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FARMING SYSTEMS RESEARCH IN THREE COUNTIES

IN LIBERIA:

A RECONNAISSANCE SURVEY IN GRAND GEDEH,
NIMBA, AND BONG COUNTIES

By
Timothy R. Frankenberger
John A. Lichte
Arthur S. Gedeo
John Kpakolo Jallah
Maran J. Sherman

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EXECUTIVE SUMMARY

A farming systems reconnaissance survey was conducted in Grand Gedeh, Nimba, and Bong counties in Liberia. The research team consisted of an anthropologist, two agricultural economists, a soil scientist, and a tree crop researcher. The survey was conducted over a three week period in 19 villages. One hundred and fourteen farm families were interviewed. A detailed topical outline was used to guide interviews, and each interview was conducted on the farm family's field with both the husband and wife present. The major findings of this study are presented below.

Two basic farming systems are found in the three counties surveyed. The key factors which distinguish the systems are the length of fallow, the rice planting method, and the degree of diversity. The rice-cassava intercrop pattern is also important in distinguishing sub-system differences in Bong and Nimba.

Grand Gedeh Farming System

Grand Gedeh farmers typically make their upland fields in high bush which has been in fallow for up to 20 years or more. The presence of numerous large trees makes tree felling the most difficult and constraining field preparation activity. Groundhogs, weeds, and birds are less of a problem than where the fallow period is normally shorter. Rice is planted using the dibble method and no soil tillage is performed. If a reasonable burn is achieved, farmers do not attempt to clear the field of remaining tree trunks and debris.

Cassava is planted on a portion of the rice field about one month after the rice is planted. This delay prevents cassava from shading the rice and minimizes competition. Bananas and plantain are intercropped with the rice on a different portion of field. A number of tubers and other vegetables are intercropped with the rice throughout the entire field. These include: cocoyams, yams, sweet potatoes, corn, okra, peppers, bitterball, pumpkin, squash, plato, watergreens, tomatoes, and sesame.

Both early and late maturing rice varieties are usually planted. The early variety is planted first so that rice harvesting can begin as early as July or August.

Farmers tend not to build fences to protect their rice from groundhogs. Instead, they try to increase the size of their field and/or locate their field far from areas of secondary bush where groundhogs are likely to be numerous.

In high bush, the dense shade of the mature forest limits the presence of weeds. With little weed seed in the soil to germinate, rice gets a head start and dominates weed competition. Farmers generally do not expect to weed their high bush fields.

Few farmers have either traditional or improved swamp rice farms. A portion of the upland rice field often descends into a swampy area. However, the swamp is considered part of the upland

rice field and is cultivated in the same manner.

Women often plant a short maturing rice and intercrops in a small "hungry farm" separate from the main field. It is usually placed on a portion of the previous year's rice field or some other area of secondary bush. This field assures the family's rice needs until the main field is ready for harvest. The remaining produce of the "hungry farm" is used to meet the personal needs of the woman.

The reciprocal kuu system is not generally practiced in Grand Gedeh villages and farmers rely more on family labor. Although some labor is hired to help with many farming activities, hired labor is more expensive and less frequently employed than in the other counties surveyed.

Cocoa and coffee are the dominant cash crops in Grand Gedeh. In addition, rice, cassava, and minor crops are sometimes sold. The sale of wild meat and produce collected from the forest (e.g. wild palm oil fruit) are other important sources of income. Farmers own and produce few animals even though they are important in meeting social obligations and as a source of ready cash for emergencies.

Nimba and Bong

Many of the characteristics of the farming system in Nimba and Bong Counties are similar. Both counties are experiencing some degree of land pressure, which has shortened fallow periods, and compels farmers to make their farms on secondary bush. In Nimba, this pressure comes from a high population density, while in Bong, it comes from the presence of concessions and from the private ownership of large estates. Problems closely associated with farming secondary bush, such as groundhogs, weeds, and rice birds, have an important impact on the characteristics of this farming system.

Farms appear to be slightly larger than in Grand Gedeh, perhaps due to some combination of the following factors: 1) felling trees is less of a constraint; 2) when large kuus do the brushing, more land may be cleared than would be otherwise by family labor; 3) poor fertility and pests associated with secondary bush may oblige families to farm more extensively to meet food requirements; 4) the absence of "hungry farms" may both permit and oblige the cultivation of a larger main upland rice field.

Few large trees are present, so the major land preparation activity is brushing rather than felling trees. More effort is also devoted to clearing small tree trunks and debris after burning so that it will be easier to hoe the field. Hoeing (or scratching) the field does not begin until 2 to 8 weeks after burning in order to give weed seed in the soil a chance to germinate. Broadcast planting is done at the same time as the scratching in order that this single hoeing might both eliminate

the weeds and cover the seeds. After hoeing, the weeds are removed from the soil and piled so they will not have a chance to grow back. A second weeding often seems to be necessary, at least in years of high rainfall. This may also be related to the severely reduced fallow period.

In Nimba, cassava is planted at low density at the same time as the rice. It is typically intercropped on the entire rice field, eliminating bananas and plantain as an important rice intercrop. If the cassava gets too tall relative to the rice, the lower branches and leaves are stripped to reduce shading. In Bong, the cassava density is perhaps even lower than in Nimba and it is planted 2 to 4 weeks before the rice. It is often planted on only a portion of the rice field and stripping the cassava leaves to prevent shading is less frequently practiced. Cassava, in Nimba seems to have a more important role in both production and consumption than in the other two counties.

In Bong, some of the corn is planted with cassava before the rice is planted. Some of the vegetable intercrops tend to be planted after the rice in both counties.

Early and late maturing rice varieties are usually planted, but the pattern is not consistent. Where birds are a serious problem, the late maturing varieties tend to be planted first. The fear is that an early maturing field will be decimated by the birds, but the attack will be spread across more fields later in the season. This strategy may lengthen the "hungry season" by delaying the new harvest by 2 to 3 months.

Farmers regularly build fences in Bong and Nimba to protect rice from groundhogs. This will occupy the men for a month or more while women finish the planting and weed. Bird-watching is also common for a week after planting and for about a month while the rice is heading.

A few farmers have swamp rice fields. Women are more often responsible for the traditional swamp rice fields, but men tend to be more involved in the improved rice fields sponsored by projects. "Hungry farms" are not common, but in some cases the swamp rice fields will take their place as well as provide a source of income for personal needs.

The diversity of farm enterprises is one of the biggest differences between the farming system in these two counties and that of Grand Gedeh. Farmers are often involved in both cocoa and coffee and perhaps sugar cane or groundnuts, as well as in their upland field and occasionally swamp rice. Rubber, citrus, or cultivated oil palm may also be present. Farmers are also more likely to be involved in some form of off-farm employment. These numerous activities in any one family tend to strain family labor resources and management capabilities. For these reasons, hiring labor and hiring kuus as well as using reciprocal kuus are very prevalent in these two counties. Farmers in Nimba often raise pigs with the intention of using them to feed kuus. The use of hired labor is further encouraged by lower day wages than those prevalent in Grand Gedeh.

CONSTRAINTS AND RECOMMENDATIONS

The survey has identified a number of general and crop specific constraints which are impinging upon the existing farming systems. The major constraints are summarized below along with possible strategies to deal with each type of constraint.

I. General Constraints

A) Access to land

- 1) Identify the most appropriate crop rotation system for specific areas.
- 2) Investigate how tree crops can be combined with food crops in the same field.
- 3) Emphasize improved swamp rice farming in areas which are experiencing severe land pressure.
- 4) Investigate the possibility of integrating chemical inputs into crop rotation systems and improved swamp rice farming.

B) Access to labor

- 1) Projects should refrain from introducing too many interventions to a given farmer at one time.
- 2) Consider use of intercropping and cover-cropping strategies to reduce labor requirements.
- 3) Investigate the economics of existing mechanical interventions and new types of appropriate technologies.

C) Access to capital

- 1) Consider introducing alternative cash crops into the system.
- 2) Improve pricing policies, processing techniques, and marketing channels for existing cash crops.
- 3) Explore replication of successful village credit associations.

II. Upland Rice Constraints

A) Pests and diseases

- 1) Investigate alternative fencing techniques and/or chemical repellants and poisons as deterrents to groundhogs.
- 2) Study the life cycle and breeding habits of groundhogs.
- 3) Incorporate bird resistant traits into improved rice varieties.
- 4) Consider the adverse consequences of using poisons to control birds and rats.
- 5) Investigate alternative means for controlling termites.
- 6) Continue research on designing inexpensive rice

kitchens that control rats.

- 7) Continue efforts of selecting for disease resistant rice varieties.
- 8) Encourage project and extension personnel to educate farmers on how to recognize rice diseases and how to deal with these when they are identified.

B) Weeds

- 1) Initiate studies on the effectiveness and costs of using herbicides.

C) Soil fertility

- 1) Promote crop rotation systems which integrate nitrogen-fixing legumes as rotation crops or intercrops.
- 2) Continue experiments on minimum tillage practices and other erosion control measures.
- 3) Investigate the use of composts, manures, and other indigenous materials like rock phosphate for restoring fertility.
- 4) Consider managed fallow using legumes as a substitute for natural fallow.

D) Other areas of investigation for rice

- 1) Compare dibbling and scratching methods of planting to determine effect on plant density, weed population, soil degradation, labor demand, ease of intercropping, and yield.
- 2) Investigate the advantages and disadvantages of intercropping other crops with rice.
- 3) Screen and compare local rice varieties with recommended varieties through on-farm trials.

III. Cassava Constraints

A) Pests and diseases

- 1) Continue multi-locational trials of disease resistant varieties through on-farm trials.
- 2) Encourage project and extension personnel to educate farmers on how to recognize cassava diseases and what to do about them.

B) Other areas of investigation for cassava

- 1) Study the effects of different spacing and timing strategies of planting cassava in relation to rice.
- 2) Determine the effects of striping the leaves and lower branches of young cassava plants.
- 3) Identify potential crops that can be intercropped with cassava which could serve as cover-crops.

IV. Swamp Rice Constraints

A) Labor availability

- 1) Research should focus on the economics of combining improved swamp rice with upland rice and other farming activities.
- 2) Identify cost-effective, labor-saving techniques to reduce labor demands of swamp farming.
- 3) Encourage farmers to delay swamp-farming activities until upland activities are completed.
- 4) Study areas where improved swamp rice farming has been successfully adopted.

B) Other areas of investigation for swamp rice

- 1) Consider the use of nitrogen fixing aquatic plants.
- 2) Investigate the effects of cutting back rice to deal with lodging.

V. Cocoa and Coffee Constraints

A) Pests and diseases

- 1) Encourage farmers to follow practices which help control stem borers such as pruning, destroying infested branches, and timely underbrushing.
- 2) Identify potential hosts which may harbor stem borers.
- 3) Investigate the economic feasibility of using insecticides for prevention and/or treatment of infested trees.
- 4) Consider the ecological effects of eliminating red ants before proposing control methods.
- 5) Explore alternative means of preventing wild animals from eating farmers' cocoa.
- 6) Identify or develop black pod resistant varieties of cocoa and/or identify other means to control the fungus.

B) Underbrushing

- 1) Explore the possibility of using cover-crops for cocoa and coffee. These could possibly be food crops.

C) Site selection

- 1) Determine the suitability of different soil types for cocoa and coffee.

D) Other areas of investigation for cocoa and coffee

- 1) Research should determine the appropriate spacing for cocoa and coffee. Explore the economic trade-offs between labor expenditure and potential yield loss when considering spacing.

VI. Other Tree Crop Constraints

A) Seasonality

- 1) Continue to identify possible varieties of fruits which bear year round or at different times of the year to deal with the problem of seasonality.

VII. Animal Constraints

A) Diseases

- 1) Encourage projects and extension services to provide better veterinary services to diagnose and treat infected animals.
- 2) Determine the extent to which identified diseases have spread.

B) Other areas of investigation for animals

- 1) Research should focus on why traditional farmers are not investing more in animals.

VIII. Marketing Constraints

A) Access to market information

- 1) Develop a low cost method for disseminating marketing information, i.e., radio broadcasts in local languages.

B) Grading of cocoa and coffee

- 1) Projects and extension services should initiate efforts to train farmers how to grade their own cocoa and coffee.
- 2) Instruct farmers as to the proper processing techniques for improving the grades of cocoa and coffee.

IX. Food Consumption Constraints

A) Areas of investigation for consumption

- 1) Conduct studies of food preferences, preparation techniques, and food taboos to determine acceptability of proposed interventions.
- 2) Varietal work on any crop should consider taste preferences.
- 3) Encourage the introduction of other beans and pulses into the farming systems such as mung beans and cowpeas.
- 4) Conduct limited consumption surveys to determine the nutritional effects of seasonal shortages of food during peak labor periods. This information can guide crop choices for intervention.

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I. INTRODUCTION

This research report presents the findings of a farming systems reconnaissance survey that was conducted in Liberia in Grand Gedeh, Nimba, and Bong Counties (see Map 1). The survey was conducted over a three week period in July, 1984, in 19 villages. One hundred and fourteen farm families were interviewed. The study was supported by the U.S. Agency for International Development Farming Systems Support Project, University of Florida with cooperation from the University of Kentucky; the U.S. AID Mission, Monrovia; and the Central Agricultural Research Institute (CARI), Suakoko, Liberia. The primary objective of this study was to provide information on the rice-based farming systems that are found in Grand Gedeh, Nimba, and Bong Counties to help establish research priorities at CARI. In addition to providing baseline data on cropping patterns, animal husbandry, off-farm economic activities, marketing and consumption, the study helps identify some of the key constraints facing farmers within these counties. Although this information may need to be verified through formal surveys and on-farm testing, it serves as a starting point for orienting research to the needs of farmers.

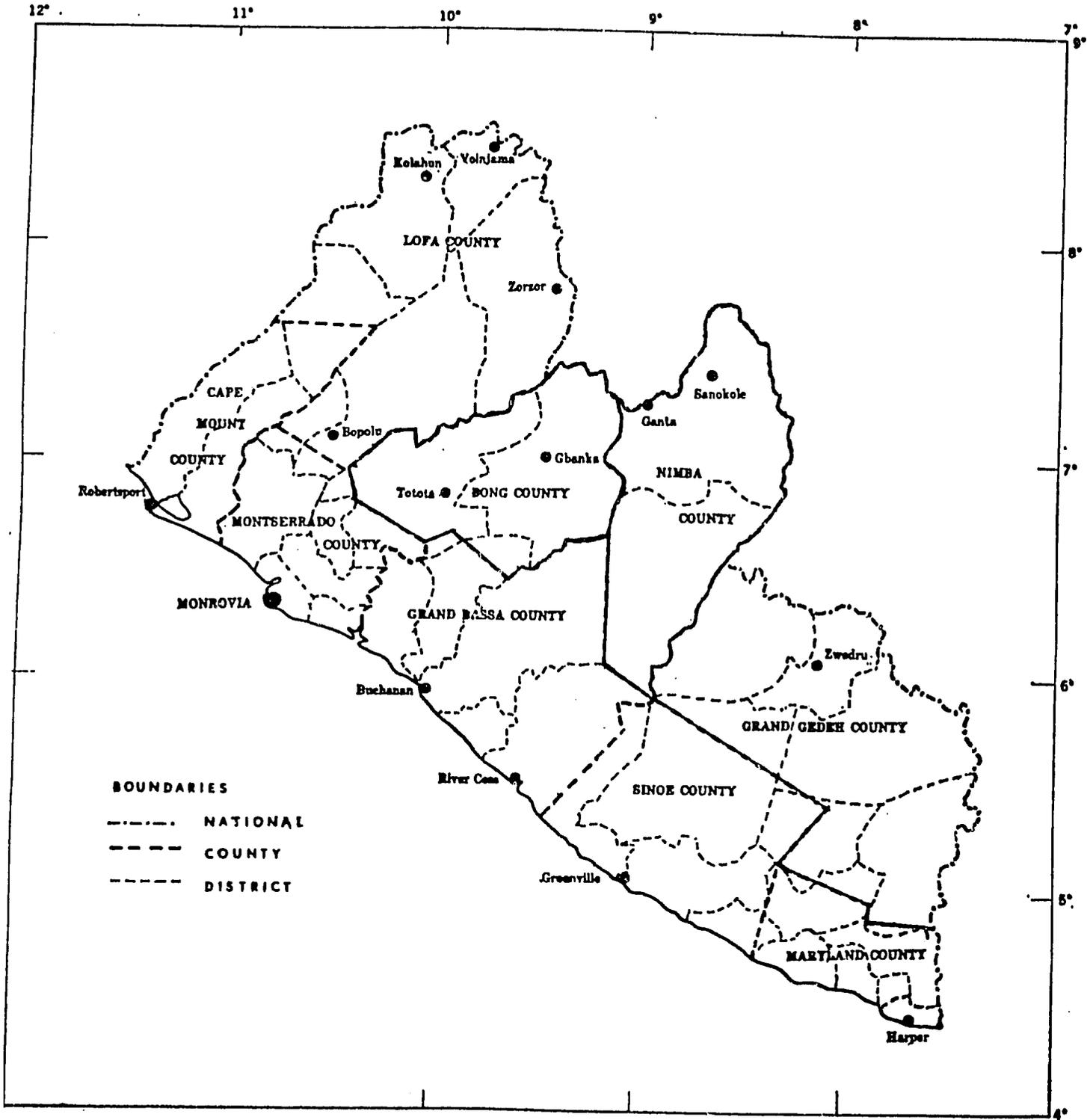
A. Methodology:

To facilitate data collection on the various factors which make up a farming system, a multi-disciplinary team was used. The team members included: Timothy R. Frankenberger (anthropologist); John A. Lichte (agricultural economist); Arthur S. Gedeo (agricultural economist); John Kpakolo Jallah (soil scientist); and Maran J. Sherman (tree crop researcher). The first two researchers mentioned were Americans while the other three were Liberians from CARI.

To help guide interviews, the team constructed a detailed topical outline prior to going to the field (see Appendix N). A structured interview format was not employed to avoid collecting biased information. In order to develop a preliminary understanding of how farmers express themselves on a variety of issues, an open ended topical list was used. The topics included in this outline were obtained from three major sources. First, secondary data sources were reviewed to obtain a list of important variables which were identified in past studies. Second, each department head at CARI or one of their representatives was consulted to identify the various kinds of information needed that would be directly relevant to ongoing research at the station. Third, the team members drew upon their own knowledge and past research experience in devising topics. Once the team reached total agreement on the items included in the list, the survey was initiated.

As stated earlier, the study focused on three counties. Grand Gedeh County was the first county studied. This county was

Map 1
Location of Counties in Liberia



selected because little information existed on the region and CARI was planning on opening a sub-station there at Saye-Dube. Prior to initiating any village surveys, meetings were held with county extension personnel for a briefing on the county and to enlist their aid in selecting villages for the survey. Factors taken into account in village selection included location, size, access to roads, and institutional complexity. In addition, attempts were made to have a village representing each of the sub-tribes in the vicinity. The seven villages selected were geographically distributed around Zwedru and the Saye-Dube Sub-Station (see Map 2). Each village was located within a 40 mile radius of Zwedru to ensure that they were reasonably accessible to the Sub-Station for future on-farm experiments.

Once the villages were selected, the team visited one village each day to conduct interviews with farm families. Upon arrival in a particular village, the team would first meet with the village chief and other villagers present to explain their mission and why so many questions would be asked. General inquiries were directed to the group assembled concerning village infrastructure, land tenure, community farming, sources of credit, project intervention, marketing, and typical labor arrangements. After these initial inquiries, the team split up into three groups.¹ Each group was accompanied by a translator,² or one of the team members who understood the local language.² A farm family with a field within a 40 minute walk of the village was then selected by each group to be interviewed. Interviews were conducted in the fields away from the village so that team members could see the fields they were inquiring about and to prevent other farmers from biasing the farmers' responses. In most cases, both the husband and wife were present for the interview. The team felt it was necessary to get both of their inputs because women were responsible for a considerable amount of the labor performed on the rice fields. Usually each group could do two complete interviews in a day. In some cases, it was only possible to do partial interviews and a group could interview more farmers in a day.

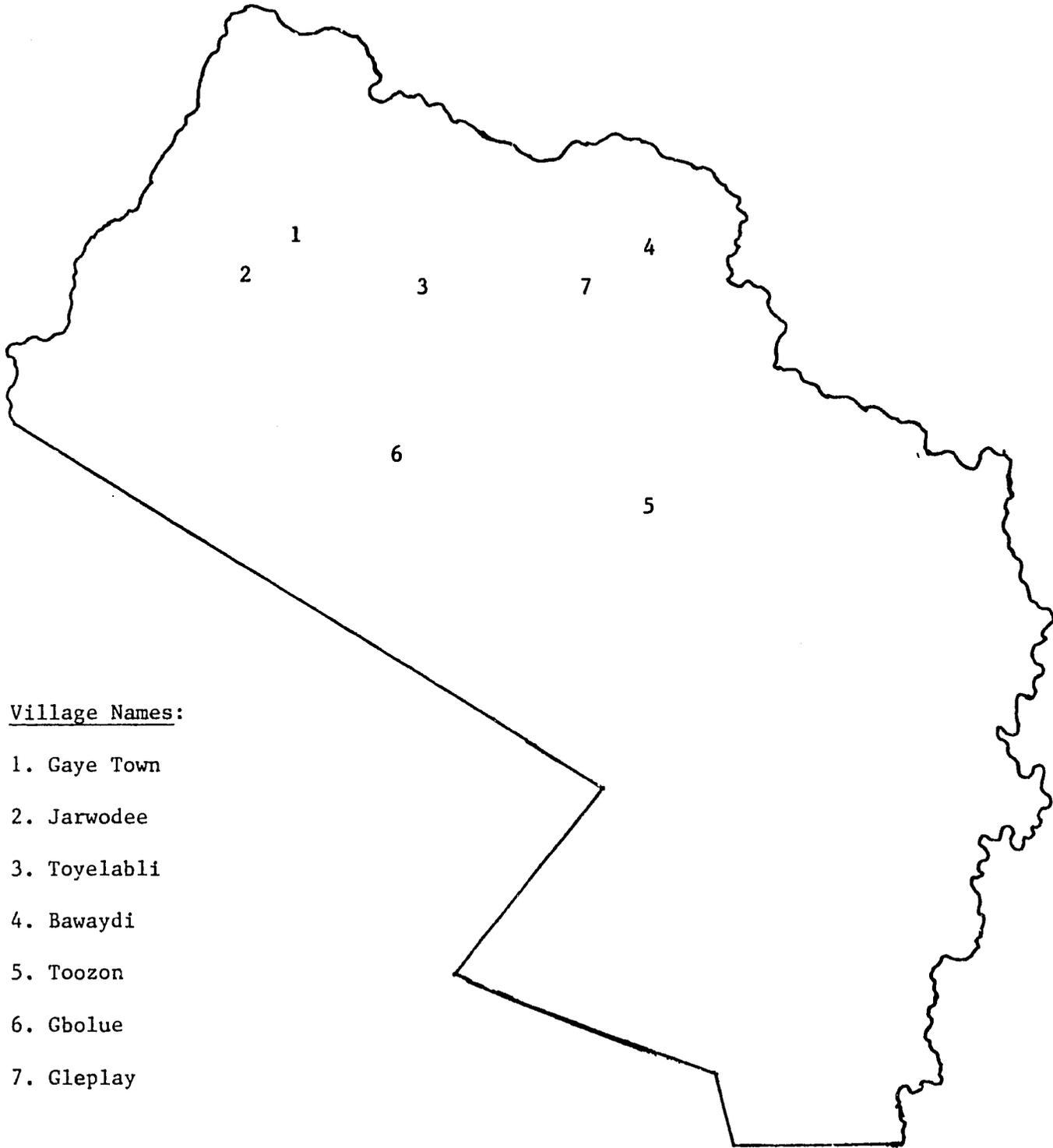
Team members did not work in the same group every day. Thus the groups did not remain constant. This was done to give every team member an opportunity to work with and learn from the other team members. This greatly facilitated an exchange of ideas and helped establish better communication between team members.

After interviews were completed for selected villages in Grand Gedeh, the team members got together and formulated hypotheses about the farming system which characterized that region (see Appendix A). This procedure helped summarize the important

¹ Alonzo Munyeneh, Manager of the Saye-Dube Research Sub-Station, participated in the study and joined the team for the duration of the Grand Gedeh survey.

² Two of these translators were local extension agents.

Location of Villages Surveyed in Grand Gedeh County



Village Names:

- 1. Gaye Town
- 2. Jarwodee
- 3. Toyelabli
- 4. Bawaydi
- 5. Toozon
- 6. Gbolue
- 7. Gleplay

attributes of the farming system and provided a basis for comparison when survey work started in the other two counties.

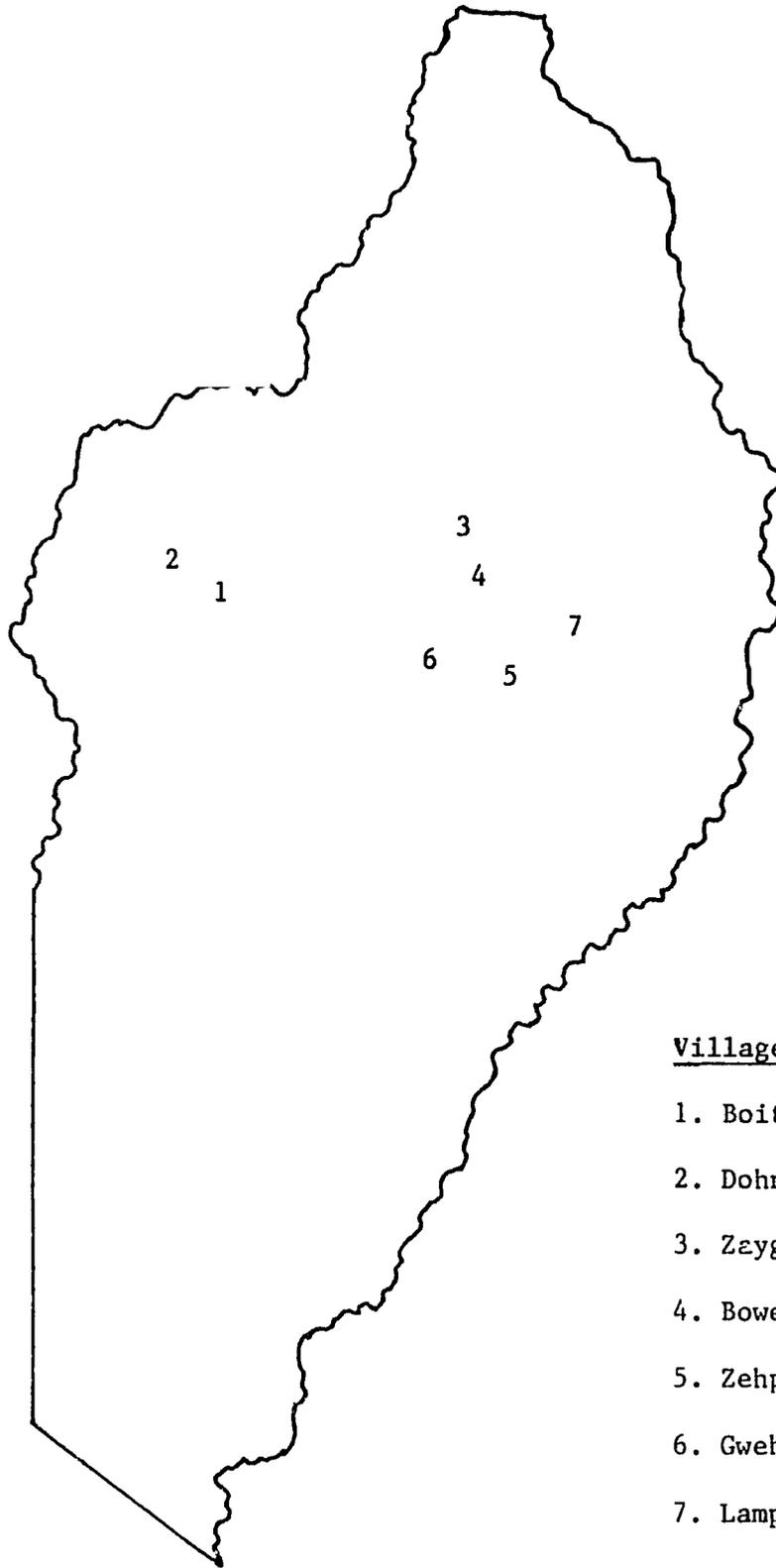
Upon completion of the work in Grand Gedeh, survey work was initiated in Nimba county. The study concentrated in the Saclepea area in order to establish collaborative links with the Nimba County Rural Development Project (NCRDP). This cooperation was considered important because NCRDP had been cited as a good model for farmer oriented development efforts. It was felt that the information provided by the study could be of use to NCRDP as well as CARI, and that future collaboration could be beneficial to both organizations. With the help of the NCRDP staff, an initial selection of villages was made. Selection criteria were similar to those used in Grand Gedeh. This selection was somewhat restricted since many of the roads were impassable due to rain. This list of villages was later modified to include some non-project villages because the initial selection strongly emphasized project villages. Interviews were conducted with farmers in seven villages in total (see Map 3). NCRDP extension staff usually accompanied the team to each of the villages surveyed.

The survey procedures followed in Nimba were similar to those followed in Grand Gedeh. Following the survey, hypotheses were also formulated about the farming system which characterized Nimba County (see Appendix A).

The last county surveyed was Bong. Bong was a logical choice for this study since CARI was located in this county. If on-farm experiments are to be carried out in villages located within a reasonable distance of the experiment station, then information is needed on the existing farming systems in the area. To facilitate data collection efforts, collaborative links were also established with the Bong County Agricultural Development Project (BCADP). As was the case in Nimba County, it was hoped that such links between BCADP and CARI could be beneficial to both organizations in future development efforts. The BCADP staff gave the team the names of extension officers in the different regions of the county to contact. These extension officers helped the team identify a variety of villages including some which had relatively little project influence. Again village selection criteria were similar to those used in Grand Gedeh and Nimba. Interviews were conducted in five villages in Bong (see Map 4). In some cases, the BCADP extension staff accompanied the team to the villages. Similar survey procedures were followed in Bong as in the other two counties. Likewise, hypotheses characterizing the farming system found in Bong County were also formulated after the completion of the survey (see Appendix A).

Once the survey was completed, hypotheses were generated which applied to the farming systems found in all three counties. Following these formulations, a series of possible recommendations were derived which could help alleviate some of the constraints which were identified in the survey. After these tasks were completed, the results of the study were written up. Each team member was given responsibility for a certain section

Location of Villages Surveyed in Nimba County

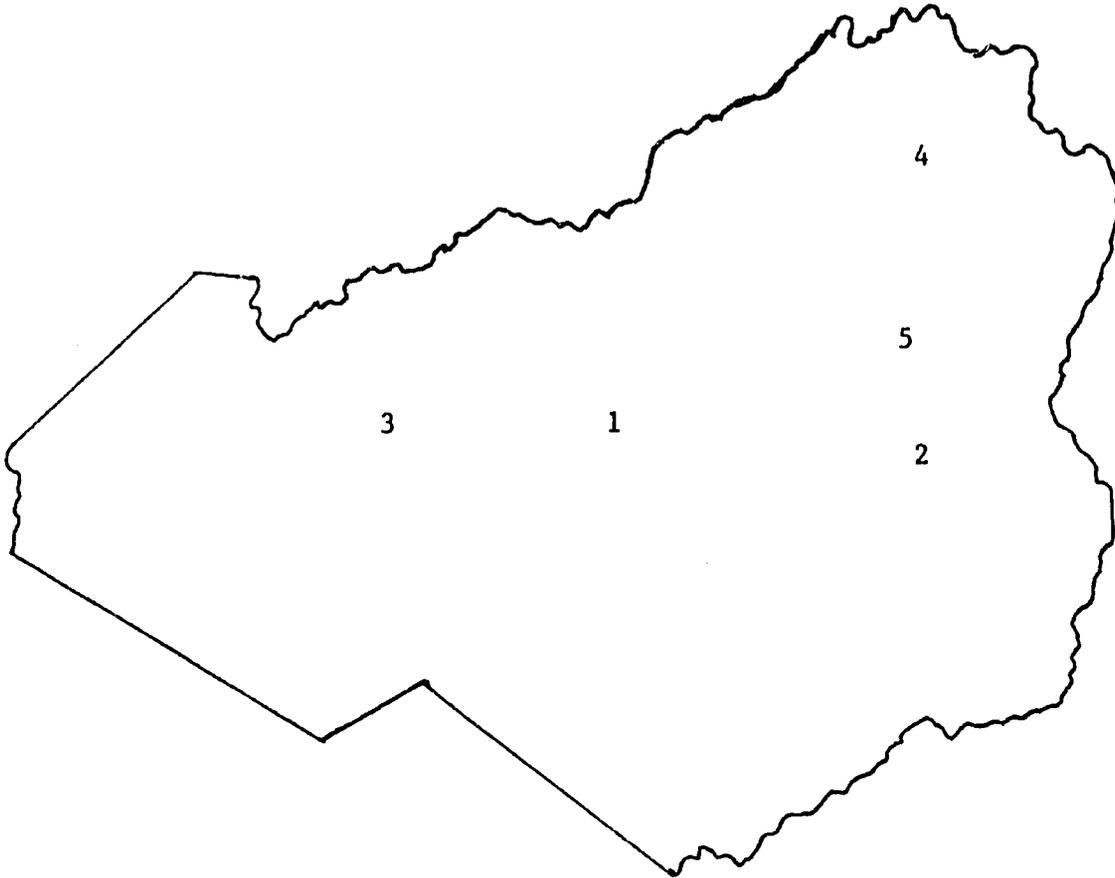


Village Names:

- 1. Boitain
- 2. Dohn
- 3. Zeyglay
- 4. Boweh
- 5. Zehplay
- 6. Gwehrlay
- 7. Lampa

Map 4

Location of Villages Surveyed in Bong County

Village Names:

1. Gbarna
2. Seata
3. Santa
4. Kollieta
5. Janniepeleta

of the report.

B. Content of the Report:

The information provided by this report is presented in three major sections. First, the general farming systems characteristics of the three counties taken together are presented. This section addresses such topics as access to land, spatial arrangements of farmers' fields, labor patterns, upland rice cropping patterns, cassava cropping patterns, sugar cane cropping patterns, groundnut cropping patterns, swamp rice cropping patterns, animal husbandry patterns, marketing patterns, other sources of income, access to credit, consumption patterns, community farms, and government interventions.

The second section of the report presents the specific findings for each county on the various topics addressed in the previous section. If farm families in all three counties follow similar patterns for a given practice, then that topic is not presented in this section.

The third section of the report presents a summary of the farming systems found in the three counties surveyed as well as the team's recommendations. The recommendation subsection is structured in such a way that: 1) a constraint is identified; 2) the farmers' present compensating strategies to deal with the constraint are outlined; and 3) recommendations are proposed that take these strategies into consideration. The constraints addressed in this section include general economic constraints, crop specific constraints, animal husbandry constraints, marketing constraints, and consumption related constraints.

The final section of this report contains the appendices. These appendices present detailed information that does not appear in the main body of the report which should be useful to researchers and administrators.

II. GENERAL FARMING SYSTEMS CHARACTERISTICS

A. Access to Land-Fallow Rotation System:

In the past, usufruct land tenure arrangements were the predominant tenure patterns found throughout Liberia. Land availability was not a constraint due to a low rural population-to-land ratio. Presently, land access is a limiting factor in areas of high population concentration and/or where concessions and private estate ownership are prevalent. Land purchases and/or land rental are not uncommon in such areas. All three tenure arrangements are found in the study area.

In Grand Gedeh, usufruct arrangements predominate in all of the villages surveyed. Land is not being purchased nor is land actually being rented. Due to the low population densities characterizing the county, a considerable proportion of the land is still in high bush. Individuals gain rights to land by being the first to clear high bush from an area. Anyone else wishing to make a farm on this land must obtain the permission of the original farmer.

When all land in the vicinity of a village has been farmed, farmers will make farms farther away by seeking out high bush or older secondary bush to clear. If these farms are far from the village, satellite villages may be created. This pattern is possible in Grand Gedeh because of the low population density and availability of land.

In Nimba, the tenure situation is more complex. Many of the villages surveyed in this county are located in an area of high population concentration.

Land pressure seems considerable in such areas. In addition to usufruct rights similar to Grand Gedeh, cases of land purchases and land rentals are found. Besides individual land purchases, sometimes a whole village bands together and purchases the land they are farming. As for land rentals, two forms are found. One is the more traditional quasi-rental pattern of giving a portion of rice at harvest for the right to farm an area.³ The second form is an actual cash payment of ten to twenty dollars for one year's access.

One consequence of the high population density in Nimba has been the removal of a considerable amount of the high bush in the area. Presently, most of the land accessible to farmers is secondary bush. In addition to this, land pressure in the area has forced many farmers to shorten the fallowing period on their land. Both the prevalence of secondary bush and the shorter fallow period have had a significant impact on the farming system

³ The amount of rice given now for land access is much greater than the traditional token. In the past, a wash pan or bucket of rice may have sufficed. Presently, 2 bags of paddy rice is not uncommon.

found in the area.

In Bong County, the tenure situation is similar to that in Nimba but for different reasons. Farmers in this county are experiencing land pressure due to the prevalence of concessions (mostly rubber) and private estate ownership. As in Nimba, usufruct tenure arrangements are still common; however, land purchases and land rentals are also found. The traditional rental arrangement of giving a quantity of rice at harvest is the only pattern identified.

Farmers indicated that cash rental arrangements are not common because of the fear that renters may later claim that they have purchased the land. Possibly to compensate for this tendency of not accepting cash rental payments, the quantity of rice given at harvest for access to land is considerably higher than that in Nimba. For instance, one farmer had to agree to give two bags of clean rice to gain access to the land he was farming. In addition, it appears that the quantity of rice charged from a stranger is more than is charged from a relative or fellow villager.

Because of the rubber plantations, private estates and government farms located throughout Bong, high bush is becoming less available to farmers. Similar to Nimba, farmers are being forced to farm in secondary bush with shorter fallowing intervals due to this land pressure. Again, this has had a significant impact on the farming system found in this county.

B. Spatial Arrangements of Farmers' Fields:

Regarding the location of fields, a similar spatial arrangement is found in all three counties surveyed, despite differences in topography. Upland rice fields tend to be located some distance from the village. This is especially true where domestic animals are prevalent and/or good farmland is a considerable distance away or not separated from the village by streams or swamps which animals are not likely to cross. If no such natural barriers exist, fences are constructed along paths or roads to keep animals out. The cocoa and coffee fields tend to be located closer to town, often encircling the town itself. In areas where traditional swamp farming is practiced (Nimba and Bong), the preferred pattern is to place swamp farms in close proximity to upland farms to facilitate easy access. If this is not possible, they may locate the swamp farms elsewhere.

Decisions regarding the location of upland rice farms are strongly influenced by the availability of land. If high bush is accessible and within a reasonable distance from the village, farmers will opt to plant their upland farms there. This tendency often results in upland farms being 1 to 2 hours walking distance from the village. Because of these distances, farmers may opt to spend most of their time living on the farm during the cropping season. Satellite villages may be created through this process.

In villages where high bush is not accessible and land

pressure is more prevalent, less flexibility exists as to where upland farms can be located. The tendency is to plant upland farms on secondary bush with short fallow periods.

Topographic considerations do not seem to play a critical role in farmers' decisions regarding upland farm location. Although some farmers indicate that they prefer flat areas to make⁴ their farms, they also say that rice does just as well on slopes.

C. General Labor Patterns:

Two major points can be drawn about the labor patterns found in the three counties surveyed. First, most labor activities seem to be adjusted around the upland rice cycle. Second, though not absolute, a division of labor exists for the performance of agricultural operations.

Upland rice farming is the primary agricultural activity performed by the farm family. A major portion of the family's time is spent on the upland farm in order to secure an adequate supply of rice. All other agricultural activities not tied to the upland farm are of secondary importance as far as labor allocation is concerned. The major labor operations associated with upland rice farming include brushing, tree felling, burning, clearing, planting, weeding, fence building, bird watching and harvesting (see Appendices E through H for labor calendar).

C.1. Sources of Labor:

To perform their agricultural activities, farmers will draw from three primary sources of labor. First, farmers may rely on family labor to do the activity. In the past, having large families was a way to compensate for the labor constraints associated with slash and burn farming. Recently, family labor supplies are decreasing due to out-migration of children for school or wage employment. Still, the number of wives a male farmer has basically represents his core family labor assets. If enough family labor is not available to perform the task, farmers have to resort to other sources of labor to get the job accomplished.

Kuus are a second source of labor. A kuu is a reciprocal communal labor arrangement which involves a group of laborers working together on a particular task, rotating from one member's field to another. Food and drink are provided by the farmer having the kuu on his/her field that particular day. Kuu labor groups for most operations are quite common in Nimba and Bong but less common in Grand Gedeh.

⁴ In fact, some farms in Bong County are located on 45 degree slopes.

A third source of labor is hired labor. In all three counties, individual laborers may be hired on a daily or contractual basis. Daily wage rates vary from one county to another. In Grand Gedeh, a common daily wage rate is \$2.50, while⁵ in Nimba and Bong, laborers would be paid \$1.00 to \$2.00 a day. Most hired laborers come from within the village or in the near vicinity. Occasionally, outside laborers from Guinea or Ivory Coast may be hired. In addition, students home on vacation will hire their labor out to earn money for school.

Besides individually hired laborers, farmers may also purchase the rights to a kuu from one of the kuu participants. Normally, the farmer pays an agreed upon sum to the kuu member who is foregoing the kuu on his/her own field, plus the farmer provides food and drink to all the participants. Hiring kuus is a common practice in Nimba and Bong but not in Grand Gedeh.

D. Upland Rice:

The upland rice field with its many intercrops, is the core farming enterprise around which family labor and other farm enterprises are organized. The traditional method of slash and burn cultivation minimizes the risk of crop failure by effectively dealing with problems like low soil fertility, soil erosion, and weeds. In some areas, this traditional system is coming under pressure from increasing population density or the sale of tribal farm land. Fallow periods have been severely reduced and certain ecological imbalances have occurred.⁶ These changes, and the farming systems which have developed over time to deal with them, are characterized by the present situation in Bong and Nimba counties in contrast to that of Grand Gedeh. Many of the major differences between the farming systems are related to the continuing existence of high bush or mature forest in Grand Gedeh and the necessity of farming on secondary bush or immature forest in Nimba and Bong.

D.1. Upland Rice: High Bush Compared to Secondary Bush

Under normal circumstances, farmers prefer to farm in high bush. The longer fallow period tends to improve soil fertility, and the dense shade eliminates many of the grasses and other

⁵ In Nimba and Bong, the equivalent to one dollar a day is paid for each member of a kuu hired to work a field, while \$2.00 a day is a common wage rate for individually hired laborers.

⁶ The groundhog population has increased rapidly as its favored secondary bush environment expanded and its main predator, the leopard, has been eliminated.

weeds. The major disadvantage is the amount of work required to fell the many large trees. A few farmers rent chainsaws for \$25 a day, but most farmers do not have access or do not feel they can afford this luxury. However, many farmers in high bush areas state a desire to use chainsaws. Once high bush is cut, it will be farmed again once or twice in more rapid succession, i.e., a second time after 4 to 8 years and perhaps a third time after an additional 8 to 12 years. Then, the field is again allowed to lie fallow for an extended period. This succession of short fallows comparable to secondary bush makes data on high bush fallows quite confusing.

With secondary bush less time is required to fell trees, although this is partially offset by the need to spend more time brushing. Secondary bush has the additional disadvantage of being a better environment for groundhogs, termites, and a number of the rice-eating birds.

Strategies for use of high vs. secondary bush:

The availability of male labor and the distance one has to go to find high bush are the considerations which dominate strategies concerning which type of bush to use. Felling trees with an axe is primarily a male activity. A secondary bush site is likely to be chosen if the head of the family is elderly, sick, or involved in off-farm employment. A woman alone would likely choose secondary bush in fallow only one or two years so that brushing (using a cutlass) alone would be sufficient to prepare the land.

Distance is also a constraint, particularly when a family has other important enterprises at fixed locations. For some reasons, a farmer may move his family to a distant field location during the farming season. This may be impractical, however, if the farmer: 1) is elderly; 2) is planting tree crops; 3) has an important tree crop or sugar cane activity near the village; or 4) has important social responsibilities. Under such circumstances a farmer may decide to use secondary bush to remain near the village.

Site selection:

In areas where the bush fallow may last up to 20 years or more, farmers have little experience with any particular piece of ground. They therefore rely on various tests and indicators to find a field site which will grow good rice. Some farmers will take a handful of soil and make a ball, checking for soil texture. Others test to see how easily plants can be pulled from the soil. Another test is to hold the soil to one's chin to see if it is "warm". One farmer tests the soil by checking if his feet left imprints. Many farmers rely more heavily on the presence of certain plants such as palm trees, "sidrew-sigbor,"

"pohseken," or a type of fern called "to-tay." Where fallow periods are shorter, some farmers used indicators, but most stated that the field had previously produced good rice for them or their fathers.

Land preparation:

The critical aspect of land preparation is obtaining a good burn. If the field burns well, there is more open space which is conducive to growing rice, and the later field operations are easier to perform. A good burn also produces more ash. This ash is the major source of fertilization, providing some additional potash, phosphate, and micro-nutrients, as well as improving the pH so that more phosphate is available to plants.

To get a good burn, farmers must remove the branches from trees and pile together the branches and other brush. If this is not done, then some of the remaining debris will have to be piled and burned again at a later date. Farmers using dibble planting want to burn as late as possible before planting, so that weeds do not get a head start on the rice. But this means waiting until the rains have started and hoping to find a day when the brush is dry enough to burn properly. In 1984, the rains came early and there has been more rain than normal. Many farmers have had to spend several months clearing their farm after the original burn. Others have had portions of their field which could not be planted at all due to the quantity of unburned brush. A few farmers try to finish brushing and felling their field before the rains start to avoid this kind of problem. They feel that weeds can be dealt with later if necessary but that a good burn and planting early are critical.

Importance of weeding:

In secondary bush areas, weeds are a major constraint. Competition from weeds can seriously reduce rice yields directly and also delay the time of planting when the field is hoed (scratched) prior to planting. After burning the field, farmers will often wait 2 to 8 weeks before starting to hoe and plant. This allows the weed seeds a chance to germinate so that the hoeing will be effective. In years of greater than normal rainfall, when weeding takes extra time, planting may be seriously delayed. The scratch-planting does save on labor by combining the hoeing and planting into a single activity. The hoeing is faster and more effective than trying to weed rice that has been broadcast sown by hand. As such, the hoeing does reduce the total labor time required for weeding during the year. Where the dibble method of planting is used, planting is done directly after burning or following the initial early rains. On secondary bush, weeding will normally begin about 6 weeks after planting. On high bush, farmers hope that weeding will not be necessary

except perhaps in the lowland or swampy portions of the field. Some farmers are prepared to weed late in the season if necessary while others state that no weeding is done.

Farm size:

The farm size in Grand Gedeh seems to be constrained by the labor necessary to fell trees on the predominately high bush fields. Even though farmers state that their strategy is to increase farm size rather than construct groundhog fences, their fields appear to be a little smaller than the fields brushed in Nimba and Bong. A few farmers in Nimba and Bong are only about halfway through with clearing, weeding, and planting when visited between July 15 and July 29, 1984. In such cases, it is not clear whether or not they can finish in time to get a decent crop or if some portion of the field will be abandoned. This delay may be characteristic of years of greater than average rainfall or may indicate a willingness to brush an extensive area and later see how much the family can actually manage. In areas where most brushing is done by kuu labor, farmers must determine field size on the basis of the number of days a kuu should work. It is safer to have too much land cleared than too little. Given the problems of low fertility, groundhogs, weeds, rice birds, and termites that tend to be associated with secondary bush, it seems logical that farmers might try to be more extensive if not constrained by the availability of land.

BCADP estimates that average farm size is 3 to 3.3 acres in Bong, and NCRDP estimates 2 acres in Nimba. We did not measure fields, but our visual estimates of rice fields are often larger than this, without taking into consideration that some families may have several rice fields. Furthermore, farm size should take into account the areas that a family has devoted to other than rice.

Planting methods:

Two methods are found in the three counties surveyed. The dibble method is used throughout Grand Gedeh, while the scratch-planting method is used in Nimba and Bong. The dibble method employs a dibble stick to open a shallow hole in the soil, and a snail shell from which the seed is poured in spurts using a snap of the wrist.⁷ This action determines how many seeds are planted

⁷ A dibble stick has a short stiff metal blade about one and a half inches wide and a straight wooden handle. The total length is usually 12 - 18 inches. Local names include pla or squagba

in each hole (e.g. usually from 5 to 20). The scratch-planting method involves broadcasting the seed by hand and scratching the soil with a short handled hoe to cover the seeds and remove any weeds in a single action. Broadcasting is a critical operation learned only by experience. To be efficient, the individual who is broadcasting must maintain not only a uniform seed distribution but also a uniform seeding rate.

Dibble planting seems well adapted to the farming conditions where high bush is prevalent and weeds are not a serious constraint. Such conditions exist in Grand Gedeh. Some of the advantages of dibble planting are:

- (1) The absence of soil tillage which might promote erosion loss and soil degradation.
- (2) The presence of tree trunks and residual debris to reduce erosion. The field is not completely cleared after burning since this interferes little with planting and there is no tillage which it might impede.
- (3) Labor requirements are low and planting is rapid, allowing early completion. Loss of potential yield due to late planting is avoided.
- (4) Early planting (of short maturing varieties) allows an early harvest and reduces the length of the hungry season.
- (5) Open spaces between the hills of rice permit the intercropping of cassava after the rice is planted without disturbing it. Planting cassava a month after the rice minimizes competition between the two crops.

Dibble planting (as practiced in Grand Gedeh) is ecologically sound and stable; it has low labor requirements and facilitates the rice-cassava intercropping. However, it would not work as well in areas where secondary bush is prevalent, and, hence, where weeds are a serious constraint, i.e., Nimba and Bong. Under such conditions, the scratch-planting method seems more appropriate because of the weed control that it provides.

Farmers using scratch-planting wait 2 to 8 weeks after burning and/or the early rains before starting. This eliminates the advantage of early planting but allows the weed seed in the soil to germinate so that hoeing will provide effective weed control. This reduces labor expenditure for later weeding. The delay also allows families with different resources and strategies of land preparation to coordinate planting and harvesting to avoid the risk of serious bird damage. Broadcast planting provides a more uniform, and probably a higher plant population than dibble planting. In addition, the hoeing should improve germination and perhaps enhance soil structure in the short run (even though the long term effect may be to increase erosion and soil degradation). These factors may help offset the yield-reducing

in Garbo Krahn and blobla in Tchien Krahn. The snail shell is about the size of a fist and has a hole drilled in the closed end.

effects of the lower expected fertility of secondary bush and the late planting.

Varieties grown and time of planting:

Because traditional farmers tend to be risk-averse, they diversify as much as possible. It is, therefore, not surprising that most of them grow more than one variety of rice. In the three counties surveyed, these tend to be both long-maturing and short- to medium-maturing varieties. (See Appendix I). Several farmers, especially in the study areas of Bong and Nimba, are growing LAC 23, both red and white. Most farmers growing this variety consider it to be high yielding and palatable. One farmer claimed that it is somewhat less favored by groundhogs than the local varieties he has been growing. However, the red LAC 23 is said to be very difficult to mill, since consumers insist that prepared rice must be white.

Of the many⁸ local varieties found, several appear to be commonly grown. According to farmers, some of these may be equally or more productive and/or palatable than the recommended varieties. Thus, although several germ plasm collection efforts have been undertaken in the past, it would be worthwhile to repeat this effort, at least in certain areas, and/or re-evaluate the germ plasm already accumulated.

In the three counties surveyed, farmers appear to be employing various strategies concerning the order of planting of long- and short-maturing varieties. In Bong and Nimba where birds are a common problem, farmers are planting the long-maturing varieties first to ensure that both short- and long-maturing varieties ripen at about the same time. The reasoning here seems to be that planting the short-maturing varieties first means they mature before most nearby fields, making severe damage by birds likely. In contrast, in Grand Gedeh where bird problems are less common, farmers seem to be planting the short-maturing varieties first with the hope that these can be harvested early enough during the season to meet some of the hungry season food requirements. In certain areas of Bong and Nimba where birds seem less of a problem, farmers also practice the Grand Gedeh strategy of planting the early-maturing variety first.

Where dibble planting is practiced, the planting season coincides with the beginning of the rainy season. However, since the operations of land preparation must precede planting and since these may be delayed by the unavailability of labor and/or inclement weather, the actual time that planting commences may be delayed until sometime after the rains begin. In Grand Gedeh,

⁸ Rice varieties are listed in the appendix by county, village, and approximate length of maturity. Desemah in Grand Gedeh and Nakatua in Nimba stand out as popular varieties.

March, April, May, and June are common planting months for farmers, while April, May, June, July, and early August (for late planters) are common planting months in Bong and Nimba. Due to yearly weather changes the ideal period for planting may vary somewhat. There is, therefore, a need to intensify agrometeorological efforts to monitor not only weather differences across the country but also year-to-year weather fluctuations. Information gathered from such a study would be useful in guiding farmers regarding the risk or expected results of a given planting date. However, only if land preparation is finished in advance can farmers take advantage of early planting opportunities in years when the rains begin early.

Planting has historically been considered a woman's job. In Grand Gedeh this is still largely true. In contrast, in the surveyed areas of Bong and Nimba, women continue to play a major role in planting, but men are also involved, especially where kuu labor is employed. The broadcasting operation associated with planting continues to be done by women.

Intercropping strategies:

The fact that farmers practice subsistence farming suggests that they would tend to diversify for food crop production. Accordingly, other crops are cultivated in association with upland rice in a mixed cropping pattern. Thus, practically all upland rice farmers interviewed in the three counties were found intercropping one or more crops with rice. These included: cassava, corn, bitterball, hot pepper, okra, tomato, eggplant, cucumber, watermelon, pumpkin, sesame, bean, water green, plato, yam, cocoyam (eddo), sweet potato, banana, plantain, sugar cane, and others.

Of the above intercrops, all but cassava, banana, plantain, yam, eddo, sweet potato, and sugar cane can be mixed with the rice seed and planted at the same time as the rice. However, not all farmers in the study areas are mixing other seeds with rice. In a number of cases, crops such as corn, beans, bitterball, pepper, and eggplant were planted separately by farmers before, during, or after planting rice. The other crops (cassava, yam, eddo, sweet potato, banana, plantain, and sugar cane) can only be planted by stem, tuber, or sucker and are thus not mixed with the rice seed. The timing of planting these crops also varies.

Intercropping is an attempt to meet multiple objectives, to reduce risk through diversification, and to maximize total production with limited resources. Competition between crops typically reduces the yield of any given crop from what it would be in a pure stand, but total production is often greater than it would be from the same acreage in pure stands.⁹ Typically, crops

⁹ The Land Equivalent Ratio is often used to measure the

grown together will have different nutrient requirements and growth patterns, so there are important complementary effects as well. Where crops differ in their requirements for moisture, such as rice and cassava, intercropping can greatly reduce the risk of total crop failure due to variations in rainfall. Certain crops, particularly legumes, may both compete with and benefit from a cereal intercrop. Research efforts should be initiated to learn the effects of the common intercropping patterns practiced as well as to determine how cropping systems might be improved.

Harvest and post harvest methods:

Harvesting rice is a long and labor intensive operation. It consists of manually cutting the panicles from rice plants one at a time, using a locally made penknife. This same method is employed in all three counties. Harvest may begin as early as late July or August in Grand Gedeh where the rains start early and short-maturing varieties are planted first. In Bong and Nimba, harvest usually does not begin until October. Rice harvest continues through December in all three counties. The entire family participates in harvesting, and kuus or hired labor may be employed as well. Fields that mature earlier than other fields in the village face the threat of serious bird damage where birds are a problem. The same threat did not seem to apply to fields harvested later. Farmers prefer to harvest quickly after the rice reaches maturity, since dry heads tend to shatter over time and the grain falls on the ground and is lost. This is easier to accomplish when birds are not a problem and harvest can be spread over a number of months.

The mechanization of harvesting and threshing using sickles and pedal threshers has not been adopted. Farmers complain that to harvest with a sickle would be harder because one must bend lower to cut the straw. Farmers use the same justification for not liking short straw rice. However, the major problem appears to be the need to change the entire storage system to accommodate threshed grain. It is likely that farmers will only be willing to adopt mechanized harvest techniques when a practical method for storing rice grain adapted to humid and high rainfall conditions has been developed, proven by farmers, and extended on a wide scale.

After harvest, the rice is taken directly to the kitchen or left to dry in the field on stumps, logs, or in heaps on scaffolds for a number days before transporting it to the rice kitchen. The farmers interviewed seem to be practicing whichever method proves to be reasonable at the time of harvest, depending on the distance between the rice field and kitchen or the frequency of fires under the rice kitchen.

(increased) productivity of intercropping.

Post-harvest operations are also found to be similar among farmers from the three counties surveyed. Storage methods seem to be closely related to the harvesting technique and involve storing (in heaps) bunches of panicles in specially constructed kitchens made of wood, thatch, and leaves. The family cooking is done in these kitchens, and frequent fires help to ensure proper drying. This also indirectly controls insects. The rice is stored in these kitchens for periods up to a year. The amount to be consumed is periodically removed, threshed, dried, and milled, often using a mortar and pestle. The milling is usually done by females.

Pests and diseases:

The major pests reported by farmers in the surveyed areas of the three counties are groundhogs, rice birds, termites, stem borers, and other small animals. The severity of damage done by these, however, varies not only within counties but also between counties. Groundhogs and birds are reported to do the most harm.

Within counties, groundhogs and birds seem to be less problematic in high bush areas, provided such high bush areas are isolated from secondary bushes, (especially for groundhogs). This implies that groundhogs and birds are less of a problem in Grand Gedeh than they are in Bong and Nimba because of the prevalence of secondary bush in the latter two counties.

Farmers appear to employ similar methods to control pests in all of the counties surveyed. They do practically nothing about termites, stem borers, and small animals. They control groundhogs by making fences or traps, or by using guns. Birds are controlled through the use of slings, scaffolds, and rattles on ropes. Birdwatching is done by women and children and assisted by men in some cases.

Other minor control measures or compensating strategies for groundhog and bird control include: making larger farms, using nets, and employing the use of poison.¹⁰ In Bong, the practice of not intercropping rice with cassava is reported to be another control measure for groundhogs. The practice, according to farmers, is based on their observation that groundhogs are attracted more to cassava than rice.

The farmers in all three counties strongly feel that groundhogs are the most serious pests. Estimates of groundhog damage range as high as thirty percent on some fields. Control measures or compensating strategies presently employed require

¹⁰ A few farmers in Bong county boil rice with an insecticide and throw the poisoned rice on the field for birds to eat. Farmers say that the poisoned rice is the most effective control, but it represents a serious long term as well as short term danger, given the use of products like aldrin.

much labor and/or are not very effective. Research projects to study the feeding habits and other characteristics of these pests should be initiated to facilitate the development of alternative, less costly, and ecologically sound control measures. The use of leopard scent as a repellent is one possibility that should be explored.

Although numerous diseases are known to affect rice, farmers in the three counties have no idea as to the extent of damage caused by these diseases. In fact, the only major disease identified by farmers is false smut. Most farmers do not regard this as a very serious problem, and no attempt seemed to be made to eliminate panicles affected by false smut. Therefore, there is a need for a pathological survey to investigate the incidence of diseases associated with upland rice and how extensive these diseases are.

Soil fertility considerations:

Soil fertility depletion is a well known phenomenon associated with traditional upland rice cultivation which forces farmers to shift periodically. In the predominantly high bush study areas of Grand Gedeh, it appears that two crops of rice are possible with practically no fertility improvement. This may account for why farmers can afford to plant a second year when the previous year's burn is bad or spotty. However, in the secondary bush areas of Bong and Nimba, even the first year's crop does not seem to be adequately supported with respect to nutrient supply. Many rice fields in these study areas are experiencing nutrient deficiencies, especially nitrogen deficiency. It is therefore suspected that rice yields per unit area in these counties are often lower than those obtained under the conditions found in Grand Gedeh. Farmers in Bong and Nimba seem to be compensating for this by making larger farms. This pattern appears to be exacerbating the land pressure that is already evident in some areas.

At present, chemical fertilizers are not commonly used by farmers and the limited amount being distributed in project areas seems to be used for tree crops and improved swamp rice. It would be interesting to investigate the economics of minimal chemical fertilizer applications for upland rice, at least in those areas initially suspected of being low in inherent fertility. Research on 3 - 5 year rotation schemes involving food and cash crops would also be worthwhile to conduct. Such research might investigate various intercropping strategies.

Hungry farms:

Although most farmers succeed in producing a major portion of the foods consumed, they do not always produce enough to feed the family at a sufficient quantity for the entire year. The period between planting and the main harvest is often called the "hungry season." To meet hungry season food requirements, farmers employ various strategies. In Grand Gedeh, farmers with more than one wife often have several upland rice fields including a major field and one or more minor fields. These smaller fields serve as "hungry farms." Early-maturing varieties are planted on these minor fields and are harvested some time during the hungry season. For those farmers having only one wife, one large rice farm is usually planted with both short- and long-maturing varieties. The short-maturing varieties tend to be planted first so that they mature at some point during the hungry season. Some families may have both hungry fields and short cycle varieties in the major field(s). Other families eat cassava as a substitute for rice during the hungry season.

The strategies of planting hungry farms and/or the early planting of short-maturing rice varieties in major rice fields are not common in Bong and Nimba. The prevalence of birds makes it impractical to have small quantities of rice mature prior to the main harvest. In Nimba, cassava and/or local rice purchases seem to be the main compensating strategies farmers use that deal with seasonal food shortages. In Bong, where less cassava seems to be grown relative to Nimba, rice purchases appear to be the major strategy. In a limited number of cases, swamp rice is reported to be an important source of hungry season food in certain areas of Bong and Nimba.

E. Cassava:

Cassava is the second most important food crop in the areas surveyed and a major food source that people rely on during the hungry season prior to the new rice harvest. It can be left in the ground a year or longer once it is mature. Although somewhat demanding of phosphate and potash, it requires little nitrogen and grows well even in soils considered to be low in fertility. Cassava is also very resistant to drought. For these reasons the rice-cassava intercrop is nearly an ideal combination.

E.1. Cassava Intercropped with Rice:

Rice is demanding of nitrogen, while cassava grows well even after the nitrogen has been depleted. Rice is sensitive to drought but tolerant of excess moisture, while cassava tolerates most conditions except poorly drained soil. Intercropping cassava with rice greatly reduces the risk of total crop failure and helps stabilize both seasonal and annual production of both crops. A different rice-cassava intercrop pattern is dominant in

each of the three counties surveyed and a few farmers in each county plant their cassava after the rice harvest.

Cassava planted after the rice:

In Grand Gedeh, cassava is planted 4 to 6 weeks after the rice. Since the rice is dibble planted, it is not difficult to plant the cassava cuttings. Because of its earlier planting, rice shades the field and dominates the cassava, limiting the effect of competition from the cassava. Cassava is usually only planted on a portion of the field and is often intercropped with the first rice planted. The fact that the earliest maturing rice varieties are usually planted first helps assure that the cassava will not shade the rice. Once the rice is harvested, the cassava can grow and mature normally. Since the cassava does not shade the rice, cassava can be planted at a fairly heavy density.

Because of the limited competition from cassava, this is probably the most efficient of the three intercropping strategies in terms of Land Equivalent Ratio. However, it is probably not practical in areas where broadcast planting is practiced. In such areas, planting cassava after rice would probably result in the removal or destruction of many rice plants. It is doubtful that farmers would accept this.

Planting cassava with the rice:

In Nimba, farmers plant the cassava cuttings at the same time that they are planting the rice. In this manner, the broadcast rice seed is moved to the side, but no plants are destroyed. The cassava does tend to grow faster and at some point begins to shade the rice. To reduce this competition, the cassava is planted at low density and the lower half of the branches and leaves are removed when it starts shading the rice. Farmers say that the leaves of immature cassava plants are not good to eat but may be fed to livestock. Cassava is intercropped throughout the entire rice field except for swampy areas. This larger area of cassava reflects its importance in consumption. Intercropping bananas and plantain in the rice field is largely eliminated since farmers believe they are too competitive with cassava.

Cassava before rice:

In Bong County, the common intercropping pattern is to plant the cassava shortly after burning the field, which may be any time from 2 weeks to 2 months before the rice is broadcast. The cassava will have germinated and will be growing before hoeing begins. In this manner it can be identified so that it is not hoed out and does not interfere with the broadcasting of rice seed. The stripping of leaves and branches to prevent shading of

the rice is not as commonly practiced as in Nimba, so farmers often rely on the low cassava density alone to reduce competition. In contrast to Nimba, cassava is frequently planted on only a portion of the field.

Rice-cassava double-cropping:

In all three counties, a few farmers plant their cassava as a second crop, after the rice is harvested. In some cases, particularly in Bong county, farmers state that this is because they believe ground hogs like cassava even better than rice. In such cases, planting cassava in this manner is a strategy to help reduce the groundhog damage to the rice field and yet take advantage of the groundhog fence, if one has been built. In many other cases, this cassava planting strategy is a reaction to problems encountered earlier in the year. If they did not have cuttings available at the normal time of planting, or if the initial planting has not done well, farmers may compensate by planting cassava after the rice harvest.

E.2. Separate Cassava Fields:

Some farmers in each county also plant a cassava field entirely separate from the rice field. In some cases, this is in addition to intercropping cassava with rice, but in other cases it represents an alternative strategy. These fields are often made on a portion of the rice field from the previous 1 to 3 years, so land preparation is not too difficult. The time of planting varies throughout the year but one important strategy is to plant a fast-maturing variety in March or April. If necessary, farmers could begin to eat this cassava 4 to 5 months later during the hungry season.

Farmers who do not build a groundhog fence for the rice field will sometimes plant a small field of cassava separately, and build a groundhog fence for it alone. As stated earlier, this separation is often an attempt to protect the rice because farmers believe that groundhogs are more attracted to cassava than rice. This belief is not universal.

E.3. Cassava Varieties:

A number of cassava varieties are found in both Grand Gedeh and Bong Counties (see Appendix J), but only a single variety is identified in Nimba. "Matadi," an introduced "sweet" cassava, is universally the choice of Nimba farmers. This variety has replaced all of the traditional local varieties in this area where cassava is eaten practically every day. In areas where cassava is less important in the diet, farmers still use many of their local varieties. Some of these are "bitter" varieties which

contain hydrocyanic acid (HCN) and must be processed before eating to prevent cyanide poisoning. Farmers say that the "bitter" varieties yield a larger tuber and mature faster than the introduced sweet varieties like "Matadi." Some of the local varieties mentioned by farmers are: mornfo, boutoh, banweh and coco in Grand Gedeh; with fusan, behuna, gbarkpalin, kpelemana, two cents, and awakana mentioned in Bong. Say-ton-pon and belaminah appear to be other names of "sweet" varieties in Grand Gedeh and Bong, respectively. One additional variety in Bong called gorbu is used for leaf production only.

One field trial of cassava varieties in Bong was visited. It included CARICASS I, II and III, NUCASS I and II, and ROCASS I and III. The farmer planted them without any specific instructions and later the extension agent made him dig them up and replant them by variety. About 700 of the 2100 plants died in the process, but the rest looked good at the time of observation. The CARICASS and NUCASS varieties did not show any cassava mosaic, but the control showed a severe attack. These varieties need to be tested in on-farm agronomic trials, particularly intercrop trials with rice. They are bushy and should produce a good leaf yield as well as tubers; however, the additional bushiness may cause shading problems as a rice intercrop.

E.4. Number of Cuttings:

Throughout the 3 counties surveyed, farmers plant cassava by digging a shallow trench and laying 3 or 4 cuttings parallel in the trench. If people are short of cuttings, the number might be reduced to two. The only major exception to this pattern was a woman in Bawaydi, Grand Gedeh, who planted 1 cutting at about a 60 degree angle in areas where there was a lot of grass. Except in grass, she also used 3 or 4 cuttings in a shallow trench.

E.5. Pests and Diseases:

Farmers do not seem to recognize cassava diseases. When asked, they consistently state that they have no disease problems with cassava, even though cassava mosaic is present and serious in every cassava field observed. Women do not even discriminate against leaves affected by cassava mosaic when picking them for eating. Cassava bacterial blight has been identified in some fields, but it is not nearly as prevalent as cassava mosaic.

The common pests identified by farmers as a problem with regard to cassava are: groundhogs, porcupine, and ground squirrel. On occasion, grasshoppers are also cited for attacking the leaves. As mentioned earlier, groundhogs are a serious problem. Stake fences are often built, but even this is often not sufficient to keep the groundhogs out. Controlling groundhogs is the primary problem cited by farmers for cassava as well as for rice. Porcupines are a problem, but they are less numerous than

groundhogs. Porcupines are heavily hunted since they are prized for their meat. Ground squirrels seem to be more of a problem in Grand Gedeh than in Nimba and Bong. It appears that Grand Gedeh hunters are less willing to waste a shell on them, given the abundance of larger game.

E.6 Other Crops Intercropped with Cassava:

When cassava is planted separately from rice, it is not usually intercropped except for a few vegetable and pineapples. However, several exceptions were observed. One farmer in Grand Gedeh intercroops cassava and sweet potatoes, and states that the sweet potatoes help to reduce underbrushing. Several farmers, particularly in Bong county, are growing groundnuts with cassava. One farmer admits that it is difficult to dig the groundnuts without damaging the cassava tubers. One tree crop specialist in Bong (a Bassa man) plants all his coffee seedlings by intercropping them with cassava. He uses his preferred food crop to provide shade for the seedlings. One other man in Grand Gedeh plants cocoa seedlings with his cassava.

F. Swamp Rice Cultivation (General)

F.1. Traditional Swamp Rice

Traditional swamp rice farming, as found in the study areas of the three counties surveyed, does not adversely compete with upland farming. This is because it is either planted as part of the upland rice field, located close to the upland farm, and/or operated in a manner that creates little conflict with the upland rice farm.

In Grand Gedeh, traditional swamp rice farming is usually part of a traditional upland rice farm. Women tend not to have individual swamp rice farms. This contrasts somewhat with the practices found in Bong and Nimba. There, a number of women do have individual swamp farms which are located, whenever possible, near the upland rice farm for their convenience. Traditional swamp rice farming may not be as prevalent in Grand Gedeh due to the availability of upland farmland in the county.

Site selection:

In those cases where the traditional swamp is associated with the upland rice, site selection is dictated by the location of the upland farm. In other cases, proximity to the upland is a major consideration. Thus, site suitability in terms of nutrient supply and water availability and control are seldom given consideration. The association of the swamp to the upland farm also suggests that continuous cropping is seldom practiced.

Methods of cultivation:

When associated with the upland rice farm, a number of pre-planting operations (brushing, felling, and sometimes burning) are done at the same time and in a similar manner as those of the upland rice farm. In some cases, even when associated with the upland farm, the brushing and burning may be delayed because of involvement with the upland field. Besides being delayed, the burning may be made impossible if the swamp is too wet. In this case, the swamp must be cleared by hand before planting. These factors, necessarily, also delay planting which is then completed after the activities in the upland field have subsided. In those cases where the swamp is located a distance away from the upland farm, a delay in the completion of pre-planting operations and, consequently, a delay in planting is a likely occurrence.

A number of examples of swamp farms located a distance away from the upland farm are found in Bong and Nimba. In one instance, the woman brushes the swamp in March (using kuu labor) while the husband fells trees in the upland. After completion of the upland, the husband then helps fell trees in the swamp. In another case, the woman brushes the swamp in June with the help of a kuu consisting of eight women, but does not have to fell trees since the swamp had been cultivated the previous three years.¹¹ Most traditional swamps are planted by broadcasting the rice seeds on the wet soil surface. In a few cases, broadcasting is followed by scratching if the soil surface is not wet enough.

The few swamp farmers interviewed in the study areas reported that they broadcast on wet soil surface or in standing water.

Varieties grown:

Gissi 27 is the most common variety grown in swamps. Sogada and Gbokala are also reported to be grown in Nimba. Menonkor, an upland variety grown in Grand Gedeh, is also reported to be a good swamp variety.

Post-planting, harvest, and post-harvest methods:

Some of the post-planting operations (weeding, bird watching, fencing) and practically all of the harvest and post-harvest operations are similar to those practiced in the upland. Weeding is performed by the women using the hands; fencing (if and when required) is done by the men. Harvesting is done mostly by the women who are sometimes assisted by men.

Most farmers interviewed report that they either sell the rice and/or use it to supplement the rice obtained from the upland.

¹¹ The swamp had been cultivated two years by other farmers and the third year by the farmer interviewed.

F.2 Improved Swamp Rice:

The term "improved," as used to distinguish certain kinds of swamp rice farming from traditional swamp rice farming, is very relative. This term refers to the method of swamp rice farming where production on the same location is anticipated for a number of years and some degree of water control is attempted. This method involves a lot of labor put into land preparation, such as the construction of bunds and canals and the leveling of swamp fields to ensure water control. In some cases, the construction of reservoirs to ensure year-round water availability is also implemented. Continuous production also suggests that chemical inputs may have to be introduced at some point to maintain fertility. It is this kind of swamp farming, that traditional farmers have shunned for so many years and still continue to be suspicious of today.

A number of reasons have been advanced to explain the indifferent attitude of many traditional farmers towards improved swamp farming. Jenne (1982) has cited some of the following reasons:

1. The traditional view that the upland rice farm is the core of the farmer's lifestyle and must not be abandoned for any new, unfamiliar, and risky enterprises;
2. The fear on the part of farmers that diseases (especially schistosomiasis) abound in swamps and may pose serious health problems with prolonged exposure of farmers to swamp environments;
3. The impossibility of simultaneously growing the many intercrops farmers are accustomed to planting in the upland;
4. Farmer's lack of experience and understanding of the importance of water control;
5. The general belief that swamp farming is the responsibility of women; and
6. Farmer's taste preference for upland rice relative to swamp rice.

Another major factor identified through this survey is the heavy labor demand for not only building but also yearly maintenance of the bunds and canals. This work generally needs to be done at the same time that the upland rice field is being prepared, creating direct competition between the two. Since the upland field is considered the core of farm activity and production, it takes priority. For many farm families, this means that the swamp infrastructure is not well maintained or labor must be hired to do the work. During the years in which the original development loan is being repaid, the repayment plus the cost of labor for maintenance may approach the sale value of the rice produced. When less labor is hired for maintenance, the work is often not completed, and yields tend to fall correspondingly. Swamp rice farming is only economically attractive to families who have a surplus of labor to do the work, or who lack access to land and do not have the alternative of making an upland rice

farm. Like many capital investments proposed to small farmers, developing a swamp appears to be economical only if the cost of the investment is ignored, or it is assumed that labor has no valuable alternative employment during the period in question.

Despite all of the obstacles to the adoption of improved swamp farming, a number of farmers are found practicing this new method. Most of these farmers participate in groups encouraged by projects such as NCRDP in Nimba and BCADP in Bong. Besides the project-motivated swamps, other developed swamps operated by private farmers are found in urban areas. Typical examples of this are found around the cities of Zwedru and Saclepea in Grand Gedeh and Nimba, respectively.

Location of improved swamps:

The location of improved swamps, when project-motivated, tends to be determined by project personnel and approved by farmers. In some cases, farmers identified the location of swamps which were then approved by projects after some investigation. Especially important in this light are those swamps being operated by working groups call "Farmers' Development Associations" (FDA's) and motivated by the Nimba County Rural Development Project (NCRDP). Non-project-motivated swamps tend to be located in urban areas or areas that were once government project swamps.

Varieties grown:

Many farmers are found growing improved swamp rice varieties. These include Gissi 27, IR5, Suakoko 8, 10, and 12, and BG90-2. No local varieties are found being grown in improved swamps.

Methods of cultivation:

The pre-planting operations involved in the development of improved swamps consist of brushing, felling, burning, clearing, and destumping, construction of bunds and canals, and leveling operations. In some cases, the construction of reservoirs to ensure the availability of water year-round is also a major pre-planting operation. However, not all of these operations have been implemented in the study areas. The construction of reservoirs is certainly not common. Also, it is only in new swamps being cultivated for the first time that most of the other operations are reported to be implemented.

Unlike traditional swamps that appear to be the responsibility of women, men and women are equally involved in improved swamp rice farming. This is especially true of the Nimba study area, where the FDA's consisting of both men and women are the active improved swamp farming groups. In one study area of Nimba, working groups consisting exclusively of men as well as those

consisting exclusively of women are found. The swamp being operated by the women has, however, not been laid out. An interview with the leader of the women revealed that the men have assumed the responsibility of developing the site being operated by the women after completion of their own site. In another area, working groups consisting of both men and women have been organized, each operating in a separate swamp. To meet labor requirements, farmers in these working groups report that they each sacrifice a day or two per week during peak working seasons to participate in the FDA swamp farm activities. In non-project swamps the source of labor is the family and/or hired labor.

Planting is done by broadcasting or transplanting. Farmers are found practicing both techniques. At least one farmer claims that broadcasting gives a greater yield per acre than transplanting, although his transplanted rice appears to have a low plant population.

Some post-planting operations implemented by farmers include weeding, birdwatching, fencing, and limited application of chemical fertilizers and insecticides. The latter operations are restricted to the study areas of Bong, where Urea, Triple Superphosphate and Diazinon are distributed to farmers. An interesting post-planting operation that is being practiced in Grand Gedeh by one farmer is the brushing back of rice to control lodging of Gissi 27 in very rich soil environments. According to the farmer, brushing back the rice 3 months after planting results in reduced plant height without any delay in maturity, thereby preventing lodging.

The many operations discussed above give an indication of the high labor demand of swamp rice farming. A number of farmers, especially in the Bong and Nimba study areas, appear to be getting involved in improved swamp rice cultivation. Some are urban dwellers lacking access to land for upland rice near the city. Many others are attempting to maintain their traditional fields and cultivate swamp rice in addition. Often, this can only be accomplished at the expense of other enterprises. Neglecting the underbrushing of cocoa and/or coffee is a common result of being over extended. This neglect is intentional to the extent that farmers admit they will not be able to underbrush their tree crops this year because of the amount of time spent on the swamp rice. In most cases, farmers believe this labor constraint will ease when the infrastructure is in place. A second compensating strategy is to simply limit the size of the swamp field even though this may conflict with the recommendations of project staff (and project targets). Many more farmers seem to be motivated by the FDA group approach encouraged in Nimba by the NCRDP than by private involvement. Many farmers continue to participate, even though it means that they must either reduce or neglect some of their family farm enterprises. It is unlikely that FDA labor requirements can continue at the present level without discouraging farmers unless substantial compensation of some form is forthcoming. It is unclear whether village improvements will continue to be sufficient compensation

to motivate them.

G. Other Major Field Crops

G.1 Sugar Cane:

Although considered a capital-intensive crop, many farmers in the study areas of Bong and Nimba were found growing sugar cane as a cash crop. However, in most cases, the high initial capital investment required is not found to be an obstacle. The majority of farmers have access to a wealthy farmer's processing facilities for a fee or a share of the product. Of course, accessibility is not only a question of availability, but it is also a question of the distance between sugar cane fields and processing facilities. Thus, farmers also have to absorb the cost of transport to the processing site which can greatly reduce profitability. Most farmers in this situation hoped to obtain their own processing facilities over time.

Site selection:

Most farmers interviewed feel that alluvial soils along river banks and deep, somewhat poorly- to well-drained soils are the best for sugar cane cultivation. Other sites with less favorable characteristics are also being used, especially for the black Chinese variety that appears to be more adaptable to a number of soil conditions.

Other factors that farmers claim they consider in site selection are access to water for processing or proximity to the nearest processing facility. To save on labor, some farmers are using old rice fields, as long as these have characteristics favorable for sugar cane growth.

Land preparation and methods of cultivation:

After site selection, the next step in sugar cane cultivation is land preparation. This involves brushing, felling, burning, and clearing. In the event that an old rice field is used, only brushing and burning need be done. The planting period depends on the location. In river bottoms and very swampy areas, planting is done about January to avoid standing water. In drier locations, planting should coincide with the beginning of the rains. However, this places the land preparation and planting of sugar cane in conflict with those same operations for upland rice, the priority crop. This suggests sugar cane operations would be delayed, which farmers agreed often happened in reality. The methods of planting again seem common throughout those study areas growing sugar cane. It consists of first preparing holes about a foot wide and an inch or two deep, using a hoe. Sugar

cane cuttings (usually taken from the top 2 to 3 feet of the cane) are then placed horizontally in these holes (one or two cuttings per hole) and covered with previously dug soil, using hoes or hands.

After planting, frequent underbrushing is carried out until harvest time. Few farmers make fences during the growing season to protect the cane from groundhogs. Due to the perennial nature of sugar cane and the susceptibility of such fences to termite damage, their use is limited to the first cane crop. Thereafter, a new fence has to be made each year. This is probably one reason why most farmers ignore the fencing operation.

Varieties grown:

All farmers interviewed growing sugar cane recognize only two varieties: the local yellow type and the black Chinese variety. Farmers report that the local variety takes about a year to reach maturity after the first planting, produces more sugar juice (commonly called "beer" by local farmers), but does not necessarily produce more alcohol (commonly called "cane juice"). However, farmers claim that the local variety is difficult to harvest and can be harvested only once a year. The Chinese variety, according to farmers, is ready for harvest in 7 - 8 months. Farmers reported that it has the additional advantage of being more adaptable to a variety of soil conditions, is less difficult to harvest because of its erect growing habits and can be harvested twice a year. It also appears that it is less favored by groundhogs since it produces harder stems than the local variety. Some farmers, however, do not hold this view. At least two farmers interviewed also claim that the Chinese variety yields more cane juice from each drum of beer distilled. They attribute this to their observation that a drum full of beer from the local variety has a higher percentage of water, particularly during the wet season, than the Chinese type.

Harvesting and processing techniques:

According to the sugar cane farmers interviewed, harvests from the ratoon crop may continue for as long as ten years or more. However, because farmers make no attempt to maintain soil fertility, yields tend to decline progressively from the first year. Most farmers are harvesting only 3 or 4 times from the ratoon crop after which they have to find a new site. Frequent interplantings within the first few years are also reported.

The harvesting method practiced by farmers consists of cutting each cane as close as possible to the base using a cutlass and then removing the top 2 to 3 feet for subsequent planting. The lower sugary stem is then tied into bunches and transported to the milling site where juice extraction by crushing begins as soon as is feasible.

The processing technique for alcohol, the major reason for which farmers grow sugar cane, consists essentially of three steps: crushing the cane to remove the juice, fermenting the juice, and distilling for alcohol. The first operation is done by a hand or a motor-operated mill. Many farmers are using the former hand-operated type. The fermenting process is accomplished by souring the crushed juice in drums made partially air-tight by covering with leaves, thatch, or other appropriate material. Farmers report that they use a minimal amount of yeast to speed up the fermentation process. After fermentation, distillation follows. This involves heating the fermented juice in a distilling pot and gradually cooling the volatile vapor using long pipes that meander from the distilling pot through a cooling apparatus (often a drum full of water) to a collecting container. The liquefied volatile material is ethyl alcohol (CH₃OH), which is a favorite intoxicating drink for many Liberians.

Farmers interviewed report that for every drum of fermented juice, two to two and one half demijohns (5 gallon container) of alcohol are obtained. For farmers renting the processing facilities of another, one-fourth to two-fifths of this yield must be given to the owner of the processing facilities. Some farmers pay this fee on the basis of fermented juice, for which one drum for every three is a common fee.

Sugar cane growing strategies:

In all surveyed areas, two primary strategies for growing sugar cane seem to be employed. First cane can be planted in separate fields sparsely intercropped with corn, banana, plantain, and other crops. Second, sugar cane can be intercropped in the rice field with other crops as well. Another labor-saving strategy also practiced is the use of old rice fields for sugar cane cultivation. This eliminates a number of steps associated with pre-planting operations. The strategy practiced depends on a number of factors. No strategy seems to be exclusively practiced in any one area.

G.2. Groundnuts:

The cultivation of groundnuts is found to be restricted to the study areas of Bong and Nimba, and cultivation methods and strategies seem similar for both counties.

Site selection:

The common tradition found among farmers growing groundnuts is to cultivate it as a second crop after rice. This seems logical since groundnuts, being a legume, are not too demanding of nitrogen, the nutrient most required and easily depleted under

rice cultivation. The choice of site also saves on labor requirements, since very little effort needs be put into pre-plant operations. This great savings on labor and the ease with which other planting and post-planting operations are done are probably the reasons why groundnut cultivation is considered a woman's job.

Land preparation and methods of cultivation:

Brushing and burning the stubble from the old rice field are the major pre-planting operations. Two methods of planting are employed: 1.) broadcasting and covering the seed by scratching the soil with a hoe; and 2.) dibbling, which involves hoeing and leveling the top 1 or 2 inches of soil, then digging holes an inch or two deep into which 1 to 2 seeds are placed and covered with soil. The latter method seems common in the areas surveyed. Planting is usually done in March or April and the groundnuts mature during June or July. This facilitates harvesting since the soil is moist and loose and the groundnuts can be removed from the soil with relative ease. Weeding can be done either before or after flowering, but when groundnuts are densely planted, little weeding is required.

H. Tree Crops:

Cocoa and coffee are important components of the farming systems in the three counties surveyed. Most farmers interviewed are growing one or both because of their complementariness to the upland rice-cassava field. Once established, the labor requirements for these crops do not fall within the periods of peak labor demand for rice. The risk of growing these tree crops is low since maintenance is flexible and underbrushing may be omitted for several years, once the trees are established, without destroying the investment. The cost of establishing the trees is relatively low, and they are a good source of cash income once mature. The relative prices at the time a farmer plants are probably a key factor in determining which crop he selects. Access to land may be a constraint in areas of severe land pressure for newcomers to a village because of the relationship between tree planting and land rights.

Cocoa is the tree crop most often grown by farmers in the three counties surveyed. It has the advantage of requiring less underbrushing than coffee, once the trees are mature. In addition, for many years farmers received a much higher price for cocoa than for coffee. Recent cocoa price instability is probably encouraging diversification of tree crops.

H.1. Cocoa

Years of experience:

Some farm families interviewed have been growing cocoa for as much as forty years or longer. A number of families have 20 year old trees in need of rejuvenation. Frequently, the cocoa farmer either has considerable experience with cocoa or represents a new generation who had grown up with cocoa. On the other hand, there are a considerable number of relatively new cocoa growers in Nimba and Bong who have been encouraged to grow cocoa by the county development projects.

Sources of planting material:

As might be expected, the source of planting material depends greatly on the period when a farmer acquired his trees. The early source seems to have been seeds that were brought back from Ivory Coast. The few original growers gave seeds to neighbors and friends in a process of spontaneous adoption. In the 1950's, the Cocopau Plantation in Nimba, and perhaps several others, became heavily involved in cocoa production. Directly or indirectly these plantations provided the seeds, and often the experience, which encouraged the spread of cocoa production.

At present, sources are more diversified. Farmers still get cocoa seeds from neighbors and friends. LCCC and county agricultural development projects not only provide seedlings but also give loans which cover the cost of seedlings, tools, and money to hire laborers for underbrushing for the first two years. These organizations also provide some extension service and may help organize marketing arrangements as well as provide guidance in selecting a site.

Site selection:

Farmers have a number of different means which they use to determine the suitability of a site for cocoa. These fall into 4 categories: 1) plants which indicate good soil; 2) traditional soil tests; 3) folk wisdom; and 4) experimentation. However, it should be recognized that the areas to which an individual farmer has land rights may not include the most appropriate environments for cocoa.

As mentioned in the rice section, there are a number of plants which farmers in different areas recognize as indicators of good fertility. These include palm trees, a fern called "to-ay", "sidrew-sighbor" and "poseken." Some farmers will look for an area where one of these is common to plant cocoa.

Traditional soil tests are also commonly used. These include looking for black soil which is considered to be rich; checking

to see how easily plants can be pulled from the soil; or squeezing a fistful of soil to test for texture.

Folk wisdom is also a common guide. The folk wisdom concerning where to plant cocoa suggested one of three possibilities: near a river; along a swamp where there is moisture but not standing water; and on an old town site. It is interesting that this folk wisdom recognizes the importance of alluvial soils or soils made rich by composting household refuse but it may lead farmers to plant in areas that are wetter than is desirable.

Finally, some farmers use different forms of experimentation. One common practice is to plant cocoa on an old rice field, using the performance of the rice to indicate if the soil is rich enough for cocoa. This process has the advantage of avoiding the need to clear a separate site. However, unless a farmer is willing to wait about 2 years, sufficient shade may be a constraint. A few farmers actually plant a few seeds or seedlings on a promising site and watch their development for about a year; only if they do well does the farmer go ahead and plant additional trees there.

Project personnel often pick sites for farmers involved in county development projects. Unfortunately, the sites selected in the past have not always been appropriate. The introduction of soil testing of potential sites will hopefully rectify this problem.

Method of cultivation:

Planting: Most farmers who have been growing cocoa for a long time began by planting seeds. It was probably in the 1950's when plantations became involved that people began to recognize the utility of nurseries and transplanting seedlings. Most farmers still only had access to seeds, but a few began making their own nursery rather than planting 2 or 3 seeds per hole. At present, seedlings are available from projects and LCCC, but some farmers are unwilling to pay their price of .15 cents per seedling and continue to procure seeds from other villagers.

Intercrops: Cocoa seedlings are sometimes intercropped. Usually, this appears to be related to the strategy of using a field which has already been cleared and sometimes for overcoming the lack of shade on such fields. Intercrops with cocoa seedlings include rice, cassava, sugar cane (when planted in a swamp) bananas, and plantain. Cola (nut) and palm trees are sometimes intercropped with mature trees. There is a suspicion that cola trees may be an alternative host for some of the pests attacking cocoa. This should be investigated.

Shading: Cocoa seedlings should be planted in shaded areas. Farmers provide shade in different manners. Some will cut part of

the trees when brushing an area for planting cocoa, leaving a general but somewhat thin canopy. Others will leave all the large trees but girdle a portion of them so they will die slowly. Farmers who plant on a previous rice field sometimes have a problem with lack of shade unless they wait several years and brush again, leaving some of the regrowth to shade the seedlings. One technique observed on a few farms which seems to overcome this lack of shade is to plant the area to bananas and plantain a few months before planting the cocoa seedlings. In this manner, the field also remains productive during the 4 to 7 years which cocoa requires to mature.

Once cocoa trees are mature, they develop a shade canopy which provides most or all of the shade necessary. This is especially true given the way farmers typically plant them. The extension services recommend spacings that vary from 10 x 10 feet to 12 x 12 feet. Most of the older fields were planted randomly, so spacing varies, but the spacing is approximately 8 x 8 feet or sometimes less. One farmer observed planting cocoa seedlings has two 10 ft. lengths of bamboo so he can use the triangulation method of spacing, but he will not use the full length of the two poles. He said this is because some of the seedlings will die and the "World Bank" (BCADP) will not provide replacements. However, in talking to farmers it is evident that they are very concerned with underbrushing. It appears that some farmers are intentionally planting more densely than recommended so that a heavy shade canopy will develop which reduces or even eliminates the need for underbrushing. Branches of trees in the older fields do interlock and provide a dense shade. This leaves the lower branches shaded and competing for sunlight. It can be expected that roots will extend as far as the branches and thus will also be intertwined and competing for nutrients. For these reasons, it is expected that the farmers' higher density will reduce potential yields. In fact, the number of pods observed on trees was very small in most cases: 5 to 10 pods per tree. Research and extension recommendations on spacing should reconsider this trade-off between yield and underbrushing, taking into account the risk that wide spacings have for farmers who cannot afford to underbrush.

Underbrushing: Cutting back the undergrowth is the only maintenance activity commonly practiced and the main labor activity concerning cocoa. For this reason, it is also the primary constraint. As mentioned earlier, farmers appear to be more concerned with the problem of underbrushing than with the yield per tree they receive. Young trees are commonly underbrushed twice a year in December-January and in July-August. When the trees are mature, this is reduced to only once a year, just prior to harvest if any underbrushing is done at all. This is commonly in July or August, but may be later depending on the harvest cycle of the trees in question.

Thinning and pruning: Except for one or two tree crop specialists interviewed, farmers rarely do any thinning or pruning of tree crops. Many farmers do not want sunlight to penetrate so the stand is not thinned, and the canopy is not pruned to allow sunlight to reach the to lower branches. Even dead, diseased, or insect-infested branches are not removed. Very old trees are left to decline naturally, though they produce very few pods, rather than cutting them back to generate a new tree. Farmers' reluctance to thin and prune may be attributed to the following:

- 1) Fear that thinning and pruning will reduce shade and thereby increase the need for underbrushing.
- 2) Time and labor constraints which prevent a farmer from bothering with activities which do not have a direct effect on production.
- 3) Hesitancy to remove a tree that is producing, given the long delay before a new tree will provide any income.
- 4) Lack of information on the importance of pruning, particularly of removing and destroying diseased or infested branches and trees.

Harvest: Harvesting must be done periodically as pods ripen, but it does not require a lot of time, particularly given the low yields commonly observed. A number of farmers have indicated that harvesting is done about every third day once some of the pods are ripe. This usually begins in August and continues for one to two months. A few farmers have stated that their trees do not begin to produce until November or December, perhaps due to varietal difference. Some, but not all farmers use a knife to remove the pods so that the tree will not be injured.

Post-harvest techniques: The adoption of recommended post-harvest techniques varies greatly. Farmers in counties with projects and well-developed extension services tend to be more aware of these techniques, but most farmers still have little incentive to practice them. With the exception of cocoa purchased by some project-sponsored cooperatives or FDA's, there is no grading of cocoa at the farmgate. Since there is no price differential for quality, farmers have no reason to follow recommended practices.

Once pods are harvested, they are left in a pile or in a basket for about 3 days before attempting to break them. Newly harvested pods are difficult to break and hurt one's fingers when they crack. The delay softens the pods, making the task easier and less painful. Following harvest, the next two post harvest techniques followed by most farmers include the following:

1) Fermentation

Some degree of fermentation is practiced by many farmers in all 3 counties. Cocoa beans are piled into a box or basket lined with banana leaves and are covered with more banana

leaves.¹²

A weight is placed on top to keep the leaves in place and perhaps to compress the cocoa as well. The amount of time the beans are allowed to ferment ranges from 3 to 7 days.

2) Drying

The beans are removed from the box or basket and placed in the sun to dry. Drying time varies from 3 to 4 days to several weeks. The time required varies according to the weather and whether farmers start the drying gradually, a few hours at a time. Some farmers place the beans on a mat on a raised platform of small wood logs or bamboo sticks to help keep the beans clean. Others simply place the mats on the ground. Most farmers periodically stir the beans as they are drying on the mat to allow for more even drying. Farmers can tell when the beans are dry by cracking open one of the beans.

Pests and diseases: Black Pod disease is a serious problem for cocoa throughout the three counties. The disease is evident on every cocoa field visited. Pods have been observed in various stages of the disease's development, from a few black spots to entirely black and empty husks. Immature pods show signs of attack less often than mature pods. More information is needed on this disease. The development of Black Pod resistant varieties would be highly desirable.

Stem borers appear to be the most serious cocoa pest. Some cocoa fields have dead branches on a majority of their trees which appear to be caused by stem borers. Farmers also have pointed out holes in the trunk of some trees going all the way to the pith, which caused the tree to die. Farmers mention that the dry season is the primary time of attack and that trees with a lot of sap are resistant to stem borers. One tree with a lot of sap had 6 or 8 holes, but the stem borer had not reached the pith. It appears that there may be two types of stem borers involved. One is a completely white beetle about the size of a large fly. Larvae with the appearance of small maggots have also been observed, but farmers say these are not the larvae of the white beetle.

The severity of stem borer attacks seems to be associated with bush overgrowth, i.e., lack of underbrushing. The fields with the most severe stem borer attack appear to be those which have not been underbrushed for several years or have been partially abandoned.

Termites are a problem in many cocoa fields observed. However, it appears that they usually start as a secondary parasite feeding on dead and decayed branches and only later spread to

¹² In some cases, farmers will place the beans in a sack to let them ferment.

healthy plants. If true, this strongly supports the need for pruning and destroying dead and infested branches.

Squirrels, domestic livestock, wild animals, and even some birds are additional pests to cocoa that are cited by farmers. Planting cocoa near the village may afford some protection from wild animals, but it increases the likelihood of damage by domestic animals unless the field is fenced or protected by a natural barrier such as a river or a stream.

H.2. Coffee:

Coffee is the second most popular tree crop. It has the advantage of performing well in somewhat less fertile soils than cocoa, but it does not usually develop a dense shade canopy like cocoa and requires more labor for underbrushing.

Years of experience:

In Grand Gedeh and Nimba counties, which border on the Ivory Coast, farmers have about the same experience growing coffee as cocoa. Some farmers have grown coffee for as many as 15 to 20 years, while perhaps one-third have started growing it in the last six years. Growing coffee seems to be a more recent phenomenon in Bong County. Recently, many farmers have begun diversifying by planting coffee as well as cocoa. However, older coffee fields tend to be abandoned more readily than old cocoa fields, probably because of the greater labor requirements associated with underbrushing coffee.

Source of planting material:

Until recently, neighbors or friends have been the most common source of seeds or seedlings. It appears that, as with cocoa, a few farmers originally obtained seeds from the Ivory Coast. Later, Cocopau and perhaps other major plantations became an important source of seed and experience. More recently, LCCC, LPMC, and county development projects have become an important source of seedlings, credit, and technical advice. Most of the coffee grown in the three counties is Robusta, with only one or two plantings of Liberica or Excelsa observed. Seedlings available within the village are frequently from coffee beans that fall and germinate.

Site selection:

Opinion is divided as to the proper soil for planting coffee. One opinion contends that coffee, like cocoa, should be planted in rich loam soils, but unlike cocoa, it should not be planted in swampy areas. These sites can be identified by the same plant indicators and traditional soil tests as used for cocoa. The second opinion maintains that coffee can grow anywhere that is well drained and that gravelly soils in particular are good for growing coffee. Coffee does seem to adapt to a wider range of soil types than cocoa, and this is advantageous to those farmers who lack access to lowland alluvial soils that are fairly well drained. On several occasions, farmers have commented that they have previously tried growing cocoa on their coffee site, but the cocoa died.

Methods of cultivation:

Planting: Coffee is more likely to be planted first in a nursery and transplanted in a field than is cocoa. Even when farmers get seeds from a neighbor, they may well make their own nursery. Farmers do not seem to believe that coffee seed is as viable as cocoa seed. This perception is perhaps related to the smaller seed size.

Intercrop: Coffee adapts to a wider range of intercrops than cocoa because coffee seedlings tolerate but do not require much shade. Coffee seedlings grow well with other tree crops like bananas and plantain, but they can also be grown with field crops such as rice and cassava. The potential for using coffee in alley cropping combinations should be explored.

Shading-underbrushing: Providing shade is not as important a consideration with coffee seedlings as it is with cocoa seedlings. However, farmers still consider shade an important aspect in controlling underbrush growth. Extension services recommend a spacing of 9 x 9 feet or more with pruning when the tree gets too tall for easy picking. Farmers are more likely to plant with an average spacing of 6 x 6 feet or 7 x 7 feet, and they often plant several seeds or seedlings together. This close spacing combined with no pruning provides enough shade that the number of underbrushings can be reduced from the two or three that are recommended. Underbrushing is most commonly done only once a year prior to harvest, even though many farmers would prefer to underbrush twice. The yield effects of this close spacing and lack of pruning should be studied and compared to the labor or cost savings from fewer underbrushings. As an alternative to close spacing, cover crops and alley cropping techniques should be investigated.

Thinning and pruning: Very little thinning or pruning of coffee has been observed except in the case of one or two tree crop specialists. As with cocoa, the reluctance to thin and prune can be attributed to the desire to control underbrush with shade to deal with labor constraints, as well as to lack of information about the importance of pruning in controlling disease and pests. The effects of pruning as a means of controlling stem borer and termites in particular should be investigated, and the results made available for extension activities.

Harvest: Harvest recommendations call for the selective picking of only ripe red cherries (coffee beans). Using this procedure, farmers must return periodically over a period of about three months to complete the harvest. This assures high quality coffee but is labor intensive over an extended period (either from November through February or July through September, depending on the variety). This could be in conflict with labor requirements to brush and fell trees on the upland rice field which is primarily done in January and February. Furthermore, except for several project-sponsored coops, buyers do not grade coffee or pay a higher price for quality. Without such incentives, there is no reason for a farmer to use a procedure requiring additional labor or to upset the work schedule on his main subsistence crop. Instead, most farmers wait until a good portion of the beans are ripe and then harvest all of them at once. This is done either by rubbing a bunch of beans with both hands or vigorously stripping the length of the branch. The presence of red ants on the trees is also a serious harvest constraint, and this rapid procedure minimizes contact with them. Unfortunately, some farmers, in a hurry to complete the harvest so they can prepare their upland rice field, do not even wait until most of the coffee beans are ripe. Grading coffee should be tested as a means of inducing farmers to produce better quality coffee and as a means of potentially improving the price paid to farmers.

Post harvest: After harvesting coffee, most farmers simply dry the beans in the sun for 3 to 14 days. One farmer had a cement slab on which to dry his coffee but most farmers place the beans on mats. The mats may be placed directly on the ground or on a short scaffold which helps minimize the amount of foreign matter that gets mixed in with the coffee. A few farmers mentioned that they mill their coffee either by hand or at a local mill in order to sell clean coffee. However, in some areas, buyers do not seem to offer a price differential between cherry and clean coffee so many farmers have no reason to bother with milling. Information should be gathered or synthesized to establish the effect of the different milling processes on coffee quality and quantity.

Diseases and pests: Farmers did not mention any diseases attacking their coffee and are probably not able to identify any particular coffee diseases. A few farmers did mention that a few trees died back, starting with the apex, but that they did not know why. Stem borer and termites are the major pests attacking coffee. As in cocoa, stem borer seems to be worse in fields where underbrushing has been neglected. Termites seem to be attracted by the presence of dead and decaying plant material but later attack healthy portions of the tree as well. Certain caterpillars and grasshoppers do attack the leaves but are observed to pose a threat only to seedlings in a few isolated cases. Red ants are a serious harvest constraint but do not appear to attack the tree itself except for the damage done by making a nest. The ecological role of these ants should be closely studied before any program to exterminate them is considered. It is possible that they help protect the tree from other insects.

H.3. Other Tree Crops:

Banana and plantain:

Banana and plantain are important secondary crops on practically every farm visited in the three counties. Most farmers grow banana and plantain with vegetables in an area around their house and/or rice kitchen. In addition, they are often intercropped in one or several farm fields. Most often, bananas and plantain are found on some portion of the upland rice field. If cassava is planted on only a portion of the rice field, bananas and plantain are usually found on a portion not used for cassava. The pattern in which they are found varies from dense plantings on a small portion of the field to widely spaced plantings on a major portion of the field. Bananas and plantain are also intercropped with coffee and cocoa seedlings and have been observed on perhaps 20 percent of the fields of immature coffee and cocoa. They also continue to be present in and around some mature cocoa and coffee fields and may be used to fill the space where a cocoa or coffee seedling has died. A few farmers intercrop bananas and plantain in their sugar cane.

Bananas and plantain are picked slightly green if they are to be marketed so that they may be transported without bruising. Because of their perishable nature, farmers have little control over when they are sold. The time of harvest depends on the time of planting. It takes about a year for the plant to flower and three to five months for the fruit to mature, depending on the variety.

No pests or diseases are specifically mentioned for banana and plantain but browning and yellowing of the lower leaves is often observed.

Citrus:

The importance of citrus varies from county to county, but only a small percentage of farmers grow citrus as a cash crop. A number of farmers have 3 or 4 trees for home consumption, but very few have 20 trees or more. Farmers complain that the flood of fruit during the short harvest period prevents prices from being favorable.

Oranges are by far the most common citrus grown followed by grapefruit and tangerines. A few rough lemon and lime trees are also grown. Most families get their seeds or seedlings locally from neighbors, relatives, or friends. No farmer interviewed has obtained any of the improved budded seedlings being distributed by CARI. Most of the citrus observed are planted around the house and/or rice kitchen. Farmers with a number of citrus trees tend to plant their citrus on the black or alluvial soils and old town sites popular for cocoa and coffee production. Underbrushing is done one or two times a year, depending on the availability of labor and cash. As with other tree crops, thinning and pruning are not generally practiced.

Mistletoe is the only pest specifically mentioned by farmers other than the red ants which hamper harvest activities. Mistletoe is not widely distributed and is not recognized as being a potential yield reducing agent. Farmers did mention that trees occasionally die back for no apparent reason and that the black leaf condition is also prevalent.

Research should investigate varieties that would allow the citrus production to be distributed throughout the year. The feasibility of processing citrus and marketing the produce should also be studied.

Oil palm:

Oil palm cultivation is primarily concentrated on large-scale corporate or parastatal plantations. With rare exception, small farmers in the three counties have not traditionally been involved in cultivating oil palm. This is changing at least in Nimba county, where the NCRDP has recently begun a program providing oil palm seedlings to farmers and encouraging their cultivation as an alternative tree crop. Most small farm families throughout the three counties use oil palm products, but exploit wild oil palms to get them. Oil palm nuts are processed into an oil which is used for cooking throughout the country. Many farm families produce at least enough palm oil for their own consumption, and many have a surplus of nuts or oil which is sold as well. Palm wine is the most common alcoholic beverage produced in the village and plays an important role in social occasions, greeting visitors, and even the daily nutrition of many people. Palm leaves are also sometimes used as a source of thatch for roofing. Other oil palm products used in the home or sold as a source of cash include the palm kernels, palm cabbage, cooking soda, and brooms. Given the many uses of the oil palm, the

improved productivity of the dwarf species, and the fact that one project is already promoting their inclusion in the family farm, research should investigate the best manner for incorporating oil palm using alley cropping techniques. Since oil palm is not cultivated, farmers seem to pay little attention to disease and pest problems. Information on oil palm pests and diseases is probably available from LCCC and LPMC or at least from the individual plantations, but it may need to be synthesized and made available to farmers through the extension services.

Rubber:

Rubber is the most important commercial crop in Liberia. When traveling along main highways, one drives through stands of rubber trees for miles and miles. However, most of the rubber is grown on large concessions or estates rather than on small farms. Those villagers growing rubber tend to be wealthier than the typical farmer. They often are the direct descendants of the village founder and can make labor demands on other villagers. Many of these families have been growing rubber for 20-25 years, and they tend to be located in close proximity to one or more rubber estates. In the past, rubber seed was usually obtained from neighboring estates or by working on one of the large rubber concessions. Some family member usually worked on a rubber estate or concession and learned the techniques for growing rubber during that experience.

Small farmers prefer high bush locations for growing rubber but, except for avoiding swamps, show little concern for site selection. Some farmers are able to plant a large tract all at one time. Others progressively clear land or their rice field and intercrop the rubber in July or August when the crops are planted and more labor is available. Farmers do not know the recommended spacing for rubber trees, but many say they measured and cut sticks or paced off the distance between trees on the estate or concession where they had worked. If labor or cash are available, rubber is underbrushed twice a year in July or August and during/after the rice harvest. Farmers complain that underbrushing is a serious problem but do not seem to use a cover crop like kudzu as many of the estates and concessions do. No thinning or pruning was observed.

Rubber fields are not generally tapped continuously but tapping increases as the price rises. Often a portion of the field is tapped for about a month and then left alone while another portion is tapped. Tapping is only done for about 3 months during the rainy season. Bark is stripped from a portion of one side of a tree and tapped for about 5 years. Then the bark is stripped from the other side, and tapping continues there for another 5 years.

Farmers usually sell their rubber as cup-lump (coagulated) to the nearest estate willing to buy. Because of transportation and storage problems, many small farmers are not able to sell their

rubber in the more valuable latex form. They may not be knowledgeable about rubber grading and subsequent pricing, but until recently, most have had little or no alternative as to where they may sell. Farmers are very suspicious about the prices they receive and tend to feel that the buyer is taking advantage of them. A new rubber marketing agency program called the Rubber Corporation of Liberia (RCL) has been established to collect rubber from small producers. This program will hopefully help small farmers receive better prices.

The only disease or pest of mature rubber trees mentioned by farmers is a type of borer described as "the rubber worm". Termites and other animals (possibly groundhogs) do attack seedlings.

The possibility of small farmers using a cover crop like kudzu should be explored to reduce underbrushing. In addition, the potential for incorporating rubber in cropping patterns using alley cropping techniques should be investigated.

I. Livestock:

Raising livestock does not appear to be an important part of the farming systems in the areas surveyed. Farmers claim that they own few animals and few animals were observed around the villages. Why so few animals are present is really not clear. Certainly disease and the lack of veterinary services is a serious problem. But if health problems could be controlled the potential for raising livestock would appear to be quite good. Several social factors may also be important constraints. First, farmers do not have a strong husbandry tradition so that the risk of livestock dying is high. Second, it would appear that private ownership of livestock is not completely respected. On occasion, a villager may grab any animal available to meet an important social obligation. Such factors may discourage investment in livestock.

I.1. General Husbandry Patterns:

Farmers tend to leave animals alone to fend for themselves. They roam the village uncontrolled, except for the use of fences and gates to prevent them from wandering too far down the road. Some farmers also put a gate on the path to their fields to discourage animals from wandering in that direction. Given this lack of control, farmers may not see their animals from one day to the next, or even every week in some cases. This is probably the reason that farmers often do not know why an animal died and probably why farmers do not recognize many disease symptoms. A few farmers have been observed feeding livestock cassava or leaves as a means to induce them to return to the house. This reduces the risk of their wandering off and allows the farmer a chance to observe them.

The freedom of livestock to roam does have an important effect on the spatial pattern of crops. Farmers are unwilling to plant field crops near the village because they would be destroyed by the livestock. Thus, even where land is not a constraint, most farmers walk 30 minutes or longer to get to their rice field. Tree crops like cocoa and coffee are often planted near the village, but cocoa in particular is subject to livestock damage. Pods near the ground are often eaten, and even higher pods may be endangered if cattle are present. Livestock problems tend to be more noticeable around large villages, because they have more livestock and are more likely to have cattle.

Animals are used primarily as a ready source of income, a source of meat for feeding kuus, and as a means of meeting social obligations. For example, in Grand Gedeh, the bride price is still often paid at least partially in animals. Animals might also be killed on other important social occasions such as weddings, funerals, or the visit of a son or daughter from the city.

I.2. Goats:

Other than chickens, goats are the animals most consistently found in villages. Except in Nimba, farmers usually owned more goats than sheep, pigs, or cattle. One of the diseases observed in goats is a form of blindness in which the center of the eyes turns white (perhaps contagious conjunctivitis). A skin disease called "zeh" affects sheep and goats where animals lose hair and develop warty growths around the mouth and on other parts of the body (perhaps mange or scabies).

I.3. Sheep

Sheep are commonly found in villages except in part of Grand Gedeh where "zeh" is endemic. Farmers say that the disease affects sheep more than goats and is so bad that they do not try to raise sheep. In one village, farmers inspect all sheep brought to the village and will not allow any sheep infected with "zeh" to enter.

I.4. Pigs:

Pigs are found throughout the three counties but are especially numerous in Nimba. Farmers say that they are particularly useful for feeding kuus since there is more meat on a pig than on a sheep or goat. The only pig disease described is diarrhea which kills piglets.

I.5. Cattle

Cattle are less prevalent in all the villages than are goats, sheep, and pigs. Some of the villages do not appear to have any cattle. Among the cattle observed, Matura are perhaps more common than N'Dama. A small group of Zebu have also been seen in Nimba on the outskirts of a city, but they are probably the inventory for a local butcher. Cattle are still sometimes used in Grand Gedeh as part of the bride price. Because no farmer interviewed admitted to owning cattle, data are not available on cattle diseases.

I.6. Poultry:

Chickens are owned by practically every family interviewed. Numbers vary from a few to 40 or more. Some farmers have mentioned that they had many chickens at one time, but an epidemic killed many of them. Symptoms mentioned are diarrhea, drooping head and salivating, and the appearance of being wet. Because of their lower value, chickens may be used for both major and minor social occasions.

Ducks are also found on a number of farms, but unlike chickens, they are usually found only on farms which had other livestock as well. Guinea fowl are also raised in a few villages.

J. Marketing:

The Liberian Produce Marketing Corporation (LPMC) was established in 1962 as a joint venture between a Danish Company, the East Asiatic Company (E.A.C.) and the Liberian Government. It is a monopoly buyer and sole exporter of cocoa, coffee, and palm kernels. It is also mandated to purchase locally produced rice and to provide extension services for tree crop (cocoa and coffee) development. Since 1975, the corporation has been solely government owned. Despite its relatively long existence, it appears that traditional farmers in the areas surveyed are experiencing difficulties in marketing their produce and are not receiving prices comparable to those LPMC pays for high quality produce.

J.1. Marketing Channels:

In order to carry out its marketing activities, LPMC operates two primary buying centers: one in Gbarnga, Bong county, and the other in Voinjama, Lofa county (and a sub-center in Ganta, Nimba county). In addition to these centers, LPMC licenses private traders and cooperative societies throughout the country to act as buying agents on its behalf.

The marketing cooperatives were established in the early 1970's to provide economic and social services such as credit and input supplies to farmers and to serve as catalysts to stimulate agricultural and economic development. In this connection, they are licensed by LPMC as buying agents and are required to pay farmers prevailing LPMC prices.

In the areas surveyed, only certain villages have an active cooperative. Where they are found, cooperatives merely serve as buying agents for LPMC, engaging in the buying and selling of produce for commissions. They have not been able to play the expected role of providing adequate and satisfactory marketing services to farmers. The poor performance and subsequent dissolution of some of the cooperatives may be attributed to poor management, the lack of "ready cash" to buy produce on delivery, inability of the cooperatives to loan farmers needed cash to pay for underbrushing or harvesting of tree crops, and in some cases, to the lack of logistics.

Because most villages are not served by an active cooperative, private licensed traders and local merchants (mostly Mandingo) dominate the produce trade. Private buying agents are more active in areas where: 1) roads and access to markets are major constraints; 2) LPMC buying centers are not present; and 3) cooperatives are irregular and inefficient. In these areas, licensed agents (Mandingo) go to the villages or hire sub-agents to go to the villages to buy produce. The buying agents provide the instruments of measurement, usually buckets or pans instead of scales. Where scales are provided, it is uncertain whether correct readings are given, because most farmers do not know how to read or use the scales. Farmers have little choice but to accept the weight and payment given by the buying agent.

J.2. Marketing of Cocoa and Coffee:

The marketing of cocoa and coffee in the area studied is constrained or enhanced by several factors. Some of the major factors are:

- 1) The presence or absence of LPMC buying centers;
- 2) The presence of active functioning cooperatives or their non-existence in a given area;
- 3) Price structure and the timely dissemination of LPMC's prevailing price information to farmers;
- 4) Access to and conditions of roads;
- 5) The lack of grading by buying agents at the farm gate.

The presence of an LPMC buying center and/or an active cooperative are important factors in establishing the price farmers receive for their cocoa and coffee. Cooperatives pay members the prevailing LPMC prices but often pay less to non-

members.¹³ Farmers typically know the price paid by the center or cooperative. Even if they choose not to sell to the center or cooperative, they are in a position to negotiate a favorable price from traders because they have a known alternative. Farmers may still sell to traders to avoid transporting produce to the local center or coop, or because cash needs force them to sell at the first opportunity, even at disadvantageous prices. LPMC's tendency to not announce prices until well after the beginning of the harvest season exacerbates the disadvantage of farmers who need cash quickly. Traders or their agents go to the villages to engage clients at the beginning of the harvest season before LPMC prices are announced. Often they insist that cocoa and coffee prices for the coming season will be low. Farmers in need of cash who have no current price information often sell for whatever price is offered. In addition, farmers who need to borrow money may obligate a portion of their produce at substantially lower prices even before harvest season arrives.¹⁴ Given these circumstances, the timely dissemination of price information might help farmers negotiate more advantageous prices.

Good roads are also an essential factor in farmers' access to markets. When villages are not accessible by truck or pick-up, transportation costs are high and farmers have few marketing opportunities. This places them at the mercy of the rare trader who does show up to buy their produce.

The fact that traders and buying agents don't grade the cocoa and coffee purchased from farmers tends to keep prices low. Buying agents and traders are paid according to the grade when selling their cocoa and coffee to LPMC. Because of the risk that the produce they buy may not receive a good grade, they are only willing to pay a price comparable to those paid for the lower grades by LPMC. Farmers receive the same price, irrespective of the quality of their produce, so there is no incentive to improve quality by following recommended harvest and post-harvest practices.¹⁵

Mandingo seem to dominate the produce trade in the study areas for the following reasons:

- 1) They are willing to go to small villages and buy produce in small quantities;
- 2) They are willing to transport the produce out of the village (even small quantities) which might otherwise cost the farmer more than the difference between what the trader pays and what he could get elsewhere;

¹³ Non-members get around this problem by having members sell the produce in their name.

¹⁴ Some farmers in Grand Gedeh said they intentionally grow cocoa and coffee so that they can borrow money from merchants.

¹⁵ Most farmers do ferment and dry cocoa, but the procedures followed vary, and may not be those recommended.

- 3) Traders are present and willing to buy produce early in the season which helps those farmers in need of cash;
- 4) Traders are one of few sources of credit available to farmers.

J.3. Marketing of Rice:

Rice is the staple food in Liberia and is grown by all traditional farmers. Therefore, the primary reason for growing it is for home consumption rather than for sale. However, rice sales are not uncommon in the areas studied, especially when there is surplus production.

Rice is sometimes sold through the same marketing channels as coffee and cocoa. LPMC is also responsible for the buying of locally produced rice. It uses the marketing cooperatives and licensed traders as buying agents. Unlike coffee and cocoa however, it appears that speculators, (Mandingo and local merchants) buy rice at low prices (7 to 12 cents per pound) during harvest seasons when rice is plentiful. Later in the year during the hungry season, these traders can often sell it at the government set price of 18 cents.

In most of the villages studied, the sale of rice is the responsibility of the women. During harvest, women sell small quantities of rice at 25 cents per cup to purchase basic necessities such as salt, chicken soup, soap, meat, etc.

J.4. Marketing of Cassava:

Cassava is the second most important staple. In addition to being produced for consumption, cassava is often sold to purchase rice and other basic necessities, especially during the hungry season. Unlike the three cash crops previously discussed, it is sold in piles at 25 cents per pile or in 100-pound bags in village, town, and city markets. Usually, it is retailed by producers/sellers in the village market or bought by market women who sell it in major towns and cities. Less cassava is sold in Grand Gedeh relative to Nimba and Bong counties. It appears that more cassava is consumed in Nimba than in Bong. However, because of its proximity to Monrovia, the market for cassava in Bong seems favorable.

J.5 Sugar Cane (Cane Juice):

The amount of fresh sugar cane marketed is small compared to the amount processed for "cane juice." Most of the cane produced

is milled.¹⁶

Because cane juice (commonly called C.J.) is a popular local rum, a significant portion of it is sold in the village. Sales outside the village usually occur when the farmer has satisfied village demand. The marketing of cane juice is restricted by government regulations to licensed traders, shops, and bar owners. Therefore, farmers usually sell their cane juice wholesale in local markets. Of course, farmers in the same villages sell at retail. The wholesale price ranges from about five to seven dollars per gallon, depending on the supply at the time of sale. The principal buyers are market women, shop owners, and other businessmen in the local major towns and urban centers. A few farmers transport their cane juice to Monrovia where prices are relatively higher.

J.6. Other Crops:

Minor crops such as peanuts, vegetables, bananas, plantains, and palm oil are marketed mainly by women. Besides being produced for home consumption, production over and above family subsistence requirements is sold to meet other basic needs.

While these crops are considered minor relative to coffee, cocoa, rice, and cassava, they serve two useful purposes:

- 1) They are an important source of income for some farmers. It is usually from the sale of these crops that farming wives are able to maintain their homes. According to discussions held with farm families during the survey, women receive all proceeds from the sale of minor crops except where the amount involved is substantial. As such, they are not expected to ask their husbands for money to purchase household basic needs.
- 2) They serve as an important source of fruits and vegetables for city dwellers.

K. Other Sources of Income:

The most common sources of income are from the sale of cash crops like cocoa, coffee, and sugar cane (cane juice) and/or from the sale of a portion of the food crops like rice, cassava, bananas, and plantain. In addition, some villagers are participating in a number of other income generating activities.

¹⁶ The milling and processing arrangements are discussed under "Other Major Field Crops" section of this report.

K.1. Off Farm Employment:

Several forms of off-farm employment are available. A few people in many villages are involved in retail trading. This may be limited to a single commodity like kerosene or cane juice, or several commodities such as cigarettes, matches, and snuff. In a few large villages or along a highway, some villagers have a small shop in the front portion of their houses where they sell a variety of articles. In a few exceptional cases, villagers near important centers may be employed by government agencies. In one village, employment is generated by a nearby government oil palm plantation. In another village on a highway near an important city, villagers are employed by a range of government agencies.

Migration provides a second type of off-farm employment. Two types of migration have been identified. Many young men leave the village for several years to work in the mines, on rubber plantations, or in Monrovia. Many will find permanent employment and remain. Others will return to the village, perhaps to get married. Their objective seems to be to make enough money to construct a house and to help pay the bride price. In addition, a number of farmers are involved in seasonal or periodic migration. Frequently, these people find jobs tapping rubber or underbrushing tree crops for a concession or large plantation. Several farmers also mention they are involved in processing and gravel from river beds in search of gold. Such migrants may or may not participate in this activity every year, depending on their cash needs, family labor situation, etc.

K.2. Farm Laborers:

Working as a farm laborer may be occasional, seasonal, or in the case of one man interviewed, fairly constant. People willing to work for cash seemed to be available in every village. Employment may be organized on either a day wage basis (common for food crops) or a contract basis (common for underbrushing tree crops). If a village has a "big man" with rubber or other extensive tree crops, some of the villagers will typically spend part of their time working for him. Kuus may also work for money once the reciprocal obligations are met, or a participant who does not need the kuu's services may sell them to someone who does. Kuu wages run about \$1.00 per person plus a good meal which usually includes some palm wine or cane juice. Student kuus are organized specifically to work for money when students are home on vacation. Another quasi-wage labor activity is the practice of helping someone harvest rice and receiving a basket or a pan of rice for each day of labor.

One old man encountered works mostly as a laborer. He is not married and says he cannot make a farm alone. He lives with his brother and helps him when he was not working on contract for day wages.

K.3. Arts and Crafts:

A number of men in each village are involved in local crafts. Those commonly encountered include mats, fish traps, cane chairs, baskets, and fanners (a winnowing device). It is difficult to ascertain how much money is generated by these activities, but one man does admit to making \$60 to \$70 from mats and fish traps. A few people also have some income from artistic activities like playing drums, sasa (a gourd enveloped in a network of strung beads) or, dancing.

K.4 Wild Game:

The sale of wild meat is an important source of income cited by many farmers, particularly in Grand Gedeh. Fresh meat is retailed locally, and dried meat may be sold locally or to traders who take it to Monrovia. Other animal products such as the hides may also be sold. Deer quarters may sell for about \$2 to \$5, depending on size. A quarter of bush hog may bring \$12.

K.5. Palm Wine:

Palm wine is a common beverage in most villages. Many farmers tap only a small amount for personal use or occasionally sell a gallon for pocket money. A few specialize in collecting palm wine for sale, especially if they are near a highway or city. Men have been observed selling as many as 5 or 6 gallons. Palm wine sells for about \$1.25 a gallon.

K.6. Fishing:

Most families fish primarily for household consumption, but if the catch is good, they may sell some as well. An excess amount is most likely when women fish out the pools remaining in the swamps during the dry season. However, like most activities, a few people do it more than others and may regularly have some surplus for sale.

K.7. Money Sent From Relatives:

Many families receive money or goods from relatives who have migrated out of the village. The most common situation is to send money home to parents or a brother or sister. The amounts may vary from \$10 or a few articles of clothing to financing the construction of a new house.

L. Credit

Credit is one of the major production constraints for Liberian farmers in general. Farmers need credit to:

- 1) Hire additional labor to work on swamp or upland rice fields where family labor is inadequate to carry out all farming activities;
- 2) Underbrush tree crops, cocoa and coffee in particular;
- 3) Purchase basic farm tools and inputs such as cutlasses, axes, hoes, and chemical inputs where they are used;
- 4) Meet social obligations such as funerals, paying children's school fees, and bride price.

In the areas studied, it appears that credit is a problem for small farmers. The credit services available to them are limited to village credit associations (susus), Mandingo traders, friends and relatives, and occasionally government institutions.

The village credit associations seem to be the most common sources of credit. The organization and management of these associations varies slightly from village to village. Basically, however, they are organized and operated on the same principle, which is to provide credit for their members in times of need. They also serve as "mini banks" which are used to mobilize village savings. To join a susu in some villages, farmers are required to pay registration fees. In others, registration fees are not required. Members of the village credit association make weekly/monthly payments to the club. In some susus, weekly payments are standardized, while in others, members pay according to their ability. In the entire area surveyed, weekly payments into the susus range from as low as 10 cents to as much as \$10. The amount a member is allowed to borrow is associated with his savings in the credit association. No one is allowed to borrow more than his savings. Non-members must go through club members to borrow.

In villages where susus do not exist, village money lenders, friends, and relatives are the credit sources. Village interest rates are relatively high; usually the repayment is 125 percent to 150 percent of the loan amount for a three-month period. If computed on a per annum basis, these rates will be 100 percent and above.

Mandingo traders sometimes provide credit for farmers. Most often, they provide credit for cocoa and coffee farmers to hire labor for underbrushing and harvesting. Though the Mandingo loans are usually interest free, they are issued to secure clients. In areas where access to markets is limited, farmers who receive such loans are paid lower prices for their produce.

Credit from government organizations:

The agricultural development projects (ADPs) and some of the public corporations such as LPMC, LPPC, and the Agricultural Cooperative Development Bank (ACDB) do provide some limited credit for farmers where they exist. Most of the credit extended by the ADPs and the public corporations is channeled through the farmers' cooperatives which serve as the links between farmers and these institutions. The presence and the role of each of the credit institutions in providing credit services vary from county to county. These variations will be highlighted under county-specific discussions on credit.

M. Food Consumption:

Although numerous similarities exist between the three counties regarding food consumption, some significant differences have also been observed. Some of the topics investigated in this study include food preferences, seasonality of foods, sources of meat, dietary patterns, food taboos, and culturally prescribed foods.

M.1 Food Preferences:

Throughout most of the areas surveyed, rice is the preferred staple. However, one exception to this is found in Nimba County among the Gio tribe. The Gio farmers who have been interviewed consistently indicate that they prefer cassava prepared as "gigbah" (pounded into a dumboy-like substance) more than rice. In fact, the amount of cassava they are growing and the number of times a day they consume it reflects this preference. (They eat it at least once a day.) This preference seems to be distinctly tribal, because the Mano living in close proximity do not grow or eat as much cassava as the Gio. The Mano farmers will often refer to the Gio as cassava eaters. In the rest of the area surveyed, cassava is considered the second most important staple. Almost every farmer interviewed has some intercropped with the rice or in a separate stand.

M.2. Seasonality:

In all three counties, a marked seasonal difference in access to food resources is found. Although large quantities of rice and a wide variety of food stuffs are available after harvest, supplies of rice begin to dwindle during the next year's cropping season. Many farmers run out of rice during July and August in Grand Gedeh, and August and September in Nimba and Bong. This season is referred to as the "hungry season". To deal with this problem, farmers are obliged to purchase rice, reduce their food intake, substitute cassava as the main staple or some combination of these courses of action. The period of time that this hungry

time normally occurs coincides with some of the peak labor periods in the upland rice cycle. During this time, women are usually doing the planting and weeding, and men are building groundhog fences and underbrushing their tree crops. These seasonal shortages may have significant nutritional effects on farm families in these counties, adversely affecting their labor productivity and health status.

M.3. Sources of Meat:

Some interesting differences are found among the three counties regarding their access to meat sources. In Grand Gedeh, probably because of low population densities and the prevalence of high bush, farmers have more access to wild game than the other two counties. Wild meat is used both for home consumption and as a source of income.¹⁷ Such wild meat is also used to feed kuu labor groups when such labor patterns exist. Freshwater fish is also consumed when it is in season.

In Nimba, less wild meat is available because of the secondary bush and high population densities. As a consequence, farmers rely more on freshwater fishing, market-purchased meat (especially marine fish), and domestic animals for their sources of meat. In addition, domestic pigs are commonly used to feed kuu labor groups. Pigs are preferable to goats and sheep for this because they contain more meat per animal than the other domesticates and can feed more laborers. Thus, it appears that pig raising is an animal husbandry pattern specifically adapted to prevalent labor patterns.

In Bong, fish is the most common meat source for most farm families. In addition to fresh water fish, dried marine fish from Monrovia is often purchased in local markets. Fish also is a common meat used to feed kuus. Some wild meat, market purchased meat, and domestic animal meat is also consumed, but less frequently than fish.

M.4. Dietary Patterns:

It is difficult to generalize about dietary patterns in the areas studied primarily because a considerable amount of variation exists from one family to another. One common pattern found in all three counties is the tendency for husbands and wives to eat separately. However, no consistent pattern exists as to the order of eating; sometimes a women will eat first followed by the man, other times the men will eat first.¹⁸ Frequently,

¹⁷ Buyers come up from Monrovia to purchase wild dried meat from farmers to sell in Monrovia and other urban centers.

¹⁸ These findings do not support the commonly held belief that

both eat at the same time. Similarly, no regular patterns are found for the other family members. Sometimes children will eat separately, other times male children will eat with the father and female children will eat with their mother.

As for the number of meals consumed a day, again, a considerable amount of variation exists across families. Anywhere from one to three meals a day are consumed.¹⁹ It appears that the evening meal is the main meal for most families. It also appears that fewer meals are consumed during the hungry season than during other times of the year. This pattern could have significant nutritional consequences, since the energy expended on labor is quite high.

M.5. Food taboos:

Although food taboos are not always strictly adhered to by everyone (especially young people), they appear to be quite common in all three counties. Most food taboos concern consumption of certain kinds of wild animals which the farmer is not supposed to eat. For example, some types of deer, monkey, or freshwater fish might be forbidden for a farmer to eat. The traditions that often surround these food taboos concern some relationship or experience that a family ancestor had with the animal in question. Food taboos can be tribal and/or specific to one family.

In addition to wild animal food taboos, cases are found where some domestic animals and certain food crops are also considered taboo. For instance, one farmer will not eat sheep, while another farmer will not eat bitterball (a common vegetable). A third farmer could not eat cassava prepared in certain ways.

These findings on food taboos have important implications. They indicate that many farmers are excluding certain foods from their diet. If such foods are common sources of protein for the rest of the community (e.g., fish), this can have detrimental effects on the farmers' nutritional status as well as on the well-being of his/her family.

M.6. Other Culturally Prescribed Foods:

In the area surveyed, certain foods appear to be prescribed

men always eat first and receive the prime share of the high quality food served during the meal.

¹⁹ Although some families indicate that only one or two meals are consumed a day, a considerable amount of snacking goes on. Not only will left-overs from the night before be eaten the next morning, but a lot of raw and roasted cassava is eaten throughout the day.

for certain occasions and for pregnant and lactating women. However, not all farmers follow these prescriptions. In Grand Gedeh, funerals appear to have certain food restrictions associated with them. For instance, if a family member dies, other relatives and friends will only bring cassava to eat. The belief is that rice will make the bereaved individual happy, and this is culturally inappropriate. A certain mourning period is often expected. The amount of time the bereaved individual must refrain from eating rice varies from one village to another. Typically, the mourning period is longer for the death of a male member of the family than a female member.

Domestic animals such as goats, sheep, or chickens are often consumed during weddings. This pattern holds for all three counties.

There are also certain cultural prescriptions that prohibit women from eating certain foods. They are often restricted from eating animals which have behavioral characteristics which are not desirable in a child. For instance, they don't eat turtles and ant eaters because these animals tend to be shy. Another food which they are not supposed to eat is the hippo. This is because it is believed that hippo meat will prevent the mother from producing breast milk. Other common restricted foods are groundhogs and water deer.

Although not common throughout the area, sometimes there are also restrictions on what lactating women can eat. For example, in Grand Gedeh, lactating women are not supposed to eat plato and okra for the first three months after childbirth because it is believed that such foods will hurt the mother's stomach. Food restrictions for lactating women in Bong and Nimba are less evident.

As for weaning foods, most families appear to feed infants from the family pot when they stop breast feeding. The timing of this varies, but usually this is done when the baby starts crawling and has grown some teeth.

M.7 Nutritional Implications of Current Dietary Patterns:

Given the array of foods consumed by most households in the study area, it appears that farm family diets are quite diversified (see section on upland rice). Along with such staples as rice and cassava, farmers are consuming a wide range of vegetables, tubers, legumes, and fruits. In addition, they are supplementing the crops they grow with wild foods such as leafy greens, fruits, roots, etc.

Despite this dietary diversity, a number of consumption patterns have been identified which could have some adverse effects on the nutritional status of households. To summarize, these include:

- 1) The seasonal shortages of food which occur prior to harvest during peak labor periods in the upland rice cycle;
- 2) The current practice followed by some households of selling

wild meat and domestic animals to urban buyers rather than consuming it themselves. This practice may lower family protein intake levels considerably;

- 3) Food taboos which restrict consumption of regularly available sources of protein such as fish and other animals;
- 4) The current weaning practices followed by farm households which may be detrimental to children's nutritional status. The shift from breast feeding to family pot may result in insufficient absorption of nutrients by young children.

Although these findings are preliminary, they point to the need for more thorough investigations into consumption patterns and their implications for the nutritional status of households. Limited consumption surveys could be incorporated into investigations of farming practices to determine the linkages between production activities and consumption. Such surveys may help identify interventions which would have a positive nutritional impact. For instance, interventions could be oriented towards alleviating the problems associated with seasonal food shortages (e.g. improvements in storage, in the timing of production etc.) as well as towards increasing production.

N. Community (Communal) Farms:

The community farm concept was introduced by the PRC Government in October of 1981 as a means of increasing food (rice) production and generating funds to finance "self help" development projects in the political sub-divisions. The program is administered by the Ministry of Internal Affairs.

Community farms are found in most of the villages visited during this study. In Grand Gedeh, there appears to be a shift from clan organized to individual village based community farms. Community farms in Bong and Nimba appear to be individual village organized.

O. Government Interventions:

The Ministry of Agriculture is responsible for providing extension and other support services to farmers throughout Liberia. Because of institutional and other constraints, the Ministry adopted a strategy of establishing area-specific Agricultural Development Projects (ADPs) and other parastatal agencies in the late 1970s as its extension arms. In areas where ADPs and the parastatal bodies are not present, the Ministry is directly responsible to provide extension services.

O.1. Project Activities:

There are two ADPs in the area studied; the Nimba County Rural

Development Project (NCRDP) and the Bong County Agricultural Development Project (BCADP). Unlike the BCADP, the NCRDP has adopted a low-key and less costly strategy which encourages "self-help" rather than direct financial aid to farmers. It encourages the development of Farmers' Development Associations (FDAs) as village working groups and provides a range of services through them. The FDAs are multi-purpose, village-based organizations which are intended to encourage cooperation among farmers and the use of communal labor in various farming and non-farming activities. They are involved in the making of group swamp rice farms, tree crop development, fish pond construction and management, and the organization of credit associations (banks). Although it appears that NCRDP does not provide direct credit to individual farmers, it assists in arranging credit for improved seeds and seedlings (cocoa, coffee, and rice), oil palm planting materials, fingerlings, rice mills, and rototiller services. It does not encourage the use of chemical inputs.

The Bong County Agricultural Development Project operates somewhat differently from NCRDP. It provides direct credit to farmers and encourages the use of chemical inputs. Like NCRDP, BCADP provides improved rice seeds (swamp and upland) and improved cocoa and coffee seedlings. Both projects provide more effective extension services than are available in Grand Gedeh.

There is no ADP in Grand Gedeh. The County Agricultural Office, under the supervision of the Regional Agricultural Officer, is responsible to provide extension services to farmers in the area. Without an ADP, there are very few resources available for extension-related activities.

0.2 Constraints Imposed on Farmers by Project Activities:

The ADPs have been very useful in providing extension, credit, and other advisory services to farmers in the study areas. However, it seems that projects and the extension personnel are introducing too many interventions to individual farmers at one time without considering the ability of the farmers to manage properly his farming operations and the demands on his time.

Most farmers in the area surveyed (particularly in Nimba and Bong Counties) are very diversified. They are involved in many different farming activities. Besides the usual upland rice fields, most farmers have a cocoa and/or coffee field, swamp rice field, and cassava or a sugar cane field. Additionally, they are required to donate 2 to 3 days per week to FDA and/or community farm activities. As a result, farmers who cannot afford to hire labor neglect some of their farm enterprises at the expense of others. For instance, when a farmer with tree crops and an upland rice field is faced with labor constraints, he may choose to spend much of his time on the upland field at the expense of underbrushing the tree crops. Even where cash credit is provided to hire labor, it seems that a number of important farm operations are not completed on farms. Therefore, projects should

exercise caution regarding the number of project activities in which farmers are encouraged to participate in a given year.

III. FARMING SYSTEMS CHARACTERISTICS IN GRAND GEDEH COUNTY

A. Access to Land:

Usufruct arrangements predominate in all the villages surveyed. Land is not being purchased nor is land actually being rented. A considerable proportion of the land is still in high bush due to low population densities. Rights to access of land are gained by being the first individual to clear high bush from an area. Permission from the individual or his heir must be obtained by other individuals wishing to make a farm on this land.

In quest of high bush, farms are often located considerable distances away from the village. Due to such distances, satellite villages are sometimes created.

B. Upland Rice

Upland rice farming in Grand Gedeh is different from that in Bong and Nimba primarily because of the availability of high bush and use of the dibble method of planting. Fields are often made on land in fallow up to 20 years or more. This long fallow strongly affects rice cultivation by reducing the presence of weeds, groundhogs, and birds. Felling trees requires more labor and is much more of a constraint than where trees are immature.

Site selection is usually based on the presence of plants which are known to indicate good soil or on traditional soil tests. Such indicators are important criteria for selecting sites for farms in high bush areas. The landscape seems flatter than in Nimba or Bong. Soil degradation and erosion losses appear low, perhaps due to the flatter landscape, the minimum tillage dibble planting technique, and the effect of long fallow on soil structure.

Farming operations take place somewhat earlier in Grand Gedeh than in Bong and Nimba because the rains begin 4 to 6 weeks earlier. Brushing typically begins between December and March, but may begin as early as October so the farmer can concentrate on felling trees during the principal land preparation period of January to March. Felling trees is an important constraint in high bush where large trees must be removed. Chainsaws are available for rent in some villages at \$25 a day, but few farmers are using them. Farms in Grand Gedeh appear to be somewhat smaller than in Nimba or Bong, although land appears to be relatively more plentiful. The additional constraint of felling trees probably restricts the amount of land prepared. In addition, high bush fields should be somewhat more fertile and less affected by weeds and pests so that higher yields might be expected. If in fact high bush fields do produce higher yields, then less area is required to feed a family of a given size.

Burning takes place from March through May. A farmer may burn as soon as he finishes felling trees and cutting and piling the branches. If he finishes early, he may burn immediately to assure

a good burn or wait until the first rains begin to minimize weed growth prior to planting. If a reasonably good burn is achieved, farmers do not attempt to clear the field of remaining trunks and debris. This is practical because the dibble method of planting used is a minimum tillage technique and is not preceded or accompanied by any soil cultivation. Planting may begin as early as March and can be completed within a few days if all the planting is done at one time. Some women wait up to a week between plantings to help spread out the harvest. Other women rely on varieties of different maturities to space out the harvest.

Most families grow several varieties of different maturities ranging from 3 to 5 months. Short maturing varieties are planted first on a hungry farm or a portion of the major farm to help meet hungry season food requirements. Hungry farms tend to be found only in families with more than one wife. Varieties cited by farmers include Desemah, Menonkor, Queekor, Doodoo, Koryea, and Vlayonedu.²⁰ Desemah is found in most of the villages surveyed and farmers claim that it is very productive. Improved upland rice varieties are not widely distributed in the area. Rice is typically intercropped with cassava, corn, yam, eddo, sweet potato, banana, plantain, and numerous other vegetables including bitterball, okra, squash, pumpkin, pepper, eggplant, and plato.

Weeding begins as early as March. Secondary bush may require a second weeding in June or July. Farmers hope that weeding will not be required on high bush fields but they may weed in July if it becomes necessary. Bird watching is not practiced in a the majority of the villages surveyed in Grand Gedeh, and groundhog fences are usually not built to protect the rice. Farmers say that it is easier to make a larger field so some rice can be shared with the groundhogs, than to fence it.

C. Cassava

Cassava is normally intercropped with rice. In Grand Gedeh, cassava is planted 4 to 6 weeks after the rice on only a portion of the rice field. The spaces left by the random nature of dibble planting make this delayed planting practical. The delay, coupled with intercropping cassava in a portion of the rice field where a fast maturing rice variety is planted, allows the rice to mature before the cassava grows tall enough to shade the rice. In this manner, the competitive effect of cassava on rice is minimized, allowing the cassava to be planted at a higher density than in other systems observed. Bananas and plantain are not planted on the same portion of the field as cassava, since these

²⁰ varieties are listed in the appendix by county, village, and approximate length of maturity.

crops will also be competitive as they mature. To plant the cassava, shallow trenches are made between rice pockets and 3 or 4 cuttings are laid parallel in each.

Cassava is also planted in the rice field after rice harvest or on a separate field. Planting in a separate field often takes place in January or February with the intent of producing cassava for the hungry season. Such fields are seldom intercropped except with a few vegetables. Farmers feel that the rice fields are too large to fence, but will often make a groundhog fence for the smaller cassava field. Other pests include porcupine and ground squirrel.

Most farmers plant traditional local varieties of cassava such as Mornfo, Boutoh, Coco, and Banweh. In addition, Say-ton-pon, an introduced variety, is grown. These varieties are not resistant to cassava mosaic, since it is observed in every field.

D. Swamp Rice:

Family members tend not to have individual swamp rice farms in Grand Gedeh. Swampy areas are often farmed as part of the traditional upland rice field but are not treated as being distinct from the rest of the field. Improved swamp farms are not common and appear to be concentrated around Zwedru and other large towns. Improved swamp farms tend to be privately operated by families or individuals but often are in areas where some defunct development project originally built the bands and canals. The general lack of swamp farming and its pattern of concentration appear to be related to the availability of land for upland rice farming. The prevalence of high bush in Grand Gedeh reinforces this thesis concerning land availability.

E. Other Field Crops:

Sugar cane and groundnuts are not commonly grown in the village surveyed in Grand Gedeh.

F. Tree Crops:

Cocoa and coffee are both important cash crops in Grand Gedeh. Cocoa is a little more common, and farmers probably have been growing it a little longer than coffee. A few farmers began growing both crops over 20 years ago after obtaining seed from the Ivory Coast. Originally, seeds were planted directly but more recently farmers usually acquire seedlings or make nurseries of their own. Site selection is based on traditional soil tests or plants which indicate good fertility, but is strongly influenced by folk wisdom concerning the best type of site. Folk wisdom concerning cocoa suggests sites with good soil and where roots will have access to moisture. Folk wisdom on coffee is

mixed, indicating: 1) that it requires sites similar to cocoa with good soil and also good drainage; and 2) that coffee can grow anywhere, even on gravelly soils. Cocoa is most often planted in a forested area which provides shade. Coffee requires less shade and may be planted in either a forested area or on the upland rice field along with various other intercrops. The spacings employed for both tree crops are always quite dense. This assures that a shade canopy will develop when the trees mature, which will minimize the growth of underbrush and the need for underbrushing. Cocoa and coffee seedlings are underbrushed twice a year in December-February and June-August. Mature cocoa is underbrushed only once if at all, prior to harvest. Most farmers try to underbrush coffee twice since they recognize that it produces less shade than cocoa, but labor and financial constraints often limit them to only one underbrushing prior to harvest.

Many farmers begin harvesting both cocoa and coffee as early as July and continue periodically through January. Cocoa tends to be fermented 3 to 7 days and then dried 3 days to 2 weeks in direct sunlight. Coffee is dried about a week and sold as cherry coffee without any milling.

As in the other counties, blackpod is a serious cocoa disease problem and stem borer is a serious problem for both crops. A variety of wild animals plague cocoa producers, given the prevalence of wildlife in the area.

Bananas and plantain are important secondary crops in Grand Gedeh. They are intercropped with a variety of field and tree crops as well as planted around the house and/or rice kitchen. Farmers try to avoid intercropping bananas and plantain with cassava. Citrus production seldom consists of more than 3 or 4 trees grown for family consumption. Oil palm is an important crop for commercial concessions in the area but is seldom cultivated by small farmers. Villagers harvest wild oil palm and produce a number of oil palm products for both consumption and sale. Rubber is not an important crop in the survey area of Grand Gedeh.

G. Livestock:

Few animals are observed in villages in Grand Gedeh. Goats are the most prevalent type of livestock, except for poultry. More domestic animals are observed in Grand Gedeh than in the other two counties, but the numbers are still very small. Important health problems observed are "Zeh" (perhaps mange or scabies), particularly in sheep, and blindness (maybe infectious conjunctivitis), particularly in goats. "Zeh" is so serious in some areas that farmers have stopped trying to raise sheep. Goats seem to be the most commonly used livestock for important social obligations and feeding kuus.

H. Marketing in Grand Gedeh County:

Markets and marketing channels are less developed in Grand Gedeh than in the other two counties. This can be attributed to the following factors:

- 1) The area is less densely populated and villages seem more widely scattered;
- 2) The road conditions are bad and some are inaccessible, particularly during the rainy season.

LPMC does not have buying stations in the county and the few marketing cooperatives in the study area are non-functional. Farmers have few alternatives with regard to marketing channels. In the absence of both LPMC and efficient marketing cooperatives, private traders, (mostly Mandingo) are the major buyers of cocoa, coffee, and rice in the study area.

Good roads are critical for marketing and market development, and farmers need alternative marketing channels to enable them to negotiate a good price.

I. Other Sources of Income:

Grand Gedeh's isolation in terms of marketing opportunities and distance from population centers limit other sources of income for farmers more than in Nimba and Bong. Local off-farm employment is less likely and the sale of palm wine is less important. The sale of wild meat and animal products stand out as an important source of non-farm income. Farm labor is less common, but more expensive than the other two counties (\$2.50 per day). Fishing, crafts, and money sent from relatives also provide income for some families.

J. Credit in Grand Gedeh County:

Credit seems to be a critical production constraint for farmers in Grand Gedeh. It appears more constraining than in Nimba or Bong counties because:

- 1). Active farmers cooperatives do not exist;
- 2). Grand Gedeh has no agricultural development projects.

The Agricultural Cooperative Development Bank (ACDB) was established in 1978 to provide short, medium, and long-term credit to both individuals and farmers' organizations and to mobilize rural savings. Because of internal operational constraints and the need to make its credit program more manageable, the ACDB channels its credit to farmers through farmers' cooperatives at relatively low interest rates of about 10-12 percent. Although there is an ACDB branch in Zwedru, small traditional farmers in Grand Gedeh seem not to benefit from the bank because the cooperatives in the area are not functional. Also, it is difficult for individual small farmers to obtain loans directly from the bank because of collateral requirements

and other credit conditions which they must meet.

The fact that there is no agricultural development project in the area compounds the credit problems. These projects, either directly or through cooperatives, provide credit and other services for farmers. LPMC and its subsidiary corporation, LPPC, are present in Grand Gedeh. Their activities are, however, limited to oil palm development, an activity in which very few farmers are engaged.

Therefore, farmers in the area rely on small village credit clubs and associations, friends and relatives, and Mandingo traders as their major credit sources. It appears that credit clubs themselves are limited in their ability to meet the credit needs of farmers since their only source of loanable cash is from members' contributions. As mentioned in the general discussion, the interest rates are high. The repayment required for a three month loan period ranges from 125 percent to 150 percent of the loan amount. The credit provided by Mandingo traders is given primarily for underbrushing cocoa and coffee. It may not be available at the time when farmers need credit to hire labor for other farming operations, even though these operations may be more critical than underbrushing tree crops.

K. Food Consumption:

Because of low population densities and the prevalence of high bush, farmers in Grand Gedeh have more access to wild game than farmers in the other two counties. Wild meat is used both for home consumption and as a source of income. Such wild meat is also used to feed kuu labor groups. The tendency for farmers to sell wild meat rather than consuming it themselves may lower family protein intake levels considerably. Fresh water fish is also consumed when it is in season.

L. Government Interventions in Grand Gedeh County:

Unlike Bong and Nimba Counties, the Ministry of Agriculture, through the local County Agricultural Office, is responsible for providing extension services to farmers in Grand Gedeh. As previously mentioned, there are no agricultural development projects. Although LPPC and LPMC operate in the area, they are mainly involved with the development of oil palm estates. Since few farmers grow oil palm in the study area, the corporations only serve as sources of off-farm employment for local farmers. The Liberian Cocoa and Coffee Corporation (LCCC) does provide some extension services for some farmers.

To be effective, extension organizations and/or personnel must have something to deliver and the means of extending it to the farmers. It appears that the regional office and the extension program are constrained by two major factors:

- 1) The lack of technical packages to deliver;

2) The lack of logistical support (transportation in particular).

The lack of technical packages and the means to deliver them make it difficult for the extension program in the area to be effective. It is not logical to teach farmers about the application of chemical fertilizers or the advantages of improved rice varieties without having these inputs to demonstrate to farmers their superior qualities. Even where technical packages are available, there must be a means of getting them to the farmers, i.e., extension personnel must also be mobile.

IV. FARMING SYSTEMS CHARACTERISTICS FOR NIMBA COUNTY

A. Access to Land:

The tenure situation is more complex in Nimba than in Grand Gedeh because of the higher population density characterizing this area. Land pressure seems considerable. In addition to usufruct rights, cases of land purchases and land rentals are found. Land purchases include individual purchases as well as village purchases. Two forms of rental arrangements are found. One is the traditional quasi-rental pattern of giving a portion of rice at harvest for the right to farm an area. This amount could be as much as two bags of paddy rice. The second form consists of cash payments of ten to twenty dollars for one year's rent.

Very little high bush is available. Thus, most of the land accessible to farmers is secondary bush. In addition, land pressure continues to shorten fallow periods. Even secondary bush may only be available at considerable distance from the village. Both the prevalence of secondary bush and the shorter fallow periods are having a significant impact on the farming system found in the area.

B. Upland Rice:

Upland rice farming in Nimba is characterized by the cultivation of secondary bush and by the integration of soil tillage and planting into one activity, scratch-planting. Problems associated with farming secondary bush, i.e. groundhogs, weeds, and rice birds, require the addition of several operations not common in Grand Gedeh.

Site selection is more restricted by land availability than in Grand Gedeh. Farmers or their fathers typically have had experience cultivating the various tracts of land available to them. They use their knowledge of the tracts and the length of time each has been in fallow to determine which site should be used in a given year. Soil fertility may be limited by the short fallow period and erosion may also be a problem due to the cultivation of fairly steep slopes. These problems are exacerbated by the use of the scratch-planting technique which loosens soil over the entire field.

In the absence of large trees, brushing is the major field preparation activity and is usually done between January and April. Felling trees is a secondary activity and is often done at the same time as brushing. Kuus of both men and women are often used, in which women do much of the brushing and men fell trees and help brush. The field may be burned as early as March, but late May is more common. Clearing the field of debris to facilitate hoeing and planting may be done as a separate activity from April through June. However, in 1984, the rains came early and were heavier than normal. Many farmers are still in the process of clearing, hoeing, and planting in late July.

Scratch-planting is usually delayed until 4 to 6 weeks after burning, i.e., beginning in April or May through July. This is done to make sure that weed seed in the soil has germinated before hoeing. Hoeing the entire field is much more time consuming and requires more labor than the dibble method, but it reduces the labor required for weeding later in the season. Broadcasting provides more uniform planting and perhaps a higher plant population than the dibble method. This may help compensate for the lower fertility expected after a short fallow period. Broadcast planting also eliminates the option of planting intercrops after the rice, since some of the rice would be destroyed. Intercrops include cassava, corn, yam, eddo, sweet potato, and a variety of other vegetables. Bananas and plantain are less common than in the other two counties because cassava is intercropped over the entire rice field.

As in Grand Gedeh, most families plant several rice varieties of different maturity ranging from 3 to 5 months. However, in Nimba this is done to spread out the planting season rather than the harvest. Because of the serious bird problem, farmers do not want any portion of their rice to mature ahead of the majority of the rice acreage. Therefore, they plant their longer maturing varieties first and plant shorter maturing varieties later in the season. This need to delay the time at which rice begins to mature reinforces the advantage of waiting a number of weeks after burning before beginning to hoe and plant. The bird problem also eliminates the possibility of using an early maturing variety to help meet hungry season food requirements. Instead, cassava is relied upon much more heavily as a hungry season food among the Mano, and as the main staple all year among the Gio. A number of farmers are growing improved upland rice varieties, including both red and white Lac 23. Local varieties grown include: Nakatua,²¹ Sankanoeh, Leebay, Meleken, Plantee, Conko, Gwesiah, and Lesah.

Birdwatching must be done for a week after planting and for about a month while the rice is heading. Farmers often build fences to protect rice fields from groundhogs. This is done from June through August, and requires a month or more depending on the amount of labor available. A second weeding is often done at this time as well.

C. Cassava:

Cassava is more important in Nimba than in Grand Gedeh or Bong. It plays a more important role in the diet and is planted over larger areas than in the other two counties

Because the rice is broadcast planted, it is impractical to

²¹ Rice varieties are listed in the appendix by county, village, and approximate length of maturity.

plant cassava after the rice. And since cassava is planted over the entire field, except for swampy areas, it is not only planted with fast maturing varieties of rice. Therefore, competition between the cassava and rice is unavoidable and cassava may shade the rice before the rice reaches maturity. To minimize this competition, farmers plant cassava in low densities and strip the lower branches and leaves to limit the area shaded. Since bananas and plantain are not considered compatible with cassava, they are eliminated as a rice intercrop, except perhaps in swampy areas. As in the other counties, the method followed for planting cassava consists of laying 3 or 4 cuttings parallel in shallow trench.

Cassava is also planted as a second crop after rice or in separate fields. Separate cassava fields may be an adaptive strategy in cases where the farmer had trouble with rice-cassava intercropping. The fear that cassava will attract groundhogs to the rice is also cited as a reason to plant cassava as a second crop or separate from the rice. Cassava planted in either of these two ways is not commonly intercropped, except with a few vegetables. Planting of such fields tends to be in November through December and/or March through April to have cassava for the hungry season. Separate cassava fields may also be planted during the rainy season.

Most farmers in Nimba have adopted an introduced cassava variety called Matadi which does not contain hydrocyanic acid. The popularity of Matadi has practically stopped the cultivation of traditional varieties in the villages surveyed. Matadi is often attacked by cassava mosaic. Porcupine and ground squirrel are other cassava pests found in addition to the groundhogs mentioned earlier.

D. Swamp Rice:

Traditional swamp rice farms are more prevalent in Nimba than in Grand Gedeh. These swamp rice farms are often the responsibility of women who may be assisted by a man. Women have limited access to upland fields, and swamp rice is one of few domains open to them as a source of personal income. In contrast to Grand Gedeh, these swamp farms may not be in close proximity to the upland rice field.

Improved swamp rice cultivation is also more prevalent in Nimba than in Grand Gedeh. Swamp rice farms are operated communally by project motivated groups as well as privately by families or individuals. Group swamp farms have been initiated by the NCRDP. Village work groups called FDA's have been established in many villages and are strongly oriented towards swamp rice cultivation as a group activity. In some cases, members spend one to two days a week during peak labor seasons working on the FDA swamp farm. The limited input approach of this project contrasts with that of the BCADP in Bong County. Private participation in improved swamp rice farming again tends to be

more common around major towns like Saclepea.

E. Other Field Crops:

Sugar cane and groundnuts are both grown by some farmers in Nimba, increasing the diversity of the cropping system relative to Grand Gedeh. Groundnuts may be cultivated in pure stands on a portion of a previous year's rice field or intercropped with cassava. Groundnuts are grown as a secondary crop for both consumption and cash income. Sugar cane is more likely to have a major impact on a farmers' activities since it can provide a major source of income. It may be grown in lieu of tree crops and may even influence the size and location of the upland rice field.

F. Tree Crops:

Cocoa and coffee are probably of equal importance as cash crops in Nimba County. As in Grand Gedeh, both crops have been cultivated by a few farmers for over 20 years. Although some early farmers obtained their planting material from the Ivory Coast, the Cocopau plantation stands out as a major source of seed and seedlings. Most cultivation operations for these tree crops follow similar patterns as those found in Grand Gedeh, except that harvest appears to be somewhat later, especially for coffee. Coffee harvest does not typically begin until October or November. Farmers in Nimba place somewhat more emphasis on processing tree crop products than farmers do in Grand Gedeh. Cocoa is often fermented for 6 or 7 days, and is stirred on the third and sixth day. Some farmers also mill their coffee after drying it, and sell it for a higher price as clean coffee. It is not clear whether the presence of LPMC buying stations or project activities have increased farmer involvement in cocoa and coffee processing.

Other Tree Crops

Unlike the other counties, banana and plantain are rarely intercropped with rice because cassava is generally planted over the entire rice field. Bananas and plantain tend to be planted in pure stands often near the rice kitchen, or intercropped with cocoa, coffee, or sugar cane. Citrus appears to be a little more common in Nimba than in Grand Gedeh but it is still not significant as a source of income. A number of small farmers are planting oil palms provided by the NCRDP. The project policy is to provide enough seedlings to plant one acre a year for up to ten years. This is a new project activity and the oil palms planted have not yet begun to produce. Rubber is an important commercial tree crop for plantations and concessions in Nimba

county but it is only occasionally grown by small farmers.

G. Livestock:

Husbandry patterns in Nimba are similar to those found in Grand Gedeh. Compared to Grand Gedeh villages, villages in Nimba seem to have a few more sheep, about the same number of goats and chickens, a few less cattle, and many more pigs. Pigs are cited as an important source of meat for feeding kuus.

H. Other Sources of Income:

In Nimba, the opportunities for off-farm employment seem greater than for Grand Gedeh, but perhaps somewhat less than in Bong. Palm wine is sold, but perhaps less than along the highway in Bong. The sale of wild meat remains important, but less so than in Grand Gedeh. Migration, crafts, fishing, farm labor and money sent from relatives are additional sources of income. Farm laborers receive about \$2 a day on average.

I. Marketing in Nimba County:

Marketing Cooperatives are more prevalent in Nimba than in Grand Gedeh. Although they are relatively ineffective in providing marketing services to farmers, the coops do provide some limited services. Compared to Grand Gedeh, it seems that farmers in Nimba have better marketing access. The road conditions are better. There are more major market centers, probably due to a higher population density and the prevalence of larger towns and villages. The LPMC sub-buying center in Ganta provides marketing services to farmers and farmers' cooperatives. Some of the FDA's sponsored by NCRDP are also beginning to take on some of the responsibility for marketing farmers cash crops.

In spite of all of the above, Mandingo traders appear to have a monopsony on produce buying in Nimba. The Mandingo and their sub-agents seem to be more organized and have established some informal but relatively efficient produce buying networks in the Nimba area of study.

J. Credit in Nimba County:

In Nimba, village credit associations (banks) are commonly found and serve as important credit sources. Compared to Grand Gedeh, it appears that there are more and better organized credit clubs, perhaps because susus are more traditional in Nimba. As in Grand Gedeh, credit club interest rates are high (i.e., usually the repayment is 125 percent to 150 percent of the loan amount for a three month period).

The presence of the Nimba County Rural Development Project

(NCRDP) is an advantage for farmers in the area. The project has adopted a low cost and low-key approach which emphasizes "self-help" rather than financial aid. It arranges credit for small tools, improved rice seeds, fingerlings, tree crop seedlings (cocoa, coffee, and oil palm) rice mills and rototiller services for farmers, especially those participating in FDA's and village working groups in the project area.

In a limited way, Mandingo traders also provide credit for some cocoa and coffee farmers in the area. In addition, farmers who do not belong to any credit association obtain credit from friends and relatives.

K. Food Consumption:

The Gio farmers in Nimba County indicate that they prefer cassava prepared as gigbah (a dumboy like substance) more than rice. They claim they eat cassava at least once a day throughout the year. The Mano, on the other hand, do not consume as much cassava as the Gio, although they do eat it during the hungry season.

As for meat consumption, less wild meat is available in Nimba than in Grand Gedeh because of the secondary bush and high population densities. Farmers rely more on freshwater fishing, market-purchased meat (especially marine fish) and domestic animals for their sources of meat. As stated earlier, domestic pigs are commonly used to feed kuu labor groups because of the amount of meat obtained from this animal.

L. Government Interventions in Nimba County:

As pointed out before, the Nimba County Rural Development Project has had some influence on the farming systems in the project area. The project's interventions include the development of FDA's and village working groups, improved swamp rice farms, fish ponds, rice mills, tree crop (cocoa, coffee, oil palm) seedlings and the use of rototillers for swamp development. The scope and intensity of these activities has caused certain farmers to become over extended and to neglect or reduce some of their personal farm enterprises.

NCRDP provides logistical and other support services for the MOA extension personnel assigned to the project. The assistance (motor bikes, gas, etc.) facilitates the work of the extension staff in the county.

V. FARMING SYSTEMS CHARACTERISTICS FOR BONG COUNTY

A. Access to Land:

The tenure situation is also complicated in Bong, but for different reasons than in Nimba. Land pressure is due to the prevalence of concessions (mostly rubber) and private estate ownership. Usufruct tenure arrangements are still common, but land purchases and land rentals are also found. The only rental arrangement identified is the traditional one of giving a quantity of rice at harvest to obtain land access. However, the amount of rice given is much more than the traditional token given in the past (now as much as two clean bags of rice is given). In one case, a farmer claimed that he had not been able to make a rice farm the previous year because he had been unable to negotiate land rental with any of the landowners. Land pressure caused by the prevalence of rubber plantations, private estates and government farms has had a considerable impact on the farming system. Similar to Nimba, very little high bush is still accessible to farmers. Farmers are making farms on secondary bush with short fallow periods (5-6 years) and are often obliged to farm at considerable distances from the village.

B. Upland Rice:

Upland rice farming in Bong, like Nimba, is characterized by the use of the scratch-planting technique and other strategies which counter the problems associated with farming secondary bush. The timing and practices employed in field operations in Bong are even more variable than in Nimba because of the diversity of farm enterprises and other family activities typically found in Bong.

Site selection for upland rice fields tends to be constrained by the availability of land. Given the short fallow periods, selection is usually based on previous experience with the piece of land being considered. Some of the villages surveyed are located in very hilly terrain, and the slope of some fields may approach 45 degrees.

Brushing may start as early as October or as late as April but is commonly done between January and April. Villages differ on whether women participate in brushing or not. The timing for felling trees varies but is centered in February and March. It may be associated with brushing as part of a kuu activity in which both men and women participate, or done separately. Burning may take place from early March to early June and often falls in April. Clearing takes place from March through June, but may be done all at once by kuu labor or be done progressively in association with hoeing and planting. Hoeing and planting follow burning by two weeks to two months, starting as early as April and continuing through August. Women weed the field again anytime between April and August, while the men spend 4 to 6

weeks building a groundhog fence. Once again, farms appear slightly larger than in Grand Gedeh and practically no "hungry farms" are found. Farmers seem to reserve their cassava for consumption during the hungry season rather than eating it as often during the rest of the year as in Nimba. Buying more rice and eating fewer meals per day seem to be other common strategies for dealing with the lack of food during the hungry season.

C. Cassava:

As in the other two counties, cassava is often intercropped with rice. The pattern in Bong is to plant the cassava 2 weeks to 2 months before the rice. Farmers must then hoe around the cassava, but it does not otherwise interfere with broadcasting the rice. Shading of rice is a problem, but stripping cassava leaves and branches is less commonly practiced. In many fields, low density alone is the only control used to compensate for this competition. The area of the rice field planted to cassava also varies from a portion to the entire field. Bananas and plantain are still usually found separate from the rice. Similar to the other counties, cassava planting consists of laying 3 or 4 cuttings parallel in a shallow trench.

Cassava may also be planted as a second crop after rice or in separate fields. The reason often cited for this practice is the fear that cassava will attract groundhogs to the rice. The time of planting of separate cassava fields is quite variable. There also is a strong tendency to intercrop the cassava with a crop other than rice, usually groundnuts. Intercropping with coffee is also observed.

Many farmers are using Matadi, the introduced variety. But most farmers also continue to grow traditional varieties as well. These include Tusan, Behuna, Gbarkpalin, Kpelemana, Two cents, Awakana, and Gorbu. As in the other counties, groundhogs, porcupines, and ground squirrels are cited as the major pests of cassava.

D. Swamp Rice:

Traditional swamp farming is basically the same as that in Nimba. Improved swamp farming, on the other hand, though project-motivated, is essentially individual oriented rather than group oriented as in Nimba. The BCADP encourages swamp rice production by providing farmers with loans to buy tools and to hire labor to build the canals and bunds and maintain them for the first two years. The BCADP agents also furnish the technical expertise. This approach, based on providing credit for private farms, contrasts with the low input and communal approach of the NCRDP.

E. Other Field Crops:

Groundnuts and sugar cane are additional sources of crop diversity in Bong County. In some villages surveyed, groundnuts appear to be an important secondary crop and are commonly present either as an intercrop with cassava or in separate pure stands. In other villages, groundnuts are cultivated by very few farmers or are not present at all. Sugar cane is frequently grown by a few farmers in each village. Cane juice may be produced primarily for a local market or oriented towards the Monrovia market depending on the location and size of each operation.

F. Tree Crops:

Cocoa is an important cash crop in Bong County. In one case a farmer claimed his family had been growing it for over 30 years. Coffee, on the other hand, appears to be considerably less common than in the other counties, and of fairly recent origins. Many of the coffee growers have only planted coffee since the BCADP began providing seedlings about 5 years ago. The BCADP provides loans to develop coffee and cocoa fields and to hire labor for underbrushing during the first two years. Project agents advise farmers on site selection, but farmers complain that in the past these agents have not always been successful in choosing the right sites for cocoa. Project supported cooperatives also have an important impact on marketing alternatives.

Banana and plantain are important secondary tree crops which are both intercropped with rice and grown in pure stands. Citrus is somewhat more important in Bong than in the other two counties. This is probably due to the access to city markets afforded by the Monrovia-Ganta highway. Oranges are the most common type of citrus grown followed by grapefruit and tangerines. Grapefruit are less favored than oranges because the trees are reputed to be short-lived and because grapefruit generally will not sell while oranges are available. Since grapefruit can remain on the tree for a considerable period without spoiling, they are often held until the orange season is over.

As in Grand Gedeh, oil palm is not cultivated by small farmers but wild oil palm is exploited for both consumption and cash income. Rubber is a very important cash crop in Bong county because of the concentration of concessions and private estates which grow it. Following this lead, more small farmers have adopted rubber as a cash crop than in the other two counties. The number and distribution of concessions and estates which are willing to buy latex or cuplumps makes marketing of rubber more practical than in other areas surveyed. Many farmers do and/or have worked on rubber estates in the past. This experience provides them with a source of knowledge about rubber cultivation practices and access to seed.

G. Livestock:

As in the other two counties, the total amount of livestock observed is quite small. The amount of livestock per village seems to be similar to Nimba except that there are fewer pigs.

H. Marketing in Bong County:

Markets and marketing channels for both the major and minor cash crops are comparatively more developed in Bong than in Nimba and Grand Gedeh. It appears that there are more and relatively good farm-to-market roads in the Bong area of study.

Because of Bong's proximity to Monrovia, the Bong farmers also have access to a larger market. City market women and traders attend the local markets to buy produce for the Monrovia market.

In Bong county, LPMC has an active buying station at Gbarnga. In addition, the Tungban cooperative is active throughout the county and is a major produce buying organization. It is supported by BCADP which also provides other commercial services, particularly credit to Bong county farmers. There are also private traders and other local merchants who are involved in the cocoa, coffee, and rice trade. Despite the existence of Tungban as a county-wide marketing organization, it appears that Mandingo still dominate the produce trade much as they do in the other two counties.

I. Other Sources of Income:

The presence of concessions, estates and/or rubber farms make off-farm employment more prevalent than in the other counties. Rapid access to Monrovia via the highway makes the sale of palm wine an important income generating activity. Wild meat sales seem somewhat less common in Bong than in Nimba. Fishing, crafts, farm labor, and money sent from relatives are additional sources of income for farm families. On the average, Bong farm laborers receive \$2 per day.

J. Credit in Bong County:

Village credit associations (susus) are as common in Bong as in Nimba. Most of the farmers interviewed during the survey belong to susus. Additionally, unlike the NCRDP in Nimba, the BCADP provides development and seasonal loans, and chemical inputs to farmers in the project area. Due to BCADP programs, credit facilities seem to be better in Bong than in Nimba and Grand Gedeh.

K. Food Consumption:

Fish is the most common meat source for most farm families in Bong. In addition to fresh water fish, dried marine fish from Monrovia is often purchased in local markets. Fish also is a common meat used to feed kuus. Wild meat, market purchased meat (other than fish), and domestic animal meat are less frequently consumed.

L. Government Interventions in Bong County:

The BCADP does have some influence on farming systems in the project area. Its interventions include the introduction and distribution of improved tree crop (coffee and cocoa) seedlings, chemical inputs, development and seasonal loans to farmers, improved rice and cassava varieties, swamp rice development, wells and other extension services.

Phase II of the project which started in 1983 is expected to cover a large part of the county and provide additional services to more farmers.

SUMMARY OF COUNTY SPECIFIC FARMING SYSTEMS CHARACTERISTICS

Two basic farming systems are found in the three counties surveyed. The key factors which distinguish the systems are the length of fallow, the rice planting method, and the degree of diversity. The rice-cassava intercrop pattern is also important in distinguishing sub-system differences in Bong and Nimba.

I. Grand Gedeh:

Grand Gedeh farmers typically make their upland fields in high bush which has been in fallow for up to 20 years or more. The presence of numerous large trees makes tree felling the most difficult and constraining field preparation activity. Groundhogs, weeds, and birds are less of a problem than where the fallow period is normally shorter. Rice is planted using the dibble method and no soil tillage is performed. If a reasonable burn is achieved, farmers do not attempt to clear the field of remaining tree trunks and debris.

Cassava is planted on a portion of the rice field about one month after the rice is planted. This delay prevents cassava from shading the rice and minimizes competition. Bananas and plantain are intercropped with the rice on a different portion of field. A number of tubers and other vegetables are intercropped with the rice throughout the entire field. These include: cocoyams, yams, sweet potatoes, corn, okra, peppers, bitterball, pumpkin, squash, plato, watergreens, tomatoes, and sesame.

Both early- and late-maturing rice varieties are usually planted. The early variety is planted first so that rice harvesting can begin as early as July or August.

Farmers tend not to build fences to protect their rice from groundhogs. Instead, they try to increase the size of their field and/or locate their field far from areas of secondary bush where groundhogs are likely to be numerous.

In high bush, the dense shade of the mature forest limits the presence of weeds. With little weed seed in the soil to germinate, rice gets a head start and dominates weed competition. Farmers generally do not expect to weed their high bush fields.

Few farmers have either traditional or improved swamp rice farms. A portion of the upland rice field often descends into a swampy area. However, it is considered part of the upland rice field and is cultivated in the same manner.

Women often plant a short maturing rice and intercrops in a small "hungry farm" separate from the main field. It is usually placed on a portion of the previous year's rice field or some other area of secondary bush. This field assures the family's rice needs until the main field is ready for harvest. The remaining produce of the "hungry farm" is used to meet the personal needs of the woman.

The reciprocal kuu system is not generally practiced in Grand Gedeh villages and farmers rely more on family labor. Although some labor is hired to help with many farming activities, hired

labor is more expensive and less frequently employed than in the other counties surveyed.

Cocoa and coffee are the dominant cash crops in Grand Gedeh. In addition, rice, cassava and minor crops are sometimes sold. The sale of wild meat and produce collected from the forest (e.g. wild palm oil fruit) are other important sources of income. Farmers own and produce few animals even though they are important in meeting social obligations and as a source of ready cash for emergencies.

II. Nimba and Bong:

Many of the characteristics of the farming system in Nimba and Bong counties are similar. Both counties are experiencing some degree of land pressure, which has shortened fallow periods, and compels farmers to make their farms on secondary bush. In Nimba, this pressure comes from a high population density, while in Bong, it comes from the presence of concessions and from the private ownership of large estates. Problems closely associated with farming secondary bush such as groundhogs, weeds, and rice birds, have an important impact on the characteristics of this farming system.

Farms appear to be slightly larger in Nimba and Bong than in Grand Gedeh, perhaps due to some combination of the following factors: 1) felling trees is less of a constraint; 2) when large kuus do the brushing, more land may be cleared than would be otherwise by family labor; 3) poor fertility and pests associated with secondary bush may oblige families to farm more extensively to meet food requirements; and 4) the absence of "hungry farms" may both permit and oblige the cultivation of a larger main upland rice field.

Few large trees are present, so the major land preparation activity is brushing rather than felling trees. More effort is also devoted to clearing small tree trunks and debris after burning so that it will be easier to hoe the field. Hoeing (or scratching) the field does not begin until 2 to 8 weeks after burning in order to give weed seed in the soil a chance to germinate. Broadcast planting is done at the same time as the scratching in order that this single hoeing might both eliminate the weeds and cover the seeds. After hoeing, the weeds are removed from the soil and piled so they will not have a chance to grow back. A second weeding often seems to be necessary, at least in years of high rainfall. This may also be related to the severely reduced fallow period.

In Nimba, cassava is planted at low density at the same time as the rice. It is typically intercropped on the entire rice field, eliminating bananas and plantain as an important rice intercrop. If the cassava gets too tall relative to the rice, the lower branches and leaves are stripped to reduce shading. In Bong, the cassava density is perhaps even lower than in Nimba and it is planted 2 to 4 weeks before the rice. It is often planted on only a portion of the rice field and stripping the cassava

leaves to prevent shading is less frequently practiced. Cassava, in Nimba, seems to have a more important role in both production and consumption than in the other two counties.

In Bong, some of the corn is planted with cassava before the rice is planted. Some of the vegetable intercrops tend to be planted after the rice in both counties.

Early- and late-maturing rice varieties are usually planted, but the pattern is not consistent. Where birds are a serious problem, the late-maturing varieties tend to be planted first. The fear is that an early-maturing field will be decimated by the birds, but the attack will be spread across more fields later in the season. This strategy may lengthen the "hungry season" by delaying the new harvest by 2 to 3 months.

Farmers regularly build fences in Bong and Nimba to protect rice from groundhogs. This will occupy the men for a month or more, while women finish the planting and weeding. Bird watching is also common for a week after planting and for about a month while the rice is heading.

A few farmers have swamp rice fields, but men tend to be more involved in the improved rice fields sponsored by projects. "Hungry farms" are not common, but in some cases swamp rice fields will take their place as well as provide a source of income for personal needs.

The diversity of farm enterprises is one of the biggest differences between the farming system in these two counties and that of Grand Gedeh. Farmers are often involved in both cocoa and coffee and perhaps sugar cane or groundnuts, as well as in their upland field and occasionally swamp rice. Rubber, citrus or cultivated oil palm may also be present. These numerous activities in any one family tend to strain family labor resources and management capabilities. Farmers are also more likely to be involved in some form of off-farm employment. For these reasons, hiring labor and hiring kuus, as well as using reciprocal kuus are very prevalent in these two counties. Farmers in Nimba often raise pigs with the intention of using them to feed kuus. The use of hired labor is further encouraged by lower day wages than those prevalent in Grand Gedeh.

CONSTRAINTS, AREAS OF INVESTIGATION AND RECOMMENDATIONS

The following discussion focuses on the major constraints and proposed areas of investigation pertinent to the farming systems found in the three counties surveyed. These are divided for convenience of analysis into general production constraints and crop specific constraints and areas of investigation. General production constraints are broken down into access to land, labor and capital. Crop specific constraints and areas of investigation include those that apply to upland rice, cassava, swamp rice, tree crops, other field crops, animals, marketing, and consumption. Each constraint will be addressed separately and recommendations will be proposed. Whenever appropriate the compensating strategies currently developed and used by farmers will be presented.

1. General Production Constraints:

General production constraints include those which pertain to all crops.

A. Access to Land:

Although access to land is not a production constraint in all areas of Liberia (e.g. Grand Gedeh), it is a limiting factor in areas of high population concentration and/or where concessions and private estate ownership are prevalent. Because bush fallow rotation is the primary means of compensating for fertility loss and excess weeds, movement to new bush every year to make a farm is the common practice. In areas experiencing land pressure, high bush is being eliminated from the rotation system, forcing farmers to farm in secondary bush with shorter fallowing intervals.

Compensating Strategies:

1. Farmers are moving farther away from villages and towns to seek out high bush or older secondary bush. If the farms are far from the village, satellite villages may be created.
2. Farmers may shorten the fallow period, returning to previously farmed areas sooner than previously practiced.
3. Some farmers may borrow land from relatives and friends to plant their upland rice. Planting tree crops is rarely permitted on borrowed land.
4. Some farmers may rent land from other people in the village. This rent may be in the form of a quantity of

rice or a cash payment. Tree crops cannot be planted on rented land.

5. In some cases, farmers may actually purchase land to secure its use. This is especially true in areas where farmers fear that concessions and private estates will acquire their land.
6. To maximize the use of individual fields, most farmers are intercropping many crops on the upland rice field.
7. Another strategy used by most farmers to maximize the use of a given field is to plant crops on that field for two consecutive years. Some alternative crop mixes used in this two year rotation include rice and cassava, rice and plantain/bananas; rice and peanuts; and rice, peanuts, and cassava.
8. Some farmers will migrate as a strategy to deal with limited land access. They will migrate to concessions and private estates for wage employment or to urban areas.

Recommendations:

Ways should be sought to stabilize people for longer periods of time on pieces of land than presently practiced. Four approaches can be proposed for working towards this goal.

1. Crop Rotation Systems - Farmers are already planting a second crop in a previous rice field so they may be receptive to trying new rotation strategies. Research should attempt to identify the most appropriate crop rotation systems for specific areas. Considerations should be given to food preferences and marketing access in developing these rotation systems. The effects of intercropping should also be investigated in proposed systems. In addition, managed fallow activities should be considered.
2. Tree Crop - Food Crop Intercropping - Researchers should investigate how tree crops can be combined with food crops in the same field.
3. Improved Swamp Rice Farming - In the near future, improved swamp rice farming is not likely to replace upland farming in most areas because of a number of constraints (see section on swamp rice). For this reason, projects and extension services should emphasize improved swamp rice farming in areas which are experiencing severe land pressure. Research

should be conducted by these organizations to determine those areas where land pressure is great and swampland is available. Further research needs to be done on the economics of combining improved swamp rice farming with upland farming.

4. Chemical Inputs - Chemical inputs are usually expensive and not readily available to most farmers. Nevertheless, the limited use of such inputs should be considered where economically feasible. Researchers could investigate the possibility of integrating such inputs into crop rotation systems and improved swamp rice farming in a cost-effective manner.

B. Access to Labor:

Access to labor is a production constraint facing many farmers in the area surveyed. Shortages of labor may arise as a result of family members migrating for school or wage employment. In addition, risk averse strategies such as enterprise diversification (e.g. growing many different crops or planting multiple fields) may put a serious strain on labor availability. Likewise, adding the additional labor demands of project activities and community farms to present farming system labor requirements can exacerbate the situation.

Compensating Strategies:

1. Many farmers are using kuu labor to perform many of the farm operations. A kuu is a reciprocal communal labor arrangement which involves a group of laborers working together on a particular task, rotating from one members' field to another. An individual farmer can gain additional access to labor by having different family members join different kuus.
2. Some farmers will hire labor if they have the means. Individual laborers may be hired on a daily or contractual basis or farmers may resort to purchasing the rights to a kuu from one of the kuu members. (Hiring kuus are common in Bong and Nimba).
3. Some male farmers marry many wives as a way to overcome labor constraints.
4. Intercropping vegetables in rice fields is a strategy farmers follow to maximize returns to labor for a given field.

Recommendations:

1. Projects and extension personnel should take into consideration the labor constraints presently facing farmers. They should refrain from introducing too many interventions to a given farmer at one time.
2. Research should consider intercropping and cover-cropping strategies to reduce labor requirements. For example, cover-crops could be planted under tree crops to cut down on underbrushing.
3. Research on various types of appropriate technologies should be encouraged. In addition, the economics of existing mechanical interventions should be investigated (e.g. chainsaws and rototillers).

C. Access to Capital:

Capital accumulation is difficult for small farmers to achieve primarily because of their subsistence orientation and limited access to credit. Furthermore, extended family social obligations may absorb a considerable amount of the surplus which is generated.

Compensating Strategies:

1. Most farmers in the area surveyed are cultivating one or more cash crops in addition to their upland rice. The main cash crops are cocoa, coffee, and sugar cane.
2. Many farmers belong to the village credit associations (susu) as a way to secure loans in times of need. Typically, weekly dues are collected from each member and loans usually have a 3 month payback period (repayment is 125 to 150 percent of the loan amount).
3. Some farmers invest their cash earnings in animals. Animals can provide a source of ready cash for emergencies.
4. Some farmers seek out off-farm employment as a means to increase their incomes. They may seek jobs in nearby concessions and government plantations or migrate periodically to other areas for wage employment (e.g. Monrovia).
5. Farmers in some areas gain income from hunting and fresh water fishing.
6. Many farmers are exploiting wild produce to supplement their incomes. For example, wild palm nuts may be collected and sold as processed oil. In addition,

palm wine is sold by many farmers, especially those in close proximity to urban centers.

7. Several farmers are manufacturing items such as wicker chairs and mats for sale.

Recommendations:

1. Research should focus on the feasibility of introducing alternative cash crops into the system. Careful consideration should be given to the marketing potential for the various proposed crops.
2. Ways of improving the earning capacity of existing cash crops should be encouraged. Three areas of inquiry might include: 1) improved pricing policies for coffee and cocoa, 2) improved processing techniques with greater emphasis on grading; and 3) improved marketing channels with wider distribution of buying centers.
3. Village credit associations (susu) should be carefully studied. Those which are successful may provide models for introducing this concept in other areas.

II. Crop Specific Constraints and Areas of Investigation:

A. Upland Rice:

Constraints:

1. Pests and Diseases

a. Groundhogs:

Without question, groundhogs are identified as the major pest attacking upland rice in all three counties surveyed. Groundhog problems are most severe on farms located in secondary bush.

Compensating Strategies:

1. Farmers will locate their farms in isolated high bush away from secondary bush where groundhogs are prevalent.
2. Many farmers build fences around their upland rice fields to keep groundhogs out. This is especially true in areas dominated by secondary bush.
3. Traps are often placed along fences to catch

groundhogs.

4. Some farmers opt to make large farms without fences rather than small farms with fences as a way to deal with groundhogs.
5. Some farmers believe that groundhogs are more attracted to cassava than to rice and will deliberately not plant cassava in a rice field.
6. Some farmers will not put their rice fields near sugar cane fields because of the groundhog's attraction to sugar cane.
7. Some farmers leave an open space between their field and the surrounding bush.
8. Some farmers rely on dogs.

Recommendations:

1. Alternative fencing techniques should be investigated to identify those which are feasible and cost effective. For example, chicken wire and battery-powered electric fences like those being tried in Grand Gedeh should be studied as possibilities. The effects of having a cleared space between the bush and the fenced field should also be considered.
2. Research should focus on the possibility of using chemical repellants and poisons as deterrents to groundhogs. For example, repellants are sometimes used to keep animals out of fields and gardens in other countries. An artificial leopard scent might be one good possibility. As for poisons, caution should be exercised in prescribing substances that are harmful to humans and other animals.
3. Literature reviews and further study on the life cycle and feeding habits of the groundhog may give researchers insights into ways of approaching the problem. For instance, some farmers believe that groundhogs have differential preferences for rice varieties.

b. Birds:

Birds are a serious constraint for upland rice production, especially in areas with extensive secondary bush. The two periods that bird problems are most severe are right after planting and during the stage when the rice is heading.

Compensating Strategies:

1. Many farmers have adopted rice planting strategies to adjust to bird problems. They will not plant their short-maturing varieties first because they would mature before the rest of the field and would be prime targets for bird attack. For this reason, farmers will plant their long-maturing varieties first and their short-maturing varieties last.
2. Scaring birds is done by most farm family members, especially children. Rock slings are normally used right after planting. (In one case a bow and arrow are being used). When the rice is heading, ropes with can-rattles on them are often distributed throughout the field and periodically shaken to scare birds.
3. Some farmers are using bird nets in their fields that they acquired from projects. Some dissatisfaction has been expressed about the effectiveness of such nets because they are cumbersome and bats can tear them up when they get caught in them at night.
4. In some villages, farmers are using poisoned rice scattered on their fields to kill birds. Although effective, the hazards of eating poisoned birds are not well understood by farmers and could have severe consequences.
5. Some farmers have identified some rice varieties with long awns which are somewhat bird resistant.

Recommendations:

1. Rice breeders should examine the feasibility of incorporating bird resistant traits into improved rice varieties. Local varieties with long awns have been identified by farmers as

being somewhat bird resistant. Investigations could possibly begin with these varieties.

2. As stated earlier, farmers have identified the use of poisoned rice as an effective means of bird control. However, the ecological effects of such practices should be examined before advocating its widespread use. Alternative low residual poisons should be screened as possibilities.

c. Termites

Many farmers have identified termites as a serious pest attacking their rice. They presently have no effective means of dealing with the problem.

Recommendation:

Research should be conducted on various means of controlling termites. One possibility is the use of chemicals. However, the cost may be prohibitive for most small farmers.

d. Rats:

Rats are a serious pest which attack the rice while it is in storage in the kitchen. Some storage experts estimate that as much as 10 percent of the rice stored in kitchens is lost every year to rats and other minor pests.

Compensating Strategies:

1. Many farmers will build traps in their kitchens to catch rats.
2. Some farmers keep cats around to control rat populations.
3. A few farmers are presently using rat poison to kill rats.

Recommendation:

1. Work should continue on designing kitchens that control rats and are inexpensive. Efforts towards the development of alternative storage facilities should be intensified.

2. Caution should be exercised in advocating poisons for rat control.

e. Diseases: (false smut, blast, brown leaf spot)

Although rice diseases are present in farmers' fields, farmers have difficulty in identifying these specifically. For this reason, no specific compensating strategies are expressed.

Recommendations:

1. Research aimed at rice selection should continue to focus on disease resistant varieties.
2. Projects and extension services should initiate efforts to educate farmers as to the recognition of rice diseases in their fields and appropriate techniques for dealing with these diseases.

2. Weeding:

Weeding is a serious constraint to production, especially in secondary bush.

Compensating Strategies:

1. In Nimba and Bong counties, farmers will hoe weeds as they are planting their rice, all in the same process. In fact, some farmers will deliberately let the weeds grow before hoeing so that weeding after planting will require less effort.
2. To avoid weeds as well as low soil fertility levels, farmers will shift to high bush if it is available.
3. If weeds are a serious problem, farmers may join weeding kuus or hire labor to do the weeding.

Recommendation:

Studies should be conducted on the effectiveness and cost of using herbicides for weed control. The trade-offs between hired labor and herbicides should be considered in such studies. The availability of the product to small farmers should be investigated as well. In addition, some attention should be given to the effects of post-emergence selective

herbicides on intercrops.

3. Soil Fertility:

As previously stated, low soil fertility due to excessive leaching, erosion and low pH forces farmers to follow a shifting cultivation pattern.

Compensating Strategies:

1. Farmers shift to new areas every year to make upland rice farms.
2. Farmers plant cassava in rice fields to utilize the cleared field a second year. Cassava is ideal for this purpose because of its low nitrogen requirements and its better utilization of potassium and phosphorous.

Recommendations:

1. As stated earlier, research should attempt to identify the most appropriate crop rotation systems for given areas. The integration of nitrogen fixing legumes as rotation crops or intercrops should be considered. In addition, the economics of such rotation systems should be studied.
2. Experiments on minimum tillage practices should continue, and other erosion control measures should be considered.
3. As mentioned previously, limited use of fertilizers may be a viable option when economically feasible and readily available. Along with imported chemical fertilizers, the use of composts, manures and other indigenous materials like rock phosphate should be investigated.
4. Research should focus on the possibility of introducing managed fallow using legumes as a substitute for natural fallow.

4. Other Areas of Investigation for Upland Rice:

a. Upland Rice Planting Methods:

Two different planting methods have been identified in this survey. In Grand Gedeh, farmers plant by using a dibbling method, which

involves digging holes with a cutlass or dibbling tool and dropping seeds in the hole. In Nimba and Bong, rice is broadcast and then scratched with a hoe.

Recommendation:

Research should be initiated to compare the dibbling and scratching methods of planting to determine their effect on plant density, weed population, soil degradation, labor demand, ease of intercropping and yield.

b. Intercropping Rice with Other Crops:

Farmers in all areas surveyed are planting a number of different crops with rice.

Recommendation:

Research should be conducted on the advantages and disadvantages of intercropping other crops with rice. Different spacing and timing strategies should be considered.

c. Multiple Varieties of Rice Being Planted:

Almost every farmer interviewed is planting more than one variety of rice. Both short-maturing and long-maturing varieties are being planted in the same field.

Recommendation:

There appear to be other popular local varieties that according to some farmers may be more productive than the recommended varieties. These varieties should be screened and compared with those presently recommended (e.g. Desemah in Grand Gedeh and Nakatuwa in Nimba). On-farm trials on varietal performance within present farming systems should be conducted.

B. Cassava:

Constraints:

Pests and Diseases:

a. Groundhogs:

As with rice, groundhogs are a serious constraint for cassava production. In fact, some

farmers believe that groundhogs are more attracted to cassava than they are to rice. The compensating strategies that farmers follow are the same as those for rice, especially since cassava is usually planted in the rice field. As for recommendations, the suggestions given earlier for upland rice groundhog problems are applicable here.

b. Cassava Mosaic and Bacterial Blight:

Although cassava mosaic is found in every field surveyed, farmers do not recognize it as a disease. Similarly, some blight has been observed, but farmers do not talk about it as a problem either. It is obvious from our survey that cassava diseases are not readily recognized by farmers.

Recommendations:

1. Multi-locational trials of disease resistant varieties should continue. If these researcher managed trials prove successful, their performance in farmers' cropping systems should also be tested in on-farm trials.
2. Projects and extension services should educate farmers on how to recognize cassava diseases in their fields, and teach them appropriate techniques for dealing with these diseases.

2. Other Areas of Investigation for Cassava:

a. Spacing and Timing of Planting of Cassava in Relation to Rice:

There are four alternative strategies for growing cassava in relation to rice. Intercropping patterns include: (1) planting cassava with wide spacing before the rice; (2) planting cassava at the same time as the rice and stripping leaves to reduce shading; (3) planting cassava three to four weeks after the rice to avoid shading; and (4) planting cassava as a relay crop after the rice is harvested permitting denser planting. Cassava also is sometimes planted in separate fields and occasionally intercropped with other crops.

Recommendation:

The spacing and timing of planting of cassava in relation to rice should be investigated to determine its effects on both crops. Possibly land equivalent ratios could be used to measure these effects.

b. Stripping Leaves and Lower Branches of Young Plants to Avoid Shading:

Farmers in Nimba and some areas of Bong will strip the leaves and lower branches of young cassava plants to prevent the cassava from shading the rice.

Recommendation:

Research should be conducted to determine the effects of stripping the leaves and lower branches of young cassava plants. These effects would include cassava performance and yields as well as interactions with rice. This work could be incorporated into on-going experiments on leaf harvesting.

c. Intercrops with Cassava Other than Rice:

Some farmers are intercropping cassava with other crops such as peanuts, sweet potatoes, and even coffee.

Recommendation:

Research should be initiated on identifying various potential crops that can be intercropped with cassava. One possible focus could be on cover-crops that not only cut down on underbrushing but also provide a second product.

C. Swamp Rice:

Improved Rice Swamp Rice Constraints:

1. Labor Availability:

One of the major constraints for farmers interested in incorporating improved swamp rice into their present cropping systems is the added labor required to construct and maintain the swamp. These labor demands can compete adversely with the labor requirements of upland rice farming.

Compensating Strategies:

1. To deal with these additional labor requirements, farmers may opt to build smaller swamp fields than those proposed by project personnel.
2. Some farmers will hire labor to build or maintain their swamp farm if they have the means.
3. Some farmers may intentionally neglect other cropping activities like underbrushing cocoa of coffee to meet the labor requirements of improved swamp farming.

Recommendations:

1. As stated previously, research should be conducted on the economics of combining improved swamp rice farming with upland rice and other farming activities.
2. Cost-effect labor saving techniques and technologies should be identified to help reduce the labor demands of swamp farming.
3. Possibly one way to deal with the competing labor demands of swamp farming is to encourage farmers to delay swamp farming activities until the upland activities are completed. This would only be possible for those farmers with year round access to water. This could be accomplished with better water control techniques.

2. Other Constraints to Improved Swamp Rice Farming:

In addition to the added labor demands, a number of other reasons can be cited as to why farmers are reluctant to commit themselves to improved swamp rice farming. These include:

Capital Investment Required - Many farmers cannot afford the added costs of building and maintaining improved swamps. Even though loans are often given by projects to farmers to help defray the costs, farmers have some difficulty paying back the loans and absorbing the necessary costs of yearly maintenance.

Inability to Intercrop - Some farmers indicate that one of the main reasons why they do not abandon upland farming and shift completely to swamp rice farming is because they cannot intercrop vegetables

and tubers in the swamp. For this reason, they continue to plant upland fields as well as swamp fields, despite the conflicting labor demands.

Fear of Disease - Some farmers are concerned that working in swampy water will expose them to diseases such as schistosomiasis. To counteract this fear, some projects have created schistosomiasis monitoring units to check for and treat possible infections. Despite the existence of such units, some farmers still are apprehensive about working in swamps.

Management Experience - Many farmers lack management experience with water control and therefore may not be as successful in swamp rice farming as they could be.

Cost of Chemical Inputs - Many of the chemical inputs used in swamp farming are costly and/or not available to small farmers, reducing the opportunity for achieving substantial yield increases. Without such yield increases, farmers have little incentive to leave upland farming.

Cultural Traditions - Farmers in many areas are not accustomed to swamp farming as part of their traditional farming system. This could make it difficult for them to readily accept the practice.

Recommendation:

Areas where improved swamp rice farming has been successfully adopted should be carefully studied to determine what factors have contributed to its success.

3. Other Areas of Investigation for Swamp Rice:

Recommendation:

Four possible swamp rice research topics worth investigating include:

1. The use of nitrogen fixing aquatic plants.
2. The use of limited chemical inputs.
3. The effects of cutting back rice to deal with lodging (e.g. Gissi 27).
4. The agronomic aspects of varietal performance.

D. Tree Crops:

1. Cocoa and Coffee:

Constraints:

a. Pests and Diseases:

Stem borers:

Farmers in all three counties identified stem borers as a severe constraint to both coffee and cocoa. The larvae attack both the branches and stems of the tree, killing the infested part or the whole tree.

Compensating Strategies:

1. Some farmers will remove the branch of the tree that is infested.
2. One farmer's strategy for dealing with the pest is to stick a long twig in the hole of entry to kill the larvae.

Recommendations:

1. The practice of pruning and destroying infested branches and stems as a means of control of stem borers should be encouraged by extension personnel.
2. Proper and timely underbrushing may help prevent the incidence of stem borer infestation.
3. Research should be conducted to identify other potential hosts which may harbor stem borers (i.e., possibly kola trees in cocoa and coffee fields).
4. The economic feasibility of using insecticides as a preventive measure or treatment should be investigated.

Termites:

Many farmers have problems with termites attacking their cocoa and coffee. They presently have no effective means of dealing with the pest.

Recommendation:

As stated earlier, research should be conducted on ways of controlling termites by using cost-effective chemicals.

Red Ants:

Although red ants do limited damage to the cocoa and coffee trees themselves, they are a severe harvesting constraint to the farmer. If the tree being harvested is infested, the red ants will attack the cocoa or coffee picker. Their sting is extremely painful, and could discourage farmers from practicing careful harvesting techniques.

Compensating Strategy:

1. To avoid excessive stinging, coffee pickers will strip all of the mature and immature berries from the branch at once, rather than selectively picking the ripe berries. This practice probably lowers the quality of the coffee being sold by the farmer.

Recommendation:

The ecological effects of eliminating red ants should be investigated before proposing control methods. It is possible that red ants might have some beneficial effect on the trees which presently is not well understood.

Wild and Domestic Animals: (cocoa only)

Farmers in all three counties indicated that both wild and domestic animals pose a constraint to cocoa production. Squirrels are a common problem found in all areas, whereas monkeys, lemurs and chimpanzees are a serious problem only in Grand Gedeh. As for domestic animals, goats and pigs are a problem in most areas, while in Grand Gedeh, cattle are also a problem in some villages.

Recommendation:

Farmers should continue to build fences to protect their cocoa from domestic animals. Although hunting is presently being used by farmers to control wild animals, alternative

means should be sought which are less destructive to existing wildlife populations.

Black Pod: (cocoa only)

Black pod is a serious constraint to cocoa production. The disease is prevalent in all three counties surveyed.

Compensating Strategy:

Some farmers will destroy the infected pod once it is detected on the tree. However, they rarely remove the infected pod from the area.

Recommendations:

1. Research should be conducted on means to control black pod disease.
2. The possibility of identifying or developing black pod resistant varieties of cocoa should be pursued.

b. Underbrushing:

Farmers often cannot meet the labor demands necessary for proper and timely underbrushing of their cocoa and/or coffee. Consequently, bush over-growth seriously lowers production.

Compensating Strategies:

1. Some farmers will hire labor to underbrush their trees.
2. Many farmers join kuu work groups to underbrush each others' trees.
3. Farmers will often plant their cocoa and/or coffee in old rice fields to reduce the work required in initial brushing and underbrushing.
4. Many farmers deliberately plant cocoa and coffee more densely than recommended with a strategy to develop a shade canopy to reduce underbrushing.

Recommendations:

1. The use of possible cover-crops for cocoa and

coffee should be researched.

2. Research should continue on the use of food intercrops planted between the cocoa seedlings (e.g. plantain and/or banana).

c. Site Selection:

Selecting a good site for planting cocoa and/or coffee is often difficult for farmers, especially those who have little experience in growing tree crops. Many times, trees are planted in inappropriate areas.

Compensating Strategies:

1. Some farmers will experiment by planting a few seeds or seedlings in an area where they want to put a cocoa or coffee field. If the seedlings do well (after 6 months to a year), they will plant the rest of the area in seedlings.
2. According to farmers, old town sites are good locations for planting cocoa and/or coffee. This strategy makes sense considering the fact that such areas are usually rich in humus.
3. Some farmers select sites for tree crops on the basis of how well their rice did in a field the previous year. They believe that if the rice did well, then the tree crop will also do well.

Recommendation:

Research should be conducted on the suitability of different soil types for coffee and cocoa.

d. Other Areas of Investigation for Cocoa and Coffee

1. Spacing:

Farmers are planting their trees using closer spacing intervals than those usually recommended. Some farmers do this systematically and others do it without measuring the spacing.

Recommendations:

1. Additional research on the appropriate spacing of cocoa and coffee should be conducted.
 2. The effects of planting trees more closely than presently recommended should be studied. This study should take into account the economic trade-offs between underbrushing cost savings and potential yield loss. This is an appropriate topic for on-farm research.
2. Other Tree Crops (Citrus - Oranges, Grapefruit, and Tangerines)

Constraints:

- a. Seasonality: (Oranges)

One problem facing farmers who grow oranges and wish to market them is that the types of oranges grown in the area tend to mature all at the same time of the year (October through December). This results in an over-abundance of oranges on the market during this time period, lowering the price that farmers receive for their fruit. Farmers do not have storage facilities, so they are forced to sell at this reduced rate.

Recommendation:

To overcome this problem of seasonality, research should continue to identify possible varieties that might bear year-round or bear at different times of the year.

General Recommendation for Other Tree Crops:

Citrus and oil palm should be considered as alternative cash crops to cocoa and coffee. Such diversity may help alleviate some of the risk associated with fluctuating world markets.

E. Other Field Crops:

1. Sugar Cane

Constraints:

a. Groundhogs

As with rice and cassava, farmers who grow sugar cane experience problems with groundhogs. Their compensating strategies are similar to those described for rice and cassava. Our recommendations for dealing with groundhogs would be the same as those prescribed for rice and cassava.

b. Lack of Processing Equipment:

A major constraint facing farmers who wish to plant sugar cane as a cash crop is the lack of available processing equipment to manufacture cane juice. As a consequence, limited expansion of sugar cane production is possible.

2. Peanuts:

Women in some areas of Bong and Nimba Counties are presently planting peanuts as a second crop after rice or in a separate field.

Recommendation:

Research should focus on the possibility of integrating peanuts into a crop rotation system for appropriate areas. Similarly, the possibility of intercropping peanuts with other crops should be explored.

III. Animals (Goats, Sheep, Pigs, Cattle, Chickens)

Constraints:

A. Diseases (Sheep, Goats)

In many villages of Grand Gedeh, sheep and some goats are contracting a skin disease locally referred to as Zeh (perhaps mange or scabies or contagious ecthyma). In some villages in Nimba, goats are contracting a disease which causes the eyes to turn white (perhaps infectious conjunctivitis.)

Compensating Strategy:

Farmers in some villages of Grand Gedeh prohibit infected sheep and goats from entering or remaining in the village.

Recommendation:

1. Better veterinary services should be provided by projects and extension services. Diagnosis and treatment of infected animals should occur on a more regular basis to prevent epidemics.
2. When a particular disease is identified, research should be conducted to determine the extent to which the disease has spread. This information could help guide disease eradication programs.

B. Other Area of Investigation for Animals:

Research should be conducted on why traditional farmers are not investing more in animals. It is possible that farmers view animal investments too risky due to the unpredictable occurrence of disease. Another possible explanation for limited investment is that the common pattern of uncontrolled grazing creates a situation where ownership is not well defined and other villagers are consuming the animals. These possibilities should be investigated.

IV. Marketing:Constraints:A. Access to Markets:

Many farmers live in isolated villages which do not have good access to roads or are located very far from a L.P.M.C. buying center. In addition, farmers in such villages do not have their own cooperative or the opportunity to join one from outside. These farmers are often forced to sell their produce to traders (Mandingo) at reduced prices.

B. Access to Market Information:

Many farmers do not know what the current LPMC prices are when they sell their produce, and are obliged to accept the price quoted to them by the trader. This is especially true in isolated villages.

Recommendation:

Efforts should be initiated to develop a low cost method for disseminating marketing information to a large portion of farmers in the area. One possibility is to use radio broadcasts to disseminate such information. Since radios are quite common in most villages, this would be an effective way of reaching illiterate farmers. These broadcasts should be done in the local languages of the area.

C. Grading of Cocoa and Coffee:

In most cases, traders do not grade cocoa and coffee when they are purchasing it from farmers. One low price is offered despite the fact that the cocoa or coffee being purchased could be classified into higher grades.

Recommendation:

Projects and extension services should initiate efforts to train farmers how to grade their own cocoa and coffee. In conjunction with this, farmers should receive instruction as to the proper processing techniques which would improve the grades of these products.

D. Lack of Processing Facilities for Citrus:

A major constraint to citrus marketing is the lack of processing facilities. As a result, farmers are often forced to sell their oranges for urban consumption during one peak period of the year.

V. Food Consumption:A. Areas of Investigation for Food Consumption:1. Food Preferences, Preparation Techniques, and Food Taboos:

Food preferences, popular preparation techniques and food taboos play an important role in the farmer's acceptance of any proposed intervention. For instance, farmers who have a strong preference for cassava dishes are less likely to drop cassava from their cropping system for a different kind of tuber. Similarly farmers who regard sheep as a food taboo are less likely to invest in sheep husbandry.

Recommendation:

Studies on food preferences, preparation techniques

and food taboos should be conducted to determine the likely acceptance of a proposed intervention. Varietal work on any crop should consider taste preferences.

2. Beans and Pulses:

Many farmers presently grow some pigeon peas and/or some broad beans for home consumption.

Recommendation:

Efforts to introduce other beans and pulses into the farming systems of these areas should be encouraged. Such crops would give farm families greater access to vegetable protein and/or could diversify their protein intake. Two crop possibilities are mung beans and cowpeas. NCRDP is presently attempting to introduce mung beans to farmers in Nimba with some initial success. However, use of such crops as cash crops is presently limited, due to the lack of markets.

3. Seasonal Food Shortages:

In addition to rice, farmers are consuming a wide variety of food stuffs in the area surveyed. However, during certain times of the year, many farmers run out of rice and are obliged to reduce their food intake and/or substitute cassava as the main staple. This period is referred to as the "hungry season," and usually occurs between July and September. This is the time when women are doing the planting and weeding, and men are building groundhog fences and underbrushing their tree crops.

Recommendation:

Limited dietary and nutritional surveys should be conducted to determine the nutritional effects of seasonal shortages of rice and other foods during peak labor periods. Such dietary surveys may indicate what nutrients are lacking in the diet and give guidance to crop choices for intervention. If nutritional status assessments are to be conducted, these should be coupled with epidemiological studies to avoid false interpretations regarding malnutrition.

APPENDICES

GENERAL HYPOTHESES FOR ALL THREE COUNTIES

Upland Rice:

1. Size of village, access to land, availability of high bush, number of livestock, groundhogs and weeds, may determine the distance of the farm from the village.
2. People plant more than one variety of rice. There tends to be both short-maturing and long-maturing varieties. These have different roles according to the system in use.
3. Upland rice is generally intercropped with other crops including: cassava, corn, plantain, bananas, eddoes, yams, sweet potatoes, peppers, bitterball, pumpkin, okra, plato, pineapple, sesame, tomatoes, watergreens, and other vegetables.
4. Fallow periods are longest in Grand Gedeh and shortest in Bong. Fallow periods in Nimba fall somewhere in between. It appears that weeds are progressively more severe as the fallow period shortens.
5. Groundhogs, weeds, and birds are more severe on farms in secondary bush than on farms planted in high bush. However, if the high bush farm is not isolated from other secondary bush, the ground hogs will still be a problem.
6. When rice is harvested, three factors appear to determine the length of time the rice is left drying in the field. These factors are: 1) the amount of rainfall during the harvest period; 2) the distance between the field and kitchen; and 3) the frequency of fires under the kitchen. When left in the field, the rice is placed on stumps or logs and/or piled in heaps on scaffolds. In some cases, the rice is taken directly to the rice kitchen the same day of harvest.
7. The major pests attacking rice are groundhogs, rice birds, and

termites.

8. The only major rice disease identified by farmers is false smut.
9. Rice harvest techniques are closely related to the storage of rice on the panicle. This storage method may have to change before the use of sickles and threshers can be accepted.

Cassava:

10. There are four alternative strategies for growing cassava in relation to rice. Intercropping patterns include: 1) planting cassava with wide spacing before the rice; 2) planting cassava at the same time as the rice and stripping leaves to reduce shading; 3) planting cassava 3-4 weeks after the rice to avoid shading; and 4) planting cassava as a second crop after the rice is harvested. In addition, cassava is sometimes planted in separate fields and occasionally intercropped with other crops.
11. The major pests attacking cassava are groundhogs, porcupines, and ground squirrels.
12. Farmers tend not to recognize diseases on cassava, but cassava mosaic is observed to be universally present.

Tree Crops:

13. It appears that farmers are intentionally planting cocoa and coffee more densely than recommended with a strategy to develop a shade canopy which reduces underbrushing. Although this strategy may reduce yield it minimizes labor demands.
14. Black pod disease appears to be a serious problem for cocoa.

15. The major pests attacking cocoa are stem borers, termites, squirrels, domestic animals and other wild animals. In addition, red ants are a harvesting constraint.
16. The major pests attacking coffee are stem borers, termites, caterpillars and maybe grasshoppers on the small seedlings. Red ants are also a harvesting constraint for coffee.
17. It appears that the severity of stem borer infestation is associated with bush overgrowth due to lack of underbrushing.
18. Coffee is usually harvested by stripping all berries from the branch rather than selective picking. This practice may be due to labor constraints and the presence of red ants.
19. There appears to be no grading of cocoa or coffee done by buying agents at the farm gate. Uniform pricing regardless of quality provides no incentive for farmers to maintain quality standards for products sold.
20. Oil palm is not usually cultivated as a cash crop by small farmers. However, wild oil palm is collected for home consumption and a small amount is sometimes sold.

Animals:

21. Animals are not usually raised for home consumption or as a major source of income. Domestic animals are used for: 1) a source of ready cash for emergencies; 2) bride price; 3) for special social occasions (e.g. death, entertainment, gift); and 4) a source of meat for feeding kuu labor.
22. Animals graze uncontrolled with no attempt on the part of farmers to corral them. Supplemental feeding is only provided to familiarize the animals with the owner's house.

23. Few cattle are found and ownership appears to be concentrated in the hands of a few. (Cattle may be more prevalent in southern Grand Gedeh.)
24. In villages where livestock are prevalent, fences are often built on the roads and pathways to farms. Livestock are often cited as one of the reasons why upland rice farms are located far from the village.
25. The fact that farmers own and raise so few animals is probably due to the presence of serious animal health problems, the lack of an animal husbandry tradition, and less than complete respect for private ownership of animals.

Inputs:

26. Fertilizer and chemicals are not commonly used. However, projects are introducing some chemical inputs for tree crops and improved swamp farms.
27. Hiring labor for most farming activities appears to be quite common for all three counties surveyed.
28. Farmers tend to be receptive to the adoption of new crop varieties.

Marketing:

29. Cash needs often force farmers to sell cash crops at the first opportunity, even at a disadvantageous price.
30. The primary reason for producing rice is for home consumption and not for sale. However, rice sales are not uncommon, especially when there is a surplus.

31. In addition to being produced for consumption, cassava and minor crops are often sold to purchase rice and other basic necessities (especially during the hungry season).
32. Income generating strategies vary from one farmer to another. Some of the sources of income include tree crops, rice, cassava, sugar cane, peanuts, wild oil palm, palm wine, minor crops, hunting, and off farm employment.

Credit:

33. Credit appears to be a problem for small farmers. Sources of credit are limited to village credit associations, Mandingo traders, relatives and friends and occasionally government organizations. Village interest rates are relatively high (usually repayment is 125 percent to 150 percent of the loan amount within a three month period).

Out-migration

34. Out-migration has reduced the labor available to most of the families interviewed. Migrants include students and those individuals seeking employment with concessions and in urban areas.

Consumption:

35. Although eating habits vary from one family to another the tendency is for the husband and wife to eat separately.
36. Fresh water fish is an important meat source for home consumption (especially during the dry season).
37. Culturally prescribed food taboos and restrictions have some influence on the consumption of meat as well as other foods (both wild and domesticated).

38. It appears that farmers are consuming fewer major meals from the planting period to the harvest period. The use of wild foods and minor crops may partially compensate for this.

HYPOTHESES FOR GRAND GEDEH

Upland Rice:

1. The number of wives may determine the presence of hungry farms and the number of rice fields.
 - (a) Farmers with one wife usually have one large rice field with a short-maturing rice planted in one portion of the field.
 - (b) Farmers with two or more wives will likely have hungry farms in addition to one major household farm.

2. The quality of the burn prior to planting will determine the use of the rice field the next year.
 - (a) If a field is cleared but not planted (e.g. due to a bad burn) it will be used the following year.
 - (b) If only portions of a rice field are planted due to a spotty burn, it will likely be planted in rice again the following year.

3. Improved swamp rice farming is not widespread in Grand Gedeh, and tends to be concentrated around Zwedru and other large towns where government projects have been developed (e.g. Zleh Town).

4. Traditional swamp rice farming in Grand Gedeh is usually part of a traditional upland rice farm. Women tend not to have individual swamp rice farms.

5. Using dibble planting, people are less likely to clear after burning.

6. Rice birds seem to be a localized problem and are not a severe problem in all areas (probably because of the high bush).

7. Farmers tend not to build fences in this area to protect their rice against groundhogs. Their strategy appears to be to

increase farm size and/or locate farms far from secondary bush.

8. The roles of men and women in upland rice cultivation tend to follow this pattern:
- (a) Brushing is primarily done by men although sometimes women are also involved in brushing.
 - (b) Felling is primarily done by men.
 - (c) Burning is done by men and women.
 - (d) Planting is done primarily by women.
 - (e) Weeding is done primarily by women.
 - (f) Harvesting is done by both men and women.
 - (g) Where bird watching is done, it is usually done by women and children. In the absence of children, men may assist.

Cassava:

9. The following planting strategies are used when cassava is planted with rice:
- (a) When cassava is intercropped with rice it is generally planted when the rice has reached one to one and a half feet (to avoid shading of rice).
 - (b) Cassava and plantain/banana are not planted in the same section of the rice field to avoid competition.
 - (c) Cassava tends to be intercropped with the rice that is first planted. This rice often tends to be the early maturing variety.

Tree Crops:

10. Commercial citrus production does not appear to be common in the area surveyed, except in a few villages near Zwedru.
11. Coffee requires more labor for underbrushing than cocoa. Due to this underbrushing constraint, farmers generally prefer to grow cocoa.

Inputs:

12. Hiring labor for most farming activities is more frequent

than expected and money seems to be more constraining than labor availability. Brushing, underbrushing and harvesting appear to be the operations for which labor is commonly hired.

13. Improved upland rice varieties are not widely distributed in the area.

Animals:

14. Zeh (perhaps mange or scabies) is a serious skin disease that affects small ruminants throughout the county (especially sheep).

15. Wild game is an important source of income for some farmers in Grand Gedeh as well as being a major source of meat for consumption. More wild meat is consumed by households than meat from domestic animals.

Marketing:

16. In the absence of LPMC, traders are the major buyers of cash crops and rice. These traders are mostly Mandingo.

17. Traders may offer loans to farmers as a means of gaining clients. When loans are given by traders, the price offered is lower in villages which do not have good roads and market access.

18. Few farmers in the area belong to marketing cooperatives.

Other:

19. Community farms are common in the area. The trend appears to be a shift from clan organized to individual village

organized community farms.

20. The reciprocal kuu system is not as common in the area as the non-reciprocal kuu system.
21. No significant differences are found among subtribes with regards to their farming systems.
22. The land tenure system found in the area is dominated by usufruct rights to tribal lands. Land sales are not common in traditional farming areas.
23. Mechanical milling of rice is not common and mills are not found in any of the villages surveyed.
24. Some limited use of chainsaws for tree felling is found in Grand Gedeh. This is likely related to the prevalence of high bush.

HYPOTHESES FOR NIMBA COUNTY

Upland Rice:

1. Scratching is the most widely practiced planting method in the area surveyed.
2. Weeding is a serious constraint in Nimba. Scratch-weeding during planting, at least on part of the field, is quite common. This strategy is employed to reduce labor requirements of weeding after planting.
3. Farmers are more likely to clear after burning where the scratching method of planting is practiced.
4. Reciprocal kuus are commonly used for a wide variety of farming operations. In addition, kuu labor is often hired.
5. The upland rice farms in Nimba County appear to be larger than those found in Grand Gedeh. Four possible explanations are: 1) access to kuu labor; 2) the necessity to cultivate a larger area due to the prevalence of secondary bush; 3) the absence of hungry farms; and 4) felling trees is less of a constraint.
6. The strategy for timing the planting of short- and long-maturing rice varieties is closely tied to bird problems. If birds are a serious problem, long-maturing varieties are planted first, and short-maturing varieties last. However, if the birds are not a problem, the opposite seems to hold true.
7. Traditional and improved swamp rice farming are more prevalent in Nimba than in Grand Gedeh. Women are mostly responsible for traditional swamp rice farming but men are also involved. Women attempt to locate traditional swamp rice farms near their upland rice farms. However, if this is not possible, swamp farms may be located elsewhere.

8. In Nimba, women seem to be more involved in brushing and men more involved in planting than in Grand Gedeh. Otherwise, the sexual division of labor seems to be similar.

9. Due to the prevalence of secondary bush, groundhogs seem to be a more serious problem in Nimba than Grand Gedeh. As a result, fence building is more common.

10. Land pressure seems to be increasing in the larger towns in Nimba. It seems that cash rental arrangements are beginning to appear.

11. Hungry farms are less prevalent in Nimba than in Grand Gedeh.

12. Rice birds are a widespread problem in Nimba, and therefore birdwatching is more common.

Cassava:

13. Cassava is usually intercropped with rice, and is planted at the same time as the rice. To avoid shading, the lower branches and leaves of the cassava are stripped.

14. Cassava intercropped with rice is planted over the whole field rather than in just a section. Very little banana and plantain are planted in the rice field. (This pattern differs from Grand Gedeh). In addition to being intercropped, cassava was sometimes planted in separate stands.

Tree Crops:

15. Although citrus appears more often in Nimba than in Grand Gedeh, its significance as a source of income is minimal for most farmers.

Animals:

16. A number of small farmers in Nimba own a few pigs. One reason for this may be that pigs are often butchered to feed kuus. Pigs provide more meat per animal than goats and sheep.
17. Some cassava, cassava leaves, and other forage are fed to animals to condition them to return to the owner's home.
18. In some villages in Nimba, goats contract a disease which causes the eyes to turn white (perhaps contagious conjunctivitis).
19. Wild game is less important as a source of income and meat in Nimba than in Grand Gedeh.

Inputs:

20. Farm enterprises are more diversified in Nimba County than in Grand Gedeh County. This, coupled with the labor requirements of FDA's and community farms may strain family labor availability and management. This may be a factor in the tendency to hire labor.
21. Hiring labor for farming operations is more common in Nimba than in Grand Gedeh. Hired labor also appears to be less expensive in Nimba, especially when a kuu can be hired.

Marketing:

22. Marketing cooperatives are more prevalent in Nimba than in Grand Gedeh. Despite their presence, they are relatively ineffective in providing better marketing services to farmers.

23. Mandingo traders appear to have a monopsony on produce buying in Nimba.

Credit:

24. Village credit associations (banks) are commonly found in Nimba.

Government Intervention:

25. Community farms are also found in Nimba and tend to be village based.

26. NRDCP has had some influence on farming systems in the project area. Interventions include F.D.A.'s, improved swamp rice farms, fish ponds, rice mills, tree crop seedlings, (cocoa, coffee, and oil palm), and the use of rototillers.

Consumption:

27. Tribal differences appear to exist in the consumption of rice and cassava. Gio seem to prefer cassava and Mano seem to prefer rice.

28. Sugar cane is an important cash crop in Nimba.

HYPOTHESES FOR BONG COUNTY

Upland Rice

1. Access to land is a critical constraint due to the presence of concessions and private ownership of large estates. A number of farm families have been forced to purchase land to secure access. Other farmers must rent or borrow land from those who own it.
2. As in Nimba, weeding is a serious constraint. Scratch-weeding is also commonly practiced in Bong. In addition, a second weeding is usually necessary. Shorter fallow periods may account for this.
3. Like Nimba, reciprocal kuus are commonly used for a wide variety of farming operations. In addition, kuu labor is often hired.
4. Due to the prevalence of secondary bush, groundhogs seem to be a serious problem. As a result, fence building is common (similar to Nimba).
5. Hungry farms are not common in Bong.
6. The sexual division of labor found in Bong is similar to that found in Nimba; however, the pattern is not consistent throughout the county.
7. Compared to Nimba and Grand Gedeh, more farmers in Bong are found growing improved rice varieties. Lac 23 and Gissi 27 are most common.
8. As in Nimba, hiring labor for farming operations is common in Bong. However, the tendency in Bong is to hire kuu labor rather than individual laborers.

Cassava:

9. It appears that less cassava is produced and consumed in Bong than in Nimba.
10. When intercropped with rice, the cassava is often planted before the rice with wide spacing. Cassava is also planted as a second crop on the rice field after the rice is harvested or planted in a separate field.
11. Some farmers do not intercrop cassava with rice because they fear that groundhogs are more attracted to cassava than to rice.

Swamp Rice:

12. Women are more responsible for separate traditional swamp rice farms, but men are partially involved (similar to Nimba). Where a swamp is part of the upland farm, there is no distinction.
13. Upland rice farming and improved swamp rice farming seem to be in competition because of conflicting labor demands.
14. Poisoned rice is used by some farmers as a strategy to deal with rice birds. Nets are also used.

Other Field Crops:

15. Sugar cane is also an important cash crop in Bong.
16. Peanuts are more common in some areas of Bong than others. They are primarily a woman's cash crop usually grown as a second crop after rice.

Tree Crops:

17. Citrus, especially oranges, are an important cash crop to some small farmers in Bong.
18. Rubber is an important cash crop for some small farmers in Bong. The rubber estates and concessions also provide some off-farm employment for farmers in the area.
19. Oil palm does not appear to be cultivated by most small farmers in Bong. However, wild oil palm is an important cash source.
20. Residents of villages located along the main highway seemed to be heavily involved in off-farm employment. Because of this and marketing opportunities, they tend to be more involved in cash crops and less involved in rice production.

Animals:

21. There appears to be less livestock in Bong villages than in Nimba and Grand Gedeh villages.
22. Marine fish appear to be the primary source of meat for feeding kuus.
23. In Bong, as in Nimba, wild game is less important as a source of income than in Grand Gedeh.

Marketing:

24. Tugban seems to be the only major marketing cooperative in Bong. However, Mandingo traders are still the dominant marketing agents for cash crops.

Credit:

25. Village credit associations (susu) are common in Bong.

Government Interventions:

26. BCADP had some influence on farming systems in the project area. Interventions include tree crop seedlings, chemical inputs, development and seasonal loans, improved rice varieties, swamp rice development, wells, and other extension services.

APPENDIX B

Summary of Results for Farming Systems Reconnaissance Survey

Grand Gedeh County

	Gaye Town	Jarwodee	Toyelabli	Bawaydi	Toozon	Gbolue	Gleplay
I. Village Characteristics							
no. of houses	79	85	50	65	57	13	32
school	1 primary	2 primary	1 primary	none	none	none	1 primary
health clinic	none	yes	none	none	none	none	none
market	Wed.	Thurs.	none	none	none	none	none
other govt. offices	none	none	none	none	none	none	none
access to roads	good	not good	bad	good	good	good	good
access to water	creeks	3 wells, creeks	creeks	creeks, making well	creeks	creeks	creeks
presence of village credit association	yes	yes	yes	yes	none	none	none
presence of marketing cooperative	no	yes	no	no	yes	yes	yes
presence of Mandingo traders	yes	yes	yes	yes	yes	yes	yes
community farms	last year, not this year	yes	yes	yes	last year, not this year	yes	yes
government loans	no	no	no	no	no	no	yes-LCC
reciprocal Kuus	no	no	no	no	yes	no	yes
II. Demographic Characteristics							
tribe	Krahn	Krahn	Krahn	Krahn	Krahn	Krahn	Krahn
sub-tribe	Gbarbo	Gbarzon	Gbarbo	Niabo	Kanabo	Tchien	Tchien
district	Gbarzon	Gbarzon	Tchien	Tchien	Kanabo	Tchien	Tchien
# of wives	1-5	1-2	1-2	1-2	1-3	1	1-3
# of children	2-17	3-9	3-5	0-5	0-11	2-8	3-8
# of other household adults	0-14	---	0-2	---	0-1	---	---
total # of household members presently living in house	4-24	5-6	4-9	2-7	3-17	4-5	4-12
III. Farm Characteristics							
Total # of fields	1-14	2-4	1-5	2-6	2-6	1-4	2-4
# of upland rice fields	0-5	1	1-2	1-2	1-2	1	0-2
# of hungry fields	0-2	0	0	0-1	0-3	0	0
# of swamp rice fields	0-6	0	0	0	0	0	0
# of cassava fields	0-1	0-1	0-2	0-2	0-1	0-1	0-1
# of cocoa fields	1	1	0-1	0-1	0-1	0-1	1
# of coffee fields	1-2	0-1	0-2	1	0	0-1	0-1
# of sugar cane fields	0	0	0	0	0	0	0
# of peanut fields	0	0	0	0	0	0	0

APPENDIX B

Grand Gedeh County (cont.)

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	Gaye Town	Jarwodee	Tovelabli	Bawaydi	Toozon	Gbolue	Glepiay
IV. Cropping Patterns							
major crops grown	rice, cassava, coffee, cocoa, plantain, bananas, corn	rice, cassava, coffee, cocoa, plantain, bananas, corn, sweet potatoes	rice, cassava, coffee, cocoa, plantain, bananas, corn	rice, cassava, coffee, cocoa, plantain, bananas, oil palm	rice, cassava, coffee, cocoa, plantain, bananas, corn	rice, cassava, coffee, cocoa, plantain, bananas, corn	rice, cassava, coffee, cocoa, plantain, bananas, corn
length of fallow	6-8	5-9	5-18	4-20	4-15	4-8	2-4
V. Crops							
<u>Upland Rice</u>							
site selection	ease of pulling plants big trees	certain plants warm soil palm trees age of bush	certain plants age of bush palm trees	certain plants age of bush black soil pull plants	certain plants black soil performance of previous crop	black sticky soil big trees age of bush footprint in soil	age of bush sticky soil
area grown (acres/bucket/sacks)	2-6 acres	3-4 acres	3.5-6 acres	1.5-6 acres	2.5-8 acres	2-4 acres	---
diseases	false smut	false smut	false smut	---	false smut	---	---
pests	groundhogs birds squirrels	groundhogs birds termites	groundhogs squirrels termites rats	groundhogs birds squirrels	groundhogs birds squirrels rats	groundhogs birds	groundhogs
land preparation							
brushing							
timing	Oct-Feb	Nov-Feb	Dec-Jan	Nov-Jan	Dec-March	Dec-Jan	January
who	husband, wife, hired labor	husband, male children, hired	husband, wife, children, hired labor, friends	husband, wife, hired labor	husband, male children	husband, wife, children	husband and children, hired labor
mandays *	12-31	27-48	28-95	24-48	9-48	24-48	48
felling of trees							
timing	Jan-Mar	Jan-Mar	Mar-April	Feb-April	March	Feb-Mar	March
who	husband and male children and relatives	husband and male children	husband, male children, male friends, hired labor	husband, male relatives, hired labor	husband, male children, hired labor	husband, male children, hired labor	husband, hired labor

* These are rough estimates.

APPENDIX B

Grand Gedeh County (cont.)

	Gaye Town	Jarwodee	Toyelabli	Bawaydi	Toozon	Gbolue	Gleplay
<u>Upland Rice (cont.)</u>							
felling trees (cont.)							
mandays	5-21	36	10-21	15-36	76	5-18	24
burning							
timing	Mar-May	Mar-April	April-May	Mar-April	April-May	March	April
who	husband, wives	husband, wife, children, rela- tives	husband, wife, male children, relatives	husband, wife	husband and children	wife and hired labor	husband and male children
clearing							
timing	none	none	none	none	none	none	none
who							
mandays							
planting method	dibble	dibble	dibble	dibble	dibble	dibble	dibble
timing	Mar-May	Mar-May	April-May	April-June	April-June	April-May	April-May
who	wives	wives, female relatives	wife, female relatives, friends	wife, female relatives, female friends	wives, female relatives, kuu	wives, female relatives, hired labor	wife, female relatives
mandays	5-15	12-14	12-18	12-32	24-48	10-41	---
intercrops	cassava, okra, bitterball, corn, peppers, plantain, tomatoes, eddoes, yams, coffee, beans	cassava, corn, sweet potatoes, red potatoes, plantain, bana- nas, eddoes, plato, pineap- ple, bitterball, eggplant, sesame, pumpkin, beans	cassava, okra, corn, bananas, plantain, egg- plant, bitter- ball, peppers, sweet potatoes, watergreens, plato	cassava, corn, eggplant, plato peppers, pump- kin, plantain, bananas, beans, yams, bitterball	cassava, okra, pumpkin, corn, eddoes, plan- tain, beans, sweet potatoes, peppers, egg- plant, bitter- ball, bananas	cassava, okra, corn, pumpkin, palaver, peppers, eddoes, pine- apple, bananas, bitterball, egg- plant, sweet potatoes, yams, plato,	cassava, corn, okra, peppers, eddoes, yams, sweet potatoes, plato, bitter- ball, plantain, bananas, beans, pumpkin
birdwatching							
timing	April-June	April-June	none	heading of rice	none	none	none
who	wives, children, husband	wives and chil- dren		husband and wife	--	--	--
fencing							
timing	April-June	July	July	none	none	none	none
who	husband and wives	husband	husband, wives	--	--	--	--
mandays	20-62	24	--	--	--	--	--

APPENDIX B

Grand Gedeh County (cont.)

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	Gaye Town	Jarwodee	Toyelabli	Bawaydi	Toozon	Gbolue	Gleplay
<u>Upland Rice (cont.)</u>							
weeding							
timing	Mar-June	May-July	April-June	June-July	none	none	none
who	wives, hired labor	wives, female relatives	wife and husband	wife, husband	--	--	--
harvesting							
timing	July-Sept	July-Oct	Aug-Oct	Aug-Sept	Aug-Oct	Aug-Sept	Aug-Sept
who	husband, wives, hired labor	wives, hired kuu	wife, husband, relatives, friends	wife, husband, hired labor	wives, husband, hired labor	husband, wife, hired labor	husband, wife
post harvest method	cut and leave in field 2-3 weeks	both - direct to kitchen and dry in field 2 weeks	direct to kitchen	both - direct to kitchen and dry in field 1 week	both - direct to kitchen and dry in field 1 month	--	--
<u>Swamp Rice</u>							
area grown (buckets/sacks)	3.5 acres (2 buckets)	--	--	--	--	--	--
varieties	Gissi 27	--	--	--	--	--	--
pests	groundhogs	--	--	--	--	--	--
inputs	--	--	--	--	--	--	--
land preparation							
brushing							
timing	May-June	--	--	--	--	--	--
who	wives, children, hired labor	--	--	--	--	--	--
mandays	--	--	--	--	--	--	--
building bunds	yes	--	--	--	--	--	--
felling trees							
timing	--	--	--	--	--	--	--
who	--	--	--	--	--	--	--
mandays	--	--	--	--	--	--	--
burning and clearing							
timing	none	--	--	--	--	--	--
who	--	--	--	--	--	--	--
mandays	--	--	--	--	--	--	--

APPENDIX B

Grand Gedeh County (cont.)

	Gaye Town	Jarwodee	Toyelabli	Bawaydi	Toozon	Gbolue	Gleplay
<u>Swamp Rice (cont.)</u>							
planting method	transplant	--	--	--	--	--	--
timing	June-Aug	--	--	--	--	--	--
who	husband, wives	--	--	--	--	--	--
fencing							
timing	--	--	--	--	--	--	--
who	--	--	--	--	--	--	--
mandays	--	--	--	--	--	--	--
harvest							
timing	Oct-Dec	--	--	--	--	--	--
who	husband, wives	--	--	--	--	--	--
post harvest method	--	--	--	--	--	--	--
<u>Cassava</u>							
varieties	Bonuah Kako	Mofo Gbato Setonpon	Gbato Koko	Gbato Koko Ban-weh Bah	Gbato Chu-pala Koko-pala	--	--
diseases	mosaic	mosaic leaf blight	mosaic	mosaic	mosaic	mosaic	mosaic
pests	groundhogs squirrels termites other animals	groundhogs porcupine	groundhogs porcupine deer	groundhogs porcupine	groundhogs other animals	groundhogs other animals	groundhogs porcupines
intercropped with rice (before, with, after)	after (rice 1 ft high)	after (rice 1 ft high)	after	after (rice 1 ft high)	after (rice 1 ft high)	after (rice 1 ft high)	after (rice 1 ft high)
separate stand	yes	yes	yes	yes	yes	yes	yes
# of cuttings	3-5	2-4	3-4	2-5	3-4	--	3-5
fencing	yes (rice)/no	yes (rice)/no	no	yes/no	yes/no	no	no
timing of underbrushing	after harvest rice	after harvest rice	--	--	after harvest rice	--	no
<u>Other Field Crops</u>							
<u>eddoes</u>	yes	yes	no	no	yes	yes	yes
intercropped with	rice, cassava, corn	rice, cassava	--	--	rice	rice, cassava	rice, cassava
<u>sweet potatoes</u>	--	yes	yes	yes	yes	yes	yes
intercropped with	--	rice	rice	cassava	rice, bananas, plantain	rice	cassava

APPENDIX B

Grand Gedeh County (cont.)

	Gaye Town	Jarwodee	Toyelabli	Bawaydi	Toozon	Gbolue	Gleplay
<u>Other Field Crops</u> (cont.)							
<u>yams</u>	yes	yes	yes	yes	yes	yes	no
intercropped with	rice	rice	rice	rice	rice	rice	--
<u>maize</u>	yes	yes	yes	yes	yes	yes	yes
intercropped with	rice, cassava	rice, cassava	rice, cassava, bananas, plan- tain	rice, cassava	rice, cassava	rice, cassava	rice, cassava
<u>sugarcane</u>	yes	no	no	no	no	no	no
intercropped with	--	--	--	--	--	--	--
<u>groundnuts</u>	no	no	no	no	no	no	no
intercropped with	--	--	--	--	--	--	--
<u>vegetables</u>	yes	yes	yes	yes	yes	yes	yes
intercropped with	rice	rice, cassava	rice, cassava, bananas, plan- tain	rice, cassava	rice, cassava separate	rice, cassava	rice, cassava
<u>Coffee</u>							
# years experience	0-20	5-17	10-15	3-16	--	--	8
site selection	old town site; experiment w/ seedlings, plant in rice field	old town site; experiment w/ seedlings	--	experiment with w/seedlings	--	--	plant in rice field that does well, grave! soil
varieties	Robusta, Local	Ivory Coast, Local	Ivory Coast	Kulu (Ivory Coast), LPMC	--	--	LCC
diseases	--	--	--	--	--	--	--
pests	--	termites red ants	--	stem borer termites red ants caterpillars	--	--	stem borer termites
underbrushing							
number	2	2	2	1-2	--	--	2
timing	July-Aug	July-Aug	July-Aug	July, Dec- January	--	--	July-Aug Jan-Feb
thinning or pruning	--	--	--	yes, thin out weak trees prunes seedlings	--	--	--
seed or seedling	both seed and seedling	seedling	--	both seeds and seedling	--	--	seedling

APPENDIX B

Grand Gedeh County (cont.)

	Gaye Town	Jarwodee	Toyelabli	Bawaydi	Toozon	Gholue	Gleplay
<u>Coffee (cont.)</u>							
harvest							
single or multiple	both single and multiple	both single and multiple	single	both single and multiple	--	--	single
timing	Dec-Jan	Dec-Jan	July, Jan	Sept, Dec	--	--	Aug-Sept, Nov-Jan
family/hired	family	family	family, hired	family	--	--	family, hired
clean or cherry	cherry	cherry	cherry	cherry	--	--	cherry
days drying	--	--	--	7-21	--	--	7-14
sacks produced	3-300 single bags	3-10 single bags	8-12 single bags	7-9 single bags	--	--	5-110 single bags
sold to whom	Mandingo	Mandingo	Mandingo	Mandingo, private buyers	--	Mandingo, private buyers	Mandingo, private buyers
price (c/lb.)	20-40c/lb.	15-20c/lb.	20c/lb.	20-40c/lb.	--	25c/lb.	25c/lb.
<u>Cocoa</u>							
# years experience	0-20	2-17	1-10	5-16	15-18	--	8-52
site selection	plants in good rice fields	Old town spot, old rice field, experiment w/ seedling	old rice field	experiment w/ seedlings, old rice field, thick hard soil	--	--	old town site, hard soil, old rice field
varieties	local	Amazon (LPMC) local Ivory Coast	Zwedru local	Ivory Coast Amazon local LPMC	local	--	LCC local
diseases	black pod	black pod	black pod	black pod	black pod	black pod	black pod
pests	stem borer deer, other animals	stem borer squirrels porcupine termites deer cattle monkeys	stem borer squirrels termites deer	stem borer squirrels porcupine termites red and black ants cattle chimpanzees	stem borer squirrels porcupine termites deer baboons	--	stem borer squirrels termites deer red ants chimpanzees
underbrushing							
number	1	1-2	1	1	1	--	1-2
timing	June-July	July-Aug	July-Aug	July	July-Aug	--	July-Aug
thinning or pruning	--	--	--	--	--	--	slight amount thinning
seed or seedling	seed	both seed and seedling	both seed and seedling	both seed and seeding	--	--	both seed and seeding

APPENDIX B

Grand Gedeh County (cont.)

	Gaye Town	Jarwodee	Toyelabli	Bewaydi	Toozon	Gbolue	Gleplay
<u>Cocoa (cont.)</u>							
harvest							
rising	--	July-Oct,	January	Sept-Dec	Sept-Dec	--	Aug-Sept, Nov-Dec
family/hired	family	family	family	family	family and relatives	--	family
days fermented	--	3-7	--	3-4	3	--	3-6
days drying	--	7-14	--	3-5	3-4	--	3-14
sacks produced	2.5	2-9	1	2	4-10	--	13-17
sold to whom	Mandingo	Mandingo	Mandingo	Mandingo, LPMC	Mandingo, cooperative	Mandingo, private trader	Mandingo, private trader
price (c/lb.)	30-40c/lb.	25-30c/lb.	30c/lb.	30-40c/lb.	35-45c/lb.	40c/lb.	35-40c/lb.
<u>Other Tree Crops</u>							
<u>Bananas and Plantain</u>	yes	yes	yes	yes	yes	yes	yes
intercropped with	rice	rice, cocoa, cola	rice, cassava, sweet potatoes	coffee, rice	rice, cassava, separate field	rice	rice
<u>Rubber</u>	--	--	--	--	--	--	--
intercropped with	--	--	--	--	--	--	--
VI <u>Animal Husbandry</u>							
<u>Goats</u>	0-5	1-3	0-1	0-4	0-7	0	0-12
diseases	blindness (infectious conjunctivitis)	--	*	--	--	--	*
<u>Sheep</u>	0	0	0	0-3	0	0-4	0-7
diseases	*	--	*	*	--	*	*
<u>Cattle</u>	--	--	--	--	--	--	--
<u>Pigs</u>	0-100	0-1	--	--	--	--	0-8
<u>Poultry</u>	yes	yes	yes	yes	yes	yes	yes
VII <u>Other Sources of Meat</u>							
wild meat	yes	yes	yes	yes	yes	yes	yes
fishing	yes (trad)	yes (trad)	yes (trad)	yes (trad)	yes (trad)	yes (trad)	yes (trad)
fish ponds	no	no	no	no	no	no	no

* Zeh (mange or scabies)

APPENDIX B

Grand Gedeh County (cont.)

	Gaye Town	Jarwodee	Toyelabli	Bawaydi	Toozon	Gbolue	Gleplay
<u>VII Other Sources of Income</u>							
wild meat sold	yes	yes	yes	yes	yes	yes	yes
migration for employment	no	yes (mining gold and diamonds)	yes (carpenter)	no	yes/no (panning for gold)	yes (recently migrated to town)	no
off-farm employment	yes (carpentry)	no/yes	no/yes	no/yes (mason) (ministry of public works)	no/yes (carpentry) (oil palm concession)	no	no/yes (trader)
arts or crafts	no/yes	no/yes, cane chairs	no	no/yes, mats	no	no	no
farm laborer	no	no	wife works on other farms	no	chain saw cutting trees	no	no
money sent from relatives	yes	yes	yes	yes	no	yes	yes

APPENDIX C

Summary of Results for Farming Systems Reconnaissance Survey

Nimba County

	Boitain	Dohn	Zayglay	Boweh	Zehplay	Gwehrlay	Lampa
I Village Characteristics							
No. of houses	62	81	166	38	35	52	23
school	none	none	1 primary	none	none	none (one in past)	none
health clinic	none	none	none	none	none	none	none
market	none	none	none	none	none	none	none
other govt. offices	none	none	none	none	none	none	none
access to roads	good	good	good	good	good	sub clan chief	none
access to water	creeks	creeks, wells in swamp	18 wells, and creek	wells in creeks	good creeks	good creeks	good creeks
presence of village credit association	yes	yes	yes (4)	yes	yes	yes	yes
presence of Mandingo traders	no	no	yes	no	no	yes	yes
community farms	yes	yes	yes	--	one last year, not this year	none	one last year, not this year
government loans	NCRDP	NCRDP	NCRDP	none	none	none	NCRPD
reciprocal kuus	yes	yes	yes	yes	yes	yes	yes
II Demographic Characteristics							
tribe	Mano	Mano	Gio	Mano	Gio	Gio	Mano
sub-tribe	Lessonah	Lessonah	Zoe	Wee	Gbao	Zoe	Gbannah
district	Saclepea-Mah	Saclepea-Mah	Zoe-Geh	Saclepea-Mah	Zoe-Geh	Zoe-Geh	Saclepea-Mah
# of wives	1-5	2-8	1-2	1-3	1-3	1-3	2-3
# of children	5-28	17-85	3-12	1-12	4-17	0-3	5-8
# of household adults	1-5	--	0-1	--	0-1	--	0-2
total # of household members presently living in house	6-21	--	6-13	9-14	6-15	5	7-12
III Farm Characteristics							
total # of fields	1-11	10	3-6	4-5	3-5	3-4	6-9
# of upland rice fields	1-3	1	1	1-3	1-2	1	1-3
# of hungry fields	0	2	0	0-1	0	0	0-1
# of swamp rice fields	1-3	3	1	0-1	0-1	0-1	0-1
# of cassava fields	1-3	--	0-1	0-1	0-1	1	0-1
# of cocoa fields	1-2	1	0-1	0-1	1-2	0-1	1-2
# of coffee fields	1-2	1	1	1	1-2	0-1	0-2
# of sugarcane fields	0-1	2	0	0	0	0	1-2
# of peanut fields	0	0	0	0	0	0	0-1
Cropping Patterns							
major crops grown	rice, cassava, cocoa, coffee, sugar cane, corn, plantain, banana	rice, cassava, cocoa, coffee, sugar cane, corn plantain, banana	rice, cassava, cocoa, coffee, corn	rice, cassava, cocoa, coffee, corn	rice, cassava, cocoa, coffee, corn, plantain, banana, cola, oranges	rice, cassava, cocoa, coffee, corn, plantain, banana	rice, cassava, cocoa, coffee, corn, plantain, banana, sugar cane, groundnuts

APPENDIX C

Nimba County (cont.)

	Boitain	Dohn	Zayglay	Roweh	Zehplay	Gwehrlay	Lampa
IV Cropping Patterns (cont.)							
length of fallow	6-10	3	6-15	11	6-10	7	10
V Crops							
<u>Upland Rice</u>							
site selection	previous experience, age of bush, presence of certain plants	age of bush	experience, old rice field, age of bush, presence of certain plants	--	black soft soil, age of bush, big trees, ease of pulling plants	tree size, dark leaves, black soil, ease of pulling plants	age of bush, presence of certain plants
area grown (acres/ buckets/sacks)	8-10 acres	--	2-6 acres	1.5-6 acres	4-6 acres	3-4 acres	4-6 acres
diseases	--	--	--	false smut	false smut	--	false smut
pests	groundhogs termites grasshoppers rats	groundhogs birds	groundhogs termites grasshoppers birds	groundhogs termites squirrels porcupine birds rats	groundhogs squirrels termites grasshoppers rats	groundhogs squirrels birds rats	groundhogs termites squirrels birds
land preparation							
brushing							
timing	Jan-Mar	Feb	Mar-April	Feb	Jan-Mar	Mar	Jan-Mar
who	husband, wives, kuu, male relatives, children	husband, wife, kuu	husband, wives, kuu	husband, wives, hired labor, kuu	husband, hired labor, children, kuu	husband, wife, hired kuu	husband, wife, children, kuu, hired kuu
mandays	52-58	24	10-44	24	16-42	48	36
felling of trees							
timing	Jan-May	Feb	April-May	Feb-April	Feb-May	April	Jan-April
who	husband, male children, male relatives, kuu	husband, kuu	husband, hired labor	husband, male children, kuu	husband, hired labor, hired kuu, male children	husband, wife	husband, kuu, children, hired kuu, relatives
burning							
timing	May-June	April	May	May-June	Mar-June	May	April-May
who	husband, male children, male relatives	husband, wives, children	husband, wives, male friends	husband, wife	husband, male children, relatives	husband, wife, relatives	husband, children
clearing							
timing	May-June	May	May-June	June-July	May-June	July	April-May
who	husband, male relatives, kuu	husband	husband, male relatives, hired labor, hired kuu	husband, male children, hired kuu, kuu	husband, male children, hired labor	husband	husband, wife, children, kuu

APPENDIX C

Nimba County (cont.)

	Boitain	Dohn	Zayglay	Boweh	Zeyplay	Gwehrlay	Lampa
<u>Upland Rice (cont.)</u>							
clearing (cont.)							
mandays	72-84	12	9-33	--	--	--	24
planting method	scratching	scratching	scratching	scratching	scratching	scratching	scratching
timing	May-July	May	June	June-July	May-July	July	April-July
who	wives, kuu, hired labor	wives, kuu	wives, female children, hired labor	wives, female children, female relatives, kuu	wives, hired kuu, children, hired labor	wife, husband	wives, children, kuu, hired kuu
mandays	39-77	--	14-48	--	18-28	48	30-58
intercrops	cassava, oil palm, yams, sweet potatoes, okra, pumpkins, corn, bitterball, sesame, plato, watergreens, peppers, eddoes	--	cassava, corn, okra, sesame, plato, squash, peppers, bitterball, eggplant, pumpkin, yams	cassava, corn, okra, bitterball, pumpkin, sesame, plato, peppers, yams, eddoes, sweet potatoes, plantain, bananas	cassava, corn, plato, sesame, watergreens, bitterball, squash, tomatoes, okra, pepper, eddoes, bananas, plantain, plato, coffee, eggplant	cassava, corn, squash, sesame, okra, peppers, bitterball, watergreens, pumpkin, plantain, bananas	cassava, corn, okra, plato, squash, pumpkin, sweet potatoes, eddoes, sesame, pepper, bitterball, tomatoes, cucumber, eggplant, bananas, plantain
birdwatching							
timing	planting, heading	planting only	planting, heading	planting, heading	planting only	planting, heading	planting, heading
who	wives, children, husband	wife, children	wives, husband, children	husband, wife, childrer	husband, wife	husband, wife	husband, wives
fencing							
timing	June-Aug	July	June-Aug	July-Aug	July-Aug	none	June-Aug
who	husband, wives, male relatives, kuu	husband, wives, children	husband, hired labor, kuu	husband, male children, male relatives, hired labor	husband, children, relatives	--	husband, male relatives, hired labor
mandays	96-102	--	36-39	--	--	--	48
weeding							
timing	before planting-June-July, after planting-Aug	--	before planting-June, after planting-July	before planting-June, after planting-Aug, or until rice flowers	before planting-May-July	before planting-July	before planting-May, after planting-Sept
who	wives, kuu	--	wife, female children	wives, female relatives, hired labor	wives, children	--	wives, children, husband

APPENDIX C

Nimba County (cont.)

	Boitain	Deha	Zayglay	Boweh	Zehplay	Gwehrlay	Lampa
<u>Upland Rice (cont.)</u>							
harvesting							
timing	Sept-Nov	--	Sept-Oct	Sept-Dec	Sept-Nov	Nov	Sept-Oct
who	wives, kuu, relatives, hired labor	--	wives, kuu, husband, children	wives, husband, children, relatives, kuu, hired labor	wives, children, husband, hired labor	wife, husband, children	wives, husband, children, kuu, hired labor
post harvest method	leave rice in field on scaffold till end of harvest, or 1 to 2 weeks	--	rice direct to kitchen or left on scaffold 3 days drying	leave cut rice in field on logs 3-4 days	leave rice in field 1-3 weeks	direct to kitchen	put rice on scaffold till harvest finished or 1-4 weeks
<u>Swamp Rice</u>							
area grown (buckets/sacks)	--	--	--	--	--	--	--
varieties	Gissi 27	Suakoko 10	Suakoko 8 Suakoko 10 IR-5 Gissi 27 Cuttington	--	Zoo	--	Gissi 27
pests	--	--	groundhogs	--	--	--	--
inputs	--	--	--	--	--	--	--
land preparation							
brushing							
timing	Feb-Mar	end July	April, Aug	--	Jan	--	--
who	women, men of the village	wife	wives, kuu, husband, hired labor	--	wife	--	--
mandays	--	--	--	--	--	--	--
building bunds	--	--	no	--	no	--	--
felling trees							
timing	--	--	--	--	--	--	--
who	--	--	--	--	--	--	--
mandays	--	--	--	--	--	--	--
burning and clearing							
timing	--	--	April	--	--	--	--
who	women	--	husband, wives	--	wife	--	--

APPENDIX C
Nimba County (cont.)

	Boitain	Dohn	Zayglay	Boweh	Zehplay	Gwehrlay	Lampa
<u>Swamp Rice (cont.)</u>							
burning and clearing (cont.)							
mandays	--	--	--	--	--	--	--
planting method	broadcast	transplants	broadcasts/ scratch, trans- plants	--	broadcasts	--	broadcasts
timing	May-July	--	--	--	June	--	May
who	women (wives)	--	wives	--	wife	--	women (wife)
fencing							
timing	none	--	July	none	none	--	none
who	--	--	husband	--	--	--	--
mandays	--	--	--	--	--	--	--
harvest							
timing	Oct-Dec	--	Nov-Dec	--	Dec	--	Sept-Oct
who	husband, wife	--	wives, husband, kuu	--	wife, children	--	wife, husband
post harvest method	direct to kitchen	--	direct to kitchen	--	--	--	--
<u>Cassava</u>							
varieties	Matadi	Matadi	Matadi local	Matadi local	Matadi local	Matadi	Matadi local
diseases	mosaic	mosaic	mosaic	mosaic	mosaic	mosaic	mosaic, black fung- us on leaves
pests	groundhogs termites porcupines	groundhogs	groundhogs termites squirrels	groundhogs goats squirrels	groundhogs deer	groundhogs deer porcupine grasshoppers	groundhogs stem borers grasshoppers squirrels rats porcupine caterpillar guinea fowl
intercropped with rice (before, with, after)	with rice	with rice	with rice	with rice	with rice	with rice	with rice
separate stand	yes	yes	yes	yes	yes	yes	yes
# of cuttings	3-4	--	2-3	4	4	--	2-4
fencing	no/yes	yes	no/yes	no	no	no	yes

APPENDIX C

Nimba County (cont.)

	Boitain	Dohn	Zayglay	Boweh	Zehplay	Gwehrlay	Lampa
<u>Cassava (cont.)</u>							
timing of under-brushing	after rice harvest	--	after rice harvest	--	after rice harvest	after rice harvest	after rice harvest
<u>Other Field Crops</u>							
<u>eddoes</u>	no/yes	--	yes	no/yes	yes	--	yes
intercropped with	rice, cassava, groundnuts	--	rice, cassava	rice, cassava, yams	rice	--	rice/separate
<u>sweet potatoes</u>	yes	--	no/yes	no/yes	yes	--	yes
intercropped with	rice and separate, corn	--	rice	rice	rice	--	rice
<u>yams</u>	no/yes	--	no/yes	yes	no	--	no
intercropped with	rice	--	rice	rice, cassava, eddoes	--	--	--
<u>maize</u>	yes	yes	yes	yes	yes	yes	yes
intercropped with	rice, cassava, sweet potatoes	rice, cassava	rice, cassava	rice, cassava	rice, cassava	rice	rice, separate
<u>sugar cane</u>	yes	yes	no	no	no	--	yes
intercropped with	separate	separate	--	--	--	--	plantain, bananas
<u>groundnuts</u>	yes	no	no	no	no	--	yes
intercropped with	rice, cassava	--	--	--	--	--	separate
<u>vegetables</u>	yes	yes	yes	yes	yes	yes	yes
intercropped with	rice, cassava	rice	rice, cassava	rice, cassava	rice, cassava	rice	rice, cassava, separate
<u>Coffee</u>							
# years experience	5	15-18	23-25	6-7	5-20	8-15	4-5
site selection	gravel or slope w/loose soil	old town spot	experiment w/ few seedlings, soft place	--	experiment w/ few seedlings	dark soil, plants pull easily, experiment with few seedlings	soft soil
varieties	--	--	from cocopau	local	local from cocopau	Ivory Coast	local
diseases	--	--	--	--	--	--	--
pests	red ants	termites stem borers caterpillars red ants	stem borers red and black ants caterpillars	stem borers red ants	stem borers red ants termites	stem borers red and black ants caterpillars termites	stem borers red ants caterpillars tree squirrels

APPENDIX C

Nimba County (cont.)

	Boitain	Dohn	Zayglay	Boweh	Zehplay	Gwehrlay	Lampa
<u>Coffee (cont.)</u>							
underbrushing							
number	2	1	1-2	2	1-2	2	1-2
timing	July-Aug-1st Jan-Feb-2nd	—	July-Aug-1st Nov-Jan-2nd	—	July-Aug-1st Nov-Jan-2nd	June-1st Dec-2nd	July-Aug-1st Jan-Feb-2nd
thinning or pruning	none	none	none	none	some pruning	none	none
seed or seedling	seedling	both seed, seedling	--	seedling	seedling	seedling	seedling
harvest							
single or multiple	both single, multiple	multiple	both single, multiple	both single, multiple	both single, multiple	single	multiple
timing	Oct-Dec	—	Nov-Feb	Nov	Nov-Feb	Dec	Jan
family/hired	family	—	family	family	family, hired	hired	family
clean or cherry	cherry	cherry	cherry	cherry	cherry	cherry	cherry
sacks produced	8	5-30	6-8	6-10	2-10	16	--
sold to whom	Mandingo	Mandingo	Mandingo, cooperative	Mandingo, Scalepea market	Mandingo, private trader	--	Mandingo
price (c/lb.)	25c/lb.	25c/lb.	25-30c/lb.	30c/lb.	25c/lb.	20c/lb.	30-35c/lb.
<u>Cocoa</u>							
# years experience	4-26	3-18	3-27	2-7	5-24	2-12	4-32
site selection	old town site, experiment w/ seedlings, swampy area	old town site	old town spot, swampy area	--	old town site, soft black soil	black soil, plants pull early, old rice field	old town site, old rice field
varieties	yellow red hybrid-LPMC	LPMC cocoapau (hud)	--	local	local	local	NCRDP cocoapau
diseases	black pod	black pod	black pod	black pod	black pod	black pod	black pod
pests	stem borers squirrels deer red ants	stem borers squirrels red ants groundhogs	stem borers termites	stem borers squirrels deer termites	stem borers squirrels termites domestic ani- mals opposums	termites squirrels caterpillars domestic ani- mals	stem borers squirrels termites opposums
underbrushing							
number	0-1	1	2	1	0-1	1-2	1-2
timing	July-Aug	Aug	--	July-Aug	July-Aug	June-1st Dec-2nd	July-Aug-1st Jan-Feb-2nd
thinning or pruning	none	none	none	none	yes	none	none

APPENDIX C

Nimba County (cont.)

	Boitain	Dohn	Zayglay	Boweh	Zehplay	Gwehrlay	Lampa
<u>Cocoa (cont.)</u>							
seed or seedling	both seed, seedling	both seed, seedling	seed	seedling	both seed, seedling	both seed, seedling	both seed, seedling
harvest							
timing	June-Jan	Aug-Oct	--	--	Aug-Nov	--	--
family/hired	family	family, hired labor	--	family	family, hired labor	hired labor	family
days fermented	6-7	6	7-8	--	6-8	8	7
days drying	3-7	4-8	2-3	--	3-7	4	4
sacks produced	6-58	28-50	5	8	2-6	12	4
sold to whom	Mandingo	Mandingo	Mandingo, cooperative	Saclepea market	Mandingo	--	Mandingo
price (c/lb.)	25-30c/lb.	25-30c/lb.	25c/lb.	40c/lb.	25c/lb.	25c/lb.	35-40c/lb.
<u>Other Tree Crops</u>							
<u>Bananas and Plantain</u>							
intercropped with	yes	yes	no/yes	yes	yes	--	yes
	rice, separate, sweet potatoes	separate	cocoa	rice	rice	--	cocoa, coffee, sugar cane
<u>Rubber</u>							
sold to	none	none	none	none	none	none	none
latex or cuplump	--	--	--	--	--	--	--
VI <u>Animal Husbandry</u>							
<u>Goats</u>							
diseases	0-9	--	0-3	0-3	0-5	--	0-4
	--	--	swelling over eye	blindness	blindness, Zeh (mange or scabies)	--	blindness
<u>Sheep</u>							
diseases	0-15	--	0-4	0-1	0-9	--	0-2
	skin disease, swelling between toes	--	--	--	diarrhea zeh	--	--
<u>Cattle</u>							
	--	--	--	--	--	--	--
<u>Pigs</u>							
	2-20	--	0-20	0-4	0-10	--	0-3
<u>Poultry</u>							
	yes	yes	yes, chickens and ducks	yes	yes, chickens and ducks	--	--
VII <u>Other Sources of Meat</u>							
wild meat	yes	yes	yes	no	no/yes	--	no
fishing	no/yes (trad)	yes (trad)	yes (trad)	no/yes (trad)	no/yes (trad)	--	no
fish ponds	no	yes (1981)	yes (FDA)	no	no	--	no

APPENDIX C

Nimba County (cont.)

	Boitain	Dohn	Zayglay	Boweh	Zehplay	Gwehrlay	Lampa
VIII <u>Other Sources of Income</u>							
wild meat sold	no/yes	no/yes	no/yes	no	yes	--	none
migration for employment	--	--	worked at cocopau 1953, firestone 1965-1974	--	--	--	firestone 1954-1958, diamond mine 1958-1975, 1975-1982
off farm employment	chief-fines	--	--	--	sells snails, forest products	--	sells gin
arts or crafts	--	--	--	--	--	--	--
farm laborer	--	--	--	--	--	--	--
money sent from relatives	yes	--	--	--	--	--	yes

Summary of Results for Farming Systems Reconnaissance Survey

Bong County

	Gbarna	Seata	Santa	Kollieta	Janniepeleta
I. Village Characteristics					
no. of houses	39	13	31	72	27
school	none	none	none	none (one in past)	none
health clinic	none	none	none	none	none
market	none	none	none	Thurs	Mon
other govt. offices	none	none	none	none	none
access to roads	good	fair	good	good	excellent
access to water	creeks	creeks	creeks	creeks (3 wells out of operation)	creeks
presence of village credit association	yes	yes	no	yes	yes
presence of marketing cooperative	yes	no	no	yes	yes
presence of Mandingo traders	yes	yes	yes	yes	yes
community farms	last year, not this year	yes	last year, not this year	yes	last year, not this year
government loans	BCADP	BCADP	BCADP	BCADP	BCADP
reciprocal kuus	yes	yes	yes	yes	yes
II Demographic Characteristics					
tribe	Kpelle	Kpelle	Kpelle	Kpelle	Kpelle
sub-tribe	Jarquelleh	Jarquelleh	Konoyea	Zota	Mbel-quelle
district	Suakako	Panta/Kpai	Salala	Zota	Jarquelleh
# of wives/husbands	1	1-5	0-2	1-2	0-1
# of children	1-7	1-15	2-7	7-11	4-8
# of household adults	0-3	0-3	0-2	0-2	0-2
total # of household members presently living in house	5-8	3-12	5-7	5-14	4-7
III Farm Characteristics					
total # of fields	3-5	2-8	2-4	3-6	2-4
# of upland rice fields	1	1-5	1-2	1	1
# of hungry fields	0	0	0-1	0	0
# of swamp rice fields	0	0-1	0-1	0-1	0
# of cassava fields	0-1	0-1	0-1	0-1	0-1
# of cocoa fields	1-3	1-5	0-1	0-1	0-1
# of coffee fields	0-1	0-1	0	0-1	0-1
# of sugar cane fields	0-1	0-1	0-1	1-2	0-2
# of peanut fields	0-1	0-1	0	0	0

APPENDIX D

Bong County (cont.)

	Gbarna	Senta	Santa	Kollieta	Jannipelata
IV Cropping Patterns					
Major crops grown	rice, cassava, corn, cocoa, coffee, plantain, bananas, sugar, cane, peanuts	rice, cassava, corn, cocoa, coffee, plantain, sugar cane, bananas	rice, cassava, corn, plantain, bananas, peanuts, rubber, sugar cane	rice, cassava, corn, plantain, bananas, cocoa, coffee, oranges, grapefruit	rice, cassava, plantain, bananas, coffee, cocoa, grapefruit, oranges, tangerine, sugar cane, corn, sweet potatoes
length of fallow	6-17	7-40	6-12	6-9	3-8
V Crops					
Upland Rice					
site selection	age of bush, old rice field, presence of certain plants or trees	old rice field, presence of fallen leaves, black soil, age of bush	presence of certain plants or trees, age of bush, old rice field	age of bush, old rice field, presence of certain trees, where one can get permission, lube tree dies	old rice field, age of bush
area grown (acres, buckets or sacks)	3-4 acres (3 1/2 buckets)	3-4 acres (1 to 2 sacks)	3-4 acres (2 1/2-5 buckets)	5-15 acres --	1.5-2 acres (2/3-2 1/2 buckets)
diseases	false smut	false smut	false smut	false smut shoot rot	false smut
pests	groundhogs termites deer rats ground squirrels	groundhogs termites birds rats porcupine ground squirrels worms (stem borer)	groundhogs termites birds rats ground squirrels	groundhogs termites birds rats ground squirrels worms	groundhogs termites birds rats squirrels
land preparation					
brushing					
timing	Nov-Feb	Feb-April	Oct-Mar	Dec-Mar	Feb-April
who	husband, hired labor, kuu, male relatives	husband, wife, kuu, male relatives	husband, male relatives, kuu	husband, children, kuu, hired kuu, hired labor	woman, kuu
mandays	38-49	20-64	9-36	54-156	16
felling of trees					
timing	Feb-April	Feb-April	Jan-Mar	Mar-April	Feb-May
who	husband, male children, kuu, male relatives, male friends	husband, wife, male relatives, kuu, male friends	husband, male relatives, kuu	husband, male children, kuu, hired kuu, hired labor	kuu
mandays	10-28	--	8-24	26-149(?)	4
burning					
timing	Mar-June	Mar-May	Mar-May	May	April-June
who	husband, male friends, male relatives	husband, male relatives	husband, male relatives	husband, male friends, male relatives	women

APPENDIX D

Bong County (cont.)

	Gbarna	Seata	Santa	Kollieta	Janniepeleta
<u>Upland Rice (cont.)</u>					
clearing					
timing	May-June	March-June	Mar-July	May-June	May-July
who	husband, male relatives, kuu	husband, male relatives, kuu, friends	husband, male relatives, kuu	husband, children, kuu, hired kuu, hired labor	woman and family labor
mandays	12-32	16-24	12-26	35-60	2-26
planting method	scratching	scratching	scratching	scratching	scratching
timing	June-July	May-June	April-July	May-Aug	June-July
who	wife, kuu, female relatives, husband	wife, husband, kuu, friends	wife, husband, kuu	wives, female relatives, kuu, hired kuu, children	women, female friends
mandays	21-52	20-42	29	134-142	10-26
intercrops	cassava, corn, planto, sesame, squash, bitterball, bananas, plantain, eddoes, peppers, cucumbers, pumpkins, eggplants, sweet potatoes	cassava, corn, sesame, pepper, okra, bitterball, eggplant, squash, tomatoes, pumpkin, watergreens, planto, eddoes, yams, sweet potatoes, cucumber, plantain	cassava, okra, corn, bananas, plantain, peppers, sesame, bitterball, pumpkin, cucumber, eddoes, yams, sweet potatoes, watergreens, planto, tomatoes, pineapple	corn, bitterball, pumpkin, watergreens, okra, cucumber, squash, peppers, eggplant, eddoes, tomatoes, millet, kellely's greens, sugar cane, planto	corn, okra, pepper, bitterball, sesame, pumpkin, watergreens, sweet potatoes, eddoes, cassava, beans, tomatoes
birdwatching					
timing	planting, heading	planting, heading	planting, heading	planting, heading	not during planting, use chemicals to poison birds, heading
who	wife, children, husband	wife, children, husband	wife, children, husband	wives, children, husband	woman and male relatives
fencing					
timing	July-Aug	June-Aug	June-Aug	July-Aug	September
who	husband, children, kuu	husband, kuu	husband, kuu	husband, children, kuu, male friends	male children, friends
mandays	24-40	20	26	--	--
weeding					
timing	before planting-June-July, after planting	before planting-May-June	before planting-April-July, after planting-Aug	before planting, after planting-Aug	before planting-after planting
who	wife, female relatives	wife, husband	wife, husband, kuu	wife, husband, kuu, children	women
harvesting					
timing	Sept-Oct	Oct-Dec	Oct	Oct-Dec	Nov-Dec

APPENDIX D

Bong County (cont.)

	Gbarua	Seata	Santa	Kollieta	Jannipeleta
<u>Upland Rice (cont.)</u>					
harvesting (cont.)					
who	husband, wife, kuu	husband, wife, children, relatives, kuu, hired kuu	wife, husband, kuu, children	wife, husband, children, kuu, hired kuu	women and kuu
post harvest method	direct to kitchen or leave on logs to dry 2 weeks	direct to kitchen or dry in field on logs or scaffold 5 days to 2 months	direct to kitchen or dry on scaffold 1 week	dry on scaffold 1-2 months	direct to kitchen or dry on scaffold
<u>Swamp Rice</u>					
area grown (buckets/sacks)	--	--	traditional 1 acre	traditional two 5 gallon tins improved 3/4 acre	traditional 1/2-1 bucket
varieties	--	--	Gissie 27	Suakoko 8 IR-5 BG.9-2 Gissi 27	Gbetala or Grampa
pests	--	--	groundhogs termites rats	--	--
inputs	--	--	--	urea, TSP, palazinum	--
land preparation					
brushing					
timing	March	before brushing upland	March	May	part of upland
who	husband, kuu	wife, husband	husband, wife, kuu	kuu	--
mandays	--	--	--	35	--
building bunds	no (next year)	no	no	yes	no
felling trees					
timing	--	--	April	no	--
who	--	--	husband	--	--
mandays	--	--	12-18	--	--
burning and clearing					
timing	April	--	April-May	May	--
who	female relatives	--	husband, wife	men	--
mandays	1	--	--	--	--
planting method					
timing	broadcast	--	broadcast	transplanting	broadcast
who	April	--	April-May	Dec, May (2)	--
who	female relatives	--	wife, husband	hired labor	--

APPENDIX D

Bong County (cont.)

	Gbarna	Seata	Santa	Kollieta	Jannipeleta
fencing					
timing	--	--	July	none	none
who	--	--	husband, kuu	--	--
mandays	--	--	--	--	--
harvest					
timing	--	--	Sept-Dec (after upland rice harvested)	--	--
who	--	--	wife, husband, female friends, hired kuu	men and women	--
post harvest method	--	--	dry on scaffold 1 week	--	--
Cassava					
varieties	Matadi Gbilin Salon	Belaminah Matadi Salon Tusan Behuna	Matadi Ghar Kpalin Caricass I-III Nucass I-II Coco Kpele mana Ghala Kpena	Matadi Two Cents Awakenah Gorbu Gangabpun	--
diseases	mosaic	mosaic	mosaic	mosaic	mosaic
pests	groundhogs red deer porcupines	groundhogs porcupines	groundhogs porcupines termites	groundhogs	groundhogs
intercropped with rice (before, with, after, relay)	before rice	relay	before rice and with rice	before rice or relay	relay
separate stand	yes	yes	yes	yes	yes
# of cuttings	2-4	3	1-3	3	--
fencing	no/yes	no/yes	no/yes	no/yes	no/yes
timing of underbrushing	after rice harvest	--	after rice harvest	March-April	July-Aug
Other Field Crops					
<u>eddoes</u>	no/yes	no/yes	no/yes	no/yes	no/yes
intercropped with	rice, separate	rice	rice	rice	rice
<u>green potatoes</u>	no/yes	no/yes	no/yes	no	no/yes
intercropped with	rice, separate	rice	rice	rice	rice
<u>yams</u>	no	no/yes	no/yes	no	no
intercropped with	--	rice	rice	--	--
<u>maize</u>	yes	yes	yes	yes	yes
intercropped with	rice, cassava, pea- nuts	rice, cassava	rice, cassava	rice	rice

APPENDIX D

Bong County (cont.)

	Gbarna	Seata	Santa	Kollieta	Jannipeleta
<u>sugar cane</u>	no/yes	no/yes	no/yes	yes	yes
intercropped with	separate	separate	separate	rice, bananas and plantain	separate
<u>groundnuts</u>	yes	no/yes	no/yes	no	no
intercropped with	corn, cassava	separate	cassava	--	--
<u>vegetables</u>	yes	yes	yes	yes	yes
intercropped with	rice, cassava	rice, separate	rice, cassava	rice	rice
<u>Coffee</u>					
# years experience	--	0-10	--	0-5	0-7
site selection	--	experiment w/ seedlings, where have land rights	--	--	on an old rice field
varieties	--	improved (BCADP) robusta	--	improved (BCADP)	--
diseases	--	--	--	--	--
pests	--	termites	--	stem borer termites	stem borer termites red ants
underbrushing					
number	--	2	--	2	1
timing	--	July-Aug-1st ---2nd	--	July-Aug-1st ---2nd	July-Aug
thinning or pruning	--	--	--	--	yes
seed or seedling	--	both seed, seedling	--	seedling	seedling
harvest					
single or multiple	--	--	--	single	multiple
timing	--	--	--	--	Dec
family/hired	--	--	--	family	family and hired
clean or cherry	--	--	--	cherry	cherry
days drying	--	--	--	--	14
sacks produced	--	2	--	--	--
sold to whom	--	--	--	--	Mandingo
price (c/lb.)	--	--	--	--	15-20c/lb.
<u>Cocoa</u>					
# years experience	1-30	4-14	1-40	9	7-25
site selection	experiment w/seedlings, old rice and sugar cane field, BCADP choose site, look for...	BCADP choose site, experiment w/seedlings	look for sandy loam, clay area w/palm trees, swampy bush	experiment w/few seedlings, old sugar cane field	experiment w/few seedlings

APPENDIX D

Bong County (cont.)

	Gbarna	Seata	Santa	Kollieta	Janniepeleta
<u>Cocoa (cont.)</u>					
varieties	improved (BCADP) local	improved (BCADP) local	local	--	--
diseases	black pod	black pod	black pod	black pod	black pod
pests	stem borers termites squirrels deer porcupines	stem borers termites squirrels porcupines domestic animals opposums bush cow	--	--	stem borers termites
underbrushing					
number	0-1	1	--	1	1
timing	July-Aug	July-Aug	--	Nov	July-Aug
thinning or pruning	none	none	none	none	yes
seed or seedling	both seed, seedling	both seed, seedling	seeds	seedling	seedling
harvest					
timing	Aug-Jan	Sept-Jan	Aug-Jan	--	Sept
family/hired	family	family	family	--	family
days fermented	2-3	3-7	4-5	5	--
days drying	3-7	6-14	14	7	--
sacks produced	1-13	1-15	5	1 1/2	--
sold to whom	Mandingo	Mandingo	Mandingo, LPMC Agent	Mandingo cooperative	--
price (c/lb)	35-60c/lb.	30-40c/lb.	45c/lb.	25-30c/lb.	--
<u>Other Tree Crops</u>					
<u>Bananas and Plantain</u>	yes	yes	yes	yes	yes
intercropped with	rice	cocoa	rice	sugar cane	coffee, cocoa, citrus, separate
<u>Rubber</u>	present	no	present	present	present
sold to	--	--	rubber concession	--	--
latex or cuplump	--	--	cuplump	--	--
VI <u>Animal Husbandry</u>					
<u>Goats</u>	--	10	--	13	--
diseases	--	--	--	diarrhea, hoof rot	--
<u>Sheep</u>	--	7	--	--	--
diseases	--	--	--	--	--

APPENDIX D

Bong County (cont.)

	Gbarna	Seata	Santa	Kolliea	Jannipeleta
<u>Animal Husbandry (cont.)</u>					
Cattle	--	--	--	--	--
Pigs	--	7	--	--	--
Poultry	yes	yes	yes	yes	--
diseases	diarrhea	--	--	diarrhea	--
<u>VII Other Sources of Meat</u>					
wild meat	no/yes	no/yes	no/yes	no	no/yes
fishing	yes	yes	yes	no	yes
fish ponds	no	no	no	no	no
<u>VIII Other Sources of Income</u>					
wild meat sold	no/yes	no/yes	no/yes	no	no/yes
migration for employment	--	--	Bong Mines 1981	electrician in Monrovia	--
off farm employment	tapping rubber, selling palm wine, oil palm	oil palm, trapper	palm nut oil seller, trapper	school teacher, oil palm, cane juice	--
arts or crafts	--	--	mats, fish traps	--	--
farm laborer	--	--	--	--	--
money sent from relatives	yes (sons, daughters)	yes	yes	yes	yes (sons, daughters)
other sources of income	--	--	firestone pension	nursery of coffee, cocoa and citrus, pastor	--

APPENDIX E

Timing of Cropping Activities for Grand Gedeh

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
<u>Upland Rice</u>												
Brushing			_____								_____	
Felling Trees	_____	_____										
Burning			_____									
Clearing			_____									
Planting			_____									
Fencing			_____									
Weeding			_____									
Harvesting								_____				
<u>Swamp Rice</u>												
Brushing					_____							
Felling Trees												
Burning & Clearing												
Planting												
Harvesting						_____					_____	
<u>Cocoa</u>												
Underbrushing								_____				
Harvesting	_____							_____				
<u>Coffee</u>												
Underbrushing	_____	2nd						_____	1st			_____
Harvesting	_____							_____				_____

APPENDIX F

Timing of Cropping Activities for Nimba County

Jan Feb March April May June July Aug Sept Oct Nov Dec

Upland Rice

Brushing

Felling Trees

Burning

Clearing

Planting

Fencing

Weeding

Harvesting

Swamp Rice

Brushing

Felling Trees

Burning & Clearing

Planting

Harvesting

Cocoa

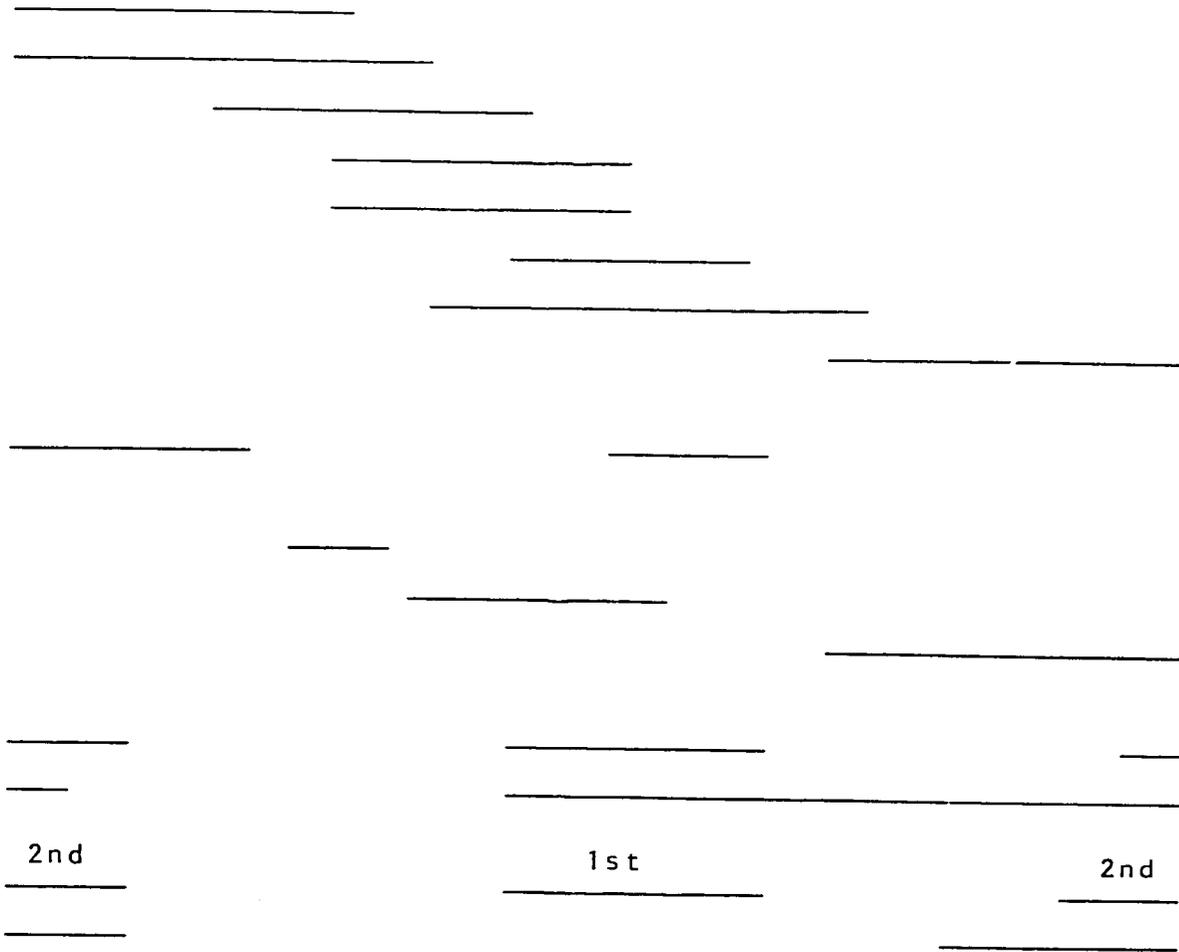
Underbrushing

Harvesting

Coffee

Underbrushing

Harvesting



APPENDIX G

Timing of Cropping Activities for Bong County

	<u>Jan</u>	<u>Feb</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug</u>	<u>Sept</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
<u>Upland Rice</u>												
Brushing	_____									_____		
Felling Trees	_____											
Burning			_____									
Clearing			_____									
Planting				_____								
Fencing							_____					
Weeding				_____								
Harvesting									_____			
<u>Swamp Rice</u>												
Brushing			_____			_____						
Felling Trees				_____								
Burning & Clearing				_____	_____							
Planting				_____	_____							_____
Harvesting									_____			
<u>Cocoa</u>												
Underbrushing							_____				_____	
Harvesting	_____							_____				
<u>Coffee</u>												
Underbrushing							_____					
Harvesting												_____

CROP CALENDAR: Months of Main Farming Activity, by County, Liberia

County	UPLAND RICE					COCOA	COFFEE
	Brushing	Burn	Clearing	Seeding	Harvest	Harvest	Harvest
Bong	Jan. Feb.	April May	May	June July	Oct. Dec.	June July	Feb. March
Grand Bassa	Jan. March	April May	May	May July	Oct. Dec.	Oct. Jan.	Dec. Jan.
Cape Mount	Jan. Feb.	March	April	May June	Sept. Nov.	Oct. Jan.	Dec. Jan.
Lofa	Jan. Feb.	March April	May	May June	Sept. Dec.	June, July, Sept., Nov.	Dec. Jan.
Montserrado	Jan. Feb.	March April	April	May June	Oct. Dec.	Oct. Jan.	Dec. Feb.
Nimba	Jan. Feb.	March April	May	June	Oct. Dec.	Dec. Feb.	Oct. Jan.
Grand Gedeh	Dec. Feb.	March	April	April May	July Sept.	Oct. Jan.	Dec. Jan.
Maryland	Dec. Jan.	March	March	April	July October	Sept. Feb.	Jan. April
Sinoe	Nov. Jan.	Feb. March (?)	Jan. Feb.	Feb. March	June July	Oct. Feb.	Oct. Jan.

Source: Table 10.1, Statistical Handbook, Ministry of Agriculture, 1976
(taken from Carter, 1981)

APPENDIX I

Names of Rice Varieties Found in Grand Gedeh

<u>Upland Rice Varieties</u>	<u>Village</u>	<u>Months to Maturity</u>
Wrakaleh	Gaye Town	4
Desamah*	"	5
Barteah	"	5
Queekor	"	4
Menonkor	"	5
Trondeh	"	4
Bogia	"	4
Neanomoe	"	5
Gblok	"	5
Niwonje	"	4
Kadeortagbo	"	4
Toueh Kor	"	5
Bay-Kor	"	4
Geletonore	"	3
Yanyari	"	5
Squasu	"	3
Cheweesson	"	2
Nowy Yonger	"	-
Foya	"	-
Mandingo	"	-
Mornlay	Jarwodee	5
Kudajaney	"	5
Moiyplee	"	4
Queekor	"	4
Trondeh	"	4
Cheeweesson	"	2
Chewelo	"	-
Menonkor	"	5
Sohr	"	-

* Desemah is found in Bawaydi, Toozon, Gleplay, Gbolue, Gaye Town, and Toyelabli.

Names of Rice Varieties Found in Grand Gedeh

<u>Upland Rice Varieties</u>	<u>Village</u>	<u>Months to Maturity</u>
Moli	Jarwodee	-
Gba da deh	"	-
Congo	"	-
Bowey	Toyelabli	4
Supukor	"	-
Sorbatia	"	5
Queekor	"	4
Cheweeson	"	2
Coruru	"	-
Tua aye	Bawaydi	4
Sorbatia	"	5
Gbar	"	3
Clemesi	"	6
Mon	"	5
Lac 23	"	-
Demali	"	-
Dema	"	-
DorNyenee	Toozon	3
Zoka	"	4
Ghe	"	4
Doodoe	"	3
Venmla	"	-
Koozoo	"	-
Pusava (local)	"	4
Bavoakor	"	4
Kli Gehee	"	-
Doo ba day	"	-
Fla Nyenoh	Gbolue	4
Nyohngbo	"	4
Kpafaday	"	3
Dianusate	"	3
Poyondequa	"	5
Dwewulu	"	3
Menonkor	"	3
Vlayonedu	"	3

Names of Rice Varieties Found in Grand Gedeh

<u>Upland Rice Varieties</u>	<u>Village</u>	<u>Months to Maturity</u>
Manpena	Gleplay	3
Dodo	"	3
Queekor	"	4
Tubotu	"	-
Kor sudi	"	-
Koryea	-	-

<u>Swamp Rice Variety</u>	<u>Village</u>	<u>Months to Maturity</u>
Gissi 27	Gaye Town	-

Names of Rice Varieties Found in Nimba

<u>Upland Rice Varieties</u>	<u>Village</u>	<u>Months to Maturity</u>
Leebay	Dohn	3
Nakatua	"	3
Sankanoeh	Boitain	2
Teabel	"	-
Lalah	"	-
Leebay	"	-
Nakatua	"	-
Plantee	Zeyglay	4
Gloh*	"	4
YooH	"	4
Kankan	"	4
Nakatua	"	3
Belenbe	"	4
Lesah	"	5
Con-ko	"	4
Tea Sah	"	3
Seayee	"	3
Kpontuzor	"	3
Wea la	"	-
Lac 23	Lampa	-
Gblay bayeo	"	5
Gbutea	"	3
Senkanoeh	"	2
Leebay	"	3
Nakatua	"	3
Lalah	"	-
Nakatua	Gwehrlay	3
Bouti	Boweh	-
Sonka	"	-
Nakatua	"	3
Sankanoeh	"	2
Bloo	"	-
Meleken	-	-

* This variety is also known as Bloo.

Names of Rice Varieties Found in Nimba

<u>Upland Rice Varieties</u>	<u>Village</u>	<u>Months to Maturity</u>
Gwesiah	-	-

<u>Swamp Rice Varieties</u>	<u>Village</u>
Gissî 27	Boitan, Lampa
Cuttington	Zayglay
Zor	Zehplay
Sogeda	Gwehrlay
Gbokala	"

Names of Rice Varieties Found in Bong

<u>Upland Rice Varieties</u>	<u>Village</u>	<u>Months to Maturity</u>
Jawortien	Santa	2 - 3
Panteah	"	2 - 3
Jandeh	"	4
Jawo	"	
Valeynu	"	
Jowee	"	5
Telami	"	3
Gbeewobed	"	5
LAC 23	"	5
Tuvborro	"	
Wirre	"	
Ghe-yo-bo	Kollieta	
Hudna	"	
Veyaa	"	
Wirre	"	
Bantain	"	
LAC 23 Red	"	
LAC 23 White	"	
Jonkanoeh	"	
Panteah	"	
Tonwontah	"	
Wirre	"	
Tegbe	"	
Gbogia	"	
Wortah	"	
Pulukpei	Gbarna	5
Gbay wo baye	"	5
Kpe tor ta ee	"	5
Jo kpo wire	"	5
Gwe fa mee	"	5
Wire	"	5

Names of Rice Varieties Found in Bong

<u>Upland Rice Varieties</u>	<u>Village</u>	<u>Months to Maturity</u>
LAC 23	Gbarna	
Guenjiji	"	3
Bototie	"	4
Botata	"	4
Tigbe	"	4
Glekoloi	"	4
Juijui	"	4
Jon kanoeh	"	3
Nhe Nhe	"	4
Way	"	4
Gobisu	"	5
Jalibolon	"	5
Konbwe	"	5
Moyea	"	3
Kunbua	"	5
Cuttington	Seata	
Yo po	"	
Yopulu	"	
Joweh	"	3
Gomea	"	4
Gbetala	Jinniepeleta	6
Mevlon	"	
Tikpee	"	

<u>Swamp Rice Varieties</u>	<u>Village</u>
Gissi	Santa
BG90	Kollieta
Suakoko-8	"
IR5	"

APPENDIX J

Names of Cassava Varieties by County

Grand Gedeh

<u>Cassava Variety</u>	<u>Village</u>
Bonuah	Gaye Town
Coco	"
Mornfo	Jarwodee
Gbarto	"
Say-Ton-pon	"
Boutoh	"
Banweh	Bawaydi
Bah	"
Coco	"
Gbarto	"
Jo-Baa-la	Toozon
Coco	"
Gbarto	"

Nimba

<u>Cassava Variety</u>	<u>Village</u>
Matadi	Boitain
"	Dohn
"	Zayglay
"	Boweh
"	Zehplay
"	Gwehrlay
"	Lampa

Bong County

<u>Cassava Variety</u>	<u>Village</u>
Matadi	Gbarna
Gbilin	"
Solon	"

Names of Cassava Varieties by County

Bong County

<u>Cassava Variety</u>	<u>Village</u>
Belaminah	Seata
Matadi	"
Solon	"
Tusan	"
Behuna	"
Matadi	Santa
Gbarkpalin	"
Caricas 1, 2, 3	"
Nucas 1, 2	"
Coco	"
Kpelemana	"
Gbala kpena	"
Matadi	Kollieta
Two Cents	"
Awakana	"
Gorbu	"
Gangabpun	"

APPENDIX K

Primary Sources Consulted

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APPENDIX L

List of People and Institutions Contacted

Institutions:

USAID, Monrovia
 Central Agricultural Research Institute (CARI)
 LSU (project team)
 Bong County Agricultural Development Project (BCADP)
 Nimba County Rural Development Project (NCRDP)
 Office of Extension, Ministry of Agriculture, Grand Gedeh
 Ministry of Agriculture, Liberia
 Saye-Dube Research Sub-Station, Grand Gedeh
 County Supervisor, Grand Gedeh

Individuals:

John Flynn, USAID Monrovia
 Mark Smith, " "
 Myron Smith, " "
 Lois Richards, Director, USAID, Monrovia
 Arthur Gedeo, Socio-Economic Officer, CARI and Team Member
 John Jallah, Fertility Officer, " " "
 Maran Sherman, Research Assistant, " " "
 Andrew Payne, Director, CARI
 Charles Mulbah, Head of Land and Water Resources Department, CARI
 Joe Subah, Research Coordinator, "
 Sizi Morris, Head of Crop Science Department, "
 Sam Hooke, Administrative Officer, "
 S. Ravindran, Head of Animal Science Department, "
 David Wounuah, Co-leader Root Crops Project, "
 Mallik As-A-Saqui, Co-leader Root Crops Project, "
 James Freeman, Head of Tree Crop Section, "
 Harold Young, LSU Team Leader, CARI
 Hugh Williams, Rice Breeder, LSU Team, CARI
 Dr. Eaverson, LSU Consultant
 John Beavers, LSU Consultant
 Grand Gedeh
 County Supervisor
 County Extension Officer & Staff
 Alonzo Munyeneh, Manager Saye-Dube Research Sub-Station
 Zleh Town Extension Office Staff
 Nimba
 Heiko Dekena, Horticulturalist, German Advisor, NCRDP
 Karl Kirsch, Self-Help, German Advisor, NCRDP
 Mr. Mah, Head of Extension, NCRDP
 Other NCRDP Staff
 Bong
 Jerry Mason, Head Monitoring and Evaluation Section, BCADP
 Other Sector BCADP Staff

Ministry of Agriculture

Deputy Minister Peter Young

Deputy Minister of Planning

Richard Edwards, Sector Analysis, AID Advisor

AID Consultants

Penn Handwerker, Team Leader, Social Institution Profile Team

Leslie Handwerker, " " " "

Jeanette Carter " " " "

APPENDIX M

List of Acronyms

ACDB	Agricultural and Cooperative Development Bank
ADP's	Agricultural Development Projects
BCADP	Bong County Agricultural Development Project
CARI	Central Agricultural Research Institute
IDRC	International Development Research Center, Canada
LCCC	Liberia Cocoa and Coffee Corporation
LP:MC	Liberia Produce Marketing Corporation
LPPC	Liberia Palm Products Corporation
LRDU	Liberia Rubber Development Unit
LSU	Louisiana State University
MOA	Ministry of Agriculture
NCRDP	Nimba County Rural Development Project
USAID	United States Agency for International Development

APPENDIX N

TOPICS OF INQUIRY FOR FARMING SYSTEMS
RECONNAISSANCE SURVEY FOR GRAND GEDEH,
NIMBA, AND BONG COUNTIES

I. Village Characteristics

A. Size of Village (either in household or population)

B. Institutional Development

- Schools
- Health Clinic
- Market
- Other Government Offices
- Access to Roads
- Access to Water

II. Demographic Characteristics

A. Ethnic Affiliation

- Tribe
- Subtribe
- Other Tribal Relationships

B. Composition of Household (who participates jointly on a family farm)

- Adults (males, females)
- Children
- Education of Household Members
- Out-migration

III. Farm Characteristics

A. Access to Land (land tenure inquiries)

- Upland
- Swampland
- Ownership

B. Farm Size (May be determined for rice fields by the amount of seed used.
Fields of tree crops may be determined by number of trees.
Some verification of field sizes will be done through measurement, e.g. # of 5 gallon tins.)

C. Family Fields vs. Individual Fields

IV. Cropping Patterns

- A. Kinds of Crops Grown (e.g. upland rice, swamp rice, cassava, coffee, cocoa, peanuts, sugar cane, citrus, oil palm, rubber, other intercrops)

Why?

- B. Sequence of Crops (period cultivated)

- C. Length of Fallow

Past and present

Indicators of when bush is ready to be cultivated after fallow (plants)

Different fallowing strategies

V. Crops

- A. Upland Rice

Area grown

Site selection

Varieties

Local-name, characteristics, source, selection criteria

Introduced-name, characteristics, source, selection criteria

Diseases and pests

Inputs used - fertilizer, pesticides

Land preparation

Brushing methods, timing, who, mandays, constraints

Felling of trees " " " " "

Burning and clearing " " " " "

Other problems and constraints

Planting methods, timing, who, mandays, constraints, intercrops,

Bird watching " " " " " replanting

Fencing " " " " "

Weeding " " " " " 2nd weeding,

Harvesting " " " " " use of weeds

Post harvest " " " " "

(drying methods, storage methods, threshing methods, milling)

Control of output

Portion marketed - income received

- B. Swamp Rice (traditional vs. improved)

Area grown

Site selection

Varieties

Local-name, characteristics, source, selection criteria

Introduced-name, characteristics, source, selection criteria

Diseases and pests

Inputs used - fertilizer, pesticides

Land preparation (traditional vs. improved)

Brushing	methods, timing, who, mandays, constraints
Felling of trees (stumping)	" " " " "
Burning and clearing	" " " " "

Other problems and constraints

Planting	methods, timing, who, mandays, constraints, intercrops, replanting
Bird watching (1st & 2nd)	" " " " "
Fencing	" " " " "
Weeding	" " " " 2nd weeding,
Harvesting	" " " " use of weeds
Post harvest	" " " " "

(drying methods, storage methods, threshing methods, milling)

Control of output

Portion marketed - income received

Linkage with upland rice and other crops

C. Cassava (pure stand vs. secondary crop)

Area grown

Site selection

Varieties

- Local-name, characteristics, source, selection criteria
- Introduced-name, characteristics, source, selection, criteria (cooking preparation, leaf characteristics)

Diseases and pests

Inputs used - fertilizer, pesticides

Land preparation

Brushing	methods, timing, who, mandays, constraints
Felling of trees	" " " " "
Burning and clearing	" " " " "

Other problems and constraints

Planting	methods, timing, who, mandays, constraints, intercrops, # of cuttings and pattern
Fencing	" " " " "
Underbrushing	" " " " "
Harvesting	" " " " "

(leaf harvesting, timing relative to rice and rains)

Post harvest

(storage - how long do they leave it in the ground and how long will it keep out of the ground?)

Preparation techniques

Portion marketed - income received

Perception of cassava in relation to rice -(hungry season crop)

Use as animal feed

D. Other Field Crops (pursue cropping pattern questions when appropriate)

Tuber crops (eddoes, sweet potatoes, yams, cocoa yams, other)

Maize

Sugar cane (cane juice preparation and marketing)

Groundnuts and other legumes (e.g. cowpeas)

Vegetables (e.g. bitterball, eggplant, okra, pepper - melegulata pepper, tomatoes, pumpkin, watermelon, greens, cabbage, onions, cucumbers, others)

E. Wild Food

Kinds
Names
Uses

F. Tree Crops

1. Coffee

Number of years growing coffee

Site selection

Area grown

Varieties

Local-name, characteristics, source, selection

Introduced-name, characteristics, source, selection

Diseases and pests

Inputs used - fertilizer, pesticides

Land preparation

Brushing timing, who, mandays, constraints

Thinning and pruning " " " "

Problems and constraints (hired labor)

Planting methods, timing, who, mandays, constraints, intercrops

Underbrushing " " " " "

Harvesting " " " " "

(years from planting, hired labor, period of harvest, cherry)

Post harvest

Pulping methods, timing, who, mandays, constraints

Drying " " " " "

Storage " " " " "

Constraints

Marketing (channels, price, transport)

2. Cocoa (see coffee list)

Site selection constraints (soils)

Harvesting

Pods (yellow color)

Post harvest

Depodding (method and timing)

Farmer practice (drying or fermenting)

(drying - tend to split)

(1 week fermenting recommended then slow drying 3-4 hours a day
and stir for 3-4 days then continual drying for 3-4 more days)

Marketing (channels, price, transport)

(price vs. quality if improper drying and fermenting)

3. Citrus (backyard vs. orchard)

Kinds grown (orange, grapefruit)

Site selection

Varieties

Local-name, characteristics, source, selection

Introduced-name, characteristics, source, selection

Diseases and pests

Inputs used

- Land preparation
 Brushing timing, methods, who, mandays, constraints
 Felling trees " " " " "
 Problems and constraints " " " " " intercropping
- Planting
 (spacing, size of seedling, seedling or bud)
 (20 x 16) (5 yr. vs. 3 yr.)
- Underbrushing timing, methods, who, mandays, constraints
 Harvesting " " " " "
 (number of years, period of harvest, days can store)
- Marketing (channels, prices, transport, days can store before marketing)
4. Bananas and plantain (see citrus list)
 How many suckers allowed
5. Mangoes (see citrus list)
6. Oil palm (wild vs. introduced)
 Area grown
 Site selection
 Varieties
 Wild name, characteristics
 Introduced " " source
 Inputs used - fertilizer, pesticides, etc.
 Land preparation
 Brushing methods, timing, who, mandays, constraints
 Felling trees " " " " "
 Problems and constraints " " " " " intercrop
- Planting
 (spacing 30 x 30)
- Underbrushing methods, timing, who, mandays, constraints
 (Intercropping or cover crop)
- Harvest " " " " "
 Post harvest
 Storage
 Sale vs. consumption
 Oil vs. wine
 Marketing (channels - LPMC, local, prices)
 Fresh fruit
 Palm kernels
 Oil
 Wine
7. Rubber
 Area grown
 Site selection
 Varieties name, characteristics, source
 Diseases and pests
 Inputs used - fertilizer, pesticides, etc.
 Land preparation
 Brushing methods, timing, who, mandays, constraints
 Felling trees " " " " "
 Problems and constraints

Planting

(intercrop or cover crop)

Underbrushing

Tapping

(frequency, professional vs. amateur, chemical aids)

Processing latex vs. cuplump (coagulated)

Marketing (channels, prices, transport)

latex vs. cuplump

8. Minor & wild tree crops

(see other tree crops lists)

VI. Animal Husbandry

A. Goats

Number

Husbandry pattern

Feeding practices

(Free vs. controlled)

Diseases, mortality

Role in system

Marketing

Storage of wealth

Social uses

(reciprocal exchange, feed communal labor, bride price, ceremonial, religious, status symbol)

Other factors to consider

(prestige differences, taste differences, ownership - ethnic, religious, sexual)

B. Sheep

(see goat list)

C. Cattle

(see goat list)

Breed

D. Poultry (chickens and ducks)

(see goat list)

Introduced breeds

Egg sales

E. Pigs

(see goat list)

Breeds

F. Food taboos

VII. Wild Game

A. Source of Meat

Deer, groundhog, bush hog, monkey, baboon, rat, snakes, lizards, etc.

B. How often wild meat eaten (importance in diet)

C. Food taboos

- D. Cultural values associated with consumption of wild meat
- E. Source of income (meat, hides, other animal products - marketing)
- F. Game population trends
- G. Hunting restrictions

VIII. Fishing

- A. Traditional Fishing
 - Fishing patterns
 - Importance of fish in diet
 - Fresh vs. dried
 - Marketing (sales and purchases, penetration of marine fish)
- B. Fish Ponds
 - Size
 - Annual vs. seasonal
 - Rice or other crop association
 - Source of fingerlings
 - Marketing
 - Feeding patterns
 - Pond construction
 - Type of fish

IX. Other Sources of Income

- A. Off-farm employment
 - Seasonal migration (concessions, mining, urban employment)
 - Local off-farm employment (shops, mills, itinerant trader, government employee)
 - Arts and crafts
 - Farm laborer
 - Money sent home from relatives (permanent migration)
 - Other enterprises
 - Bride price

X. Credit

- A. Credit association (formal)
- B. Susu
- C. Government loans (projects, Ag. Coop. Dev. Bank)
- D. Relatives
- E. Cooperatives
- F. Other sources
- G. Loan terms (time, interest, grace period)
- H. Reasons for borrowing (social, production improvements, sickness, home improvement)

XII. Consumption

A. Food preferences

Crops

Meat

B. Food habits

Who eats with whom

Number of meals (timing, composition)

Consumption of main meal

Order of eating

C. Recipes (ingredients in main dishes)

D. Seasonality of foods consumed

E. Culturally prescribed foods (infants, lactating women, elderly)

F. Home grown vs. market purchased food

G. Ceremonial foods (occasions and kinds of food eaten)

H. Food taboos

XIII. Material Good Status Indicators (observation)

A. House construction (zinc roof, wall characteristics, type of door and windows)

B. Radio/tape recorder

C. Other

XIV. Kuu Labor

XV. Community Farms

XVI. Other Labor Requirements (village self help)

XVII. Project Interventions