study also quantifies palm production in reference to the individual farmer, indicating that all processing and retail takes place in one household. This was seen not to be the case, but instead a complex market exists. Before one can determine the local value of all of the oil palm products and the market which exists around these, the products must be identified.

Fruit/seed uses

Seed and fruit products have historically been the most important economic aspects of the plant because these are the products that have the most value in international markets. The edible palm oil comes from the red fleshy exocarp of the fruit and, using traditional methods, requires a labor-intensive process for extraction. The
production of oil probably came about from a local dish called palm nut soup. The oil extraction process is an extension of the palm nut soup cooking process. The only additional steps in oil refining require that all of the water is boiled out and the sediment is allowed to settle and is removed.

The pericarp of the fruit, which consists of the shell and pulp, contains the palm oil \([dzomi]\) (Figure 8). Palm oil is one of the main sources of the fats and oils components of the Ghanaian diet, and is a notable source of Vitamin A. Upon the removal of these to parts for oil extraction, producers are left with the endocarp, which consists of the kernel and its shell (Figure 9). The kernel shell contains no oil, but has uses as a fuel and in building materials.

From the kernel, an entirely different oil, \(nefimi\), is extracted. This oil is not consumed locally as a food oil to any significant degree. Local uses are limited to lamp oil (although imported kerosene is now more common) and a local soap industry. Industrial uses were discovered abroad and palm kernel oil was essential in the early days of margarine production. Since kernel oil’s uses are primarily industrial, over 97% of total palm kernel oil production is sold (Anyane, 1961).

With the advent of international trade in these markets, mechanized and more efficient methods were developed and continue to be improved for both palm oil and palm kernel oil extraction. Locally, the traditional methods, with some introduction of labor saving machinery, are still used in processing.
Figure 8 – Palm oil.

Figure 9 – Palm kernel oil
In traditional processing, not only are the oils marketed, but also nearly all of the by-products of the oil extraction are used. The fibers left from the fruits are dried and used as tinder for starting fires. The cracked shells of the kernels are used as a fuel by blacksmiths, or can be mixed with mud and formed into blocks for the construction of traditional homes. The sediment of the red oil processing is eaten with garri, shredded and dehydrated cassava. The sediment of the kernel oil process is formed into cakes, dried, and either fed to live stock or used as fuel. Utilization of these by-products has recently been adopted in palm oil plantation industries in Malaysia (Tay 1990).

The Leaf

The products of palm leaves have been of lesser relative economic importance when compared to oils and libations, although they are ubiquitous in daily life around the study area. Since there has been a decrease in wild palm, the fronds have become a commodity. Utilization of the leaf material as a market commodity is a recent development, consequently there is the most tension in the tenure issues of palms. This is discussed in the management section.

Products made from the frond of the palm use the fibrous qualities of the leaves. The entire frond is utilized for various household and market items, though basket weaving is the most common utilization of palm fronds (Figure 10). Baskets are woven from the frond structural walls, and are the main containers used in the transportation of goods. Only in this product does a recognizable internal market exist.
Construction material for household and farm structures is another major use of palm leaves, although the market for these is less defined. Entire fronds are used for shade structures, which involve the construction of a simple timber frame, across which fresh cut fronds are laid. These are most often constructed for community purposes, in which case they are not marketed, but given out of a sense of civic duty. However, there are exceptions to this rule. For example, market women who do not have a spot in the established market have to construct their own stalls. A male laborer is contracted who collects all of the materials for construction, including fronds for the roof, to build a stall.

Fronds are also used in traditional house construction, primarily the non-load bearing ‘rafters’ in the roof. The crossbeam of the roof, which ultimately supports the weight the roof, is constructed from timber (about 4” in diameter) trusses, to which the fronds are lashed. It is these frond rafters to which the thatch roof is attached. The door in the traditional house, is a panel made from palm fronds attached to two sticks. This panel can also be used as a sort of prefabricated building sheeting material in semi-permanent construction.

Fronds are also commonly used in making brooms for the daily sweeping of houses. While the economic importance of the broom industry may be less than significant, most households in rural Ghana rely on these brooms. Hence, there is a constant demand for brooms.
Figure 10- Market uses of fronds - Baskets for transport of goods.

Figure 11 – House hold uses: Chicken coop (left), Roofs, Doors, and *Ava* (right).
For all of the products listed above, the live fronds must be cut from the tree. The severing of the fronds for these uses leaves the leaf petiole, *f\textit{Jkp Jlo}* attached to the tree, which will eventually be shed from the tree as new leaves develop. These leaf bases can be collected when dry to be used for cooking fuel, used either in the home or taken to the market and sold. *F\textit{Jkp Jlo}* are also used in very light construction, namely for *avawo*, the traditional maize storage structure, and for chicken coops.

Unopened leaves, the ‘spear’, are also used for general cordage needs. The spears can be cut and woven into rope, which is used in the construction methods described above, as well as for other cordage needs. This rope is considered essential for the structural stability of the *avawo*.

The Stem

Oil processing and all of the fibrous uses of palms have been in Africa, and E\textit{Y}e culture, since time immemorial. Tapping of palm wine has also been so, although distillation of palm wine into a much more potent spirit is a development of this century (Akyeampong 1996). Palm wine is the liquid which flows from the xylem of tree (Figure 12). It is a milky white, effervescent drink, which has no alcohol at the initial extraction. Natural yeasts already present in the tree ferment the wine to a maximum alcohol content of about 5% (Ayenor and Matthews 1971). Aside from extraction, it requires no processing. Palm wine is a notable source of vitamins (vitamin C and niacin) and minerals (primarily potassium) (Herzog et al. 1995).
Traditionally, the natural yeast which accumulated at the bottom of the collection pots were used for baking *abolo*, a type of steamed bread in the Eʋe diet. This has been replaced by imported bread yeasts.

The wine can be consumed raw or distilled (Figure 13). The resulting distilled spirit is known in Eʋe as *dekele*, or by any number of euphemistic names, *sodabi* (Togo), *tsimadzele* (The water in which mosquito larvae don’t appear), *afevi* (the homeboy), *mJ sese la* (the hard road), and others less polite. It is intranationally known by its name in the Ga language, *akpeteshi*. 
Although a method exists which palm wine is tapped without killing the tree (standing tapping) commonly practiced in both Nigeria and Cote d’Ivoire, the unanimously preferred method of tapping in Ghana is fell-tapping (Figure 14 & 15). In the days of the development of an akpeteshi market, palm tappers from Sierra Leone were brought to Ghana in order to teach standing tapping. This effort failed because tappers claimed it produced inferior wine (Anyane 1961). An example of this was never seen in Ghana, and most tappers had never heard of it. One claimed that it must be a different palm that can be tapped standing Dodonu personal communication).

Hartley (1988) claims that tapping method is not a merely a matter of preference, but is related to palm populations. A shortage of palms would necessitate the development of standing tapping methods. Palms shorter than knee high are tapped in the study area, thus refuting Hartley’s claim.
Figure 14 – Palm felling.

Figure 15 – Preparation for tapping - Peeling of the leaves to expose the apex.
The sweet wine has a very short shelf life, about six hours, and is highly prized when it is available. Although there are a few companies today which have begun to pasteurize and bottle palm wine, the locally produced version must be consumed the day of tapping and within a reasonable distance from the tapping site.

*Akpeteshi* is much more readily available. Being storable, it is distributed around the country. It is reputed to have medicinal values, although it is most valued for its socio-cultural uses. As was mentioned before, the cultural importance of *akpeteshi* is a development of this century.

Cultural Origins of *Akpeteshi*

It is believed that *akpeteshi* did not exist before direct European influence on Coastal Western Africa. The British Governor of Nigeria claimed that distillation began in the colony in May of 1931, although a report claims a group of Ewes learned the art of distillation earlier. This report claims that European missionaries, who had experimented with just about every agricultural crop in Ghana to distill alcohol, taught a group of Ewes distillation in the mid-nineteenth century (Akyeampong 1996). Regardless of *akpeteshi’s* origins, it was in the early 1930’s when *akpeteshi* first became a recognizable force in Ghanaian culture.

Sweet and mild palm wine is traditionally not only a delightful beverage, but also a symbol of power in Ewe culture (Akyeampong 1996). Chiefs and elder men
historically controlled the distribution of land, and consequently, the palm groves. The ability to tap and drink palm wine was limited to these elders and consequently was a symbol of social status (Akyeampong, 1996). It was, and still is to a certain extent, a stigma for young men to drink at all.

The development of alcohol consumption by the general population originated as a result of the British colonial period. Colonial development in the later 19th century brought about an urban migration, especially of young men who joined the emerging industrial and marketing sectors. In the urban lifestyle, young men replaced traditional kinship sources of leisure time with western style dance clubs which, not surprisingly, sold imported liquor. Without traditional elder values to influence them and with newfound economic independence from wage labor, young men and women were able to usurp traditional authority. Consequently a popular culture emerged, centered around dance clubs and drinking bars.

A joint effort among traditional elders and colonial administration attempted to reverse the trend by strengthening liquor laws and raising import duties on liquor. In effect, this raised the price of liquor to a level which only the affluent could afford. *Akpeteshi* distillation was a response to the demand vacuum that was created from the import duties. In the early 1930’s illicit *akpeteshi* distillation flourished. For example, in 1933 there were six cases brought against illicit distillers, in 1934 there were 558 (Akyeampong 1996).

As a cheap drink, *akpeteshi* came to represent the working class. Throughout the independence movement, the Convention Peoples Party, the proponent of independence, sought support in this working class culture. Their rallies resembled the concert parties
where *akpeteshi* was illegally sold, with speeches interspersed with live musical performances. The CPP eventually disengaged themselves from popular culture, pursuing active prosecution of distilling in early independence. However, *akpeteshi* had found its place in Ghanaian culture and in 1962 *akpeteshi* distillation was legalized.

Thus, it became profitable for oil palm owners to fell and tap their palms for the production of alcohol to serve the widening customer base. Previously when palm oil was not profitable, the prices offered for export oil were too low and local markets had been supplied, much of the palm fruit was left unharvested and rotted in the groves. Tapping of palms was limited to filling a narrow local market. After the emergence of the *akpeteshi* market, a whole new management regime developed to fill the changing markets.

The Farming System

At one time there were vast groves of oil palm. Today, population pressure and intensification of agriculture has diminished the size and number of these groves. Oil palms now more frequently occur integrated into farm lands.

In order to establish the role of an individual species in farms, it is necessary to look at the farm system as a whole. Farm system analysis is an extrapolation of Western agronomic science which is applied in development of third world countries focusing on “the interdependencies between the components under the control of members of the
farm household and how these components interact with the physical, biological, and socioeconomic factors not under the household’s control.” (Shaner et al. 1982).

Beets (1990) summarizes six types of crop based farming systems. The Dzodze traditional area can be described as an upland cereal-based system, although in respect to oil palm, aspects of a small landholder cash crop system are apparent.

A cereal-based system is the most common agricultural system in seasonally humid Africa, which probably evolved from a shifting cultivation system. A shifting cultivation system is the traditional agriculture system practiced in most forested areas in the tropics (Figure 16). It is characterized by the clearing of about 1/3 hectare per year for cultivation while cultivated land from the previous two years is used for longer growing season crops (≥ 1 year). The land is then fallowed for at least 20 years to allow for forest regeneration, hunting, and gathering. It is an ecologically sound system provided there is enough land available to support the population (Beets, 1990).

With population pressure however, the fallow period is shortened, decreasing forest regeneration. Eventually it becomes necessary for land to be assigned as private holdings. Landholders now have less than five acre holdings while people in more populated urban areas have no land.
Cropping System

In southeast Ghana the system is based on maize (Zea mays) which is characteristic of the cereal based system where rainfall is adequate. Cassava (Manihot esculenta) is a secondary staple which supplements maize. The maize and cassava are frequently intercropped in individual rows, the maize overtaking the cassava during the three month rainy season. At harvest, the maize stalks are snapped, not only to mark which ears have been harvested, but to allow sunlight to reach the cassava, which requires a one-year growing season. Other crops planted regularly include peanuts.
(Arachis hypogaea), peppers (Capsicum spp.), okra (Abelmoschus esulentus) and, if near a water source, onions (Allium spp.) and tomatoes (Lycopersicon lycopersicum). All of these are used to prepare the soups which accompany the staple gruel made with the maize and cassava.

While the agricultural production level indicates a subsistence economy, all of these crops could be considered cash crops to a certain extent. Excess harvested maize and cassava, that which could not be consumed by the household in the following year, are often sold to purchase manufactured goods. Peanuts are treated almost exclusively as a cash crop since the proportion consumed in a household to that produced is very small. Peppers and okra also produce large amounts of produce which can be harvested twice a week. These are also sold more than used in the home. Tomatoes and onions are generally only grown in the rainy seasons, and must be marketed immediately. Both peanuts and peppers can be dried and stored for a long period of time. If household expenses allow, food which can be dried is stored until the high supply around harvest time wanes and the price increases.

Some other crops are raised in smaller amounts and almost exclusively for cash. For example, beans, watermelons and cocoyam are grown to fill the market of the street food sellers who serve them as snacks, rather than an integral part of the diet. Some crops are much more common in other areas either being the staple crop of another tribe or more suited to other habitats. These include yams (Dioscorea spp.), guinea corn (of which the leaf is the main product, although the ‘corn’ is eaten as a staple in northern Ghana), plantain and banana (Musa spp.), and pineapples. In water logged areas, sugar
cane is planted. Sugar cane can be sold raw and chewed for the sugar content, or the
juice can be extracted mechanically, then distilled in the same manner as palm wine.

Indigenous wild plants, which occur spontaneously on the farm, are also collected
and sold. Edible weeds known locally as *ama* are harvested and sold. Fruit trees are also
often treated in this manner.

**Trees in the Farm System**

Despite recent attempts to integrate agroforestry techniques, the majority of
woody species are voluntary. They are frequently exotic species (Figure 17). Woody
species are mainly used for fuel and construction needs. The most prevalent species is
neem (*Azadirachta indica*). Neem was introduced early this century and has been
dispersed throughout the country by bats. Other common woody species in the system
are *Senna semenea*, *Leuceana leucocephala* and *Albezia lebbek*.

Fruit trees that are planted, the most common being exotic, are mango (*Magnifera
indica*) and orange (*Citrus spp.*). These are planted in the houses as well as in farms.
Orchards of these tree species do exist in Ghana although none are found near the study
area.
Indigenous fruit trees that occur commonly in the farm system include tsitoe and ag. Common non-fruit species include yevuti, the leaves of which are eaten, anyiti, is a border marking tree also used as firewood, and luti, used for carving pirogues. The numbers of fruit trees and woody species occurring on the farm are dwarfed by the number of oil palms to be found.

The place of oil palm in the farm system somewhat defies Beets (1990) outline of farm system characteristics. A plantation crop system includes a dominant cash crop, usually set up by government programs and dependent on external forces for both inputs (seed sources, fertilizer, pesticides) and marketing (price trends). Most tree crops are more effective and sustainable than annual based systems within the small holder plantation system. This has happened with the oil palm in Malaysia. In a plantation crop system, subsistence activities are often decreased due to input demands, mainly in labor
invested in the cash crop reducing food production. This was the case with cocoa when it was introduced to Ghana in 1898. Cocoa was Ghana’s leading export through the first half of the century, when world cocoa prices dropped which lead to economic decline and food shortages shortly after independence. The preference for cocoa led to the abandonment of palm cultivation (Anyane 1966).

Farm Preparation

There are two options for land preparation in the system. Some people till the land mechanically, with a tractor. This is an expensive venture, and impossible for most of the population. The alternative is to plow by hand, with a small hoe. To hire labor to do this requires about 1/3 the cost of mechanical plowing, so more people are able to do this. The majority of people use family labor for hand plowing, thus eliminating the cash input in tilling.

Sowing of seed is done exclusively by hand. This usually employs family members, though sometimes friends will help out in exchange for return of the favor on their own farm.

Through the growing season, the farm is weeded twice, about 30 days and 60 days after sowing. The use of herbicides is rare; the farms are weeded with the same hoes used in tilling. Instead of turning the soil, the weeds are more or less scraped off the field. If cash resources allow, hired labor is used. Like tilling, most families weed themselves.
The Land Tenure System

Land tenure issues are of critical importance to agricultural and environmental development. Land tenure in Ghana cannot be generalized. Literature on tenure issues in Ghana most frequently refer to the organized abusu/abuna sharecropping system of the Akans, where either one half (abusa) or two thirds (abunu) of harvest automatically goes to the lessor. But, throughout Ghana, tenure is defined by local custom and varies between areas, even within the same tribe (Anyane 1961).

Tenure can be generally categorized into systems defined within individual tribes in the context of Stool (the local authority, or chief), family, and individual lands. The tenure system described by authors focusing on Eʋe land tenure systems point out differences within the culture, so the local land tenure system will be briefly described in reference to how it applies to the oil palm.

Traditionally, land in Ghana is in the possession of the Stool, the extended family, or the individual. In many cultures, the Stool has the ultimate authority in land administration. While this is less so among the Ewes, the Stool had direct interest in the exchange and use of land (Kludze 1973). In the past, the chief would distribute land to deserving men, such as heroes of war or industrious farmers, as well as to confirm individual rights to land. This has not been in practice since the days of colonial authority. Increase of population and land pressure, along with a western concept of land registration, limits redistribution. With the fairly recent attempts to register land holdings, there is no longer any unowned land. Today, most of Eweland is in family or individual holding.
Family land management is directed toward subsistence earnings, a mixture of cereal crops for sustenance and cash crops to buy household items. Management decisions are made by the head of the household, usually the oldest male, although he often will take input from the rest of the family. Women play an important part in this, as they are the ones that ultimately market farm produce. It is not unheard of for a woman to own land, although it is not common. Women can acquire land though inheritance when a patriarch has no male children, or through direct purchase. Land sales are probably a new concept, introduced through European contact (Kludze 1973).

Individual land ownership originates from land purchases, which now requires titling under the land title registration law of 1986 (Kuntu-Mensah 1998). Land sales can come about in a long term agricultural venture, such as oil palm or cocoa plantation establishment (Kludze 1973, Gyasi 1994). Although this has been noted as common in the northern and mid-Volta Region, no examples of this were seen in the study area. The only examples of land sales in the study area were for building plots.

Dzodze has always been a unique oil palm producing area in Ghana, because there is no competition of other cash crops (Anyane 1961). The only example of agro-economic ventures was the newly introduced cashew production, which took place exclusively on family owned lands. Land leasing is much more common in the annual cultivation of maize and cassava. Agreements consist of the owner or steward of a plot allowing another person use of the land for cultivation on an annual basis. An agreement is made for a share of the harvest, or a flat-rate annual cash lease.

The agreements are similar to the abunu or abusa system of the Akans. In the Ewe version, deme (dibimadibi to Northern Ewes), the ratio of harvest share is not
automatic. Rather it is much more subjective. The wide range of possible values of the land use rights can be attributed to any number of circumstances. For example, the land value may be based on fertility of the land or the relationship of the owner to lessee (Kludze, 1973). It was also noted that if the lessee would profit from his/her labor the share the landowner will collect will be more than the share if the land is going to be cultivated for strictly home consumption crops.

Owners of land have from one to three acres, although there are a few people who hold more. The owner of the largest plot in the study boasted nine acres. It must be pointed out that land lease agreements are not exclusively cases of landowners leasing to the landless. Landowners will often hire plots of land for a number of years to allow their personal farms to lay fallow and restore fertility. This same practice can be seen in Honduras (Jansen, 1998).

Oil palm in the tenure agreement.

In land hiring agreements, the cropping system usually employs an intercrop of maize and cassava. Any other dominant crop would indicate a profit-making venture, and thus the land owner would take a larger share. During cultivation, the lessee doesn’t have the right to harvest any economically valuable perennials, trees,(i.e. *Zuti* for timber, large saplings for firewood, oil palms for wine) or tree produce for sale (mangoes, *tsitoe* fruits, baobab leaves). However, all of these products to be used for non-market ventures, e.g. one basket of mangoes for household consumption, a couple of palm nut
bunches for nightly soup, dead twigs for home fuel consumption, are generally overlooked. Tenure understandings like these are generally assumed, according to the relationship between the landowner and lessee.

Harvesting of fruit trees is not allowed, although the person who hires the land does have the right to prune oil palm, removing all of the leaves except the main spear (unopened leaf). This is because the large numbers of drooping leaves compete with the maize for sunlight. The palms will continue to produce leaves and eventually achieve a full crown.

A communal system of oil palm use ruled by the Stool occurred in the past in Western Ghana around Nzima, and the same distance to the east in Nigeria, allowing unlimited harvest in natural groves for home consumption. Undertaking production of palm oil for profit would be contracted by the Stool with the collection of a ‘consulting fee’ paid to the Stool. Historically, this was the case around Dzodze before increased demand on resources brought about individual ownership of both land and palm groves.

Today, ownership of palms is invariably in the hands of the landowner, until the points of sale. Harvesting of the nuts by small holders is performed solely by the landowner, then sold to refiners. Contractual harvest has been known to occur in the neighboring Krobo Mountain area, where the landowner allows a refiner to enter the grove and harvest and refine for one-third to two-thirds of the profit. Individual holdings of oil palms are limited so that this does not happen. Usually, when a large tract of palms (greater than one acre of grove or three acres of farmland with high palm populations) is owned by one person, the farmer and the refiner would ultimately be in the same
household. With a constant source of palm nuts as could be derived from over an acre, it would appear ludicrous if the household did not have an oil refiner.

When palms reach a height of one meter or more they can be sold for tapping wine. Again, the owner of a large amount of palms will most likely tap and/or distill himself, otherwise individual trees within farmland are sold separately.

Cooperatives

Cooperatives make a significant impact in the marketing of akpeteshi throughout the country. It is through cooperatives that akpeteshi reaches to the far north of Ghana where there are no palms.

The cooperative movement in Ghana dates back to the 1920’s when farmers organized themselves for land acquisition to farm cocoa. President Nkrumah closed the co-operatives in 1961, seizing all their assets in the name of socialist doctrine. The co-operative movement has been revived, now existing in all of the regions of Ghana. However, the infrastructure in existence is ineffective in helping members with inputs, marketing, or credit, and “has not made any impact on production” (Tutu, 1988).

Cooperatives are divided into agricultural, industrial, financial, and service categories. The District cooperative representative for the Ketu district, admitted to the author that the only truly functional and profitable cooperative is the distillers’ cooperative, or the local akpeteshi producers, despite valiant efforts to establish other cooperatives. A palm oil co-operative does not exist in Ketu district.
In effect, the distillers co-operative allows distillers to bring their product to a urban area and store the product until buyers come in looking for it. If the cooperative movement were expanded in the Dzodze area to encompass palm oils, large amounts of both palm oil and palm kernel oil could be amassed in one area, making it profitable for palm oil distributors to come to Dzodze to collect palm and palm kernel oils.
Chapter 3 Methods

This section contains the methods of the study. First, the way in which palm markets were defined are described. Next, the local measurements used in processing are defined. This is followed by a description of experiments which took place. In these descriptions, the processes of preparation for each of the main palm products are described. Finally, the method used to interview individuals on palm management is explained.

Conducting this study required both quantitative and qualitative methods of data collection. Living and working in the area for one year prior to development of the study allowed for a broad observation period in defining oil palm markets. Subsequent quantitative data collection on pricing and marketing of palm markets was gathered with informal directed surveys (Bernard 1995) with palm producers and palm goods tradeswomen. Directed surveys were taken in the central markets in Dzodze, Denu, Agbozume, and Afidenyigba, from December, 1998 through October, 1999. These surveys contained information such as the price and sources of oil palm products.

An experiment in the processing of each of the main production processes was undertaken to determine the costs and benefits of each. These observations involved the participation of the author to varying degrees. Determining the decision-making by these palm producers as well palm land managers required informal directed and semi-directed interviews (Bernard 1995).

For experimental trials, the author purchased inputs required for the production of palm oil, palm kernel oil, palm wine, akpeteshi, and baskets. A processor of each was
then employed to process each product. Each of the contracted tradespeople was interviewed throughout the process.

Measurements of Ghana

As scales and other measuring equipment are not readily available in Ghana, measurements are determined by locally accepted units of measure. Local units of measure are a mixture of traditional measurements, British imperial measurements, and the metric system. Measurements of farm produce are derived from containers which are readily available in the area.

Because this study was based on local perceptions of the palm markets, the local measurements were used. The measurements which are commonly used in the exchange of palm products are:

*Agba* - A 2-quart aluminum bowl.

*Tukpa* - A bottle of palm oil or palm kernel oil. Usually equal to one liter.

*Gagbe* - A head pan which is believed to hold 25 *tukpa*, or 25 liters.

*Gago* – A twenty-liter jerry can.

The currency in Ghana is the Cedi. Being a weak and inflated currency, its value changes in relation to the U.S. dollar fairly quickly. During the study the cedi lost value to the dollar at Foreign Exchange Bureaus from ₋ 2,400 = US$ 1.00 on June 10, 1999 to ₋ 2,700 = US$1.00 on August 20, 1999. Since this was period in which the majority of semi-structured interviews were taking place, the
average of these will be used for conversion: $2,550 = US$ 1.00. To add some perspective to the economic situation, it should be noted that the national minimum wage for a full day of manual labor is $2,000 ($0.78) and a public school teacher’s monthly salary is $111,000 ($43.53).

Land is measured with a piece of rope, and the traditional unit of measurement is the *abjenyi* [eight arms]. This is sometimes referred to as the ‘local acre’. This is measured by eight arm spans. While this obviously varies from person to person, the accepted conversion is that 21 *abjenyi* is equal to an imperial acre, or about 2,079 ft² each. Some farmers prefer to measure in local units while some prefer to measure in the imperial measurement system.

**Oil Processing**

To observe the palm oil extraction process, forty seven *agba* of palm nuts were purchased for extraction. Daavi Nkutsila, a reputable palm oil extractor was then contracted to conduct extraction and refining, during which she was interviewed on aspects of the palm oil industry.

The process of extracting the oils of the palm nut is a task undertaken exclusively by women. Despite mechanization elsewhere in other palm oil areas, the process observed in Dzodze does not differ significantly from the methods described by Gray (1922).
Extraction of palm oil took place in a specialized area, the *tok* J. Smaller operations are able to use only wooden mortar and pestle for separating the pulp and skin from the palm kernel, so a temporary *tok* J can be placed anywhere. Large operations, like the one in the experiment, use a stone lined pit six feet in diameter and four feet deep, a “*to*”. This requires the establishment of a permanent *tok* J. The mortar and pestle method can be carried out by only two laborers, while the stone *to* method utilized instruments similar to a polo mallets and human feet, using both to crush the nuts against the stone, requiring more labor (Figure 18). The author participated as a laborer.

The process of oil production began with the boiling of the raw nuts in water for four hours to soften the pericarp for easy separation. The boiled nuts were then put into the *to* and smashed, so that the oil is released. Water was added throughout this process which causing the unrefined oil to float to the top of the water. The kernels remained on bottom, with the fibrous material on top of these. The oil was collected off the top with a calabash, and returned to the fire and heated to release all of the water. The kernels which remained were collected in a basket and shaken under water to release any residual oil.

The oil was known to have released all of the water, and the process finished when the shape of a crucifix appeared on the top of the oil. The oil was then cooled in a pan, and stored for retail.

The unshelled kernels were then taken to a kernel cracker. The unshelled kernels were singly smashed with a rock to release the kernel. The kernel cracker was interviewed about her profession.
The raw kernels were then returned to the market to be sold to kernel oil refiner. Kernel oil extraction was observed in the same manner as palm oil, in that raw materials were purchased by the author to be extracted and refined by a professional. The refiner was then interviewed during the processing.

Twenty agba of palm nut kernels were purchased and given to Daavi Akpeato, the refiner, who then fried them in one tukpa of the oil remaining from the previous extraction. The fried kernels were then taken a grinding mill, which people commonly use to grind their corn (Figure 19). The kernels were ground into a paste, which was set to boil with one head pan of water. As the paste was heated and stirred, the oil rose to the top. The oil was collected with a calabash and stored in containers. The paste, after the oil had been extracted, was collected with a bowl and set aside to dry into kernel cakes. Kernel cakes from previous extraction were used to supplement fuel wood in the process.
Figure 18 – Palm oil processing - Mashing palm nuts to extract the oil.

Figure 19 – Palm kernel oil processing - Grinding of palm kernels.
Frond Processing

Manipulation of the palm leaf is more of a craft than a trade. The interview method was relied upon more than in the other trials. In order to understand the construction and household uses of the leaf, the interviews relied upon a semi-structured interview method (Bernard, 1995). The author participated in basket production. This participation in the process was limited to nominal weaving of one basket, and needless to say, the author’s basket was ultimately not sold.

Leaf midribs were both purchased and collected for basket construction. The leaves which were collected, were supposedly acquired with permission from the land owner. After pruning the live fronds, it was necessary to strip the leaflets from the midrib. The remaining leaf midrib was then split vertically, and all of the vascular material from the center is removed. Strips of the adaxial face of the frond are used to form the spokes of the basket frame and the less rigid abaxial face pieces are used in a plain weave between these spokes. The rims were then tied with some of the outer vascular material from the frond (Wells and Jordan, 1989). The amount of fronds used varied depending on the size of the basket (Figure 20).

Leaves harvested for household construction materials used the whole leaf midrib. For roofing rafters, the leaflets were simply stripped from the midrib.

For the construction of \( \text{ } \), the sheeting material adapted from doors, the midribs were trimmed to length and then notched in two or three places to be attached to the door.
crossbeams. Light construction materials (for chicken coops and *avawo*) used only the petiole, and require little manipulation aside from collection.

The items which require the least amount of craft labor, but are still quite commonly produced are household brooms. In order to learn this craft, the author happened upon an elementary school, whose headmaster was having the school girls raise funds for the school by producing brooms.

Two types of brooms were produced, one which uses the whole frond, the outdoor compound broom (*x]*nuha), and one which uses only the leaflet midribs, an indoor broom (*meha*). The compound broom is used for sweeping the packed earth which forms the compound ‘yard’.
The brooms were produced by removing all of the green material from the leaf. An example of the traditional method was demonstrated.

The traditional method of broom making entails holding the five or six full leaves together and forcefully brushing it along at the spines of leaf bases still attached to a tree. Today it is more common to see a razor blade employed in this process. Five or six of the resulting leaf skeletons are bound together to make one broom.

For indoor household brooms which are used to sweep the cement floors the leaflet midrib is then cut form the leaf stem, leaving only the spines. Three or four hundred of these, the product of four or five leaves, are then bound together to form one broom.

Palm spear rope was made by stripping off three or four of these attached leaflets at a time and braiding them.

The Stem

For the palm tapping experiment, sixty-three palms were purchased by the author for tapping. Koko Ahiavidila, a professional tapper, and Todia Ampesidula, a distiller, were contracted to carry out the process.

Tapping involved the labor intensive severing the roots, using a spud, until the tree was grounded. After a three days time, all of the fronds, including the leaves were removed with a large machete in order to expose the apex of leaf production. Two weeks after the initial felling, a small trough was cut in the apex of the tree and a hole was
drilled at the bottom of the trough. A hollow tube (the stem of a forb, locally known as *ayiti*) was inserted. The wine flowed through this tube into a collection jar placed under the felled tree. The wine flowed in quantity for three weeks, gradually diminishing. Wine production completely ceased on day forty.

During the time of wine flow, the trees were attended to twice a day. In the morning, the wine was collected and the trees are ‘burned’ (Figure 21). Burning involved binding split and dried fronds into a torch, inserting the flaming end into the trough through which the wine flows, and blowing at the fire through a tube made of the leaf stem of a papaya (*Carius papaya*) plant. This served to sanitize the collection trough by killing bacteria present, and was also said to improve the flavor of the wine. The trees were then ‘burned’ again in the evening. After burning, the burnt face of the apex where the wine is flowing is shaved away, to allow smooth flow of wine (Figure 22).

A portion of the wine was transported to a retail establishment immediately after collection, to be sold as fresh palm wine. The remainder was collected for a number of days allowing maximum fermentation and accumulation of an adequate amount for distillation (~90 L).

The distillation process involved construction of a *mlekpui*, a semi enclosed fireplace, on which a fifty-five gallon drum was placed. The drum was then filled one-third full with overfermented palm wine, and a wood fire was built underneath. The drum was sealed save for a copper tube which was coiled through two drums of cold water. As the alcohol evaporated it escaped the drum through the copper tubing, condensing where the tube is coiled in the cool water, and forced out the other end through continued evaporation.
Figure 21 – Burning palms for tapping.

Figure 22 – Tapping of palms - Shaving of the apecurial face.
This first cycle was referred to as *ahagbagba*, the ‘breaking’ of the wine. The entire process was then repeated with a second batch of wine. The two *ahagbagba* distillates were then mixed with a smaller amount of wine (~30 L) to achieve the final product, *akpeteshi*.

**Interviews**

Exploring the supply side to fill these markets was undertaken with thirteen informal interviews with land managers. The purpose of the interviews was to examine how the farmers managed their farms and palm groves in order to supply markets for oil palm products. The interviews with these farmers took place in the villages of Dekpor Home, Dekpor Yaa, Kuli, Kasu, Deme, Konkogbui, and Tofoe. A list of quoted informants can be found in appendix 2.

Interviews employed an ethnographic approach relying on key informants (Williams 1967). These informants were selected based upon their palm management reputations, and because of the personal relationships established before the study began. It was assumed that they could draw an accurate picture of localized palm management.

The methods employed in interviewing these informants was an anthropological method called the semi-structured interview (Bernard 1995). Since the topic of this study was a specific aspect of the culture, the informants were directed to talk about the oil palm in reference to their respective trades. Questioning was usually limited to a
“probe” (Bernard 1995) although, especially with senior citizens, directed questions sometimes became necessary.

Regression

Because it was hypothesized before the study began, and reinforced by interviews, that farmers prefer to manage their palms for the alcohol market, an exploration of how management schemes affected the alcohol production levels was undertaken. Variables measured were chosen given the cultural knowledge elucidated in the interviews. Thus, local perceptions of how trees are affected by different cultivation treatments were analyzed.

The variables which were measured were: size of tree (height, girth, and resulting volume), flower ratio (number of male and female flowers present on the tree), site (type of cultivation or vegetation), competition (individuals within 10m² of measured tree), and extreme pruning (represented by a dummy variable, whether the palm had been pruned to the spear during a recent cultivation). A regression was run based on these data to determine which variables were significant in estimating production of wine.
Chapter 4 Results and Discussion

This chapter shows the results of the palm product processing and the interviews with palm processors and palm managers. This begins with the results of the trials which define the costs and benefits of palm processing. These are summarized in tables. The results of the interviews describe how people perceive the state of the palm industry in the Dzodze area. In discussing these results, three types of palm management which dependent on land and financial resources are defined.

Palm Oil

To begin processing palm oils, palm nuts were acquired. The three common varieties of palm nut have been described: dura, macrocarpa, and tenera. The indigenous population has developed a version of this differentiation. Larger nuts with thick pericarps are refered to as amide [oil nuts], and smaller nuts with less oil potential as detside [soup nuts]. The local names indicate that the former nuts are more suitable for oil extraction and the latter are better utilized for home use and not for marketable oil. The descriptions of these differences seemed to coincide with the differences attributed to the biological variation of fruit types. Although the amide can fetch a slightly higher price, the difference in variety is more descriptive than economic. Because of limited sources of palm nuts, all nuts are used in oil processing (Nkutsila personal communication).
The largest input into the production of palm oil, once the tok is established, is the capital in which to buy the raw material, the palm nuts (Figure 23). Materials costs are initially high in the construction of the tok, although, if applying western standards, these costs would be amortized over an extended period of time.

A wooden mortar of the size required for mashing an appreciable quantity (up to five agba) can cost ₦35,000 ($13.73), and the pestle ₦10,000 ($3.92). These are said to last at least 10 years. This can not be considered strictly a oil producing investment however. Wooden to are also used in the household for pounding fufu, a local starchy dish. The pit to, in which a greater quantity of nuts can be processed (up to 100 agba) are made of locally quarried stones, collected along riverbanks, and consequently are acquired at no cost aside from labor. Again, this cost is amortized.
Although the to operation can handle a larger amount of nuts ground at one time, both processes are limited by the size of the pot in which the nuts are softened. The capacity of the standard is 23 agba of nuts (Nkutsila, Akpeato personal communication).

In the trial run of palm oil processing, a stone to was used to process the nuts. Forty seven agba of palm nuts were acquired for the study. The prices of palm nuts fluctuate with the season, reaching as low as ₦700 ($0.27) in the peak production season up to ₦2,500 ($0.98) in the dry, low fruit production seasons. During the trial run, which took place at the close of the 1999 rainy season, the price paid was ₦1,500 ($0.59) per agba. The price and availability of nuts will invariably affect the price of palm oil on local markets, although the price of palm oil is somewhat more stable, since palm oil does not spoil like fresh palm nuts. (Dodonu personal communication)

Water and fuel are also significant costs in the process. Potable water is a commodity even in the most rural of areas with natural water sources, since it is considered uncivilized to cook food with or drink river water. In the production of food goods it is necessary to use collected rain or well water. Processing the forty-seven agba of palm nuts required six gagbe of water, at a cost of ₦200 ($0.08) per gagbe. Fuel is also a scarce commodity in the Dzodze area, a result of conversion of forest cover to farm land. There is, however, no standardized measurement of fuelwood, and consequently, like many things in Ghana, the price is inconsistent. In the case of this process, one faggot of firewood was approximately one half meter in diameter and two meters in length. Three were purchased at ₦2,000 ($0.78) each.

Labor cost in this process was limited. Although for the mashing process there are actually four or five adults (or 6-7 children) doing the labor in one hour, other parts of
the process consist of only feeding the fire, which is not constant labor and offers women an opportunity to do other tasks. For the the mashing of the nuts in this case, six children were employed for one hour after school. Although the informant claimed to pay the children ₢ 200 ($0.08) for this labor, the children claimed to the contrary; they were there without pay, out of elder respect.

An individual woman can do this labor herself, subcontracting additional labor for just the mashing of nuts. An informal co-operative can also be developed in which five or six women would go to a different woman’s house each day, and process one batch of nuts (Mama Tsitsi personal communication).

Outputs from palm nut processing are the red palm oil, and remaining palm kernels. The perceived ratio of agba of palm fruits processed to tukpa of oil produced is estimated to be 2:1, although some less healthy nuts can give as little as a half a tukpa from two agba. (Asimetowo personal communication)

A certain amount of residue (beku) is left in the bottom of the pot which is edible, and is commonly eaten with beans and gari, because it has the flavor of palm oil without the expense (Figure 24). One case was seen where the beku was sold for ₢ 50 ($0.02) per spoon full, but the seller had a reputation as a miser (Asimetowo personal communication). Beku is otherwise in the market place along with the oil, but cannot be considered a commodity by itself.

The costs and benefits of the palm oil processing are summarized in Table 2.
Figure 24 – Refined palm oil - Removing *beku* from refined palm oil

Table 2 - Palm Oil Cost/Benefit

<table>
<thead>
<tr>
<th>Costs</th>
<th>Quantity</th>
<th>Units</th>
<th>Unit Cost (¢)</th>
<th>Total Cost (¢)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palm nuts</td>
<td>47</td>
<td>Agbas</td>
<td>1,500</td>
<td>70,500</td>
</tr>
<tr>
<td>Firewood</td>
<td>3</td>
<td>Bundles</td>
<td>2,000</td>
<td>6,000</td>
</tr>
<tr>
<td>Mashing</td>
<td>6</td>
<td>Person/hour</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Water</td>
<td>6</td>
<td>Gagbaɛ</td>
<td>200</td>
<td>1,200</td>
</tr>
<tr>
<td>Cracking</td>
<td>8</td>
<td>Agbas</td>
<td>200</td>
<td>1,600</td>
</tr>
<tr>
<td><strong>Total Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>78,300</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Quantity</th>
<th>Units</th>
<th>Unit Price (¢)</th>
<th>Total Benefit (¢)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palm oil</td>
<td>24</td>
<td>Bottles</td>
<td>3000</td>
<td>72000</td>
</tr>
<tr>
<td>Nefi</td>
<td>8</td>
<td>Agbas</td>
<td>1400</td>
<td>12600</td>
</tr>
<tr>
<td><strong>Total Benefits</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>84,600</strong></td>
</tr>
</tbody>
</table>

*Total*

Net Benefit 6,300
Estimates of ratios of palm nuts processed to palm kernels leftover ranged from 3:1 to 5:1, although in this case 8 agba of kernels were seen from the 47 agba of nuts, roughly 6:1.

These kernels with shells intact, which remained from the palm oil processing, were then turned over for the cracking process. This process has been mechanized in industrial palm production (Figure 25), which has reduced costs. Dzodze boasts one cracking machine. Mechanical cracking costs € 600 ($0.24) for one gagba of kernels, equal to about eight agba. The manual cracking costs € 200 ($0.08) per agba. One would think that people would always opt for mechanical cracking. Many people, however, still rely on the traditional hand cracking method primarily because it provides employment for invalids (Nkutsila personal communication) (Figure 26). Older women and/or cripples are limited in their productivity, and traditionally the role of the nutcracker has been assigned to them. Four agba of uncracked palm kernels will give one agba of kernels. The cracker also has the cracked shells of the palm kernels, the exclusive fuel used in forging steel. An agba was sold to blacksmiths for € 400 ($0.16).

The cracking of nuts undertaken by women for whom it is the primary occupation are divided into two groups. The kernels which remain from nuts which were processed by palm oil refiners are given to elderly or infirm women, who are paid €200 ($0.08) for each agba of shelled palm kernels returned to the red oil refiner. The palm oil refiner in turn sells them to a kernel oil refiner.

The other class of nutcrackers are collectors of palm kernels. These collectors travel from house to house purchasing small amounts of palm kernels which were used in
Figure 25 – Palm kernel cracking machine.

Figure 26- Palm kernel hand cracker.
the household for palm nut soup. They also collect wild nuts in groves which were not harvested. These kernels are the results of palm nuts which were eaten by rodents or birds, either fallen or still on the tree. The nuts that are purchased in homes are difficult to price. The price is inconsistent and the units of measure are usually less than one agba of cracked nuts. Rarely will a house have enough palm kernels to warrant collecting more than $0.20. The wild nuts obviously require no investment, and permission is usually not even sought from the grove or palm owner, since the owner has no use for them. (Tsitsi personal communication)

From the nutcracker or collector, the kernels are sold to the nefmi `ala, palm kernel refiner. Palm oil refiners may also be able to refine kernel oil, although specialization is more common. Historically, the grinding was done between two stones, as was the staple corn, and was quite labor intensive and time consuming (Akpeato personal communication). In modern times, this aspect has been completely mechanized, utilizing a common grain mill. The extraction efficiency is 40-50% (Anyane, 1961).

The price paid in the trial of palm kernel oil extraction was $0.61 per agba, for 30 agba. Estimates of prices given throughout the year varied only by $0.08. Input costs are less than that of the palm oil refiner, although the grinding is exclusively mechanical which requires cash payment for each cycle. Water is consumed less than in palm oil extraction and fuel is supplemented by leftover kernel cakes from the previous extraction.

For a grinding of 150 agba of nuts, the operator collects $3.92, although in this experiment only 30 agba were ground for $2.75. The mill operator claimed this was because his machine gets just as dirty from 30 agba of nuts as
from 150, and he must compensate for the down time of cleaning during which he can not grind maize.

The fuel costs in this process are minimal. Fuelwood is supplemented with leftover kernel cakes. This process used little fuelwood, estimated to be one quarter of a bundle. As with palm oil extraction, labor in this process is not strenuous, consisting of tending to the fire with occasional stirring, and transportation to and from the mill. The labor required was one woman day, to process 30 agba of nuts. Again, however, the process is limited by the size of the pot, so while the extraction of 30 agba of nuts was one day, the larger undertaking of 150 agba takes four days.

Outputs from the kernel oil refining consisted of one gago of kernel oil from thirty agba kernels. This was sold for € 60,000 ($23.53). This ratio of yield was confirmed by the refiner (Akpeato personal communication). Eight agba sized lumps of kernel cake were left, could be sold as animal feed for € 250 ($0.10) each.

These results are summarized in Table 3.
Table 3 - Palm Kernel Oil Cost/Benefit

<table>
<thead>
<tr>
<th>Costs</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Cost (¢)</th>
<th>Total Cost (¢)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palm Kernels</td>
<td>30</td>
<td><em>Agbas</em></td>
<td>1,500</td>
<td>45,000</td>
</tr>
<tr>
<td>Firewood</td>
<td>.25 bundles</td>
<td><em>Bundles</em></td>
<td>2,000</td>
<td>500</td>
</tr>
<tr>
<td>Grinding</td>
<td>1</td>
<td><em>Gagbae</em></td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Water</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>52,700</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price (¢)</th>
<th>Total Price (¢)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kernel Oil</td>
<td>1</td>
<td><em>Gago</em></td>
<td></td>
<td>60,000</td>
</tr>
<tr>
<td>Kernel Cakes</td>
<td>9</td>
<td><em>Lumps</em></td>
<td>250</td>
<td>2,250</td>
</tr>
<tr>
<td><strong>Gross Benefit</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>62,250</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Benefit</td>
<td></td>
<td></td>
<td></td>
<td><strong>9,550</strong></td>
</tr>
</tbody>
</table>

Figure 27 – Retailing of palm kernel oil.
Frond Products

The industry based on palm leaves (fronds) is based on home and market use. Its significance is in the money saved in using items constructed with palm fronds as alternatives to more expensive manufactured and imported goods. A notable market exists in these products. One basket weaver recalled the days when lorries were not as common of a form of transportation, so he would routinely walk to Keta, a distance of 30 miles, to sell baskets on market day.

Modern times however have decreased palm density causing a greater demand for palm fronds. Fronds have become a merchantable item with a significant local economy. In the metropolitan area of Dzodze for instance, fronds are imported from the Ave areas, up to 15 miles away.

Woven baskets can be marketed locally, although they fetch a higher price in the district capital, Denu, located on the coast. It is said that coconut, the only palm which grows on the shoreline, does not have good fronds for weaving baskets. Since there is no source of fiber for weaving containers, there is a greater demand for baskets in Denu.

Fronds 6-8’ in length sell for in bundles of 60 for 61,500 ($0.59) in the Dzodze area. Very large fronds (over 12’) can sell for 62,000 ($0.78). Villages surrounding Dzodze, such as Deme and Tofoe supply these frond bundles for 61,000 ($0.39), the excess costs in Dzodze being added for the transportation of the bundle (Figure 28).
Figure 28 – Fronds for sale.

Small home use baskets, 12” to 16” in diameter, can be woven at a rate of 3 to 5 an hour using 4 or 5 fronds. These fetch ₵ 300 ($0.12) in Dzodze and ₵ 500 ($0.20) in Denu. Baskets used for transporting goods to and from the market are from 2 to 3 feet in diameter using 15 fronds to weave in about 1 hour per basket. These sell for ₵6,000 ($2.35) and ₵10,000 ($3.92) in Dzodze and Denu respectively. Baskets used to transport farm produce to the household measure up to 5 feet in diameter. These use 20 or more fronds and require two to three hours each for crafting, and sell for ₵8,000 ($3.14) locally and ₵12,000 ($4.71) in Denu.

Construction materials will necessarily use the largest and thickest fronds for which basket weavers would pay a higher price. Construction materials are not needed on a regular basis as they are used by individual families in the home. Therefore, fronds for this purpose are not sold. Also, the modern 2x4 truss frame - aluminium sheeted roof
is preferred to the traditional thatch roof. Thatch roofs are still common only out of necessity due the price of alternatives.

[ŋ], which were used as doors in the traditional household are still widely used. Today, they are not often used as doors, although they retain the name [ŋ]. They are more today as fences and gates and in compound houses and animal pens. They are also used as walls in structures which don’t require security such as cooking areas. [ŋ] sell for ₦1,500 ($0.59) for a 4x6 sheet.

Leaves processed for brooms use smaller fronds, 3-4’ in length, which would be unsuitable for basket production. Because of this, fronds for brooms are not purchased, only collected. Brooms for sell for ₦200 ($0.08).

Rope is not made from fully developed leaves, but from the immature emerging leaves. At this stage of development the leaflets have not separated, but are still connected and folded in an accordion fashion along the seam. These leaf spears are merely harvested and woven. The rope sells for ₦500 ($0.20) per abẹnyi.

The benefits of palm products are summarized in Table 4. The right column in Table 4 shows the benefits which would be seen assuming the fronds are purchased, the craft person is working an eight hour day, and the products are marketed locally. This is not the case in reality. Unlike palm oils and palm wine, which are consumed daily, frond products are not purchased daily by the household.
Table 4 - Frond Product Cost Benefit

<table>
<thead>
<tr>
<th>Baskets</th>
<th>Number of Fronds</th>
<th>Cost of Fronds (¢)</th>
<th>Local Price (¢)</th>
<th>Denu Price (¢)</th>
<th>Units/ hour</th>
<th>Benefit/day Production Labor</th>
</tr>
</thead>
<tbody>
<tr>
<td>12”</td>
<td>4</td>
<td>0-100</td>
<td>300</td>
<td>500</td>
<td>4</td>
<td>6,400</td>
</tr>
<tr>
<td>16”</td>
<td>5</td>
<td>0-125</td>
<td>500</td>
<td>800</td>
<td>2</td>
<td>6,000</td>
</tr>
<tr>
<td>36”</td>
<td>15</td>
<td>0-375</td>
<td>6000</td>
<td>10000</td>
<td>.5</td>
<td>22,500</td>
</tr>
<tr>
<td>60”</td>
<td>25</td>
<td>0-750</td>
<td>7000</td>
<td>12000</td>
<td>.25</td>
<td>12,500</td>
</tr>
<tr>
<td>4x6</td>
<td>30</td>
<td>0-750</td>
<td>1,500</td>
<td>N/A</td>
<td>1</td>
<td>6,000</td>
</tr>
<tr>
<td>Brooms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>House</td>
<td>4-5</td>
<td>0</td>
<td>200</td>
<td>N/A</td>
<td>2</td>
<td>3,200</td>
</tr>
<tr>
<td>Compound</td>
<td>4-5</td>
<td>0</td>
<td>200</td>
<td>N/A</td>
<td>3</td>
<td>4,800</td>
</tr>
<tr>
<td>Rope</td>
<td>4-5</td>
<td>0</td>
<td>500</td>
<td>500</td>
<td>1</td>
<td>4,000</td>
</tr>
</tbody>
</table>

Like collectors of wild palm kernels, there are collectors of wild *fJkpolo*, to supply the cooking fuel market. These women require no inputs other than collection labor and are able to sell a bundle of 10 or 12 *fJkpolo*, for 600 (0.24) (Figure 29).

Shade structures are a single use utilization of palm, and there is usually no monetary exchange involved. The community contributes the largest structures which are necessary for community events, funerals, fundraising, town meetings, and church events. Private shade structures are also common in compound houses. Often, these temporary structures are preferred to live shade in the house because at certain times the scorching sun is necessary in the compound for drying of crops.
Tapping

Palm wine tapping is what many consider to be the most lucrative of palm endeavors. Like oil processing, where initial capital is necessary to invest in palm nuts or kernels, tapping requires the investment in live standing trees. Distillation requires a large initial investment in materials.

There is a difference between tapping for wine and tapping wine to distill akpeteshi. Although the process undertaken is identical in respect to the tapping of the trees, the scale of the operation is much larger if the wine is to be distilled. An individual tapper who is to supply a palm wine bar will tap only ten to thirty trees at one time, felling another group of trees halfway through the tapping process of the first. This insures a constant tapping income. A distiller will tap a larger number of trees, upwards
of 100, to have a large amount of wine flow at one time for distillation. He can then sell the *akpeteshi* as the need for cash arises.

Unlike nuts and kernels which have a standard (albeit unconventional) unit of measure, trees of different sizes have individual values. The largest in the trial run was said to have a value of ¢ 5,500 ($2.16), though the smallest was said to have no value. For this reason, in large tapping ventures, often a flat rate is assigned to all trees. In this type of purchase a tapper must be quite savvy in order to maximize profit. For example, the flat rate assigned to trees in the trial run was ¢ 2,000 ($0.78) for each of the 63 palms. Some palms proved to yield much less than ¢2,000 of product, some yielded much more. (Appendix 1). A tapper who does not scrutinize the trees runs the risk of taking a loss.

Tapping is more consistent labor than oil production or basketry, requiring two daily visits to the tapping for the one month or so of wine flow. The felling and peeling of the trees proves to be intensive labor. It is for this reason that tapping labor is often contracted in the larger distillation ventures.

In the trial run, the price of felling the trees was ¢ 400 ($0.16) per tree. One week later the trees were ‘peeled’- all leaf bases were removed to reveal the apex, again at ¢ 400 per tree. An individual tapper can do this labor himself in one day if there are fewer than 20 trees. A professional distiller exclusively contracts this labor.

In large operations, tapping labor will be hired for either a percentage of the profit, or for a flat rate. The percentage is similar to the land hiring agreements, sometime one-half, usually one-third, while flat labor rates are ¢1,000 ($0.39) per tree for the duration of the process.
Tools required for the hard labor tasks are a type of adze, for severing the roots in felling, and a large machete for cutting away the leave bases in peeling. Both of these items are made with used suspension springs from old automobiles. Costs on these are limited, since it is the responsibility of the person in need of the tools to acquire the suspension spring. He then gives the spring to the blacksmith, who will hammer the tool out of a portion of the spring, keeping the remaining steel as payment for the workmanship. The depreciation of these tools is said to be low; one tool can be used through many rotations of tapping.

A knife is also necessary for the daily cutting of the apex throughout the tapping process. These can also be fashioned from the spring, or simply purchased for €1,500 ($0.59). These are said to last for one year of constant tapping, or two to three for seasonal tapping.

The last necessary input for tapping is the specialized collection pots for the wine. They cost €300 ($0.12) new, although bulk purchases can bring the price down to €200 ($0.08). The depreciation of these is variable as they are clay; some were said to last more than 10 years, some were said to break in the first use.

Distilling also requires a significant investment to construct the still. A 50’ length of copper tubing was purchased for €40,000 ($15.69) which was then crafted into what is locally known as a ‘machine’. The tubing is bent and coiled to run from the drum, through one to three pots of cold water, and into a collection container. The lifespan of the ‘machine’ is reputed to be more than 10 years.

The steel petroleum drum, however must be purchased for every cycle or two of distillation. It is dangerous to try to extend the use of the drum beyond this. The constant
heat pressure of the distillation process inside the drum causes the integrity of the drum to
deteriorate. An explosion of the drum is known to be the cause of not only personal
injury but the loss of a significant amount of product.

Fuelwood, as in oil production, is a significant cost in distilling. Each distillation
process requires a constant fire. Although like kernel oil refining, a by-product of the
process (the *fJkpolo*) can be used to supplement fuel costs. Early in the process,
however, when these are freshly pruned, they are not efficient as fuel. Only toward the
end of the process can the *fJkpolo* be used efficiently (Figure 30).

In comparing the yield of wine tapping and distillation tapping one must consider
that much of the product yield is consumed in the field, and is to be considered a labor
cost. Palm wine is a luxury and therefore not frequently purchased for consumption by
the general population. Therefore, when tapping is undertaken, the activity draws many
‘volunteer’ helpers, who assist in the burning and cutting of the palm in exchange for a
calabash or two of fresh wine. It averaged that six people were involved in tapping every
day, twice a day, drinking a calabash (~1/2 L) each time. Tapping continued for more
that 30 days, leaving the estimate of wine consumed in the bush to be 180 liters. It
should also be noted that the first days collection of wine, the *atade*, although drinkable,
has the texture of sweet and sour soup. Consequently, lacking the liquid quality of most
beverages, it is not sold in palm wine bars, but is distilled into *akpeteshi*. 
The trial run showed that 1,102 liters of marketable palm wine was extracted from the 63 oil palms. As was mentioned, a considerable portion of this was consumed on the site. Another portion, although intended for akpeteshi, was sold to palm wine retailers. Interviews showed that a gago of palm wine wholesales at ₦8,000 ($3.14) (₦400/L). It is the role of the retailer to come to collect the product. Therefore, in order for a retailer to stay open for business, she must search for alternative sources of wine when her connections fall through. Because this trial took place at the end of a tapping season, the fresh wine was able to sell for ₦600/L.

Palm wine retailers sell their wine for ₦400 ($0.16) per calabash, which measure 400-500ml. Rumor has it that they also mix bitter, day old wine with fresh wine and water to increase their profits.
Of the 1,102 liters of wine yielded from the trees, 846 L were distilled. Toward the end of distillation, 56.5 L of wine had to be purchased from another tapper to complete distillation cycles. From this wine, 110.6 liters of akpeteshi was distilled. The wholesale price of akpeteshi in 20 liter gagowo is € 60,000 ($23.53).

The cost/benefit analysis of palm wine tapping is summarized in Table 5. The cost/benefit analysis of akpeteshi distillation is summarized in Table 6.

Results of Interviews

Interviews conducted with farmers elucidated how the establish, manage and harvest palms. There have been government sponsored efforts to improve oil palm production throughout suitable habitats in Ghana, led by the establishment of the oil palm Research Station in Kade, Eastern Region. This institute practices controlled germination and raises nursery seedlings for distribution. While this appears to be a viable operation, especially in the immediate geographical area around Kade, the overwhelming majority of standing palms in the country, and especially in the Dzodze area, are spontaneously germinated from the rich seed bed in the soil strata (Konkogbui, Wometo personal communication).
Table 5 - Palm Wine Tapping Cost/Benefit

<table>
<thead>
<tr>
<th>Cost</th>
<th>Unit Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td>2000</td>
</tr>
<tr>
<td>Knife</td>
<td>1500</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Avg. Yield</th>
<th>Cost/L (¢)</th>
<th>Yield/tree (¢)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palm Wine</td>
<td>17</td>
<td>600</td>
<td>10,400</td>
</tr>
</tbody>
</table>

Net Benefit per tree: 8,400

Table 6 - Distilling Cost Benefit

<table>
<thead>
<tr>
<th>Cost</th>
<th>Unit Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>63 Trees</td>
<td>2,000</td>
<td>132,000</td>
</tr>
<tr>
<td>Felling</td>
<td>400</td>
<td>25,200</td>
</tr>
<tr>
<td>Peeling</td>
<td>400</td>
<td>25,200</td>
</tr>
<tr>
<td>2 Knives</td>
<td>1,500</td>
<td>3,000</td>
</tr>
<tr>
<td>Oil Drum</td>
<td>31,500</td>
<td>31,500</td>
</tr>
<tr>
<td>Firewood</td>
<td>-</td>
<td>26,800</td>
</tr>
<tr>
<td>Palm Wine</td>
<td>10000</td>
<td>10,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>251,700</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Benefit</th>
<th>L yield</th>
<th>price/L</th>
<th>Total Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akpeteshi</td>
<td>110.6</td>
<td>3000</td>
<td>331,800</td>
</tr>
</tbody>
</table>

Net Benefit: 80,100

*Total*
Local Perceptions

The older generation recalls of the times of high palm nut production. It was claimed that “here, in our area, this [palms] can said to be our primary occupation.” (Konkogbui personal communication).

Others recall times during the palm nut harvest when “palm nuts would be stacked so high that if a person was standing on the other side, you would not be able to see him and … palm groves which were so thick, the sun would be blocked out, and you would be afraid to enter them even in the daytime.” (Ampesidula personal communication).

While the men reminisce days of active palm work on the farm, women recall a time of active palm processing in the tok. One Dzodze resident recalled times when entire families “would get up and go to the tok and [work] there for a long time before they would go to their farms.” (Mama Tsitsi personal communication).

It is the women’s voices which show lamentation in reference to historical oil palm production. In interviews it is exclusively the women who claimed “there are no more palms.” An elderly widow who once would have been able to earn a living from palms, “now, you can’t go to the farm anymore and collect kernels. Where are you going to see them?”
Men also notice the change in palm populations. One man in the village of Deme (meaning “inside the palms”) remembers, “in the past this [palms] was our main occupation. Now we are only cultivating maize and cassava. In the past, you would make a farm and cultivate palms. You cut the savanna grass once, burn it, and new grass came. Then you plant crops and palms. Keep going for years until you have farms and groves, farms and groves. Today people are not going into palms.” (Aglawuko personal communication).

When asked what caused the change in palm management, people sometimes refer to environmental change in the area. Lack of rain, deforestation, bush fires, and decreased soil fertility were some reasons given. All of these can be considered a function of increased population pressure, and the change in the landscape associated with increased cultivation.

Premature akpeteshi tapping was the main reason give for the demise of the oil palm populations. One man noted that “in the olden days only the tallest palms were tapped. The trees which we are tapping today, they are not palms. You could carry them to another place on your shoulder” (Donukomo personal communication).

Women saw the problem to be that “the palms which we fell we are not replanting in their place” (Mama Tsitsi, Nkutsila personal communication). Men however see the state of the palm populations as a result of palm felling for akpeteshi as less problematic. They claim “[E] [land germinates palms like weeds” (Nkuto personal communication).

Palms spontaneously germinate on almost every farm in the area. It was recognized that many places in which palms grow in the area are not natural palm habitat.
One man claimed that “forest is the place for the palm. If you see palm on savanna land, you know [it was] planted.” (Wometo personal communication).

It is especially the older generation which distinctly remembers that, in the past, oil palm was actively cultivated. Today, it is seen as unnecessary to plant palms. “Our forefathers planted palms. They would weed, cultivate palms, and then fell. Now, there are many seeds in the ground. So if you weed, the seed themselves will germinate” (Konkogbui personal communication). Today, the elder generation recalls the strategy people would use to cultivate palm. “You can plant on your farm border, and it will surround your farm. Then you can broadcast palm seed inside. But there are not many [people who do]” (Konkogbui personal communication).

Although few people plant palms, the way the farm is managed still favors oil palm regeneration. In clearing fallow land or a successive plot for cultivation, oil palms are always spared from removal in clearing fields, unless they are mature enough to harvest for palm wine. Crops are then planted between or around the palms.

Many people also refuse to till the land mechanically, although it is widely known to increase crop yields. They fear that the viable oil palm seeds in the soil will be plowed under the soil to a depth which prevents germination. Spontaneous germination of palm is the most common, but not the only, strategy for palm cultivation.

While artificial germination of palms is notoriously difficult, local people have developed methods for doing so. One who wants to cultivate palms simply retains a few of the seeds which would otherwise be used for palm nut soup or palm oil. A small bed is then raised in better soil. The bed is soaked with water, and the seeds are broadcast on
top. The seeds are then covered with palm fronds and watered daily. This method results in 50% germination (Tsitsivi personal communication).

People will also attempt to direct sow palm seeds in the same manner that maize is planted. Two or three ripe seeds are dropped into a hole which was tilled with a machete. This method is not common however; it requires watering which is a labor intensive task. One example of it was seen on a river side farm plot.

A few farmers have taken advantage of Ministry of Agriculture Research Stations, buying ten pre-germinated improved variety seeds for €1,500 ($0.59). These were then planted at the recommended triangular spacing of 29 feet (Dodonu personal communication).

Another intentional method which is used to cultivate palm is to transplant naturally germinated palms. An example of this was seen at an elementary school in Gagodo, where the teachers for the school farm desired to have palms in their school farm. They required each student to uproot one palm from their father’s farm and bring it to school one morning. The palms were spaced nine feet apart, between the pepper plants in the field.

While the palms are in the establishment stage, their management depends on how valued they are by the landowner. Some farmers manage specifically for oil palm, investing labor into weeding around the palms to prevent competition. This is especially true of those who planted the palms. It is more common, however, that weeding around the palm is incidental while weeding annual cereal crops. A similar situation of palms benefitting from annual crop is seen in Sri Lanka (Liyanage, 1984).
In the early stages of growth, despite the weeding around palms, the farming method is actually harmful to the palm. In the early seedling stage, when the palm is under one meter in height, taller crops, such as the maize and cassava staples, reach a mature height taller than the young palms, limiting the photosynthetic capability of the palms. The crowns of palms, which are at or under the height of the annual crops, are pruned to prevent competition for light and space. Cases like these entail the complete removal of all of the opened leaves, leaving only the two to three unopened leaf spears. (This was referred to as ‘extreme pruning’ in the regression). The palms can then take up to 22 months to regenerate to full crown (Hartley, 1988).

By the time palms reached maturity, they are not considered to be a threat to other crops and would be allowed grow unhindered. However, the palms at this stage are considered mature enough to be felled for wine.

Fronds that are pruned, if large and healthy, can be sold to basket weavers. Management of palms specifically for fibrous uses does not exist, although most palms are pruned in order to use the fronds. Few palms with a full leaf crown were seen throughout the study area. Fronds were historically, and continue to be, harvested for both the fiber uses in the market, and in the home. Selling fronds, as a commodity, is a new development.

It is widely known that pruning of fronds decreases nut production. The local belief is when the leaf is cut, the palm “does not spread its wing to allow anything in the armpit,” i.e. the weight of the leaf no longer pulls the petiole away from the stem, leaving no room inside the leaf base for the nut bunch to develop. Harvesting fronds requires careful selection and limiting the number of fronds harvested to two or three per palm.
Ideally, careful selection involves taking only fronds that cover mature or male flowers, so as not to limit production (Donukomo personal communication).

Many of the fronds harvested from palms in the study area were not harvested by the land owner. Every palm owner interviewed claimed to have had fronds taken from his farm. Theft is a serious crime in Ghana which results in a public beating of the thief. For palm fronds there is no cultural definition of frond taking as theft. This can be seen in the local language, where the verb used for taking of fronds was “to cut” [sɪ] while the verb used when other farm produce was taken was “steal” [jɪ]. Palm frond products are also where the tenure issue of rights to palm use comes into play. Historically, when there were large groves of palm, fronds could be collected freely without harm to the palm. It is believed that taking one to three live fronds from a palm does no harm to palm growth and production.

Prosecution of frond thefts are uncommon because a large number of these criminals go uncaught. Fronds are stolen from farms which are far removed from the towns and villages. If a farmer does have the opportunity to come upon an enterprising yet morally challenged youth, the farmer will first have to catch him. The child is then let off with a less than severe beating. Some thieves when caught will be taken to traditional authority, the Stool, instead of the police, because “the police will just take a bribe, while the chief will distribute justice” (Dodonu personal communication). Once case was seen where a fourteen year old boy was caught with two bundles of fronds from a farmers land. The boy was taken to the local chief for judgement, who sentenced the boy to pay ¢ 5,000 ($1.96) per frond stolen. This sets a local precedent that shows the chief attitude about deterring palm frond taking.
The reason that many frond thieves go unpunished is a function of the management of palms. Most palms are spontaneously germinated, and then in many cases are uncared for. Lack of effort on the part of the landowner, indicates that the palm has little or no value, and consequently, it becomes a free resource. As with wild *fjkpolo* and *neku*, it seems that the farmer has no intention to utilizing the raw materials from his palms, showing them to be free for the taking.

Of course, not all of the fronds which end up being weaved into baskets are stolen. Basket weavers will travel around an area in search of fronds to buy. People in need of immediate income, which is often the case, will harvest their own fronds.

Palm owners can have up to 300 palms per acre. In general palms are treated as a secondary tree crop instead of as an agricultural crop. Since voluntary palms regenerate on their own, they require no inputs outside of what is already being done when cultivating annual field crops. They serve as reserve capital for the landowners, similar to the way woody forests serve as a “storable, renewable resource,” which can be harvested as need arises (Tietenburg, 1988).

The fruits of palms are harvested throughout, though yield is usually limited by both palm density and the degree of pruning. Local perception states that an individual palm can produce four to six bunches in one year. A close spacing or severe pruning is known to limit fruit production, and both the bunches and nuts of ‘local varieties’ are known to be small compared to improved palms (Dodonu personal communication).

When palm bunches are gathered from voluntarily germinated individuals, two to three bunches are required to fill one *agba*. The palm is also claimed to be periodic in fruiting for three-year intervals in a non-plantation setting (Ampesidula personal
communication). Hence after a good year of harvesting palm nuts from the palms, two years of decreased production will be observed. This has also been noted by Anyane (1966).

Since fruit production of the ‘wild’ palms is known to be low, and this level of production is intensified by the pruning of leaves for craft and household goods, the focus of management tends to be toward production of palms for tapping. Although this is the final product in palm production, and it is harvested at an early state of maturity, the other products are of equal necessity in daily life.

In alcohol production, standing palms need no investment in labor or capital. Even after the palms have decreased nut production because of pruning to benefit other crops, the palms have a standing value as a reserve capital resource. Although harvesting palm nuts is known to bring more financial benefit over the long run, the distribution of labor and benefits limit the farmers in the amount of care given to the palm.

In response to the demands of palm markets, palms continue to be actively managed by individual land owners, although not necessarily for palm nuts, as in the past. In analyzing the ways that palm is now managed in this area, three types of palm land managers were delineated.

Management toward nuts / Palm “Plantation” Owners

If nut production is desired to fill local oil markets, it has become almost necessary to intentionally cultivate palms. In nationwide extension efforts to improve the
oil palm industry, the people of Dzodze have come to learn that their area is not the optimal habitat for oil palm. Thus, the local people are less likely to cultivate palms, and the government of Ghana is less likely to direct palm production efforts in the area. It is therefore up to the individual land owner to instigate palm cultivation.

Major limiting factors in this are land availability and cash resources. The land tenure system is generally prohibitive in that land is not leased for multi-decade intervals. The sale of farm land to continue to be used as farmland is also uncommon. There are a few people who have both land and cash resources. People would prefer to cultivate improved varieties from purchased seed. Sources for improved seed are far removed from Dzodze, requiring travel, so the acquisition cost is often prohibitive.

Local palms can be cultivated. This was the most common method of propagating palm farms before the establishment of oil palm research stations. Today, intentional cultivation of local palms is seen as an unsatisfactory compromise between managing wild groves and cultivating genetically selected palms. While cultivated local palms produce a significantly higher yield than improperly spaced voluntary palms, they have only half the production capability of improved varieties (Anyane, 1961)

Acquisition of improved seed cannot be considered the limiting factor, since it was seen that in the establishment of tilled land for palm planting, the expense of land preparation far outweighs the expense of improved seed. There are few who continue to intentionally cultivate local palms, including intensive weeding and sheltering. Those who do, claim to produce twice as many nuts per acre as untended palms (Tsitsivi personal communication).
People who intentionally plant palm usually utilize services provided by the Oil Palm Research Stations. Farmers are able to acquire genetically improved varieties (locally known as ‘agric Two’ varieties) and consultation involving production maximizing spacing. The recommended spacing allows for 70 palms per acre. These varieties are said to bring as much as 20 agba per acre every two weeks during the peak rainy season, and as much as 200 agba throughout the year. No annual fluctuation of yield was reported in a well-tended plot (Dodonu personal communication).

The largest expense in cultivation of palm is the preparation of land. Mechanical tilling of land costs £50,000 ($19.61) to 90,000 ($35.29) an acre with a tractor, depending on distance of the farm from the tractor, density of vegetation on the farm, etc. Plowing by hand, which is locally known to cause lower yields, costs £21,000 ($8.24) per acre. (£1,000 /abonyi) The local belief that mechanical plowing buries existing palm seed in the soil strata means that in intentional palm cultivation mechanical plowing is preferred, since wild palms will not germinate to compete with planted palms (Nkuto personal communication).

The next most limiting factor in palms is the five to seven year period before the palm begins to fruit. This was first addressed by Anyane in 1961, and was seen to be a concern of most of the farmers who would otherwise cultivate palms. A common response when asked why palm is not cultivated was “if I plant palms, when will I eat?”

Another disadvantage in palm nut management is the fruiting cycle of palm nuts. At the time most palm nuts ripen, there is a surplus, bringing low prices. One way to alleviate this is to extract oil in the household, in effect storing the nuts as oil until a
higher price can be sought. However, in the economic situation it is not usually possible to hold out for a higher price with pressing household expenses and indebtedness.

The advantage of managing palms for fruits is that it does not exclude wine tapping, unlike the reverse management strategy. Managing for nuts will create larger palms, increasing wine yields through time. It was noted, however that if the palms are too tall, they may break when they are felled, rendering them useless for wine.

Figure 31 – Oil palm plantation.

Multiple Use Management / Individual Farmers

The majority of palms occur in land which is utilized in the modern shifting cultivation system. The palms which naturally occur on this land can number up to 100 per acre. Palms in any greater numbers would result in a dense palm grove prohibiting
the possibility of cereal cultivation. The existing palms are excessively pruned during cereal cultivation years, until they reach a height where the leaves will not affect the growth of cereals. Land managers admitted this extreme pruning drastically reduces nut production. So few palm nuts are produced that they can not be sold wholesale. These nuts are utilized at home or sold in handful size amounts to be cooked as palm nut soup. Since farmland palms have such small palm nut yields, they have little value outside of their standing value for tapping.

When the palms reach an age of ten to fifteen years, they are sold to a palm wine tapper or akpeteshi distiller for cash. The deciding factor for the time of final sale of the whole tree is not as dependent on when the tree is considered mature for tapping but when a tapper is working in the area and is able to tend to the purchased palms. Consequently, younger palms, in some cases less than one meter high, are sold for tapping.

Figure 32 – Multiple use management in establishment stage.
Management of the Stem

Many of the people who do not plant palms in a plantation setting still have sizeable palm holdings resulting from spontaneous germination which occurs in farmlands. These plots can develop into palm groves, with a very high palm density. These are generally one or two acres in size, though one man interviewed has five acres. In this semi-wild grove setting the number of individual palms can reach 300 per acre. This is said to be too many, and maintaining such a close spacing causes the palms to “not have a healthy body”. Three hundred stems per acre is triple the agricultural research station’s recommendation for good fruit production. Such spacing can cause unhealthy trees and a decrease in nut production. Therefore, these groves are not managed for nut production.
Fruiting activity in wild groves was not observed, since groves are managed to remain in an early establishment stage, and peak fruiting age is never reached. Naturally regenerating groves are the most common high density palm areas, but they are not managed to harvest the palm nuts. One informant claimed that he doesn’t harvest nuts from his grove because people have been coming to the grove and taking them. “When I got to the farm, I saw that all of the bunches were gone, so I went home” (Ampesidula personal communication). As was the case in the taking of fronds, the failure to pursue of a culprit indicates that the product is not highly valued. Instead, these groves are managed exclusively for alcohol production.

Tapping of palms for alcohol was noted by many, including the people who cultivate palms for the fruit harvest, to be not necessarily the most lucrative, but the preferred way to deal with palms. Tapping for alcohol is preferred because “[managing for] palm nut harvest, the money comes in a little at a time. But if you fell it and tap wine, the money will come all at once. It will come plenty. If you [measure palm nut harvest] every ten years, the money will be plenty, more than tapping. But it doesn’t come at one time that you could take it and do something” (Wometo personal communication).

Groves are land holdings of wealthier people, who have surplus land not necessary for annual crop cultivation. The germinated palms are cared for, at least enough to reduce competition until the palms are established. Once a dense canopy forms, there is little competition. Palms fruit production is known to be limited at close spacing and therefore not regularly harvested.
In managing for alcohol production, palms are felled on a rotational basis of three to five years. At this rate around 100 palms can be harvested, bringing up to €400,000 ($156.86) per harvest. With such a frequent tapping, the labor is undertaken by the land owner. When tapping is taking place, people who have palms in adjacent farms with individual mature palms will sell them to the tapper. The felling of the palms create gaps in which new palms are able to germinate. This allows for notable income to be generated from the plot on a regular basis, with virtually no investment costs in establishment.

Figure 34 – Dense grove.
Results of Regression

Regardless of management strategy, the ultimate harvest of the tree will be for tapping. Interviews with farmers revealed local perceptions of reasons why a palm might produce higher or lower volumes of wine. Farmers listed fruit sex ratio, pruning, type of cultivation in palm areas, and competition as variables which could affect the yield of palm wine. Data for these variables were collected for 63 palms. The data are shown in Appendix 1. Several regressions were run with different combinations of independent variables. Table 7 shows the variables in the final regression and Table 8 shows the estimated parameters.

P-values indicate 95% confidence that stem volume, the number of male inflourescences, and extreme pruning of the palm significantly affect palm yield. The P-value for site indicates Site 1 is significant at 94% confidence. From this data, the yield of palm wine from a tree can be predicted using the equation:

\[ Y = 5.20 + 51.76V + 3.02M - 8.42P + 5.43S1 - 2.58S2 - 0.07F - 1.13C \]

The adjusted \( r^2 \) is 0.72. There remains some random error in the regression. As would be expected the size of the tree is a significant factor in the amount of wine yield. A large number of male inflorescences also proves to indicate a higher wine yield, confirming local beliefs. Extreme pruning was seen to reduce wine production. It is indicated that site has an effect on palm wine yields, although the variability between the
three sites in any combination type of cultivation, time since cultivation, soils, etc. means it is difficult to interpret underlying causes.

Individual fronds were collected from all sixty three of the palms. Some research assistants who were employed to transport the fronds to the data collection center redirected the fronds en route, presumably since the fronds are a commodity. This resulted in an incomplete data set in the number of fronds per tree. In the regression of palm wine yield on the number of fronds with the remaining data, the estimated parameter for fronds was not significant.

Table 7 – Regression variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>Yield of palm wine [dependent variable]</td>
</tr>
<tr>
<td>V</td>
<td>Volume of the tree to the apex in m³</td>
</tr>
<tr>
<td>M</td>
<td>Number of male inflourescences</td>
</tr>
<tr>
<td>S1</td>
<td>Site 1 (1 if Site 1, 0 otherwise)</td>
</tr>
<tr>
<td>S2</td>
<td>Site 2 (1 if Site 2, 0 otherwise)</td>
</tr>
<tr>
<td>P</td>
<td>Extreme pruning (0=no 1=y)</td>
</tr>
<tr>
<td>F</td>
<td>Number of female inflourescences</td>
</tr>
<tr>
<td>C</td>
<td>Competition (# palms in 10m² area)</td>
</tr>
<tr>
<td>D</td>
<td>Fire Damage</td>
</tr>
</tbody>
</table>

Table 8 – Regression analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimated Parameter</th>
<th>Standard Error</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>5.20</td>
<td>2.49</td>
<td>0.04</td>
</tr>
<tr>
<td>V</td>
<td>51.76</td>
<td>5.40</td>
<td>0.01</td>
</tr>
<tr>
<td>M</td>
<td>3.02</td>
<td>1.16</td>
<td>0.01</td>
</tr>
<tr>
<td>S1</td>
<td>5.43</td>
<td>2.79</td>
<td>0.06</td>
</tr>
<tr>
<td>S2</td>
<td>-2.58</td>
<td>2.25</td>
<td>0.25</td>
</tr>
<tr>
<td>F</td>
<td>-0.07</td>
<td>0.89</td>
<td>0.94</td>
</tr>
<tr>
<td>C</td>
<td>-1.13</td>
<td>1.31</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>0.93</td>
<td>2.10</td>
</tr>
<tr>
<td>---</td>
<td>-----</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>P</td>
<td>-8.42</td>
<td>2.92</td>
<td>0.01</td>
</tr>
</tbody>
</table>
Chapter 5  Conclusion

The oil palm plays a significant role in the local economy of southeast Ghana. The advantage of the oil palm as an agricultural crop is its annual fruit production for regular income, as well as a standing value for mature trees. In the Dzodze area trees are harvested at a stage when fruit production has not been maximized. At first it seems illogical that indigenous farmers with such a historical knowledge and economic history of a certain species would harvest that species at a fraction of its production capabilities. There are, however, logical reasons for the decisions the farmers make for palm management.

Despite the change in the role of oil palm in southeast Ghana in this century, the local market for products of the oil palm still thrives. In local consumption, palm oil does not have a significantly higher demand in relation to other palm products. Palm wine and akpeteshi are valued as a cheap local alternative to bottled recreational beverages, as well as for cultural and ceremonial use. The fiber from the leaf stalk produces household items which are much cheaper and more familiar than manufactured goods. These products are also in continued demand.

It was noted at the Symposium on Agricultural Engineering in Ghana, that “unless a farmer is sure of the market and of receiving a fair price for his produce, he will not put any effort into growing a crop, whatever the other advantages may be.” (Wadwha, 1971). Attempts to modernize the palm industry earlier this century, confirm this. The failure of processing mills in the 1920’s and 1930’s was not due to a lack of palm fruit supply, but inadequate compensation for the farmers’ labors. Farmers ultimately preferred to process
the oil themselves, and market it locally, than to take a lower price for their unprocessed palm nuts (Anyane, 1961).

With the introduction of *akpeteshi* into the palm market, it has become more profitable for farmers to manage palm for its final value as a tapping tree. Only limited investment is necessary to produce alcohol trees compared to management for oil. Further, farmers prefer the single large payment from alcohol trees compared to a small but steady income from palm fruit production.
Literature Cited:


http://www.lib.utexas.edu/Libs/PCL/Map_collection/africa/Ghana_rel96.jpg


Thomas, Peter.  2000   Trees: Their Natural History. Cambridge University Press.


APPENDIX 1
Glossary of terms

Abenyi – Local land measurement equaling eight armspans squared.

Agba - A 2-quart aluminum bowl.

Abolo – A steamed bread product.

Ag - A tree whose fruit is a cluster of black seeds individually surrounded by a white pulp.

Agrictwo - A combination of English and Ewe roughly meaning “the agricultural ones”. Used to describe improved varieties.

Ahagbagba- “The breaking of wine”. Refers to the first distillation process which does not produce drinkable akpeteshi.

Akpeteshi – A Ga word for distilled palm wine. To Ewes it is sodabi, or dekele.

Ama- A category of edible plants which are collected in the wild.

Amide- “Oil nuts”- Palm nuts preferred for processing oil.

Anyit – The tree used for marking borders of farms. Also known as lifoti.

Atade – The first day’s collection of palm wine. It is thick and generally not drank raw.

Ava – The traditional maize storage structure. It consists of a platform raised above goat height, on which the maize is stacked and bound. It is then roofed with thatched grass.

Avawo – Plural of ava.

Ave – Forest

Ayiti – A hollow stemmed plant used as a tube in tapping palms.

Beku – Residue left at the bottom of a pot used in oil processing. Dzomi beku is eaten, Nefimi beku (Kernel cake) is used as animal feed.

De – Either an Elaeis guineensis (oil palm) plant, or the fruit (palm nut) of the plant.

Detsi – Soup. To specify palm nut soup is dedetsi.

Detside – “Soup nuts” – Palm nuts which are known not to give high oil yields.
De ’J - The emerging, unopened leaves of a palm. Hartley (1988) refers to this as the ‘spear’.

Deme (dibimadibi) - The share-cropping system of the Ewes.

Dzomi – The edible, red, palm oil from the pericarp of the fruit.

Eta - Head. To be specify speaking about palm nut bunches, deta can be used. (De-eta).

FI - Palm leaves, fronds.

FIkpolo – Petioles or leaf bases of palm leaves.

Fufu – The preferred dish of Akans and northern Eʋes. Made by pounding boiled cassava or yams.

Gari – Shredded, roasted Manihot spp. (cassava). It is considered poor mans food, but can be resorted to in crop failure years.

Gagba - A head pan which is believed to hold 25 bottles, or 25 liters.

Gago – A twenty-liter jerry can.

Mlekpu – A horseshoe shaped mound of mud that reflects heat and supports pots above cooking fires.

Nef imi - Palm kernel oil from the endocarp of the fruit. It is generally not used in cooking.

TJgbui- Old men, elders. Implies wisdom.

TJgbuiwo – Plural of TJgbui.

To- The pit or mortar where palm nuts are ground for oil extraction.

TokJ - A palm oil processing area.

Tsitoe - A tree with a velvety berry sized fruit.

Tukpa -A bottle of palm oil or palm kernel oil is a one-liter Pastis bottle.

情人 - A tree which is allowed to grow large because of its characteristic straight bole. This is used almost exclusively for canoes, although a cotton like fiber in the seedpod is used for stuffing pillows and mattresses.
“Doors” - Palm leaf midribs attached to a frame of sticks. These have multiple semi-permanent construction uses.

Yevuti- A common local species used for both food and fuel.

Ahiavidila- A school-teacher, palm wine tapper, and enlightened individual. Interviewed throughout the study.


Ampesidula – A palm grove owner in the the district of Ablome. Interviewed on 9-25-99.

Asimetowo – A key market informant. Surveyed throughout the study.


Donukomo – A multiple use palm manager in Kuli. Interviewed on 10-26-99.

Konkogbui – A palm wine tapper in the village of Mekpodziku. Interviewed on 7-14-99.

Nkutsila – A palm oil refiner. Interviewed on 8-11-99.

Nkuto – A multipule use palm manager in Tofoe. Interviewed on 9-12-99

Tsitsi – A wild palm product collector. Interviewed on 8-12-99.

Tsitsivi – A local variety cultivator. Interviewed on 9-02-99.

Wometo - A grove owner and akpeteshi distiller. Interviewed on 7-29-99.
APPENDIX 3