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of Small-Scale Farmers in Jamaica**
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Major professor

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**INDIGENOUS KNOWLEDGE RELATING TO FODDER TREES
AND SILVO-PASTORAL MANAGEMENT SYSTEMS
OF SMALL-SCALE FARMERS IN JAMAICA**

By

Bruce J. Morrison

A THESIS

**Submitted to
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in fulfillment of the requirements
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ABSTRACT

INDIGENOUS KNOWLEDGE RELATING TO FODDER TREES AND SILVO-PASTORAL MANAGEMENT SYSTEMS OF SMALL-SCALE FARMERS IN JAMAICA

By

Bruce J. Morrison

A study of indigenous knowledge relating to fodder trees and silvo-pastoral management systems of small-scale farmers in Jamaica was conducted. The objectives of the study were to 1) explore small farmers' indigenous knowledge relating to fodder trees and silvo-pastoral management systems in a tropical dry climate; 2) conduct a preliminary investigation of the social/cultural environment of the proposed target area; 3) examine pastoral land-use systems and technologies in current use. One fodder tree species (*Brosimum alicastrum*, Breadnut), valued as an important charcoal source, is on the verge of local extinction. Reasons behind the conflict over this species and possible solutions are discussed. Recommendations for introducing improved silvo-pastoral management systems are presented. These include increasing the production of indigenous fodder tree species, introducing improved tree fodder species, and planting improved pasture grasses at the same time as cash trees.

Key words: Indigenous knowledge, fodder trees, silvo-pastoral management system, living fences, Breadnut (*Brosimum alicastrum*).

Dedicated to
my grandfather, who introduced me to trees,
my parents, who allowed me to explore,
and my wife, who encouraged me to persevere.

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Chapter 1

INTRODUCTION AND OVERVIEW OF THE STUDY SITE

1.1 Introduction

The Jamaican Agricultural Development Foundation (JADF) has targeted the Green Park area of Trelawny Parish, Jamaica (Figure 1), as a possible on-farm research/demonstration site for introducing silvo-pastoral innovations among small-scale farmers. Planting trees for cattle fodder is one innovation under study. An in-depth survey of area cattle farming was undertaken in order to examine the validity and increase the potential success of such an innovation. It was the intent of the researcher to gather indigenous knowledge about cattle farming in the area, but also to observe Green Park activities, behaviors, and relationships in trying to determine how these play a part in the bio-physical/social/economic milieu of the area. The success of research activity should be evaluated not only in terms of the number of trees planted or the amount of increased fodder available to animals, but in terms of "social acceptability by the farmer and the people, and how it fits into their socio-economic framework" (Titilola *et al*, 1989).

While indigenous knowledge relating to silvo-pastoral management systems was being gathered, concurrent research was conducted by an agroforestry scientist in Moneague (Figure 1) to test different methods of integrating fodder trees into the pastoral system on small-scale farms in Jamaica. In September 1990, a year-long in-depth socio-economic study was started in Green Park by an anthropologist. In late 1991, a second

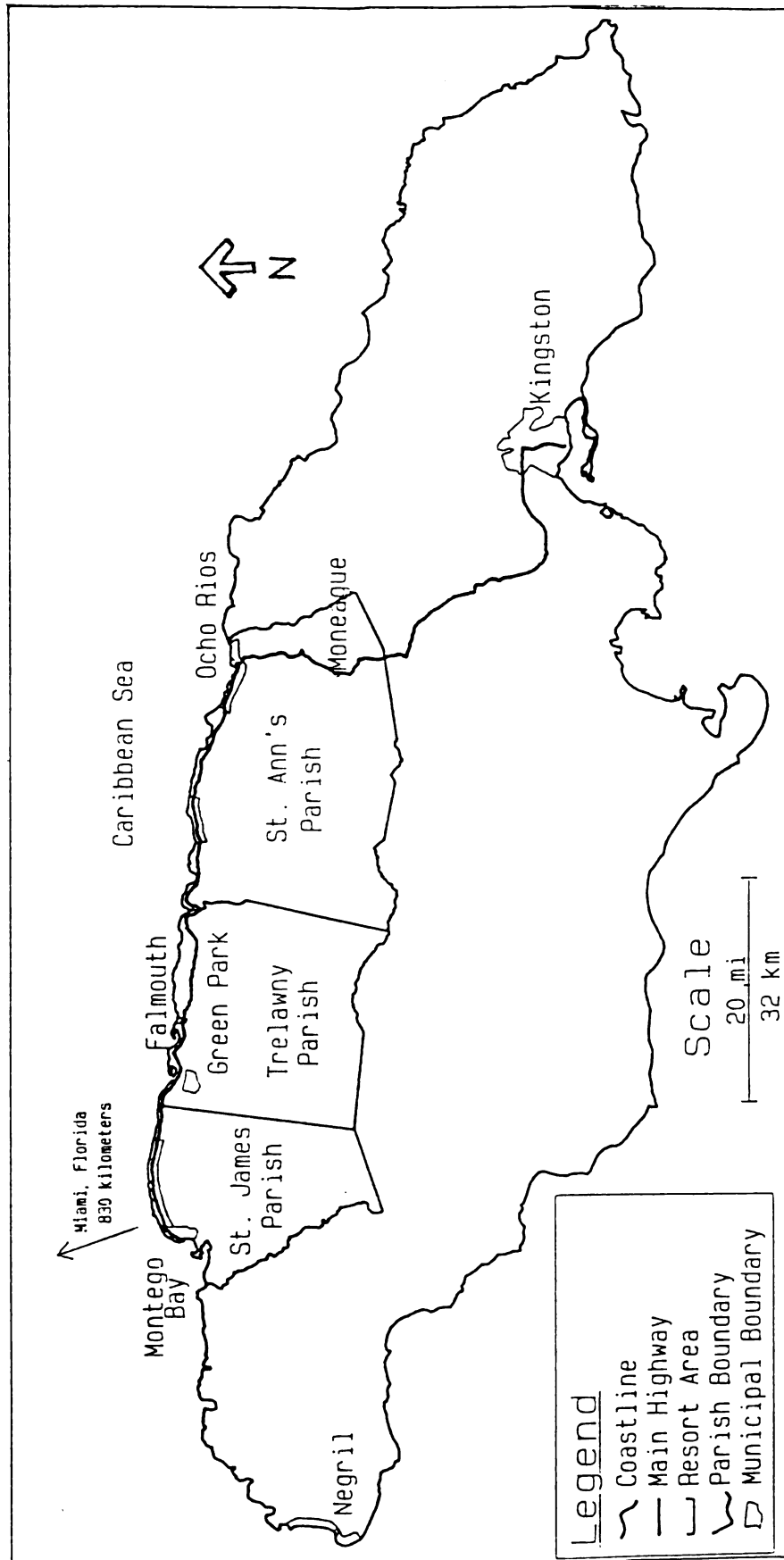


Figure 1. Map of Jamaica

agroforestry scientist will begin incorporating management techniques and monitoring activities based on farmers' knowledge and the previous projects' findings.

1.2 Overview of the Study Site

Green Park, Jamaica (Latitude 18°27' N, Longitude 77°42' W) is located between 6.4 and 9.6 kilometers from the northern coastal town of Falmouth (Figures 1 and 2). Green Park is a valley subdivided into three areas: one farming area known as Green Park proper and two residential areas known as Hammersmith and Lime Skill; the Green Park/Hammersmith/Lime Skill areas will be collectively referred to as "Green Park."

The study site is situated in a rolling valley, comprising five square kilometers with the elevation ranging between 70 and 232 meters above mean sea level. It is bounded on the north by a coastal foothill (of the Cockpit Hills), on the east by Granville and Carrick Foyle (a commercial chicken farm), on the south by another hill and a village called Bounty Hall, and on the west by Georges Valley, a commercial beef cattle ranch incorporated into the Orange Valley Ranch (to the west) many years ago. There are no rivers and only one intermittent creek in the immediate vicinity; the Martha Brae River is over five kilometers away from the area.

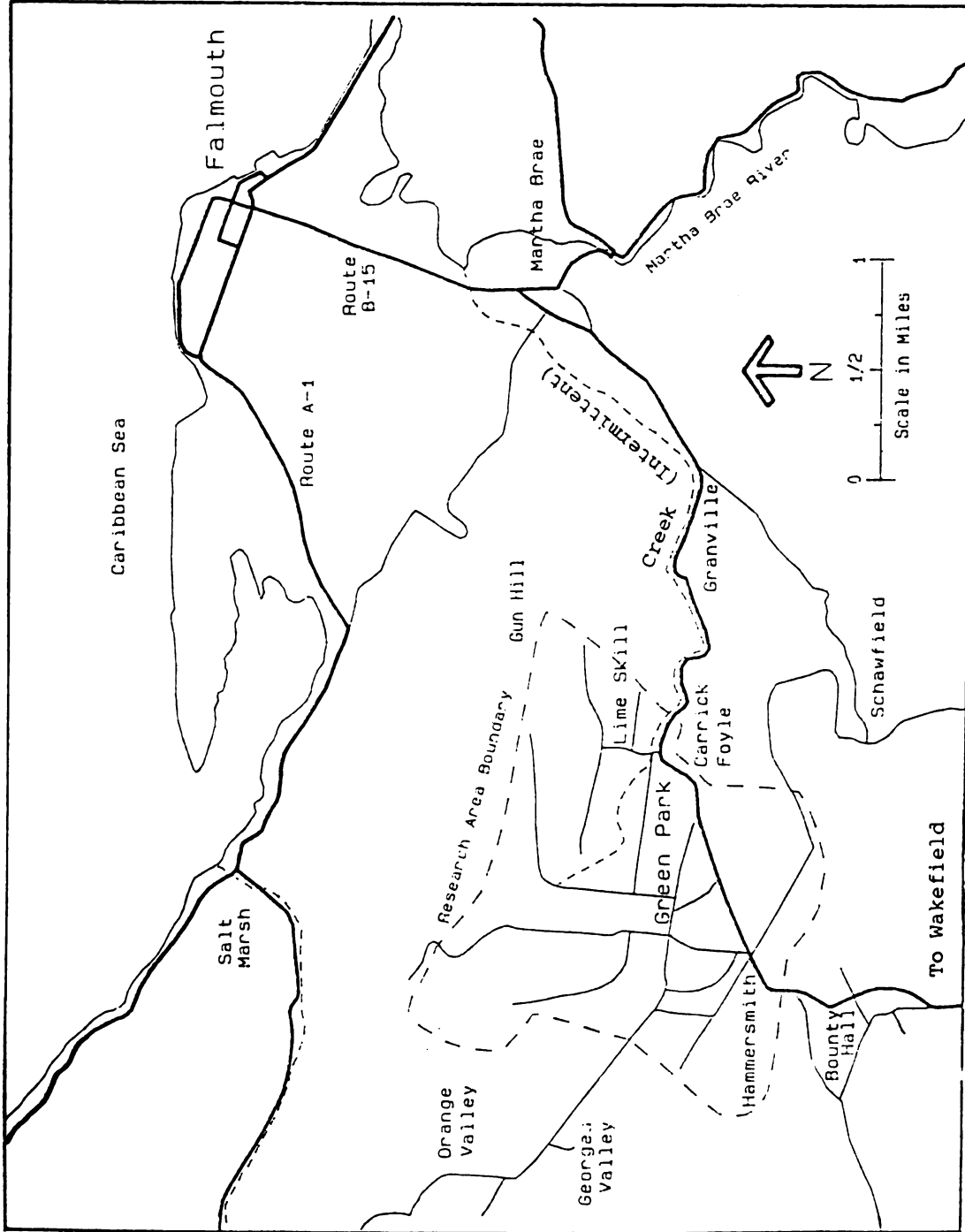


Figure 2. Map of Trelawny Parish--Northwest Portion

Chapter 2

LITERATURE REVIEW

2.1 Climate and Natural Resources

The climate in northern Jamaica is heavily influenced by orographic rain. From November to March, strong northeast winds bring periodic rains and occasional cooler temperatures lasting less than a week (Regional Research Centre, 1970). Green Park has a climate similar to the adjacent Orange Valley ranch, where rainfall data was collected for 91 years through 1960 (Figure 3). The area is prone to drought between the months of January and August, with more than 6 months of the year averaging less than 100 millimeters rainfall per month. In contrast to the average of 1140 mm of annual precipitation recorded at Orange Valley, annual precipitation over a four year period (1977-81) averaged 1880 mm at Allsides (in the Cockpit country), 40 kilometers inland from the coast in southeast Trelawny Parish, (IICA, 1988).

Minimum temperatures at Orange Valley vary between 18° C and 22° C and maximum temperatures vary between 29° C and 33° C; humidity is high at all times, particularly at night (Regional Research Centre, 1970).

In addition to varied rainfall and temperature patterns, area soils partly determine the dominant vegetation. Surface soils are generally loams with limestone subsoils suitable for timber production, improved pasture, sugar cane, and vegetables (Regional Research Centre, 1970). Nearby forests have

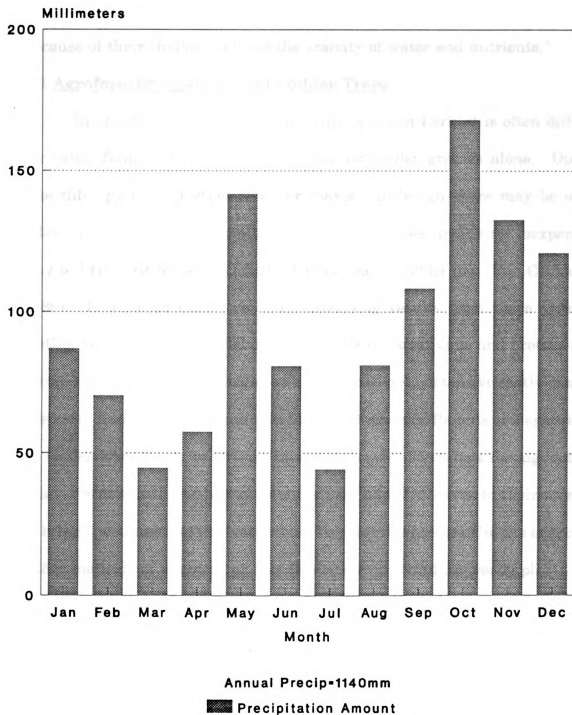


Figure 3. Orange Valley Average Rainfall Distribution: 1870 - 1960.

From: Soil and Land Use Surveys, Regional Research Centre, Soil Science Department, UWI, Trinidad

been classified as severely disturbed dry limestone vegetation (Kapos, 1986). Cleared dry limestone forests "are not especially productive for agriculture because of their shallow soil and the scarcity of water and nutrients."

2.2 Agroforestry Systems and Fodder Trees

In drought-susceptible regions such as Green Park, it is often difficult for cattle farmers to feed their livestock on fodder grasses alone. During droughts, grass production slows or ceases. Although there may be other alternatives available, increasing the tree fodder resource is an inexpensive way to help farmers better bridge the dry-season fodder gap (Von Carlowitz, 1989). Murgueitio (1990) reported promising results from three years of testing an agroforestry model based on utilizing sugar cane and protein-rich, nitrogen-fixing trees and shrubs as an alternative to extensive cattle-grazing systems. Rusten (1989) found that farmers in the middle hills of Nepal relied on fodder trees for up to 50% of the intake needs of livestock throughout the year. Farmers cut tree branches and either take the leaves to their animals or bring the animals to the trees where they eat the leaves off of the branches. Other methods of augmenting tree fodder are to introduce woody plants into the pasture system either as hedgerows or living fences.

A silvo-pastoral hedgerow system might include growing fodder grass between alleys bordered by rows of fodder trees planted a specified distance apart (Atta-Krah and Sumberg, 1988; Wilson *et al*, 1986). These trees are trimmed back periodically. The use of a woody perennial nitrogen fixing hedgerow species might increase grass production. Succulent, protein-rich

regrowth would be fed to the cattle. Deep-rooted woody perennials withstand periodic drought better than shallow-rooted grasses, and provide multiple benefits including: nitrogen fixation (when appropriate species are used), generation of organic matter, improved nutrient cycling, amelioration of the microclimate (flora and fauna), protection of soil against erosion, better use of available phosphorus reserves, and enhanced phosphorus cycling (via mycorrhizal fungi). Francis and Atta-Krah (1989) reported that 10 of 14 farmers at 1 of 2 on-farm research stations in Nigeria have had success with alley cropping using *Gliricidia sepium* (Quickstick); part of the reason for failure at the other station was due in part to farmers' insecurity of land tenure.

Quickstick can be established easily, grows quickly, fixes nitrogen, is not a prolific seeder, and provides leaf fodder for cattle, goats, and pigs. Crude protein content ranges from 20-27%, providing up to 25% of cattle feed input (Atta-Krah and Sumberg, 1988; Budowski, 1987). Addition of cassava to the diet can raise the dry matter digestibility of Quickstick leaves alone from 54-57% to 70-74% (Ademosum *et al*, 1985; Reynolds and Adeoye, 1986).

Farmers in many countries often do not realize the potential of Quickstick as an alternative fodder source. Farmers in Nigeria were surprised and suspicious when informed that Quickstick can be used as fodder (Atta-Krah and Sumberg, 1988). Getting ruminants to eat Quickstick can be difficult since it takes some days before they develop a taste for the leaves (Atta-Krah and Sumberg, 1988). But once the repulsion is overcome, animals

browse it in preference to other sources. Nigerian farmers have been known to add a salt solution to the fodder to make it more palatable before giving it to animals. Another method used in Nigeria is to bring an animal from a household where Quickstick was eaten by animals to help introduce the unfamiliar animals to the feed (Atta-Krah and Sumberg, 1988).

Budowski (1987) describes four main tree species that are planted as living fences in the Caribbean and Central and South America: *Gliricidia sepium* (Quickstick), *Bursera simaruba* (Bujgum), *Spondias purpurea*, and *Erythrina berteroana*.

There are many advantages of using living fences. These include: lower cost for initial material (if nearby and easily accessible); low cost of increasing post density along fences; long durability; possible organic matter production, nitrogen fixation, and beneficial effects on soil fertility; wind and rain erosion is decreased; protection of grasses and animals against wind and sun; added multipurpose benefits of food, feed, medicine, firewood, sticks for growing vegetables, and more live fence posts (species dependent) (Budowski; 1987).

There are disadvantages of living fences over wooden (dead) fences. First, leaves of some trees are not palatable to cattle. Second, generally trees require pruning or else they become too big. Third, trees used with barbed wire that have been blown over in heavy winds are difficult and costly to replace. Fourth, soils may not be adequate to support the species of choice. Finally, the woody plant may compete for water, nutrients, and light with nearby crops or grasses (Budowski; 1987).

There are two systems (active and passive) involved in increasing tree fodder for animals. In active fodder tree management systems (e.g. in Nepal), farmers take their livestock near selected trees along the roadside or in the forest and cut off branches or allow the animals to graze on the lower branches (Panday, 1982). In addition, farmers plant trees for fodder in pastures or on other private property, either specifically for fodder or as a secondary benefit. The extent of a passive systems is to allow livestock to graze upon fruits and leaves of existing woody plants without much input from the farmer.

2.3 Indigenous Knowledge

Gathering indigenous knowledge (local knowledge and experience) of fodder trees in the Green Park area of Jamaica was the major focus of this research. This section centers on indigenous knowledge. In particular, how has indigenous knowledge been overlooked when designing projects, what are the reasons for and examples of its inclusion in project design, and what is the current state of indigenous knowledge specific to fodder trees.

Rural Development

Cernea (1985) contends that if goals involving technical innovations are to be achieved, social and cultural factors, among others, need to be included as project plans are formulated. Brokensha and Riley (1980) claim that a successful agricultural development plan should "emphasize both local vegetation and local knowledge of plants." One way to do this is to explore indigenous knowledge of small-scale farmers (Brokensha *et al*, 1980, Howes, 1980; Rusten, 1989).

Although it may seem innately obvious to incorporate indigenous agricultural knowledge into the design of research projects and extension programs in developing countries, it is seldom done (Schafer, 1989). This oversight has contributed to the failures of many development plans. The oversight is rooted in a "top-down" approach to development, i.e. project planners and administrators, armed with specialized disciplines and information, create and implement plans that affect farmers without consulting them (Chambers, 1983). Development from above has been a common pattern when designing projects, where indigenous knowledge is neglected by both administrators and researchers (Brokensha and Riley, 1980; Rusten, 1989). Many of the mistakes attributed to international development efforts are a result of a "lack of appreciation for the depth and empirical accuracy of much of indigenous knowledge" (McClure, 1989).

Brokensha and Riley (1980) stress the need to combine some aspects of "development from below" with those of administrators and researchers who generally have access to information about farming systems that is generally unattainable by local farmers. "Science" should not oppose "custom", but compliment it. Therefore, if administrators and researchers take advantage of indigenous knowledge and combined it with their own knowledge and experiences, the "international development mistakes" might be reduced.

There are two more reasons why indigenous knowledge should be used in international development projects. McClure (1989) maintains that indigenous knowledge research related to agricultural systems has low costs

and potentially high benefits: the knowledge can serve as a basis for new initiatives in project plans. Finally, Brokensha and Riley (1980) state that "even if most beliefs proved to be empirically unverifiable, it would still be courteous, and efficacious, to find out what people believe, before trying to persuade them to adopt new beliefs."

Fodder Trees

There is little information available to date regarding **actual** fodder productivity and yield of trees and shrubs (Von Carlowitz, 1989). But studies have been done that demonstrate the wealth of information available from indigenous knowledge of farmers. Brokensha and Riley (1980) discuss the comprehensive knowledge base of the Mbeere people of Kenya relating to their surrounding vegetation. They describe how implementation of Mbeere knowledge of indigenous species of fodder trees helps to reduce shortages of animal fodder in the region. The authors maintain that without such knowledge, the Mbeere's very survival would have been threatened, given the dry environment in which they live. Continuing studies in the region (spanning fifteen years) have armed the authors with so much information that they have published two volumes of a book which examine the Mbeeres' extensive knowledge base related to the use of plants and crops as well as trees (Riley and Brokensha, 1988).

Carlioni (1984) reported that farmers in a hillside project in Jamaica were highly adept in traditional mixed farming and could be very articulate about their reasons for allocating their land, labor, and capital. Such

knowledge can be a useful tool in designing an on-farm research project. Knowledge that is borrowed from farmers, developed by foresters and agronomists, and returned to the farmers is more likely to be adopted than outside knowledge (Richards, 1975).

More recently, Rusten (1989) carried out research involving indigenous knowledge of fodder tree resources by small-scale farmers in Nepal. He discovered that farmers in one area in the middle hills of Nepal have sophisticated knowledge of fodder trees and tree fodder, nutritional content of leaves, changes in leaf nutrition that occur over time, and the impact of feeding specific tree fodder admixtures on animal health. Exposing this information is invaluable to foresters throughout the middle hills of the Himalayas who decide which tree species to grow in local nurseries for distribution to interested farmers, and who must learn to "communicate" with farmers based on a clear understanding of the way farmers perceive and use fodder trees.

Bayer (1990) reported that Fulani pastoralists were able to identify 39 shrub and tree fodder species, many of them indigenous. Pastoralists' ranking of the fodder species reflected both the plants' relative abundance and nutritive value when chemical analysis of the plants was completed.

Collymore (1986) described how small-scale farmers in St. Vincent have demonstrated an abundance of local knowledge and environmental awareness that is skillfully used in managing their farming resources despite governmental intervention. Their decision-making centers around the extent of cultivation, crop types and combinations, fertilizer use, and market outlets.

Although the intervention strategies are designed to guide farmers and stimulate development and improvement in the system, these have had little influence on farmers' decision-making processes. Collymore maintains that this failure is due to inappropriate reference and attention to the farmers' working environment: inaccessible farms, rugged and marginal terrain, labor constraints, and market uncertainty. He goes on to say that the situation will persist "as long as agricultural planners adhere to the 'cold rationalism' which is entrenched in their normative models." It is important to understand the dynamics of existing indigenous farming systems before planning changes that may or may not benefit the targeted group and their customs (McClure, 1989).

Although indigenous knowledge is often disregarded in project development, there are instances where assimilation of indigenous knowledge into project design has resulted in increased success. Scott and Gormley (1980) describe how pastoral development projects in the Sahel have often resulted in additional degradation of the resource base. These problems emerged because projects have often ignored traditional mechanisms of survival practiced by pastoral people of this region. In contrast, the authors describe an Oxfam project that was based on an understanding of pastoralists' survival strategies, specifically the custom of "animal of friendship" relations. Planners incorporated the indigenous system of lending animals into the project design, resulting in improved productivity, larger herds, and for the most part, repaid loans. The project administrators were able to respond to pastoralists' needs without generating new dependencies.

2.4 Project Development

Green Park is a non-irrigated, drought-susceptible region comprised of small-scale farms. It was selected as the research site as it provides the opportunity to explore on-farm agroforestry innovations of pastoral land use systems¹. Such areas are often ignored in development because harsh environmental conditions often limit the production and yield of commercial crops or cattle. Less risky research endeavors in higher rainfall regions may result in more fruitful outcomes, but the majority of small-scale farmers in low rainfall/higher risk areas often do not benefit from such research (Chambers, 1983).

Many technological advances in agriculture have been developed through research, particularly on-station research. Although this type of research is important, if the end effect is to transfer the technology to local farmers, it is equally important that local technologies be studied on-farm as well, in order to discover what viable technologies already exist (Titilola *et al*, 1989). In Nigeria, many of the new technologies developed through on-station research involving exotic crop varieties often proved inappropriate for low resource agriculture on surrounding farms. In some cases, the improved crops failed to outyield local varieties, and even where they have done very well, social resistance to change was still a problem to be resolved.

Rather than disrupting a farming system by introducing inappropriate technology or replacing a fodder resource which is adequate with one that is

¹Wilson, George 1990. Personal communication. Dr. George Wilson, Director of Research, Jamaican Agricultural Development Foundation.

unfamiliar to the farmers, it is more beneficial to include local technology in the project (Chambers, 1983; Rusten, 1989). Unless all of the available technology is implemented (including management of the plant), results of any forestry project cannot be guaranteed; "simply getting a tree into the ground does not necessarily mean it has value" (Fortmann, 1988).

Effectively gathering and utilizing indigenous knowledge and technology is realized only through the cooperative effort of four groups: farmers, agricultural scientists, extension agents, and ethnoscientists (Schafer, 1989). Cooperation and integration of knowledge into the project design are the keys to successfully moving technology from on-station controlled experiments, which are replicated in rectangular blocks, to the village, where farmers have carved out all types of field shapes and developed multiple cropping systems.

When designing a development project, especially one that will affect people day in and day out, planners need to be aware of the socio-cultural elements as well as bio-physical elements in the targeted area (Casley and Kumar, 1988). LeFranc (1986) reported that the "importance of local participation in project planning and implementation cannot be overemphasized. Any project must therefore of necessity expend time and effort in identifying the most appropriate ways of ensuring its social and economic acceptability."

Exploratory research is one technique used in attempting to get a better picture of residents' perceptions of farming, institutional constraints, and social interaction patterns (Casley and Kumar, 1988). In this type of research,

residents are encouraged to introduce and expand on topics in which they are interested. By using the results of this exploratory research, planners should be better able to pinpoint barriers to and limitations of success during the project's conception.

2.5 Methods

Data was gathered through informal observation and informal topic-focused interviewing (including ethnographic analysis) based on snowball sampling (information gathering and building) (Casley and Kumar, 1988; Knoke and Kuklinski, 1982; Patton, 1990; Rusten, 1989). Using multiple techniques as a means to gather information is more reliable, adds depth of understanding, and reduces the margin of error compared to the use of only one technique (Webb *et al*, 1966). Crane and Angrosino (1984) claim that "no single approach to field data collection is fool-proof."

Data can be collected quantitatively using an interview guide; other data can be collected qualitatively through informal observation and field note descriptions (Monette *et al*, 1986).

Informal Observation

Informal observation is an open method of observing the behavior of people (Patton, 1990). The observer is direct about the intentions of the research and communicates this openly to those being observed. The role of the observer is one of "onlooker." Observations take place unpredictably and are of limited duration.

There are advantages and disadvantages to informal observation. One advantage is that "observers see a fuller picture beyond the actual interview: they observe actual behavior" (Casley and Kumar, 1988). Informal observation also enables the researcher to acquire a more holistic view of the program being studied (Patton, 1990). Third, Patton contends that if there are time constraints involved (i.e. the researcher does not plan to stay in the area for over a year), informal observation is preferred over a more formal method of observation, such as participant observation.

One disadvantage of field observation is that it is subject to control effect (Webb *et al*, 1966). This means that the initial observation of abnormal activity becomes everyday activity and as the research proceeds, the investigator becomes complacent. This may have been true of the research in Green Park as the researcher became more familiar with daily activities or responses to interview questions. But while observations of general activity may have decreased over time, Barrett (1984) contends that the increased knowledge of the researcher "increases his capability to formulate penetrating questions, thereby eliciting new information."

Finally, Webb *et al* (1966) contend that a biased viewpoint may occur when the principal observer "selectively exposes himself to the data, or selectively perceive them, and shift over time the calibration of his observation measures." This can be minimized by: 1)checking and comparing observations against interview responses; 2)countering with disinformation during interviews as a validity check (Douglas, 1985); 3)re-interviewing farmers for

verification; and 4) discussing questionable behavior or actions with the facilitator or other trusted informants (Barrett, 1984).

Informal Interviewing

The appearance, style, and manner of introduction are crucial in gaining acceptance into the community and in developing trust between the interviewees and the researcher, allowing him to better accomplish his objectives (Casley and Kumar, 1988). The intent is to establish a role as a "conspicuous visitor" rather than a "spy" (Barrett, 1984). By living in the study area, the researcher is considered less of an outsider and able to learn more about the area (Chambers, 1983).

When interviewing farmers, it is important that the researcher word questions in a manner that elicits responses that are crucial to understanding the whole farming situation (Casley and Kumar, 1988; Crane and Angrosino, 1984). When given the chance it is more important to probe deeper into new "pay dirt" (Douglas, 1985).

There are advantages and disadvantages of conducting semi-structured interviews. Casley and Kumar (1988) note some of the advantages. First, information obtained is specific to the needs of project planners. Second, the information from various respondents is comparable enough to determine the simple frequency of responses, although the main emphasis continues to be placed on the in-depth understanding provided by the respondents. Third, this type of interview can be conducted more rapidly than formal surveys. Finally, compared with other types of qualitative interviews, success is less dependent

upon the interviewer's interpersonal communication skills and grasp of the subject.

There are also disadvantages to conducting open-ended interviews. The most outstanding disadvantage is that if respondents are given liberty to talk, they may end up conversing about irrelevant information. Webb *et al* (1966) refer to this as dross rate. If this happens and the interviewer has to constantly "pull" the conversation back, the respondent may be offended and alter his/her answers or refuse to continue.

Another disadvantage of an open-ended interview is that the researcher may determine that questions should be deleted or added based on the relevance of the shared information after beginning the interview process (Casley and Kumar, 1988).

Logistics are critical to the interviewing process. Interviews should start with the most trustworthy and the most experienced informant and proceed from there to the less trustworthy and less experienced (Douglas, 1985). Only one question should be delivered at a time to avoid confusion on the part of the respondent (Casley and Kumar, 1988). Whenever possible, the researcher should volunteer information about himself (or herself) or the topic at hand in order to help the informant place the researcher in a familiar social category. Once the respondent feels at ease, the researcher can move on to more in-depth and more sensitive questions, being careful not to offend the respondent or cause him to suspect that the researcher is anyone else (e.g. a government worker or someone who would raise their taxes).

Snowball Sampling

This method of sampling occurs when one farmer refers the interviewer to another farmer until all farmers in a study area have been contacted (Knoke and Kuklinski, 1982). Research boundaries are established according to the study objectives, the time allotted for the study, and the expected number of respondents who can be interviewed within the specified time-frame.

2.6 Study Objectives

The objectives for the study in Green Park were to: 1)explore small-scale farmers' indigenous knowledge relating to fodder trees and silvo-pastoral management systems; 2)conduct a preliminary investigation of the social/cultural environment of the proposed target area; and 3)examine pastoral land use systems and technologies currently being used by farmers. Research was carried out between April and July, 1990.

Chapter 3

MATERIALS AND METHODS

3.1 Materials

A three-page interview guide was developed to elicit candid verbal responses and allow the researcher to record non-verbal communication of farmers during interviews (the guide was created before the study, and revisions were made during the initial weeks of the study). A portable cassette recorder was used to record verbal responses during interviews in case there were any discrepancies when transferring responses to more permanent records. Finally, the researcher used a bicycle to aid in observation of the study area and its inhabitants.

The researcher had fifteen weeks to gather as much relevant information as possible. He worked closely with one farmer who knew the community well and served as a logistician, facilitator, and as an interpreter at times (when the researcher was unclear about interviewees' responses). The facilitator "opened the door" to Green Park and its residents for the researcher. This farmer was perhaps the most important key to the researcher's success at having interviewed over 90% of the cattle farmers in Green Park at a time when their perceptions concerning development projects were less than positive.

During the fifteen week study, the researcher lived with a retired couple within the community. He wore clothes that were acceptable in appearance, without "over-dressing." In meeting Green Park residents, he made attempts

to greet them cordially and relate with them openly in order to minimize suspicion and rumors. Like most of the farmers in the area, the researcher was on foot when meetings took place; at other times he was either on foot or on a bicycle.

3.2 Methods

Data was gathered using informal observation and informal topic-focused interviewing based on snowball sampling. Most data was collected quantitatively using the interview guide (Appendix A.). Other data was collected qualitatively through informal observation and field note descriptions. Data categories and collection modes used are listed in Table 1. Information from some data categories was collected using both modes. For example, during the survey, farmers indicated that praedial larceny was one of the impediments to raising animals (quantitative data), but the researcher also observed the affect praedial larceny had on farmers and the degeneration of trust that ensued between victims and suspicious residents (when warranted) as a result of the offense (qualitative data).

It would be pointless to claim that there were not any factions among the farmers in Green Park. The researcher realized this when he arrived and made attempts to remain open-minded. It should be noted that there were instances where some farmers were suspicious of the research, the researcher, or possibly of initial meetings with farmers other than themselves. In the end, only two farmers refused interviews. Suspicion diminished as the study progressed and the intent of the research became known by way of meetings,

Table 1. Data Categories and Collection Modes Used

<u>Data</u>	<u>Collected</u>	
	<u>Quantitatively</u>	<u>Qualitatively</u>
<i>General Information</i>		
Farmer's age; gender; occupation	X	
Years in Green Park; years raising cattle	X	
Means of transportation	X	
Underemployment in the area		X
Farmers' involvement in projects	X	
Farmers' knowledge about plowing with animals	X	
Animals other than cattle raised by farmers	X	
Impediments to raising other animals	X	
Vegetable crops raised by farmers	X	
Problems with securing labor for farm work		X
Problems with praedial larceny	X	X
Farmers' outlook on government policy & programs		X
Trust within the farming community		X
<i>General Cattle-Related Information</i>		
Time spent doing tasks	X	
Reasons for raising cattle	X	
Impediments to raising cattle	X	X
Interest in continuing raising cattle	X	
Number of cattle; number that died during drought	X	
Acreage available to raise cattle	X	
Service bull information	X	
Methods of cattle and paddock management	X	
Costs involved with cattle/paddock management	X	
<i>Selling Cattle</i>		
Who is involved in selling cattle	X	
Price paid for selling cattle	X	
Age of cattle when selling	X	
Steps involved in a feasible sale		X
<i>Fodder Information</i>		
Fodder available with/without adequate precipitation	X	
Methods of and time and cost involved in retrieval	X	
<i>Tree Fodder Information</i>		
Techniques related to tree fodder management	X	
Knowledge of tree species used for tree fodder	X	
Fodder tree reproduction and seasonality of fruiting	X	
Process involved in planting trees	X	

interviews with acquaintances of the suspicious farmers, and conversions between farmers.

Informal Observation

Informal observation was carried out in Green Park through the following activities: 1)casual conversations between residents; 2)examination of everyday activities, especially those concerning farming in and around the research site; and 3)researcher participation in various farming activities, including: driving and watering cattle, "cleaning" pastures (removing or setting back unwanted vegetation), and working with other farmers in "field day" projects. It was through these activities that the researcher began to understand some of the socio-economic problems that existed in the community. For example, there is a tree species in Green Park and environs that is highly valued as fodder by cattle farmers and as a source of fuel by charcoal producers. By observing a short, but intense, conversation between members of the two groups one day, it became apparent that a verbal agreement over rights to certain trees had been violated.

Informal Interviewing

Informal topic-focused interviews were conducted to gather baseline information and indigenous knowledge relating to cattle farming in Green Park. The researcher, not previously trained to conduct interviews, had four years of international forestry experience in lesser developed countries where he communicated readily with farmers involved with social forestry projects.

During interviews in Green Park, knowledge about local politics and socio-economic situations, as well as cattle and fodder information, was conveyed to the interviewer. Cattle farmers were encouraged to talk about matters which they deemed important. While conducting interviews, the researcher had few problems with drop rate. In the few instances when it

happened, the researcher brought the respondent back on task by acknowledging concern but then posing the next question.

As it turned out, a few of the guide questions were added and a few were dropped. With respect to the latter, the deleted questions did not jeopardize attainment of the stated objectives. The added questions were posed to all but one of the initial farmers before the researcher left the area, so the data collected is virtually complete.

The researcher started his interviewing with the facilitator and continued with others using a snowball sampling method. Not only did the facilitator know a lot about cattle farming in the area, but he also had worked with outside interviewers before. He was capable of offering alternative ways of stating questions, thus enabling informants to share their knowledge with the researcher more easily. Once minor revisions were made, other informants were interviewed.

Informal interviews were carried out in the following manner. Generally, interview meetings were arranged ahead of time by the facilitator, the researcher, or both. Before beginning the interview, the researcher introduced himself, explained why he was doing the study, and that any responses would only be used by the researcher and aggregated so that there would not be any way for outsiders to associate the data with the respondent. Depending on the reaction of the respondent, further explanations were offered until the farmer understood what the study was about and felt comfortable with being interviewed. Then the researcher asked if he could use a tape recorder during the interview. If respondents were amenable, the interview started. If they were not, they were told that only the researcher would use the recorded responses to clarify any points or anomalies that arose while going over the responses during the post-interview data processing.

A few respondents did not want to be recorded, and their wish was granted outright. One farmer stated that he would be willing to be recorded, but wanted to hear the whole interview played back after completion. Nightfall was imminent and it was important to interview the farmer while he was available, so the researcher abandoned use of the recorder in lieu of manually recording the responses.

Interviews were started by asking general questions: e.g. where the respondent grew up, when they started raising cattle, how many people were involved in raising the cattle. Only one question was delivered at a time. Whenever possible, the researcher volunteered information about himself or the topic at hand. Once the respondent felt at ease, the researcher moved on to more in-depth and more sensitive questions, being careful not to offend the respondent or cause him to suspect that the researcher was anything other than a student doing research. All but two interviews were completed once they began. Information from these incomplete interviews were not aggregated with other responses.

Initially, a few of the researcher's questions were posed in different ways by the facilitator. Once the researcher discovered the means by which respondents understood these questions without second-guessing, he posed them himself.

Rather than asking "what do you do when you plant a tree?," the statement put forward was "describe to me the steps involved in planting trees around your house or in your field." Probing for answers was not that necessary in Green Park. Most interviewees were quite open and willing to divulge their successes and hardships.

Snowball Sampling

Attempts were made to interview all small-scale farmers who have cattle in the Green Park valley within the 15 week time-frame using snowball sampling. Initially, a short list of small-scale farmers' names were collected during an introductory meeting with the farmers. Other qualified farmers in the valley were added when they were mentioned during interviews with farmers or during meetings with the facilitator. The research area boundary was established based on the 15-week time-frame and the goal of interviewing all of the farmers with cattle in Green Park (the primary zone). There was not enough time to interview farmers in other zones, so names of these farmers were eliminated. Also, since results of the research were intended to be used in a project design for small-scale farmers, those valley farmers with over 40 head of cattle (large-scale farmers) were eliminated.

From a list of 45 names, 40 farmers agreed to be interviewed; 1 farmer refused to be interviewed, but still talked about barriers to development; 1 farmer refused to continue the interview under the suspicion that the researcher was a government spy. Three farmers either could not be contacted or were too busy to participate in the interview process.

Chapter 4

RESULTS

Introduction

Information collected during the study is listed in Table 1. A detailed description of Green Park appears in section 4.1. Indigenous knowledge of local fodder trees appears in section 4.2. Information related to the social/cultural environment appears in section 4.3. Finally, pastoral land use systems and technologies in Green Park are described in section 4.4.

4.1 Detailed Description of the Study Site

The Green Park Community

Thirty-five (39%) of the approximately 90 households in the Green Park valley had at least one member who was engaged in raising cattle. Thirty-two of these 35 individuals, plus 8 cattle farmers living outside of the area (who had cattle in Green Park), were interviewed during the field research. None of the farmers belonged to the Jamaican Livestock Association or any other organized group. All of the farmers in the study have secure tenure of, or have access to, some land and tree resources. With regard to land holdings, three out of 40 cattle farmers had access to land over 100 acres; the remaining 37 held claim to an average of 13.9 acres (range 3-55), with an average of 11.4 acres (range 1.5-50) available for raising cattle (82.2% of total acreage).

Unlike most Jamaicans, most Green Park farmers have not acquired their holdings through ancestral inheritance. Historically, Green Park was a sugar cane estate with facilities and equipment to process cane into sugar.

This sugar was sold on the world market out of Falmouth, the fourth most important town in Jamaica in the early 1800s (due to wet sugar exports) and a major shipping port through the mid-1900s (Clarke and Hodgkiss, 1974). In 1955, the estate was closed, the equipment auctioned off, and the Kaiser Bauxite Mining Company acquired the estate property and nearby forested hills. The mining company divided up the land into parcels and used them for resettlement purposes. In the 1960s and 1970s, in various areas throughout Jamaica where Kaiser Bauxite wanted to mine, farmers were given the opportunity to acquire a parcel of land and relocate elsewhere. Green Park was set aside as one area for relocation. A few farmers opted to relocate to Green Park from other areas, while others sold their acquired Green Park parcels to nearby inhabitants or to Jamaicans who had been working overseas, returned, and were in search of a place to settle. As such, the general makeup of the Green Park population today is quite varied. The cattle farmers who were interviewed were represented as follows: 10% were relocated from nearby parishes, 10% worked overseas and resettled in Green Park, 12.5% grew up in the area, and 67.5% lived outside of the valley and purchased parcels in Green Park from residents who were moving out or from resettled farmers who did not move to Green Park from mining areas.

All of the cattle farmers in the study live in their own homes. Older houses have a wooden-frame construction, while those that were built in the past 10-20 years have either wooden-frame or cement block/concrete construction. About half of the houses have protective bars over the windows

or surrounding the verandas, a consequence of increased reports of larceny in the past decade. Most houses have been connected to the public water supply and electric power, although cutoffs are common if residents fail to pay their bills or if they have attempted to make illegal connections. Power outages were not uncommon during the research period due to malfunctioning generators in the capital city, Kingston. There are no phones (private or public) in the valley.

A few children go to private schools. There is an all-age (grades 1-8) school in Granville, 1-3 kilometers away, and a high school in Martha Brae, 5-6.5 kilometers away. Both schools are just off the road leading to Falmouth. Almost all of the children in the area go to school, regardless of their economic background.

The only church (Catholic) in the research area is located near Hammersmith. Other religions in Trelawny Parish include: Baptist, Anglican, Methodist, Presbyterian, and Mormon (Clarke and Hodgkiss, 1974). There are at least 6 stores in the immediate area, and 3 of these carry more than the basic amenities of soaps and canned goods. Some of these stores serve as outlets for farm produce. There are at least 5 bars in the valley.

Past Projects in the Area

There have been a few projects in the area. Some were private ventures between Americans and Jamaicans², but these did not affect farming practices

²Brooks, Charles 1990. Personal Communication. Mr. Brooks is an Extension Agent in Trelawny Parish and is in charge of activities in the Green Park District (the boundaries extend beyond those of the research area).

in Green Park. One of the biggest projects that did influence farming in Green Park was the Agricultural Marketing Corporation (AMC).

Created by an Act of Parliament in 1963, the AMC originally had two objectives: 1) to encourage local food production as a means of reducing imports by providing farmers an assured market and guaranteed prices; 2) to provide food to consumers at the lowest possible price (Lewars, 1981). In the 1970s, Prime Minister Michael Manley (People's National Party) gave increased support to the program and also established agricultural cooperatives (Stone, 1989). Farmers enjoyed many benefits from the AMC program, including a guaranteed market for their crops. But in 1980, Edward Seaga (Jamaica Labour Party) took over as Prime Minister and essentially dismantled the corporation, citing losses stemming from stiff competition with higgler³ and losses from spoilage. Farmers looked for alternative methods of raising income.

Through the 1970s, the Agricultural Office in Trelawny Parish had a number of extension programs that transferred the latest technical know-how by holding "field days," a variation of "morning sport" where the host farmer feeds those who assist him (Henry, 1980). Extension officers would plan a day when farmers would assemble at one farm and transfer new technology via short introductions and direct farmer involvement. These would include planting fruit trees, grafting demonstrations, or planting improved varieties of crops or pasture grasses. Women often participated in the activities. Food

³ People who generally buy from farmers and sell to shop owners or vendors along streets or in the local markets.

was prepared, and after a few hours of labor, the farmers would have a feast. According to two farmers, everybody looked forward to and enjoyed the field days. These demonstration programs and most of the field extension officers' positions were phased out in the late 1970s and 1980s.

There was a soil conservation project in the southern part of Trelawny Parish from 1985 to 1987 called the Pilot Hillside Agricultural Project, sponsored by the International Institute of Caribbean Agriculture (IICA, 1988). The focus of the project was to install erosion barriers along the contour of the hills (terracing). Between 1977-1980, growing fodder grasses on risers was explored. IICA reported that zero-grazed Napier grass was successfully grown on risers totalling 0.07 ha (0.18 acres), feeding 2 head of cattle and 4 goats. As long as the grass was not grazed, Napier served a dual purpose: stabilizing the risers and feeding animals.

Another project called JAMGIS analyzed deforestation in the Cockpit country in 1987 using geological information from satellite imagery data, but this had no impact on farmers (Eyre, 1989).

Farming Practices

Cattle paddocks surround Green Park proper (Figure 4), and are usually sectioned off with barbed wire attached to naturally decay-resistant wooden posts that are cut nearby. Houses dot the rolling landscape. There is a centralized water trough for cattle, with water being supplied at no charge to the farmers through an agreement with the water commission. The water cannot be used for irrigation of surrounding paddocks or fields. If improved

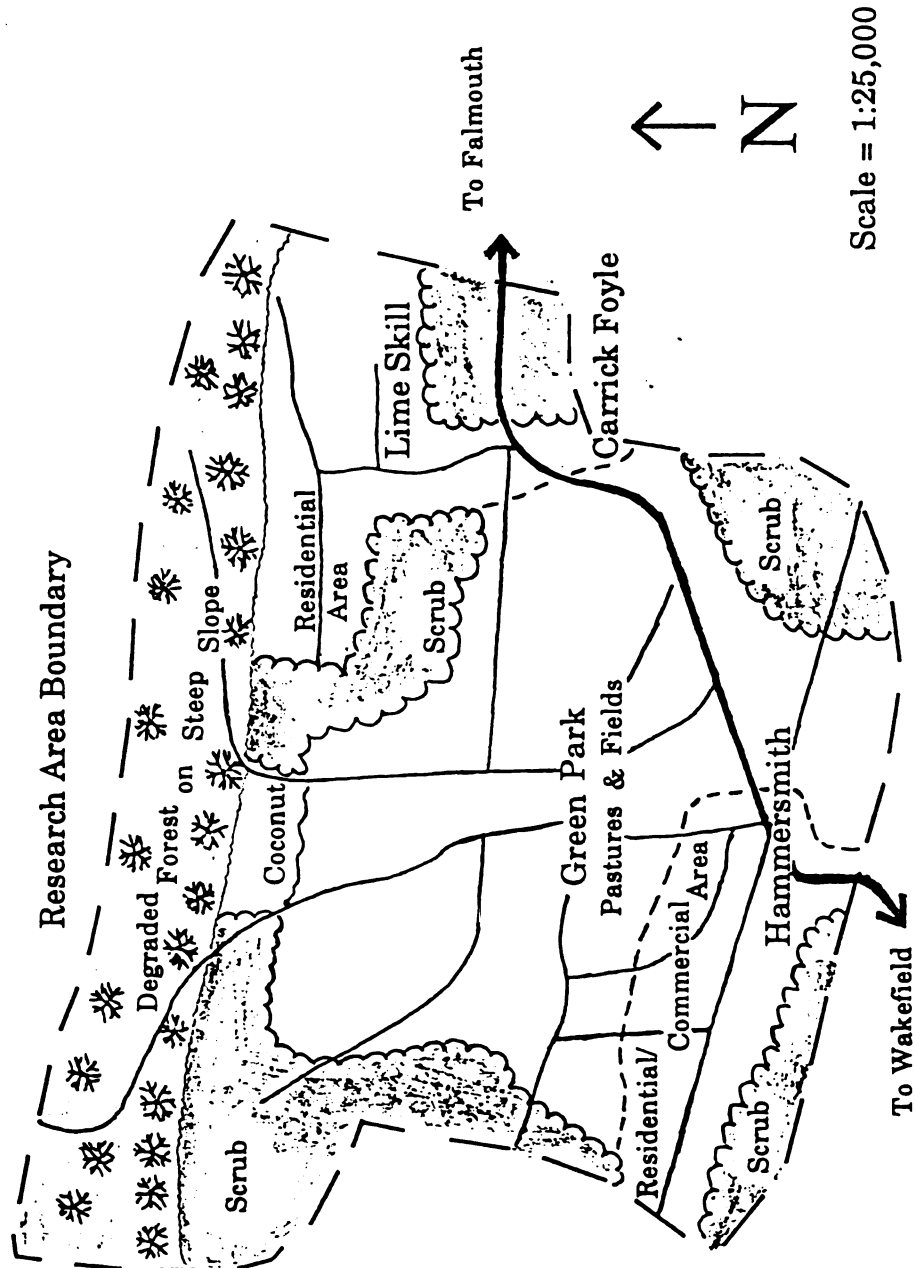


Figure 4. Land-Use in the Green Park Research Area

pasture grasses become overgrazed or revert back to less productive indigenous species, farmers often choose to interplant improved grasses with vegetable crops in the months when rainfall is adequate. Most paddocks are under pressure from the proliferation of *Haematoxylum campechianum* (Logwood), a thorny pioneer tree species.

The parcels of land in and around Lime Skill and Hammersmith are smaller, with more houses and less land set aside for pasture. Fruit trees and gardens are more plentiful in these areas than around Green Park proper, and some residents opt to use collected rainwater or household water to sustain these crops during dry times. Throughout the valley, there are pockets of land that are not in production, and most of the vegetative cover is made up of Logwood.

Remnant patches of forest in the Green Park research area belong to private individuals or the Kaiser Bauxite Company. This forest resource is under pressure from: 1) natural forces, i.e. hurricanes and strong winds; 2) removal of trees for charcoal production; 3) clearing hillsides for expansion of pasture land; and 4) clearing of hillsides to plant crops. Like many forested hill areas in Jamaica, these pressures are resulting in the degradation of the forest resource and eventual erosion of soils (Government of Jamaica, 1987; Kapos, 1986).

Vegetable crops and fruit trees that are grown and harvested by the cattle farmers in the Green Park area are listed in Tables 2 and 3. In general, cattle farmers plant the first three crops listed (pumpkin, red pea, and corn)

Table 2. Vegetable Crops Grown by Cattle Farmers in Green Park (by number of cattle farmers stating actual recent plantings; from: Adams, 1972; Caribbean Food and Nutrition Institute, 1986).

<u>Local Name</u>	<u>Genus and Species</u>	<u>No. of Farmers Planting</u>
Pumpkin	<i>Cucurbita maxima</i>	17
Red Pea (Kidney Bean)	<i>Phaseolus vulgaris</i>	16
Corn	<i>Zea mays</i>	13
Tomato	<i>Lycopersicon esculentum</i>	12
Calaloo	<i>Amaranthus sp.</i>	12
Potato	<i>Solanum tuberosum</i>	10
Sugar Bean	<i>Phaseolus lunatus</i>	8
Yam	<i>Dioscorea sp.</i>	8
Cucumber	<i>Cucumis sativus</i>	6
Cassava	<i>Manihot esculenta</i>	6
Pakchow (Popchow)	<i>Brassica chinensis</i>	5
Carrot	<i>Daucus carota</i>	4
Onion	<i>Allium cepa</i>	3
Okra	<i>Abelmoschus esculentus</i>	2
Cane	<i>Saccharum officinarum</i>	2
Cabbage	<i>Brassica oleracea var capitata</i>	2
Gungo (Pigeon Pea)	<i>Cajanus cajan</i>	1
Melon	<i>Citrullus lanatus</i>	1

Table 3. Fruit Trees Grown by Cattle Farmers in Green Park (by number of cattle farmers stating actual ownership or rights).

<u>Local Name</u>	<u>Genus and Species</u>	<u>No. of Farmers Owning</u>
Orange	<i>Citrus sinensis</i>	34
Mango	<i>Mangifera indica</i>	32
Coconut	<i>Cocos nucifera</i>	20
Banana	<i>Musa sapientum</i>	18
Ackee	<i>Blighia sapida</i>	16
Pear (Avocado)	<i>Persea americana</i>	15
Breadfruit	<i>Artocarpus altilis</i>	12
Grapefruit	<i>Citrus paradisi</i>	14
Star Apple	<i>Chrysophyllum cainito</i>	5
Pimenta (Allspice)	<i>Pimenta dioica</i>	5
June Plum	<i>Spondias dulcis</i>	4
Lime	<i>Citrus aurantifolia</i>	4
Naseberry	<i>Manilkara zapota</i>	4
Sweetsop	<i>Annona squamosa</i>	4
Cherry	<i>Malpighia punicifolia</i>	3
Plantain	<i>Musa paradisiaca</i>	3
Soursop	<i>Annona muricata</i>	2
Almond	<i>Terminalia catappa</i>	1
Anatto	<i>Bixa orellana</i>	1
Coffee	<i>Coffea sp.</i>	1
Eggfruit	<i>Pouteria campechiana</i>	1
Guava	<i>Psidium guajava</i>	1
Guinep	<i>Melicoccus bijugatus</i>	1
Jackfruit	<i>Artocarpus heterophyllus</i>	1
Pawpaw (Papaya)	<i>Carica papaya</i>	1
Tamarind	<i>Tamarindus indica</i>	1

as cash crops. These grow well in Green Park as long as there is adequate rainfall. Many of the other vegetables are grown for home consumption. If yields are good, surplus vegetables are sold to neighbors, in the Falmouth market, or along sidewalks near the center of town. Eleven of the 26 farmers (42%) who had been living in the area for 15 years or more indicated that vegetable crop yields were favorable in the early 1970s, but have since diminished, making it difficult for Green Park farmers to grow crops throughout the year.

Based on the survey, fruit trees play a minor role in providing additional income to cattle farmers. Since hurricane Gilbert destroyed many of the coconut palms (*Cocos nucifera*, already weakened by a disease epidemic), as well as mango (*Mangifera indica*) and pimenta (*Pimenta dioica*) trees on the island, the market prices for these fruits have remained strong (based on personal observations and conversations with farmers). Coconut is an especially good income generator, and six farmers have taken advantage of a re-planting program offered by the Coconut Industry Board soon after the hurricane. Many of the mango and pimenta trees that were ruined have not been replaced, although there were six farmers who said that they would plant more if they had some incentive besides the strong market prices (e.g. subsidized seedlings and/or extension workers who would give timely advice and provide information about fertilizers and pesticides). Grafted mango seedlings reportedly cost as little as US\$0.07 fifteen years ago, whereas now they cost US\$2.85. Other trees listed in Table 3 generally are grown around

houses for home consumption, although, like vegetables, if there is surplus, these are sold to neighbors or in Falmouth.

Raising Cattle

Of the 40 small-scale farmers in the formal survey, 37 males (92.5%) and 3 females (7.5%) were primary caretakers of cattle. Ages ranged from 37 to 77 years, averaging 60 years. Thirty-one (77.5%) lived and raised cattle in Green Park Valley; 8 (20%) lived outside but raised their cattle within; 1 (2.5%) lived in the valley, but usually kept his cattle outside the area. The farmers collectively had almost 400 head of cattle: 11 bulls, 193 cows, and 194 calves. Eight (20%) farmers had automobiles; 5 (12.5%) had pickups or trucks. Other means of transportation included motorbikes, bicycles, donkeys, and walking.

Twenty-seven of 40 farmers (68%) said that one of the reasons they raise cattle is to generate income. Two of the farmers referred to their cattle as "walking banks," gaining higher interest and involving less risk than any other investment within their means. With options for liquidation on short notice, they had control over their assets, rather than the bank or some other institution, public or private.

Farmers devote varying levels of attention to raising cattle, depending on the number in their herds and other time-consuming tasks (Figure 5). These tasks include raising vegetable crops for consumption, for market sale, or raising other animals. Although these endeavors may be profitable at one time or another, varying market conditions result in fluctuating prices. In

	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB
Annual Distribution of Labor	HARVEST FRUIT FROM TREES: ORANGE (85%), MANGO (80%), COCONUT (50%), BANANA (45%), ACKEE (40%)											
							PLANT/WEED RED PEA AND CORN (40%)			HARVEST RED PEA AND CORN (40%)		
							PLANT/WEED PUMPKINS (42.5%)			HARVEST PUMPKINS (42.5%)		
	PREPARE PASTURES & FIELDS FOR PLANTING GRASS & CROPS (60%)											
	SEARCH FOR ALTERNATIVE FODDER RESOURCES TREE (67.5%) GRASS (57.5%) CANE TOPS (52.5%) BAG FEED (37.5%)											
	CULL HERD TO AVOID LOSSES (52.5%)						INCREASE HERD SIZE (100%)					
							SERVICE CATTLE; SELL CATTLE, RETRIEVE 5TH QUARTER (100%)					
							WATER CATTLE; DEWORM, DETICK, VACCINATE CATTLE; CLEAR PASTURE WEEDS; REPAIR FENCES (100%)					
							CARE FOR AND SELL GOATS (52.5%), CHICKENS (40%), AND PIGS (20%)					
MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	
Month												

Figure 5. Tasks of Green Park Cattle Farmers by Month (percentage of farmers involved)

contrast, the local demand for beef has been steady over the past few years, so raising cattle remains one of the best alternatives for income generation.

Cattle farmers in the Green Park valley have private pastures where their animals graze on succulent grasses as long as rainfall amounts are sufficient. These grasses include: *Cynodon plechtostachyus* (African Star), *Panicum maximum* (Guinea), *Andropogon pertusus* (Seymour), and *Panicum muticum* (Brachiaria). African Star (introduced in the mid-1970s) and Guinea grasses hold up well under the pressures of drought and grazing. Seymour grass survives lengthy drought periods, but takes a longer time for new growth to emerge when the rains begin than African Star and Guinea grasses. Brachiaria (also introduced) has not proven to be a choice species in Green Park, as it does not survive well under pressure of grazing and drought. *Pennisetum purpureum* (Napier grass) is managed like *Saccharum officinarum* (Sugar Cane). It is not grazed by cattle, but cut and carried.

When rains taper off, grass production slows or ceases. This causes a gap in the fodder supply. Even though the majority of farmers have mixed breeds (Jamaican Red Poll X Local or Jamaican Black X Local) that hold up well under drought conditions, they are forced to look for alternatives. Sugar Cane tops⁴ and local roadside Guinea grass are used extensively until the cane harvest is over and the summer drought strikes hard, generally in June or July. In 1975, a drought occurred for 12 consecutive months; more recently in 1989, a drought lasted for 6 months. It is not uncommon during weeks of

⁴Known locally as cane burn ("cane baan"). It is the top part of the stalk that is cut and discarded during harvesting. Usually the field is burned a few days beforehand to expedite the harvest process.

drought for Green Park farmers to observe rain falling every day or two just south of the valley.

During extended droughts, farmers have four alternatives to keep their cattle fed. One alternative is to procure sugar cane tops. Another is to travel further inland where rainfall is sufficient for year round growth of Guinea grass. A third is to obtain bag feed, but this is quite expensive, ranging from J\$50-60 for a 50-pound bag (US\$6.30-7.55 for a 20 kilo bag)⁶. The fourth alternative is to use tree fodder. In actuality, farmers use a combination of all four, but trees are the only local resource available to fill the fodder gap.

⁶At the time of the study, the conversion factor was J\$7 = US\$1.

4.2 Indigenous Knowledge Relating to Fodder Trees and Silvo-pastoral Management Systems

Using Trees as Alternative Fodder Resources

"When cattle cannot find adequate pasture grass to graze," one farmer said, "they look up, and what do they see? Trees!" Cattle will eat leaves and/or fruits from certain species of trees with or without coaxing from their caretakers. If these tree leaves/fruits are within reach of the cattle in the pasture, they will browse on them. Trees are found growing in the fenceline or free-standing in the pasture. Cattle will also nibble at tree leaves or fruit when they are being moved from one pasture to another or to a source of water and back again. These management systems can be considered passive, meaning that the farmer does not actively pursue, plant, or manage these trees as fodder sources. The extent of active management systems in Green Park to date is exemplified by farmers who take their cattle outside of their pastures to graze on trees along the roadside and in the nearby forests and those who search for tree fodder resources.

Twenty-nine (72.5%) of the forty interviewed farmers said that they collect tree fodder when needed. Thirty-eight farmers (95%) mentioned at least one fodder tree species that they currently use or that could be used as an alternative to grass. One of the two farmers who did not mention any fodder trees recently moved his cattle from an area where there was sufficient year-round grass production, and the other had helpers who do most of the

collection of roadside fodder grass when dry conditions reduce grass production in his own pastures.

Thirty-eight farmers described 17 tree species that were or could be used for fodder. Species most often mentioned were *Guazuma ulmifolia* (Bacedar), *Samanea saman* (Guango), *Brosimum alicastrum* (Breadnut), and *Gliricidia sepium* (Quickstick) (Table 4). Other trees used for fodder include: *Haematoxylum campechianum* (Logwood), *Bursera simaruba* (Bujgum), *Piscidia piscipula* (Dogwood), and *Bambusa vulgaris* (Bamboo).

Guazuma ulmifolia

Guazuma ulmifolia (Bacedar) provides one of the best fodder sources. Both leaves and fruit are fed to cattle (Table 5). It is indigenous to Jamaica and a medium size tree, growing up to 16 m high (Adams, 1972). The fruit falls from November through April; leaves are obtained by cutting branches with a machete, usually in late summer when other fodder resources have diminished due to drought. Most Bacedar trees are found in pastures and along roadsides.

Bacedar trees in Green Park are not numerous. General observation of paddocks reveal an average of 1 to 3 trees per hectare, usually found alongside the fenceline. Every observed tree had been lopped. Leafy branches are immediately eaten by animals beneath the tree where the farmer has selectively lopped. Although farmers focus on Bacedar leaves, the fruit is also eaten by animals. The black subglobose fruit measures 3 cm long and 2 cm broad, about the size and shape of a black olive (Adams, 1972).

Table 4. Local Fodder Tree Species by Number of Farmers and Location

Local Name	Genus & Species	No. of Farmers Mentioning Trees	Location: ¹			
			Pasture	Fence- Line	Forest	Around House Roadside
Bacedar	<i>Guazuma ulmifolia</i>	36	29	2	5	12
Guango	<i>Samanea saman</i>	33	30		2	14
Breadnut	<i>Brosimum alicastrum</i>	18	6		14	
Quickstick	<i>Gliricidia sepium</i>	9		8		1
Logwood	<i>Haematoxylum campechianum</i>	6	5		1	
Bujum	<i>Bursera simaruba</i>	5	3		1	1
Dogwood	<i>Piscidia piscipula</i>	4	3		1	
Bamboo	<i>Bambusa vulgaris</i>	3	2		1	
Almond	<i>Terminalia catappa</i>	2				2
Figwood	<i>Ficus spp.</i>	2	1			1
Mango	<i>Mangifera indica</i>	2				2
Mimosa	<i>Mimosa spp.</i>	2	2			
Never Die	<i>Erythrina corallodendrum</i>	2		2		
Trumpet Tree	<i>Cecropia peltata</i>	2			1	1
Wild Tamarind	<i>Leucaena spp.</i>	2	2			
Huak	?	1	1			
Sydney	?	1	1			

N=40

¹ Farmers may know of more than one location for each tree resource.

Table 5. Local Fodder Tree Species by Number of Farmers and Parts of Tree Used

Local Name	Genus & Species	No. of Farmers Mentioning Trees	Parts of Tree Used:		
			Leaves	Fruit	Both Leaves and Fruit
Bacelar	<i>Guazuma ulmifolia</i>	36	10	2	24
Guango	<i>Samanea saman</i>	33	1	22	10
Breadnut	<i>Brosimum alicastrum</i>	18	15		3
Quickstick	<i>Gliricidia sepium</i>	9	9		
Logwood	<i>Haematoxylum campechianum</i>	6	6		
Baylun	<i>Bursera simaruba</i>	5	5		
Dogwood	<i>Piscidia piscipula</i>	4	4		
Bamboo	<i>Bambusa vulgaris</i>	3	3		
Almond	<i>Terminalia catappa</i>	2	2		
Figwood	<i>Ficus</i> spp.	2	2		
Mango	<i>Mangifera indica</i>	2	2		
Mimosa	<i>Mimosa</i> spp.	2	2		
Never Die	<i>Erythrina corallodendrum</i>	2	2		
Trumpet Tree	<i>Cecropia peltata</i>	2	2		
Wild Tamarind	<i>Leucaena</i> spp.	2	2		
Huuk	?	1	1		
Sydney	?	1	1		

N=40

Samanea saman

Samanea saman (Guango) is a fast-growing, multipurpose, nitrogen fixing tree found throughout the tropics (NFTA, 1987), providing fruit and leaves for fodder. It is indigenous to Jamaica. The dark brown, slightly sweet, pulpy pods measure 10-25 cm long and 15-18 mm wide and are available from December to May (Adams, 1972). When drought is severe, the leaves are also used for fodder. Thirty of the thirty-three farmers who mentioned Guango as a fodder species have the tree in their pastures, although it also occurs along the roadside and in nearby forests. It can grow to be a huge tree (up to 20 m) and is native to grass savannas. It rarely grows in forested areas (NFTA, 1987). Guango seeds germinate easily after passing through the digestive tracts of cattle. Some germinate directly from cow dung, a readily-available natural fertilizer. NFTA reported that Guango tolerates a broad range of soil types. Many of Green Park's Guango trees were blown over by the winds (up to 170 m.p.h.) of hurricane Gilbert in September of 1988.

NFTA (1987) reported that mature Guango pods have a crude protein content of 12-18% (dry matter). Farmers perceive the pods as one of the best fodder sources in Green Park. A medium size tree (10-15m) might yield enough pods to fill one 50-pound (22.7 kg) sack (holding about 5 kg) per week. Two farmers were observed doing this. Vigorous regrowth from lopped or pollarded trees is also used as fuelwood. Guango is used in multi-layered agroforestry systems in the tropics, providing shade for cacao, coffee, vanilla, and nutmeg (pimento). Pimento, an export cash crop in Jamaica, was

cultivated in Green Park. Hurricane Gilbert killed many trees, so this multi-layered system was not in evidence at the time of the study.

Farmers like Guango trees in their pastures and along the roadside for four reasons. The first three reasons are documented elsewhere (NFTA, 1987). First, cattle eat accessible nutritious pods and leaves without input from farmers. Second, cattle are attracted to the shade of Guango trees, offering a cool place to rest in the heat of the day. Third, grass grows better around and under Guango trees than in the open. Fourth, three farmers in Green Park inferred that cattle eating Guango pods drink more water, and in turn eat more grass, than those cattle that do not. They concluded that the cattle are healthier and better able to maintain their weight during times when fodder grasses are dry.

The improved grass growth under Guango is thought to be due to increased nitrogen levels under the canopy and nyctinastic leaf movement (Halliday, 1984; NFTA, 1987; Palmer and Asprey, 1958). Although nitrogen fixation is confirmed, nodules were found below the grass root zone; it is suggested that recycled leaf litter is the enrichment source (NFTA, 1987). Cattle dung also add nutrients to the soil, demonstrating the symbiotic relationship between tree and animal. Guango leaf movement benefits plants growing beneath it: "At night and on cloudy days, branches hang down and the leaves fold inward, allowing rain to fall directly on the ground and promoting cooling through unrestricted ground radiation to the sky. In the morning leaves unfold and resume a horizontal position, giving full shade and helping

preserve moisture" (NFTA, 1987). NFTA also reported that grass dry matter production under *Samanea saman* was not significantly reduced and had a higher protein and lower fiber content than unshaded grass in a control plot.

In spite of its benefits, farmers want to limit the number of Guango trees in their pastures. Too many trees create a closed canopy, limiting penetration of sunlight, thereby reducing or eliminating grass production. One farmer girdled most of the trees along the fence bordering his paddocks. Given the benefits, a heavy pruning of Guango trees is more beneficial than complete removal.

Brosimum alicastrum

Green Park farmers reported that *Brosimum alicastrum* (Breadnut) is a good fodder species. This species grows slower than Bacedar or Guango, measures 10-30 m high, and is indigenous to Jamaica, as well as Cuba, Central America, and northern South America (Adams, 1972; Pardo-Tejeda and Muñoz, 1980). The few remaining Breadnut trees in Green Park are found primarily in the forest on hillsides surrounding the valley, although a few trees are found in pastures.

Fifteen farmers mentioned that Breadnut leaves are cut and fed to cattle as fodder. Three farmers said that the fruits are used. As Breadnut is mainly in the hillside forest, branches are cut and carried to the cattle or dropped to the animals beneath the tree. The drupaceous, yellow fruits are relatively small, measuring 1.5-2.5 cm in diameter (Adams, 1972). Only three farmers use the fruit, although Pardo-Tejeda and Muñoz (1980) reported that on the

basis of amino acid content, seeds of Breadnut compare favorably with other animal feeds currently in use.

Breadnut is also a valuable tree for making charcoal, used as a means of income generation for a few people in Green Park. Breadnut is on the verge of local extinction in the Green Park valley, due to hurricane Gilbert, lopping for fodder, and charcoal production. Only a few Breadnut trees remain in pastures and fields, and the research facilitator reported that the numbers of large trees in the forests surrounding the valley were dwindling. Most of the remaining forest-grown Breadnut were saplings under 5m, not yet large enough to provide fodder or charcoal.

The main reason for the decline is debatable, but there was visible friction between farmers and charcoal producers. The latter group has few means of survival, and has little alternative but to cut trees that make the best charcoal, regardless of the damaging impact (Eyre, 1987). Although charcoal producers work primarily in the forest, there have been instances of illegal trespassing onto private land. When permitted to "trim" some Breadnut trees in private pastures, charcoal producers have removed whole trees, failing to comply with local laws or agreements with farmers. Farmers are at a disadvantage when dealing with charcoal producers. They are often left with a "take-it-or-leave-it" proposition and settle for some charcoal or work out an agreement for selective cutting if at all possible. Involved farmers have done little to ameliorate the problem, partly because they fear repercussions.

Although no farmer said what these may be, reports of larceny and vandalism in the area abound (Section 4.3).

Gliricidia sepium

Gliricidia sepium (Quickstick) is known and used in Jamaica as an alternative fodder resource. The recently introduced exotic species is also known in the Green Park area as: St. Vincent Bush, Quick Catch, and El Maranga. Farmers plant Quickstick as living fence posts (Table 6). The fast-growing tree reaches heights of 5-6 m, producing 10-12 cm long pods (Adams, 1972).

Nine farmers mentioned that Quickstick leaves are used for fodder, but only six farmers have planted it, and only two have done so on a scale that would provide them with a resource for more than a day or two every three or four months. None of the Green Park farmers were aware of the highly nutritious value of Quickstick fodder, but three farmers mentioned that cattle need to acquire a taste for the leaves before it becomes a part of their diet.

It was not clear why or when Quickstick was introduced into the area. Besides the two farmers who have significant numbers of Quickstick, the other seven farmers who mentioned it referred to it more as a living fence post, adding strength to the fence. If this was the reason for introduction, it may provide insight into why the tree has not been planted on a larger scale in Green Park. Quickstick was susceptible to the damaging winds of hurricane Gilbert, and tended to blow over. Wind-damaged Quickstick growing in the fenceline made it difficult to repair the barbed wire around farmers' pastures.

Table 6. Local Trees Used as Fenceposts by Number of Farmers and Location.¹

Local Name	Genus & Species	No. of Farmers Mentioning	Location: ¹		
			Pasture	Fence- Line	Forest
		Trees			
Logwood	<i>Haematoxylum campechianum</i>	33	21		15
Brazalita	<i>Peltophorum linnaei</i>	13	1		13
Never Die ²	<i>Erythrina corallodendrum</i>	7		6	1
Bullet Tree	<i>Bumelia nigra</i>	6			6
Dogwood	<i>Piscidia piscipula</i>	6			6
Fiddlewood	<i>Citharexylum fruticosum</i>	5			5
Quickstick ³	<i>Gliricidia sepium</i>	3		3	
Fustic Tree	<i>Chlorophora tinctoria</i>	3			3
Pimenta	<i>Pimenta dioica</i>	2	1		1
Figwood	<i>Ficus</i> spp.	1			1
Yellow Sanders	<i>Fagara elephantiasis</i>	1			1
Blind Eye	<i>Helicteres jamaicensis</i>	1			1
Bacedar	<i>Guazuma ulmifolia</i>	1		1	
Bujgum	<i>Bursera simaruba</i>	1			1

N=40

¹ Farmers may have more than one location for each tree resource.

² Never Die is propagated vegetatively and is used for demarcation and living fence posts.

³ Quickstick is propagated vegetatively and is used for living fence posts.

Haematoxylum campechianum

Haematoxylum campechianum (Logwood) was mentioned as a fodder resource by 15% of the farmers, but they manage it differently than other species. Cattle are permitted to nibble on its small leaves while in their paddocks. The fast-growing Logwood is viewed as a nuisance by Green Park farmers because it invades their pastures, crowding out preferred grass and tree species. It is a naturalized exotic species, grows to a height of 10 m, and is a prolific seeder (Adams, 1972). Unless farmers keep it cut back, it will start producing thin 3-5 cm long pods, within 3 years. Logs from the tree are used for fenceposts (Table 6).

Other Species

Bursera simaruba (Bujgum) was mentioned by 5 farmers (12.5%) as a viable fodder species. It is indigenous to Jamaica, grows up to 15 m and produces fruits 1 cm long (Adams, 1972). Three farmers allow Bujgum to grow in their paddocks, but it was also observed to be growing along roadsides and in the forest.

Piscidia piscipula (Dogwood) was reported as a fodder species by 10% of the sample population. Only the leaves are fed to cattle. It is an indigenous species, grows up to 20 m high (Adams, 1972), and is found in both pasture and forest.

Bambusa vulgaris (Bamboo) was mentioned as a dry season fodder by three farmers (7.5%). Bamboo is a naturalized exotic species, grows in groves to 10 m, and is propagated by transplanting culms (Adams, 1972). Two

farmers have this growing in their pastures, and one of them mentioned that cattle will not eat the coarse bamboo stems until the finer grasses are finished.

Uses of Living Fences

As part of raising cattle on private pastures, farmers have need for fenceposts. Farmers' species preferences for fenceposts are listed in Table 6. Two species, *Erythrina corallodendrum* (Never Die) and *Gliricidia sepium* (Quickstick) are used as living fence posts; both are propagated by cuttings, but Never Die establishes itself more easily than Quickstick⁶.

Never Die is indigenous and has been used traditionally as a demarcation post, usually planted at the point where one farmer's pasture boundary meets another's. As a recently introduced exotic, Quickstick is used more generally along the fenceline, adding strength to the fence. Never Die withstood the high winds of hurricane Gilbert much better than Quickstick.

⁶ Brown, Rupert, Research Facilitator 1990. Personal communication.

4.3 Investigation of the Social/Cultural Environment

The focus of this section centers on the economic, social, and cultural aspects of Green Park residents and farmers. Most of the information came from interviews with farmers or observation of their behaviors or activities during the study. Topics include the area's underemployment and options available to residents, farmers' perspectives on raising cattle as a means of income generation, and impediments to cattle herd expansion.

Underemployment in the Area and Residents' Options

Although Green Park is located near the north shore of Jamaica, most people in the area have not benefitted from the tourism boom of the past two decades. Falmouth, the largest coastal town in Trelawny Parish (6.4 kilometers from Green Park), is located between the tourist areas of Montego Bay, in St. James Parish to the west, and Ocho Rios, in St. Ann's Parish to the east (Figure 1). Tourism development in Trelawny Parish is lagging, due in part to its coastline. Much of Trelawny's coastline is mangrove swamp, while the other two parishes have vast stretches of sandy beach that lure thousands of tourists yearly (Government of Jamaica, 1987). Trelawny Parish has only one large tourist hotel and is much less densely populated than the other two parishes. As Montego Bay becomes more densely populated, construction of new tourist facilities moves eastward toward Trelawny Parish and Falmouth. However, few people from the parish help construct these newer facilities or work in the service sector within these completed facilities. According to three cattle farmers in Green Park, if one has reached the age of forty (95% of the

interviewed farmers are in this category), it is very difficult to find work at a hotel or factory.

Employment opportunities in the area are limited. One cattle farmer works part-time at a large chicken farm in Green Park where broilers are produced, processed, and packaged. A few farmers work at one of two large sugar factories: Hampden (10 kilometers southwest of Green Park) and Long Pond (29 kilometers east of Green Park). All together, 21 of the 40 interviewed farmers held an additional job. Thirteen farmers (32.5%) were working off-farm full-time and 8 (20%) part-time. Farmers were employed in mills (7), government (3), retail stores (2), schools (1), or were involved in trades (5) or gardening/cane (3). Virtually all of the cattle farmers have raised crops at one time or other.

Although farmers in the Green Park area still make attempts at growing sugar cane, pumpkins, or other vegetables, without a guaranteed market for their crops, some of them have placed more emphasis on rearing animals. Animals raised in the area for income generation or home consumption include: cattle, goats, pigs, chickens (both broilers and egg-laying), turkeys, guinea hens, and donkeys (raised for hauling heavy loads). Raising pigs and goats has become a risky undertaking. In the former case, pig prices have fluctuated drastically (as observed during the study). Eight farmers have taken losses after market prices fell years later. Raising goats was a favorite choice of income-generating activities through the 1980s, netting a good price on the local market without much farmer input (i.e. watering, feeding, rearing, and

caring for the goats). But available rangeland has diminished as more parcels of land become developed or are put into crop production. Also, praedial larceny⁷ has increased, despite farmers' attempts at finding the offenders. Seventeen of the farmers (42.5%) reported having lost goats to thieves; every farmer reported being concerned about losing goats. Nine of the farmers (22.5%) have stopped raising goats because of thefts.

Risks Involved in Raising Cattle

Raising cattle may be profitable in Green Park, but there are inherent risks. First, cattle have health problems. Most cattle in Green Park are exposed to a number of diseases and ailments. These include: ticks, intestinal parasites, and black leg (an often fatal disease which affects cattle between the ages of 6 months and 3 years) (Jamaica Livestock Association, 1983). Second, there is a possibility of larceny of cattle, although this has not occurred to a degree where it has caused farmers to consider getting out of cattle farming.

Prices for beef cattle are not guaranteed, although farmers reported that prices have remained stable or have increased slightly in the past few years. Hypothetically, price guarantees could be secured by farmers who are close to tourism centers if they could locate steady buyers. But all too often, this is not an option for the farmers in Green Park. Those who want to sell crops or cattle are often limited to local markets. This is because first, small-scale farmers in Green Park lack resources and irrigation equipment that would otherwise allow them to produce a steady supply of grain-fattened cattle or

⁷The willful act of taking and carrying away personal property on or attached to land or farms without the owner's consent (McKechnie, 1983).

crops. Second, restaurants are required to serve food that has been inspected; it is not clear that farmers themselves could employ an inspector on a part-time basis without any kind of guaranteed market.

Finally, pasture grass production decreases during the drier periods to the point where it is insufficient to satisfy the intake needs of the cattle. As a consequence, the overall health and weight gain of Green Park cattle can not compete with animals produced elsewhere in Jamaica.

Farmers' Perspectives on Raising Cattle to Generate Income

Farmers raise cattle in Green Park for a number of reasons. Income generation was a primary reason (mentioned by 67.5% of the farmers) (Table 7). Although they usually do not sell cattle every 2 weeks (as they would when selling vegetable crops), they net a substantial profit when they do. Raising

Table 7. Reasons Why Farmers Raise Cattle

<u>Reasons for Raising Cattle</u>	<u>Farmers Responding</u>	
	<u>Number¹</u>	<u>Percentage</u>
Income Generation	27	67.5
General Interest	12	30.0
Inheritance	5	12.5
Efficient Use of Land	4	10.0
Project-Related	1	2.5

N=40; from data collected during interviews.

¹Farmers could give more than one response.

cattle assures them instant income when needed, as much as J\$2000 (US\$285) when selling a three-year old bull.

Farmers also mentioned that during drought periods there is less financial risk involved in raising cattle than growing crops or raising other animals. If a short drought period sets in, cattle tend to be resilient. Almost all of them survive and net a profit when sold (during the six-month long drought of 1989, 29 cattle died (about 7% of the total of around 400)). The same cannot be said for vegetable crops, which can be adversely affected by as little as two or three weeks of drought.

General interest and inheritance are two other reasons farmers raise cattle. Cattle farmers in Green Park have been raising herds for an average of twenty-four years. Thirty-four farmers (85% of the total) have been raising cattle for eight years or more. Nineteen (47.5%) have been doing it for twenty-five years or more. Many cattle farmers have years of experience, often without any outside assistance. Thirty-eight farmers (95%) foresee raising cattle in the next 5 to 10 years. One farmer said "I think I love raising cattle" and that he would prefer to stay in cattle for life. Yet not all of the farmers in Green Park are content. As one farmer phrased it, "the small [-scale] farmer can't make a big living raising cattle...just enough to help yourself."

Impediments to Expansion of Cattle Herds

Almost all small-scale cattle farmers would like to make a bigger profit, but there are many impediments to herd expansion. These include: 1)lack of land for cattle grazing; 2)lack of capital to invest in improving existing

paddocks; 3)difficulty in obtaining bank loans; 4)inability to secure labor; 5)fear due to praedial larceny; 6)less-than-optimal prices for cattle sold on the open market; 7)government policies focused on tourism rather than farming during the past decade; 8)lack of trust with government institutions; and 9)varied trust between farmers in the Green Park area.

Lack of Land for Cattle Grazing

One way for cattle farmers to increase income is to expand the number of paddocks to enlarge their herds. Ten farmers pointed out that they need more land. Yet land is at a premium in Green Park. Most of the good pastures in the area are already owned or leased and remaining pasture land is expensive. Farmers are taxed for their paddocks, but because the land is not being used intensively, taxes are not a significant part of any farmer's income.

If farmers decide to improve their existing paddocks, expenses for plowing and fencing add up quickly. For each acre, it costs J\$500-600 (US\$71-85) for a tractor to come in and plow (though it is difficult to secure one). During and after this operation, other tasks need to be done: overturned rocks removed, scrub gathered and burned, roots cut out; farmers generally do this themselves or hire laborers. Depending on the workload, this totals 1-2 person days per acre at a cost of J\$30-60 (US\$4.30-8.60 per acre). Installing 3 chains⁸ (almost one side of a square acre) of fencing would require posts (J\$132, US\$19), wire (J\$387 per roll, US\$55), staples (J\$6 a pound, US\$1.90

⁸One chain = 66 feet (= 20.1 m)

per kilogram), and an installation charge of J\$100 (US\$14). The total cost per acre would therefore be approximately J\$1150-1300 (US\$165-185).

Lack of Capital

Green Park farmers generally do not have the financial resources to cover these costs. Often, they would have to make certain sacrifices in the short run in order to make gains in the future, e.g. selling a few head of cattle from their stock. But not everyone has a large herd from which they could sell cattle. The cattle they sell do not always net a profit sufficient to allow for all of the necessary changes. One farmer explained the difference between management of herds at a commercial farm, such as Orange Valley, and his own: "the big man can take on large investments, make for them cow look nice. They have plenty water, and they can buy rock salt and ... molasses. But the small man cannot do that. When we sell a little cow, we can't get cash for all of those things."

What little cash they earn often goes towards outside obligations or one of the many other cattle-related expenses such as vaccinations, worm and tick medicine, paying laborers to clear weeds from paddocks, and fence-mending. One farmer said "as a small [-scale] farmer, I do not have the money to look out for the cattle as I am supposed to. The medication is so dear, sometimes I cannot afford to buy things to use on them. We have to go on with what we have." Another said that "you have to make sacrifices, self denial, to carry on, to keep up. I had a nice piece of 4 acre and a quarter land up there [outside of the Green Park valley], and I have to just sell it out cheap, cheap."

According to the farmers, they have less available capital now than in the past. This is partly due to increasing electric and water bills, higher taxes, and the ever-present costs for those farmers who have children or grandchildren in school. There are also unexpected costs. Sometimes cattle get loose, break through fences, and cause hundreds of dollars (Jamaican) in damage to vegetable crops in gardens. Hurricane Gilbert not only caused much damage to houses, but also to fruit trees and zinc roofs of chicken coops and pig pens. And of course, when droughts hit and fodder sources diminish, cattle farmers are often left without any choice but to buy supplemental feed in bags, which is becoming more expensive every year. Still, concessions have to be made. One farmer contends that "there are many people who lose cows to the drought. But some of the time you really have to think of the animal as yourself. You might have a few dollars and you have to sacrifice and buy them feed. So I never lose one."

Loans

If farmers lack capital, but have a means of generating income by raising cattle, it might be hypothesized that they could easily get a loan to increase their paddocks or to plant improved fodder grasses in the paddocks that they have. Generally, this is not the case as it is difficult for small-scale farmers to get loans for a variety of reasons.

First, lending institutions generally do not consider giving loans to older farmers who do not have younger members of the family living at home (Stone, 1985). Three farmers said that they were turned down due to their age.

Second, a farmer may have outstanding loans. Two farmers mentioned that they are still paying back loans for pig-raising ventures from AMC days (10 years earlier). Third, the credit rating may be poor. Three farmers reported that they were not able to pay back loans in a timely manner, but also felt misled into undertakings that resulted in losses, without any lenience on the part of lenders. Fourth, loans are often targeted for enterprises other than raising cattle, such as growing crops or raising pigs. Two farmers claimed that lending institutions are willing to lend money for quick-return enterprises such as raising pigs, but as the market is easily glutted and pig feed expensive, it is not a viable means of raising income. One prominent farmer contends that they were once told to plant cassava because a factory was going to open. They secured a loan, planted cassava, but the factory was not built and their crop was not purchased. They had to pay back the loan. He retorted: "small farmers have been BURNED."

Labor

Even if farmers were able to secure capital, through banks or other means, they often need help to realize their paddock improvement or expansion plans. This usually involves hiring laborers or getting other farmers to participate. If farmers are on good terms and can work out some arrangement, they sometimes help each other when needed in a "day for day" or "morning sport" agreement. Sometimes farmers need to hire outside help. According to seven farmers, there are plenty of laborers who want money but do not want to work. One of these farmers said "after one week, they say 'it's not enough

money; I'm tired.' Then they go." Another farmer who could no longer depend on outside labor elaborated: "they ask for tea, work a couple of hours, and then leave." Finally, one farmer recalled the following: "workers need an advance and tools before beginning. I bought a machete and a file for them. They worked for a couple of days and then left, taking the tools with them. I cannot trust them now. I did up to two years ago."

Praedial Larceny

Concern over losing cattle to thieves also makes cattle raising risky. As previously mentioned, increased larceny has caused 9 out of 30 farmers to stop raising goats. Although cattle larceny does not occur that often, it does happen and is cause for concern. Bulls are especially vulnerable as they can be sold for quick cash or rented out as studs elsewhere. Two farmers had their service bulls stolen in the last three years. They did not replace them for fear of repeated larceny. Because of their losses, two others sold their service bulls because they could not watch over their herds as often as they wished. Five farmers said they no longer allow their cattle to roam as they too are afraid of larceny. Four farmers stated they have reduced their herds for one or both of the following reasons. In the case of larceny of multiple heads, they would not have to absorb heavy losses. Second, after culling marketable animals, remaining cattle would not be as prone to thievery because of their age (too old or too young).

Farmers gave various theories about who is stealing goats and cattle, but they revolved around two scenarios. The offenders are people who do not

live in the Green Park area and steal on impulse. Or they are people who live or work in the area, are familiar with the movements of certain herds, and carry out their acts when they are least at risk of getting caught, usually at night. In the former case, sometimes the outsiders are caught and dealt with, either with police or with a machete. In the latter case, often there is not enough evidence to prosecute a worker or "neighbor." A false accusation can be considered a crime in itself, which makes the matter difficult to deal with. But suspicion lingers on for months or even years and causes friction within the community.

During the study, there were reports of recent larceny. One incident involved the theft of a farmer's young bull in broad daylight. A couple of people saw a man walking out of a nearby town with the young bull. Suspecting the farmer had not sold it to the man, they contacted the farmer, and all of them assaulted the thief with machetes.

In another incident, a worker at a nearby sugar mill was going to work and noticed that a bull being raised at a local school was being readied for slaughter. He went to get the police and five men were arrested, including a butcher who claimed that he had no part of it. However, the butcher could not produce a written permit signed by the police saying the bull was purchased from the school. To avoid this dilemma, farmers have the option of filling out a bill of sale with the police when selling to another farmer to avoid future confrontations (the bill of sale includes markings of cattle so that old bills might not be used repeatedly). One farmer said that most farmers do not

exercise this option because it would take up too much time. Whether the police were interested in promoting this option was not clear.

Selling Cattle

Prices of certain commodities are regulated by the government, though this is not true of beef prices, so there is room for bargaining. Generally, retail beef prices on the local market have remained consistent or have risen slightly over the past few years (all cattle sold for beef by the Green Park small-scale farmers fall into this category). When prices of other goods rise, beef prices also tend to rise. Two Green Park farmers said that the price farmers net for selling beef cattle is affected minimally by outside factors, such as a mild drought. Prices did not fall during the six-month drought in 1989, though they did during the harsh drought during twelve months in 1975. Prices are mainly affected by the cattle's appearance and weight. Outside elements such as drought may cause cattle to lose weight if they do not consume enough fodder or water, but for those cattle who have access to both, weight gain or ability to reproduce is largely unaffected. When selling cattle, two-to-three year old bulls and cows that have had six or seven calves are generally culled. Older cows do not net a good price because consumers complain about the meat being tough.

In general, the farther the distance farmers go in seeking a butcher (e.g. from Green Park towards Montego Bay), the higher the price they will receive. The local butcher in Green Park paid J\$700 per hundred-pound-weight

(US\$100/100)⁹ to butcher a bull or cow. Farmers reported getting between J\$750-800/100 (US\$107-114/100) from a butcher in Falmouth and up to J\$900/100 (US\$128/100) from a Montego Bay/St.James butcher. When butchers outside of Green Park deal with small-scale cattle farmers for the first time, they will initially offer the same rate as the country butchers (J\$700/100).

Once certain agreements are made, most farmers regularly deal with one to three butchers. When farmers are ready to sell, they will try to get in touch with the butcher who offers the best price, but this is not always possible given their own time constraints or the butcher's low demand for beef at that time. They will then go to the second or third butcher.

When farmers have cattle to sell, they will exercise one of many options available to them to let others know of their intent to sell. Farmers will sometimes contact the butchers themselves. Other times butchers come to Green Park expressing their desire to buy. They either contact farmers directly or inform one or more key farmers¹⁰ of their intent to buy through an informed network of small-scale farmers. Finally, farmers may inform one of the key farmers of their wish to sell; the key farmers then notify other farmers and butchers of the intent to sell.

Cattle are usually sold by weight, but sometimes by sight, especially if another farmer is buying. If butchers are buying, once a meeting is set up for

⁹Or US\$45 per hundred-kilo-weight (1 pound = 2.2 kilograms).

¹⁰Those who are able to notify other farmers of the butcher's desire to buy. Generally, these key farmers move around during the day carrying out tasks, but also acting as messengers in the network of small-scale farmers.

the sale of cattle, they or other buyers come in a truck to get the animal. Either they butcher it on the farmer's premises or take it away to their facilities for butchering and processing.

During the meeting between farmer and butcher, they haggle over the price and the fifth quarter (parts of the animal that the farmer keeps). At times, the exchange becomes quite animated. Technically the fifth quarter includes the tail, two feet, most of the entrails, and a few pounds of meat. But the fifth quarter is used as a bargaining tool. According to one Green Park farmer, he usually receives the tail, only one of two feet, 1-1/2 pounds (0.68 kilograms) of liver and a little meat, although he stated that "they do not want to give you this." If farmers ask for more of the fifth quarter, the butcher may lower the price he is offering to pay. As one farmer explained, "they beat it down." If farmers are dissatisfied with the outcome, they always have the opportunity to sell to another butcher. One farmer mentioned that if he approaches town butchers with a good attitude and works at building a relationship with them, he will get more of the fifth quarter without compromising the price.

Sometimes the butcher sees that the farmer has a good business going. The research facilitator reported that if a butcher wants to encourage farmers to call him back, he will give them a better deal or more of the fifth quarter. Sometimes the haggling becomes more of a game. One farmer recalled a recent exchange with a butcher:

"Me tell im dat me wanted to sell it on scale, and when he come look on it, he say 'well he small', so he priced it, and buy it down

from \$800 (per 100 pounds). We never have too much a problem either, because what me expect to get for it, he give me about \$50 less. Me tell im 'No', he have to give me piece of the meat for me dinner because me want to sell it on scale. And he say 'Yes.' So me and im, me canno complain about im, me and im get on all right."

There are times when farmers want to get the best rate, but feel they are being patronized when butchers who supposedly pay higher rates come to work out a deal. One farmer who took pride in her cattle management practices complained that when buyers come from Montego Bay, they "believe that the country people are idiots. When they come here, they think that we are a hungry people, that we are not people that think." Recognizing the fact that Montego Bay butchers will generally charge their customers J\$12-14 per pound (US\$1.70-2.00 per pound), it might be expected that they would pay much more than local butchers, but often they pay only a little more. But one farmer said that one of the advantages of selling to the Montego Bay butchers is that they divide the meat and provide payment right on sight, so that the farmer does not have to go into town to get the fifth quarter.

One farmer said that he would not mind it if the butchers paid fifty cents less than the retail rate. But when he sells cattle for J\$7 per pound (US\$2.20 per kilogram), it bothers him that the butcher turns around and sells the beef for J\$8 per pound (US\$2.52 per kilogram). In his mind, the profit margin of J\$300 for a 300 pound bull in one day (US\$45 for a 140 kilogram bull) is too much after he has raised the cow for two or three years. "I ask them to return the fifty cents per pound difference" he said with a smile.

Government Policies

During interviews, twelve farmers commented on the government and its policies even though there were no such questions posed. Topics included non-support of small-scale farmers, binding contracts that import food products, favoritism, and clientelism.

As previously mentioned, the AMC was essentially liquidated during the 1980s. In 1990, five farmers were still bitter about the program's cancellation. One farmer said "Uncle Henry [Seaga] wrecked the farmers. Those banana farmers with 20 acres or so, they just chew it up. The larger farmers with over 50 acres did okay. But we're just living from hand to mouth." One farmer did concede that such a vast program as the AMC will probably not be started again because the initial inputs at this point would be astronomical, given the costs of setting up the infrastructure and the poor condition of the soils after years of neglect in places such as Green Park. Still, despite the major costs to the government, many feel that something should be done to help out the small-scale farmer.

One farmer talked about how producing food for the country made him feel proud:

"Farming is a great thing. As a farmer, you are feeding the nation. It's something which is worthwhile. Once you are producing something, that's one of the greatest things for the economy of the country--food! Small-scale farmers that are old could have been a strong backbone of this country. But you find that they don't bother about them anymore."

Another spoke about farming as a foundation for the country as a whole. "We really need government help to bring back this country to what it was." For those in government, the farmer had this message:

"I understand how the past made me see something. I went to the country and it's people, exploring what farming was...it was wonderfully good until they turned it down and import; not export, IMPORT. And that's what killed Jamaica. Jamaica is not supposed to import corn for bag feed! We should HAVE that here."

One farmer was quite upset about all of the hype of politicians of late:

"In Kingston, every day them talking about farming, farming, farming. And nobody give you no help about that. If a farmer is going to do anything, he should do a feasibility study himself. Don't you ever go by what the minister (of agriculture) said, because all they do is yap, yap, yap. No one looks on what the government do."

He pointed out that government price regulations do not work; items are sold above the set prices on the open market. He also noted that small-scale farmers are not exporting products because they do not get the loans to plant banana, cane, coffee as the government wants them to. The large-scale farmers get the loan.

"The small farmers are being used as guinea pigs. The only advice I can give to a small farmer is this. Do your own feasibility study. After you arrive at your conclusion, make a decision that you are going to do this, because there is a market for this on the local scene. Check with the hotels; then tell the farmers what to plant."

Another farmer expressed his displeasure at the "leftover's" policy dictated by the Ministry of Agriculture. "Anything that the big farmers do not plant, the government tells the small farmers to take out a loan and plant that crop." The first farmer concluded that "our problem is too heavy," meaning it is

difficult for small-scale farmers to make a profit given the government's misguidance and lack of support.

One farmer was quite open about his bewilderment upon discovering that an in-depth agricultural research project was underway in Green Park. "Why are they choosing Green Park?" he demanded. "They have been doing nothing. And then to see you come out of the blue to find out about the way that we are doing farming here... I don't know how to talk about it." After some probing, it became apparent that the farmer was convinced that the only way for small-scale farmers to benefit from projects like the silvo-pastoral scheme planned for farmers in Green Park would be to satisfy the politicians and large-scale farmer first. "Mr. Big's belly has to be full before the farmers can get a little. And if he is not satisfied, then there is no chance for us."

Since the AMC program was revoked, the only time that cattle farmers have received support is during long periods of drought, but not all of them benefit. Truckloads of supplementary bag feed are sent to Falmouth Agriculture Office. But there are problems with distribution. Supposedly the feed is available to all small-scale cattle farmers in drought-stricken areas and is allocated according to the herd size. But nine of the Green Park farmers said that they were not able to secure any bags in 1989. They gave one or more of these reasons: they did not hear about it. They heard about it, but by the time they went to find out, there was none left. Some people who do not have cattle received it and reportedly used it for other animals or gave it to their friends. Two farmers said bag feed was given to people farming in areas

where grass fodder was plentiful. Ironically, these areas were the same places where Green Park farmers were cutting grass to take back to their cattle. In reality, bag feed was made available on a first-come, first-serve basis for farmers and non-farmers alike. The means of distribution are quite upsetting to the 12-15 farmers who would have benefitted from the allocations.

Nineteen of the farmers interviewed (47.5%) reported buying their own bag feed whether they received allocations or not. They have had to rethink their strategy for getting their cattle through drought periods because feed is becoming more expensive every year. In 1990, the feed costs were J\$50-60 for a 50-pound bag (US\$6.30-7.55 for a 20 kilo bag). It also costs J\$4 (US\$0.57) per bag to transport it from Falmouth to Green Park. Because of costs and time, farmers search for other alternative resources first.

One farmer points out that members of parliament have neglected farmers and others living in Trelawny Parish:

"The MP has not been responsive to farmers' needs. Trelawny is a forgotten parish. Brownstown (in St. Ann's Parish) is a busy area, with tourists going through morning to night. Look at Falmouth. It's degrading. Nobody seems to care. Falmouth needs a lot of input, a lot of investment."

Another farmer thinks that the government should stay out of farming matters:

"They want to bring politics into everything. Every time you arrange this, now here comes our representative in our area, saying that he's supposed to know about it. And then they use it as a measure to go onto political platform. They'll tell them that 'See, I got that for Green Park farmers!' So we want to get rid of them permanently. We don't want them to even mention at all."

Failings of Government Institutions

Government institutions have influenced much of the activity in rural Jamaica, and Green Park is no exception. One institution, the Ministry of Agriculture, has sponsored projects, offered services, provided extension, and made policy that affected many area farmers. Although there have not been any major projects since the AMC, the Ministry office in Falmouth has maintained very basic services and extension to farmers throughout Trelawny Parish. From conversations with farmers in the Green Park area it is apparent that they have not benefitted much from this and have become quite distrustful. Although many problems were disclosed during the study, two basic concerns surfaced frequently: extension, and services available to small-scale farmers.

Extension

Six farmers indicated that local extension workers were inept at providing valuable information. Two farmers complained about how little the extension workers help out although the farmers understood that extension agents are taxed with extra work. Two other farmers mentioned that they need someone who can research their questions and follow up with useful information, respond to their concerns, and inform the farmers about pesticides and disease that are related to raising vegetable crops or animals. They mentioned that the agricultural extension worker often gave out bogus information rather than admitting his ignorance on a given subject and make attempts to find out.

There was also an accessibility problem. One farmer said that the agricultural extension worker was not regularly available. "If one extension worker cannot come out, then another assistant should be nearby to help out." Another felt that extension workers should go on foot to visit farmers and seek out answers to the farmers' questions rather than driving around to an area of his choice.

Two farmers were unaware of certain programs open to area farmers. One remarked that "in the 70s there used to be extension officers that would chat with farmers and let you know what was going on." Another farmer did not know that there was a coconut tree program started in the area and that farmers could be updated with the status of current projects.

Services Available to Small-Scale Farmers

Every cattle farmer in Green Park benefits from one service made available through the agriculture office: administration of vaccinations against Black Leg and worm medicines. This is usually administered during one or two days in March or April. Cattle farmers take advantage of this in lieu of losing cattle to Black Leg disease. Two other services available are securing free or subsidized bag feed (already discussed) and hiring the services of an operator (employed by the Ministry of Agriculture) to clear their land with a bulldozer or plow their fields with a tractor and a disc. In 1990, the subsidized fee for this was J\$500 per acre. But continued problems are in evidence.

Ten farmers reported making recent attempts to secure the Ministry of Agriculture's clearing/plowing services to make improvements to their land.

Only two had been successful, although not without great difficulty. Supposedly, these services are available to all farmers in Trelawny Parish. Herein lies half of the problem. Since the area is large, moving the equipment is a logistical problem, and there are limited numbers of working machines at any given time. But there are other reasons too.

Green Park cattle farmers concede that the tractor is in high demand a few weeks before the beginning of the fall planting season, but they believe that they should be able to get it at other times of the year. Three farmers said that when the equipment is in the area, often the work that is done is not necessarily related to agriculture. In fact, for three weeks during the study, the tractor was used for non-agricultural purposes by an influential resident in plain sight of Green Park farmers. At least two farmers expressed their displeasure with this predicament, especially after having heard from Agriculture Office personnel that the machine was reserved by a nearby neighbor. The farmers could clearly see that their neighbor's work was unrelated to agriculture. One remarked that "Mr. Big had the Ministry tractor for three weeks. We needed it for only two days and could not get it."

One member of the Agriculture Office staff claimed that the reason farmers were complaining was because the cost of the service had increased since the 1970s when it was available at a highly subsidized rate, and farmers were expecting more of the same. He also mentioned that some of the concerned farmers did not pay for past work, and were not willing to pay in advance, which was the practice. But two farmers said that even after paying,

the job was not completed before the tractor went off to plow the land of another, more influential farmer.

Without access to the Agricultural Office services, farmers are left with few options. Five farmers said that they are faced with using private tractor operators at a higher rate than with the Agriculture Office. When asked about farmers forming a cooperative and buying and maintaining their own equipment, two farmers thought that it might work, but the thought of political intervention stalled the idea. "The banks are so manipulated [manipulated] by politics that they are going to say 'We need the MP [Member of Parliament] signature, parliamentary signature, permits, everything.' That even makes it worse."

Trust Within the Farming Community

Relationships among farmers in Green Park vary between the close and the very distant. Some farmers work with others in a "day for day" system whereby farmers lend their labor or work animals for a work day to another person, who then returns the day when he is called upon (Henry, 1980). A few farmers are very independent, having little reason to associate with or depend on others. How cattle farmers execute their daily activities is often a matter of personal choice, but there are also certain factors that help determine their strategy. Whether they solicit the help of another farmer depends on mutual trust between farmers. Trust is partially affected by actions and reactions within a community. By focusing on various actions concerning cattle farmers and the reactions to them, one can get a sense for trust, or lack thereof, within

the community. Discussion includes the following topics: cooperation, conflict, and perceptions of other Green Park farmers/residents.

One way in which farmers cooperate is through stud servicing, either borrowing friends' bulls or paying a fee. Ten farmers have bulls, and six of them use their bulls for stud service. Of the 30 farmers who do not have bulls, 12 of them have privileges to borrow bulls from friends for servicing their cows. The remaining 18 reportedly pay a stud fee to owners of the bulls. One farmer conceded that half of the time he takes his cows to the service bull and pays, but if a bull appears at the watering trough, he gets free service. The free service may actually be the norm in Green Park. Stud fees reportedly were J\$100 (US\$14.30) in 1990, although one farmer said that no one had paid him any fees in the two years since his bull has been used for services. Two farmers reported that most of the farmers who pay for service get two chances for their cows to become pregnant, but one farmer said that he knew some farmers who demanded payment for each servicing.

Farmers help each other with some of the tasks involved with keeping cattle. If cattle break out of their paddocks, some farmers will escort the herd back, fix the fence temporarily, and notify the owner. Three farmers said that they help each other mend fences, especially those that are shared between paddocks or fields. At least four farmers share their paddocks with others, and three graze their animals on others' property (squatting) in exchange for keeping the area clear of weeds. One farmer said that if someone's cattle die, sometimes other nearby farmers help to bury them or burn them (if they have

suffered from Black Leg disease). One farmer who has donkeys lends them to other farmers who are in need.

In 1975, there was a 12-month drought period where cattle farmers faced extreme hardships. It was difficult for farmers to find fodder for the cattle, but even more so to find adequate water resources. Some farmers took their cattle to the Martha Brae River, over five kilometers away. But farmers also relied on water in large holding tanks near the center of what was the Green Park Estate. Besides the river, this was the only source of water large enough to support the cattle in the area. Farmers worked together, scooping out buckets of water and passing them up to the cattle, often for hours at a time. Although the task was difficult, especially given the imminent threat of losing cattle to disease brought on by the drought, this was an opportunity for farmers to work together.

The next year, six to eight concerned farmers made attempts to solicit funds from all Green Park cattle farmers to build a new water trough in a centralized area where farmers would be able to get water at any time. This was somewhat unsuccessful (due in part to the lack of financial resources of some households), but farmers with large herds in nearby pastures went ahead with the plan anyway and built a trough after getting permission to tap into a water supply line from the appropriate authorities. The trough has doubled as the main meeting place for farmers since 1976. It is still the farmers with the larger herds, sometimes acting alone, who maintain the tank.

Two farmers stated openly that there is minimal cooperation between farmers. One reported that some farmers will take advantage of overseeing other farmer's cattle (e.g. grazing their own cattle in the other's paddocks). Both farmers stated that farmers need to be more trusting, explaining that a more relaxed environment would relieve them of the stress caused by the day-to-day concerns that they harbor.

Praedial larceny and vandalism are two such concerns. One farmer remarked that "thieves have taken the wind out of my sails." Another said that larceny is perhaps the biggest deterrent to farming and is a major cause of distrust in the area. Three farmers who have independent water tanks or rain catchments for their cattle reported that youngsters had smashed them, leaving them no other option but to bring their cattle home or to the main water trough. Two of these farmers suspected local kids of the crime, and one took them to court, but to no avail. Such accusations, whether justified or not, cause friction within the community.

More than half of the forty farmers reported losing their zinc roofs during hurricane Gilbert in 1988 and many of these claim that they could have reused their old roofs had they not been confiscated by junk scavengers. All but one received some of the relief material that was sent from other countries. It is common belief that a lot of the material was absconded and sold on the open market for large profits. But there were at least ten farmers who strongly believed that most of the other farmers received this material for free and that they received none. There was no method to verify these claims, but

it did indicate that either these farmers believed that they had somehow been excluded from benefits that were available to other farmers or that others were somehow involved in the scandal and could not be trusted. Such beliefs have only increased friction and decreased trust between residents.

Even though Gilbert did a lot of damage, two farmers reported that the disaster made people more aware of others' desperate situations. "Even if you were okay, you knew someone who suffered," one said. "It taught people to be more loving."

Three farmers were quite concerned with the over-harvesting of trees by some people living in the area. They said that as a result of this, less rain was falling in Green Park. It has already been mentioned that Breadnut is on the verge of local extinction partly because it is used for charcoal production. Many other trees have also been cut out of nearby hillsides and the forest has become degraded.

4.4 Pastoral Land Use Systems and Technologies

Every farmer with cattle in Green Park has at least one paddock or large area around the house where their cattle can graze on grasses and tree leaves. Farmers do not stall-feed their cattle as this would place greater demands on time spent doing regular farming activities. Thirty-one Green Park farmers (77.5%) have more than one paddock and have the option of moving their cattle between them. Two of these farmers and 7 farmers with only one paddock tie their cattle to a stake or tree and move them around from day to day. Two farmers had access to unlimited pasture areas just outside of Green Park. It was not apparent that the 29 farmers with over 2 paddocks were following any rotation management scheme. Instead they would move their cattle between paddocks when the grass was low or every few days if they had only two paddocks. For the 27 farmers who rotate their cattle every 60 days or less, the average number of days cattle spent grazing any 1 paddock decreased from 24 to 10 when grasses became desiccated. As drought extended, cattle were seen to overgraze their paddocks.

When paddocks are overgrazed, preferred fodder grasses diminish, and other grasses and unwanted vegetation grow in its place. Farmers have the option of upgrading their paddocks or converting vegetable fields into pasture by planting improved grasses, such as *Cynodon plechtostachyus* (African Star Grass) or *Panicum maximum* (Guinea Grass). Many of the vegetable fields were converted into pasture when the AMC project ended as farmers became more involved in raising animals.

Upgrading paddocks or converting vegetable fields to paddocks and maintaining them as such is not an easy task. Decisions need to be made regarding labor, land preparation, fencing, which trees to remove and which to retain, grass species to plant, whether to plant vegetables or trees along with the grass, and the time involved in maintaining the paddock once established. Discussion in this section will focus on the tasks involved with pasture establishment/improvement and maintenance, and the technologies utilized in providing fodder to cattle.

Pasture Establishment/Improvement and Maintenance

When farmers acquire land or make a decision to improve their paddocks, they first assess the work that needs to be done in the conversion. Trees may have to be removed, especially if the area has remained fallow for a number of years. One tree in particular, *Haematoxylum campechianum* (Logwood), is known to flourish in open, disturbed areas, and to grow into a thicket in 3 to 5 years. If this is the case or there are large unwanted trees, a bulldozer may be needed to remove them. Otherwise, the farmer will try to obtain a tractor and plow to turn the soil while the farmer and/or laborers cut back the small trees with an axe or machete. Roots are usually burned out. Securing labor and equipment is discussed in section 4.3 under "Labor" and "Services Available to Small-Scale Farmers."

Assuming farmers have made arrangements for plowing and labor, they are faced with the prospect of transforming the physical landscape. They cut out small to medium trees (Logwood and other unwanted species), and leave

certain trees that provide shade for animals. If fence posts are needed, sections of 3- to 5-inch diameter logs are often installed or set aside for future installation. Species used for fenceposts by farmers are listed in Table 6. Trees that they leave standing tend to be multi-purpose species, improving the micro environment or providing fodder. These would include any of fodder trees mentioned by farmers during the study (Tables 4 and 5 in section 4.2). The species observed most often in existing paddocks included *Samanea saman* (Guango) and *Guazuma ulmifolia* (Bacedar). Both of these trees provide fruits that cattle eat as a supplement to fodder grasses.

Once it is determined which trees will remain, clearing and plowing begins. During one observation of plowing, the Agriculture Office tractor operator cut a swath around the outside perimeter of the farmer's area, moving in smaller circles until he was finished. When approaching a small tree, he signaled to the farmer to remove it. The farmer and laborers cut small trees/scrub and removed overturned rocks, tossing them in separate piles. The farmer burned the brush if the winds were not too high. Sometimes the farmer placed the brush against trees or stumps that were difficult to remove and burned it. He said that it was the only way to keep unwanted species (e.g. Logwood) from re-sprouting.

When the area has been plowed and conditions are right (rainy periods begin), the farmer will plant grass, often with a vegetable crop or tree crop. Farmers in Green Park usually plant *Cynodon plechtostachyus* (African Star Grass) after obtaining cuttings from other farmers. *Panicum muticum*

(Brachiaria Grass) had been introduced into the area in the 1970s, but it does not withstand drought well in the area. Live African Star runners are placed in furrows every couple of feet and covered with nearby soil. Usually the farmers cannot afford to fertilize the area. If the soil is rich, rains are plentiful, and the area is not grazed, the area will be covered with grass in six months. The research facilitator reported that farmers could start to graze their cattle at that time, but usually wait another six to eighteen months so that the grass can become well established. During the wait, farmers may cut the grass by hand and carry it to their cattle. Once paddocks are established with improved grass, farmers have only to maintain fences and keep unwanted species from growing (using a machete).

Farmers attempt to reduce the risk of losing their investment of time and work into the operation by planting both grass and vegetable or tree crops together. Most farmers plant pumpkins, red peas, or corn. If the rains are good in the first six months, both the vegetable crop and grass do well. If drought sets in after the third or fourth month, the grass may become desiccated before establishment.

Six of the 40 farmers interviewed (15%) have planted or have future plans to plant African Star grass among their coconut, orange, pimenta, and mango trees. These farmers cut grass or tie up goats or cattle to graze the grass as the saplings grow in the area. Once trees are established, the animals are free to graze under the trees, while at the same time providing a natural fertilizer for the trees.

Methods of Planting Trees

Since the main goal of JADF is to introduce the idea of using tree fodder as a means of coping with the fodder gap, farmers were interviewed about methods of planting trees. Thirty-four (85%) farmers had planted trees at some time in their lives, although most of these were fruit trees around their houses. Information about planting appears in Table 8; farmers said that they would use the same methods, regardless of the species planted (except for *Gliricidia*, where a cutting was planted at a depth of 61cm). Of the farmers who planted trees, 26 (79%) watered them, although these were near houses, not in plantation areas. *Gliricidia* is usually planted in fencelines and is dependent upon rainfall for water.

Table 8. Tree Planting Information (with number of farmers in parentheses)

<u>Species Planted</u>	<u>Tools Used¹</u>	<u>Hole Depth</u>	<u>Fertilized</u>	<u>Mulched</u>
<i>Mangifera indica</i> (14)	pitchfork (26)	15-29 cm (6)	Bag (11)	Leaves (8)
<i>Citrus sinensis</i> (14)	pickaxe (11)	30-44 cm (23)	Manure (7)	Manure (2)
<i>Cocos nucifera</i> (3)	hoe (4)	45-61 cm (4)	None (15)	Grass (3)
<i>Musa sapientum</i> (1)	machete (3)			Stones (1)
<i>Persea americana</i> (1)	mattuck (1)			None (19)
<i>Gliricidia sepium</i> (1)	crowbar (1)			
	digger (1)			

N=34; from data collected during interviews

¹Farmers may have used more than one tool

Technologies Utilized in Providing Fodder to Cattle

When pasture grass production decreases during drought periods, farmers seek alternatives: grass growing outside of paddocks, sugar cane tops,

supplemental feed, or tree fodder. The focus of this section centers on the latter alternative, specifically how farmers acquire tree fodder.

When farmers face severe shortages of cattle fodder, twenty-nine (72.5%) of the farmers collect or use tree fodder when needed. Sixteen (55%) of these farmers procure the help of others when collecting fodder, half of them getting aid from family members, half from helpers or hired workers. Initially, they will search for fodder within the valley, but some venture further inland towards Wakefield or west toward Orange Valley. Time spent cutting and/or collecting all supplemental fodder varies between 0 and 14 person-hours per day, averaging 3.2 person-hours per farmer (Table 9). Hours reflect totals for all participating, farmers plus family members, helpers, or laborers. Time spent conducting the task per head of cattle per day appears in Table 10.

Fruits and leaves of trees are cut or collected by farmers (Table 5). Only three fruits are eaten by cattle: *Guazuma ulmifolia* (Bacedar), *Samanea saman* (Guango), and *Brosimum alicastrum* (Breadnut). Cattle usually pick these up from the ground, eating them on site, so farmers need only to take their cattle to an area where the fruits are available. Sometimes farmers collect them and bring them to the animals. Only one farmer mentioned storing fruit for a future date.

Based upon interviews with the 40 farmers, leaves of all 17 tree species mentioned in Tables 4 and 5 are eaten by cattle. Again the farmers may take their cattle to a nearby area where the leaves are, or if the area is far from the cattle (over 1 km), the farmers transport the fodder leaves back to the paddock

Table 9. Time Spent Cutting and/or Collecting All Fodder per Day in Dry Season by Farmers

<u>Time Spent</u> <u>(Person-Hours/day)</u>	<u>Number of</u> <u>Farmers</u>
0.0	6
1.0	8
2.0	9
3.0	6
4.0	2
5.0	1
6.0	1
7.0	1
8.0	2
9.0	2
10.0	1
14.0	1
$\bar{x} = 3.2$	

N=40; from interview data.

Table 10. Time Spent Cutting and/or Collecting All Fodder per Head of Cattle per Day in Dry Season by Farmers

<u>Time Spent</u> <u>(Person-Hours/Head/Day)</u>	<u>Number of</u> <u>Farmers</u>
0.0	6
0.1	5
0.2	4
0.3	7
0.4	2
0.5	4
0.6	4
0.7	3
0.8	2
0.9	1
1.0+	2
$\bar{x} = 0.4$	

N=40; from interview data.

or house. The means of transportation vary: truck/pickup (7), automobile (5), bus (5), donkey (4), walk (4), tractor (1), motorbike (1). Once at the site of the trees, farmers cut the branches, drop them to the cattle grazing beneath, or collect and transport them to the cattle. Some of the older farmers said that they would get help to do this as they were not able to climb trees easily.

4.5 Summary

Thirty-five of the approximately 90 households in the Green Park valley had at least one member who was engaged in raising cattle. Each had their own home and tenure of or access to land for raising crops and animals. The AMC was instrumental in providing a market for selling crops, but was rescinded in the late 1970s, leaving farmers with few options to sell their goods. Cattle farmers generally graze their animals in sectioned-off paddocks. When drought strikes, grass production slows, and farmers have to search for alternative fodder sources: cut grass, bag feed, and tree fodder.

Thirty-eight farmers (95% of those sampled) mentioned at least 1 of 17 species that they used or that could be used as an alternative to grass. Species most often mentioned were *Guazuma ulmifolia* (Bacedar), *Samanea saman* (Guango), *Brosimum alicastrum* (Breadnut), and *Gliricidia sepium* (Quickstick). Breadnut was also a valuable species for making charcoal. Logs from 14 different trees were used as fenceposts.

Employment opportunities in the Green Park area are limited. Few residents work in tourism sectors, and many have only to raise crops or animals as a means of generating income. Raising cattle is one of the best

means for this. Some farmers would like to improve their paddocks and expand their herds. They are constrained (among other things) by insufficient capital, difficulty in obtaining loans and securing equipment, lack of consistent labor, and government policies that generally do not support the small-scale farmer.

Finally, if farmers are able to improve their paddocks, they plow up their fields, plant *Cynodon plechtostachyus* (African Star) or *Panicum maximum* (Guinea Grass) alone or with crops, and wait 6-18 months for the grass to establish itself. Methods of planting trees are described and farmers' technologies in providing tree fodder to cattle are outlined.

Chapter 5

DISCUSSION

5.1 Making the Transition from Pastoral to Silvo-Pastoral Management Systems

Changing to a Silvo-Pastoral System

Green Park cattle farmers utilize several fodder resources through various silvo-pastoral management systems in their attempts to feed their cattle. With the information gathered during the study, project planners will not have to "reinvent the wheel" in trying to determine how to ameliorate the situation. There are a number of possible methods whereby trees can be introduced into or expanded in the existing pastoral system. These include: planting trees in the fenceline, in fields with crops or improved grasses, in pastures, or in other sites. These methods will be explored in detail and each will be analyzed to determine its feasibility, given the constraints outlined by the farmers.

Planting Trees in the Fenceline

One area where trees could be planted is along the fenceline. This is very common throughout Central America whereby barbed wire is attached to trunks of trees acting as posts or the woody plants are established as hedgerows (Budowski, 1987). In Costa Rica alone, 92 woody plant species (of which 21 produce fodder) have been identified in living fences (Budowski, 1987).

There are instances of using fodder trees that grow in or along the fenceline in Green Park. Some trees have regenerated naturally, while others have been planted. *Guazuma ulmifolia* (Bacedar) and *Samanea saman* (Guango) are two species in the former group, while *Gliricidia sepium* (Quickstick) and *Erythrina corallodendrum* (Never Die) fall in the latter category, primarily to strengthen the fence and for demarcation.

Nine of 40 farmers (22.5%) in Green Park mentioned using Quickstick as a fodder tree, but only 6 (15%) of the farmers have actually planted it, albeit 1 or 2 trees. And only one other farmer manages Quickstick intensively, even though they had already been planted on the land when he moved into the area 3 years prior. One farmer did mention that Quickstick is used as a charcoal in preparing jerk seasoning in Portland Parish. Also, intensive agroforestry and silvo-pastoral innovations involving Quickstick and other species are being tested in St. Catherine and St. Elizabeth Parishes¹¹. Given the fact that it is such a good fodder source and possibly a good charcoal species, it might be hypothesized that it would be planted more intensely in Green Park, but this is not the case. There are several reasons for this.

First, from conversing with farmers, trees that can be used as fodder have not been promoted to the extent of other fodder sources (such as improved grasses), either by formal or informal means of extension. The reason for and method of introduction of Quickstick into Green Park is

¹¹Wilson, George 1990. Personal Communication (see footnote 1).

unclear. Many innovations in Green Park have evolved through informal extension systems whereby farmers will visit other farmers and bring a "successful" technology back to their own farm.

Second, since only a few trees are available, there may be too long a period between feeding for the cattle to maintain the taste. It is possible that the composition of the leaves change over time, and are no longer palatable to the cattle (Borel, 1991). Green Park farmers said that even the best fodder tree leaves dried out to some degree and/or fell off of the trees during the dry season and were no longer viable as fodder. Rusten (1989) found this phenomenon to be true in the middle hills of Nepal.

Third, most Quickstick trees in Green Park are not being managed in a way that is maximally compatible with other systems or lifestyles. The one farmer who intensely manages his Quickstick said that he has not planted any more of it because "it grows to be too much of a big tree." Indeed, some farmers have cut down large trees on or near pastures, presumably to increase grass production during periods of rain. Large Quickstick trees cast shade over other plants, and are susceptible to high winds. If Quickstick trees that have been planted in the fenceline blow over, the farmer has to untangle the wire and fix the fence, resulting in many hours of work.

A management technique that would keep the branches from growing too large without cutting down the tree would be the lopping of branches with a machete. If the branches were lopped back to the trunk (pollarding)

periodically (every 3 to 6 months), Quickstick would not grow to the point where it would blow over easily or be a problem for other plants growing underneath. Farmers in the area are familiar with lopping branches when they need poles for crude construction, so it may take only a simple demonstration of this technique before they would realize the potential benefits involved: nitrogen fixation, stronger fences, free fodder, and small poles (depending on the size of branches at the time of lopping). The time spent lopping might be less than or comparable to maintaining traditional fencing or the time and energy involved in searching for and cutting fodder elsewhere.

Planting Trees in Fields with Crops or Improved Grasses

In order to reduce the risk of losing crops from drought, it is common practice, when upgrading grazing grasses from the indigenous Seymour grass to the drought-tolerant African Star grass, to plant crops along with the grass in pastures that have been recently plowed. But this practice is also being used when farmers plant cash trees either in or near their pastures. Farmers in Brazil, among other places, use a similar system, initially using cash trees with cash crops; as the tree canopies close, fodder grasses are planted and animals are allowed to graze after a few years (Johnson and Nair, 1985).

This concept could be used to establish fodder trees in Green Park. As long as farmers can keep their cattle away from the plants and trees for a specified time (6 months to 3 years, depending on the crop or tree species),

the trees should grow well. Once it is safe to let animals graze freely, farmers can let their animals roam the area. Eventually, the trees will shade the crops or grass during the hotter months, reducing incoming solar radiation and moderating soil temperatures and plant transpiration rates. Once the trees become well established, if farmers opt to keep growing crops or grass, they will have to prune the tree crown if orange, pimenta, or mango trees are used. This may be accomplished using a machete to thin the crown.

Finally, Liyanage *et al* (1990) reported that attempts were made to incorporate *Gliricidia sepium* and *Leucaena leucocephala* with pasture grasses inside of coconut groves in Sri Lanka in order to alleviate dry season feed shortages for cattle. *Leucaena* became susceptible to the *L. psyllid* during the dry season, but *Gliricidia* results were rather promising. In comparison with gains during the wet season, "reduction in mean total and daily liveweight gains per head during the dry season was only 33.6% and 21.2%, respectively." They also reported dry season daily milk yield increases of 14.8% over wet season daily yields, attributing part of the increase to the integration of *Gliricidia* fodder into the diet of the cattle.

Planting Trees in Pastures

It may be feasible to plant trees directly into pastures, possibly using a silvo-pastoral hedgerow system. African Star could be grown in alleys bordered by rows of fodder trees. During the study, about a dozen farmers were told about the possibility of introducing an alley cropping/hedgerow

system technology. Three of the farmers responded negatively. Farmers depend on grass to "carry their cattle through," meaning that as long as the grass is in production, the farmers have little to do besides watering the cattle and checking to see that they are in good health. Some farmers said that they prefer grass over anything else, and even have cut down Guango trees in pastures because the trees "take too much sun and nutrients from the grass."

At present, in pastures where the Guango tree canopies are touching and grazing takes place, fodder grasses were in poor condition. It is unclear whether the condition is caused by overgrazing, reduction of light penetration, or both. Farmers tend to believe the second hypothesis. Therefore, to captivate farmers initially, if trees were planted in rows in the pasture, they would have to be either trees that cast little shade or trees that cast shade but would require periodic maintenance by the farmer (e.g. Guango branches could be thinned out to allow light penetration to the pasture). In the second case, farmers would have to be made aware of the labor needed for maintenance.

Another option would be to plant trees in pastures where grass currently is not growing due to the spread of pioneer shrubs and trees. For instance, due to lower numbers of goats in the pastures, the thorny *Haematoxylum campechianum* (Logwood) is proliferating and becoming difficult to control. Because of this and the fact that good laborers are hard to secure, it is usually the farmer who cleans the pasture with a machete,

either continuously or occasionally. If Logwood is allowed to go to seed, it seriously threatens future grass production in the pasture. If specific "useful" trees were introduced to help keep Logwood in check, this might appeal to the farmer. The farmer could cut down the existing trees and use the thorny branches to protect newly planted trees from cattle or other animals. This could be done on an individual basis. If the Logwood trees occupied a corner of the pasture, the outer perimeter of the invading trees could be left as a temporary fenceline where the thorny branches from the cut trees could be piled, creating an impenetrable barrier, protecting newly planted seedlings.

Other Systems

A few farmers with smaller herds mentioned using trees around houses for fodder. This practice stems from either a marked dry spell when fodder resources are minimal or to the fact that cattle will try anything growing close to where they are grazing. In general, good fodder trees are not planted nor encouraged to grow around houses. It can be seen in Table 4 that 5 fodder species were mentioned as growing around houses.

Guazuma ulmifolia (Bacedar) and *Bursera simaruba* (Bujgum) around houses were a result of natural regeneration; *Gliricidia sepium* (Quickstick), *Terminalia catappa* (Almond), *Mangifera indica* (Mango) were planted.

In the Green Park area, almond trees are planted almost exclusively for shade or ornamental purposes; mango trees, as well as many other fruit trees, are planted for their fruit. Most likely, this practice will continue into

the future. Therefore, the possibility of planting many trees around houses exclusively for fodder would not be a viable alternative. If a selected tree species served a dual purpose, providing fruit for human consumption or sale and fodder for animals, it might be considered valuable when planting and caring for trees around houses; *Artocarpus heterophyllus* (Jackfruit) or *Ficus* spp. (Fig) (well known in Nepal) might be species to investigate.

Since trees around houses are more accessible for management and cutting, establishing a few multipurpose fodder trees there might yield some benefit, especially for those farmers with only a few head of cattle (Francis and Atta-Krah, 1989).

There was no evidence indicating that any farmer had planted trees along the roadside (defined here as an area along roads which includes a 1.5 to 6 meter wide strip between the road and fenced-in pastures). Generally the roadside is a commons area, used by all, cared for by few. There was no incidence of private ownership of trees in this area. Since local roads are major travel routes for scores of cattle being transferred to other pastures or to the watering trough and back, these roadside areas sustain much pressure on the grass and tree resources and contributes to soil compaction and erosion. The area is important for some farmers who have limited pasture resources and are forced to tie up their cattle along the roadside for all or part of the day.

The thought of planting fodder trees along an unproductive roadside is intriguing, considering the potential increase of available fodder and the

secondary effects of windbreaks on protecting nearby vegetative resources. But unless there is an increase in cooperation among all of the farmers who use the roadside areas, not much thought should be given to roadside planting at this time, since cattle damage unprotected trees while they are in their early years of growth.

It may be possible to plant trees in nearby forests, but this would be perhaps the least viable means to implement a fodder tree initiative. First of all, the sloped land in the nearby forest is leased, rented, or privately-owned. It would be difficult to get various owners and users to agree on how the land should be managed. The parcels of land generally are not large enough to warrant such tree planting endeavors (using heavy machinery) without influencing neighbors lands. Second of all (and this is perhaps the most significant reason not to plant), there are people who make charcoal out of forest trees, both alive and dead. The controversy over whether Breadnut should be used for charcoal or fodder is a case in point. The perception of some farmers is that people cutting trees for charcoal are doing so illegally or over and above the limits that are set by land owners and farmers who are leasing or renting. Since these people have few income generating options other than selling charcoal and often compete with each other, it may be difficult to control their movement or restrict their access to parts of the forest. It may be possible to involve them in a planting-managing-cutting program whereby certain species of trees would serve both the cattle farmers searching for alternative sources of fodder

while the trees are growing and the people making charcoal once the trees attain a certain diameter which makes it easy to produce charcoal.

Whether or not a silvo-pastoral project is to be implemented in the area, it is important that this management issue be dealt with and all party's concerns are woven into the development plans. If the charcoal producers are not involved in decisions relating to management of existing forest resources, they could undermine activities that only benefit cattle farmers.

5.1 Constraints to Improving Pastoral Systems

Green Park cattle farmers have made various attempts over the years to improve conditions that would allow them to increase their income. Mixing improved breeds with local varieties, upgrading paddocks, and intermixing crops with fodder grass have been the main focus of the improvements. By examining current pastoral land-use systems and technologies in Green Park, further improvements might be made in the future. Before attempting to do this, it would be advantageous to pinpoint constraints to improving the system.

Governmental Programs

Since the AMC was retracted in the early 1980s, no new major agricultural programs have been launched. Also, during Prime Minister Seaga's and the Jamaica Labour Party's dominance in the 1980s, private sector led development was promoted, agricultural cooperatives were discontinued, and farming policies were changed to benefit the large-scale farming operations much more than small-scale operations like those in Green Park (Beekhuis, 1981; Stone, 1989). Essentially, there has been minimal governmental support in the small-scale farm sector in the past decade and few farmers in this sector have benefitted from any agricultural program. At the end of the study, major reorganization of the Agricultural Department was taking place, but it was not clear on how this might affect small-scale farmers.

Even if the government created a program to aid small-scale farmers, success could not be guaranteed, given the responses of some of Green Park's farmers towards governmental programs (e.g. the bag feed distribution program). LeFranc (1986) reported that small-scale hillside farmers in Jamaica have "fairly high levels of cynicism and skepticism towards officialdom--and it is an attitude which is the result of long years of broken promises, official inefficiency and clientelism." This dilemma has seriously jeopardized the working relationship between Green Park farmers and Agriculture Office staff in Falmouth, the very people hired to help the farmers.

Limits to Income Generation

Raising cattle in Green Park appears to be a viable option in generating income. Many farmers have attempted raising other livestock and various crops over the years, but without a steady market, prices can not be guaranteed. The market demand for cattle has been constant over the past few years. Also, the mixed breed of cattle are more resilient to drought than crops. Therefore, farmers will continue to focus on raising cattle to generate income. Raising goats could also be a profitable undertaking if the risk of larceny could somehow be decreased.

Cattle farmers would like to increase their cattle herds as a means of increasing their income, but generally have not been able to do so. Farmers talked about improving or increasing their paddocks so that they could enlarge their herds, but they need capital to initiate changes.

Means of Obtaining Capital

One method of securing capital would be to use some of the income from selling cattle, but it has already been determined that most of the farmers have little left after they cover expenses for the health and well-being of the herd and their own personal expenses.

Changing the marketing system for selling cattle could be one way to increase income. Although there are many butchers in the area, most cattle farmers have few options when it comes to selling their cattle. Hotels buy only from commercial cattle farms because the cattle have to be healthy and large. Farmers hiring their own butcher would also be out of the question for a number of reasons. First, the liability costs (in case of a lawsuit) would be too expensive. Second, farmers would have to get a licensed butcher to slaughter the cattle, process the meat, and get a government inspector to approve sales to the public. Third, the farmers would have to transport cattle to the slaughterhouse themselves. All told, it might be difficult to compete with established butchers. In the end, butchers have better means of generating income than farmers.

Securing a loan to make improvements is another method. Yet few of the Green Park farmers have been unable to obtain loans lately. Beckford and Witter (1982) described the difficulties faced by small-scale Jamaican farmers in securing loans. Since the 1960s, land and finance "has been monopolized by agrarian capitalists, foreign monopolies, and banks. Banks maintain their attentiveness towards large-scale farmers while neglecting

small-scale farmers.” Securing a small amount of capital to improve paddocks may seem viable to a small-scale cattle farmer, but to banks, it may not be worthy of consideration in light of the number of applications they receive and the number of past loans that farmers have been unable to repay. In a Jamaica Small Hillside Farmer Project survey, it was determined that most of the credit problems of small-scale farmers lie in the bureaucratic delivery systems of banks and other lending institutions (Carlton, 1984).

Lest it be thought that little can be done for small-scale farmers, there are instances where credit has been granted to people who never before could secure loans. In Nepal, low-caste women developed a successful fruit tree nursery (among other projects) with loans from a production credit program (Axinn, 1988). It was reported that the percentage of loans repaid by these women (and others in similar programs) was higher than average for the area. If the farmer’s incentive is there and the loan is applied towards a reasonable project, the outcome can be successful.

Securing Labor and Equipment

Farmers with adequate capital still face the prospect of acquiring labor and equipment. It is clear from interviews with farmers that outside labor is difficult to obtain for any given period of time. Farmers tend to rely on neighbors and people that they know, but this limits the number of laborers available and the amount of work that can be accomplished.

Farmers sometimes help each other when the need arises in a "day for day" arrangement.

During interviews with farmers, it was apparent that securing a tractor-drawn plow or bull-dozer was perhaps the most limiting factor to making major improvements in their paddocks. Private tractor operators charge more than the Agriculture Department, so farmers are limited in how much land they can plow at one time. It was not apparent at the time of the study that any changes in the Agriculture Department's lending system were imminent in the future.

One alternative to using these machines is the use of animal traction. Eight farmers had either used or had heard of using animals for plowing. One said that mules were used to plow cane fields in Green Park in the 1930s. Five farmers mentioned that there was one farmer who would lend both his mules and a man to plow farmers' fields or paddocks in Green Park through the late 1970s. Another said that he knew of using oxen for plowing in Clarendon and using donkeys or mules in Westmoreland and St. Elizabeth. One farmer said that one of the advantages of using animal traction over heavy equipment is that soil is compacted less, allowing the grass roots to become strong.

Given the inaccessibility of heavy equipment, this method of plowing might seem feasible in Green Park. But there would be problems with implementation. Six of the eight farmers were somewhat skeptical of the

idea. They were not sure of the of the viability and thought the method "old-fashioned."

But this belief might be just the means of keeping the idea apolitical, rebuffing the influential farmers who might otherwise take advantage of it. Yet even if the idea caught on, there remains the problem of who would oversee the service and care for the animals. One farmer was responsible for his own animals and equipment in the 1970s, but has since passed away. There is the possibility of the Agriculture Office overseeing the effort, but this option should be avoided, given the skepticism of the farmers towards institutions. JADF could be in a position to demonstrate the feasibility of and oversee implementation of reintroducing animal traction. Finally, a group of farmers might consider taking on the task, but this would depend on the degree of farmers' cooperation within the community.

Community Cooperation

Cooperation in the community is mixed. Some cattle farmers meet daily and work together when the need arises. Some of the farmers work independently, and therefore do not seek out the company or help of others. It was apparent during the study that there is a certain amount of distrust between some farmers and others. Results from the socio-economic study being carried out in 1991 might reveal some of the reasons why this is so.

Relations between farmers could improve if the means were present. Before leaving the area, the principal researcher decided that he wanted to "repay" the farmers for their help, openness, and candid remarks by holding

a field day. At least half of the forty farmers participated in cleaning the central water trough, preparing food, and engaging in conversation among themselves. A few farmers later remarked that they enjoyed talking with farmers they never really knew before. Such activities can help "break the ice" and compel farmers to talk about similar activities.

Summary of Constraints

Although cattle farmers in Green Park have made attempts at increasing income through expansion of their cattle herds, they have been met with limited success. One reason is that small-scale farmers have to work within institutions that do not necessarily cater to them. Another is that they have few options in selling their cattle to anyone but local butchers. Finally, they have limited access to equipment and labor to make improvements to their paddocks.

5.3 Summary

Methods of increased tree integration are discussed. Planting trees in the fenceline, in fields with crops or improved grasses, or scattered throughout pastures appear to be the most viable options, since they would interfere least with the existing pastoral grazing system.

Making improvements to the existing pastoral system appears feasible if constraints are taken into account. Governmental programs have not supported small-scale farming for over a decade. Farmers are restricted to dealing with local butchers and therefore do not always obtain the best price when selling cattle. Securing loans, labor, and equipment to improve paddocks is difficult. Community cooperation varies according to established relations and need of the farmers, although it might be improved if the means were present (e.g. field days).

Chapter 6**RECOMMENDATIONS, SUMMARY AND CONCLUSION****6.1 Recommendations**

One of the biggest constraints to development of an improved silvo-pastoral system in Green Park is the farmers' inability to obtain credit. Since the problem is rooted in the breakdown of the institutional delivery system, much could be accomplished if JADF could help alleviate this, either by establishing a independent lending institution geared towards small-scale farmers, or by convincing nearby banking institutions to be more lenient.

In the same vein, it is obvious that Jamaican Government policies are not oriented towards small-scale farming. It would be in the interest of the government to reorient priorities toward this sector as small-scale farmers are weary of politicians' jargon.

The method of marketing cattle might be improved. One option for the farmers is to form some sort of cooperative whereby prices for Green Park cattle and contents of the fifth quarter would be established ahead of time. Although the butchers might have to pay more, the time spent haggling over prices would be diminished. The higher prices would benefit farmers who want to maintain their investment in cattle, one of the best means of income generation in Green Park. This arrangement would require more uniform cattle quality. Such quality was not apparent during the study.

If the risk of goat larceny could be decreased in Green Park, raising both goats and cattle would provide better means for increasing income generation. Goats tend to be generalists when it comes to consuming tree fodder, whereas cattle are more specific. There are fodder niches in Green Park for both animals. Raising both animals concurrently would utilize more of the available tree fodder resources.

In light of the difficulties experienced by farmers attempting to rent tractors and bulldozers from governmental institutions or other farmers, investigating alternative means for land preparation is warranted. Although farmers were unreceptive to the idea of using animal traction (used in Green Park through the late 1970s), it would allow them more freedom in scheduling, save them money, inspire them to work cooperatively, and provide a reason to hold field days. Animal traction may be considered "old fashioned," but this reason could be used to ward off large-scale farmers and politicians who otherwise might jeopardize the project.

Problems related to the overharvesting of *Brosimum alicastrum* (Breadnut) must be addressed. One option is to plant more of it as well as alternative species. One species that might prove successful is *Calliandra calothyrsus*. Small-scale plantation trials of fast-growing fuelwood trees sponsored by the Jamaican Forestry Department began in mid-1980, and a more recent project in Moneague has tested a variety of fodder tree species, so some information would be available. If trees are planted for fuelwood in

Green Park, it is of utmost importance that the charcoal producers be given some sort of tree tenure. Without it, friction in the Green Park community will only increase as valuable species are removed without permission.

At present, in pastures where the Guango tree canopies are touching and grazing takes place, fodder grasses were in poor condition. It is unclear whether the condition in Green Park is caused by overgrazing, reduction of light penetration, or both. Also, the optimal number of *Samanea saman* per hectare (in pastures) is unknown. Further studies are warranted in these areas.

Guazuma ulmifolia (Bacedar) fruit production is not as prolific as *Samanea saman* (Guango), and there were no reports of collections for future use. It would be worthwhile to investigate the amount of tree fruit (fodder) that these species produce and how long the fruit could be stored for future use (both species cease fruit production by May although the hard drought generally takes place in July and August).

Rather than cut down the "extra" Guango growing in pastures, it might be worthwhile to investigate lopping off branches when crowns become full, thereby allowing sunlight through to grass growing underneath.

One *Ficus* tree was mentioned by Green Park farmers. The genus is reported to be a choice fodder tree species in Jamaica (Jamaica Livestock Association, 1983). *Ficus* species are well-known and highly-prized in Nepal as a fodder source (Panday, 1982). Although a species screening trial of

introduced and exotic fodder species was conducted concurrent to this indigenous knowledge research, a larger trial of indigenous multipurpose tree species is warranted.

If Quickstick or other tree species (both indigenous and introduced) are to be planted in fencelines in Green Park, different establishment methods need to be reviewed or tested to determine if transplanted seedlings or different types of rooted cuttings are less susceptible to strong winds.

The most viable options of incorporating or further expanding silvo-pastoral initiatives are in fencelines, in fields with crops or grasses, or in pastures. Whichever option or options are developed, it is important to keep a few points in mind.

First, concurrent efforts should be made to develop a complete management package to optimize the positive aspects of trees in Green Park while minimizing the negative impacts. It is fortunate that JADF has sponsored this study, as well as a species trial and a socio-economic study of Green Park residents. In the end, the data collected in all three studies should help project planners identify the possible negative outcomes of silvo-pastoral designs, thereby increasing the chances of success.

Second, efforts should be made to introduce small-scale cattle farmers to new technologies being considered for introduction into Green Park. For example, farmers generally do not have access to tractors. Rather than

attempting to change the system that would allow them to gain access to tractors, animal traction might be more appropriate.

Third, attempts should be made to have the farmers assume some of the responsibility for the innovations. Nothing would lift spirits or maintain enthusiasm more than successful co-developed technologies, i.e. technologies developed between academicians and farmer/consultants. For example, a farmer could participate in on-station research at Bodles Agricultural Research Station, help determine what would work in Green Park, and disseminate the technology upon return. In a study of small-scale farmer adoption of soil conservation practices in the Dominican Republic, one of the farmers suggested that a local farmer be sent for additional training (Erbaugh, 1983). There were farmers in Green Park who would be willing to partake in such training. Upon returning, they would act as para-technicians, helping out others in Green Park.

Fifth, farmers should be given some latitude to modify suggested technologies as they see fit during the implementation stage. Green Park farmers appear to be quite innovative when coping with drought situations. In Haiti's Agroforestry Outreach Project, farmers were given leeway in their decision-making and played a major part in the outcome's success (Gow *et al*, 1989). When local farmers are consulted and given a chance to explore new technologies, "there have been some stunning successes even when orthodox forestry practice was violated" (Fortmann, 1988). Therefore, input

from Green Park farmers should be incorporated into the planning and implementation phases of any silvo-pastoral project.

Finally, when possible, field days should be scheduled so that farmers can learn about new technologies, talk about similar concerns, and build positive relations with their neighbors.

Summary and Conclusion

The focus of this study was to gather indigenous knowledge relating to fodder trees and silvo-pastoral management systems of farmers in Green Park, Jamaica. Cattle farmers mentioned 17 tree species that produce leaf and fruit fodder. Tree fodder, along with cut grass, cane tops, and supplemental feed, help fill gaps resulting from occasional drought due to bimodal rainfall. Although there are fodder trees growing in paddocks, only 6 of the 40 farmers interviewed had planted and managed an introduced fodder tree (*Gliricidia sepium*). One fodder tree species (*Brosimum alicastrum*, Breadnut), also valued as an important charcoal source, is on the verge of local extinction.

Pastoral innovations in the area have occurred, but have been limited. Cattle farmers have upgraded paddocks by planting improved grasses, managed certain pasture trees to provide fodder and shelter for cattle, and have established living fences (albeit limited). Raising cattle has become one of the best means of raising income in Green Park, but expansion innovations have been repressed due to a number of reasons. A change in government policy in the 1980s has shifted the focus of

development away from farming and small-scale farmers. There is a lack of land, financial resources, and equipment needed to implement innovations. Problems with securing labor exist as does praedial larceny. Marketing favors butchers over farmers. Extension is inadequate and mistrust exists within the farming community.

No single tree species will be the total solution for the fodder shortage. It will only be part of the silvo-pastoral system. Farmers will still have to reduce the size of their large herds as the drier weather approaches and will still have to rely on outside inputs of cane tops, cut grass, and bag feed.

Table 11. Botanical Names and Local Names of Species Referred to in the Text and Tables (From Adams, 1972 and Jamaica Livestock Association, 1983)

Trees

<u>Genus & species</u>	<u>Local Name</u>
?	Huuk
?	Sydney
<i>Bambusa vulgaris</i>	Bamboo
<i>Brosimum alicastrum</i>	Breadnut
<i>Bumelia nigra</i>	Bullet Tree
<i>Bursera simaruba</i>	Bujgum, Beechgum
<i>Cecropia peltata</i>	Trumpet Tree
<i>Cedrela odorata</i>	Cedar
<i>Chlorophora tinctoria</i>	Fustic Tree
<i>Citharexylum fruticosum</i>	Fiddlewood
<i>Citrus sinensis</i>	Orange
<i>Cocos nucifera</i>	Coconut
<i>Erythrina corallodendrum</i>	Never Die, Grow Stick, Grow Tree
<i>Fagara elephantiasis</i>	Yellow Sanders
<i>Ficus</i> spp.	Figwood
<i>Gliricidia sepium</i>	Quickstick, Quick catch, St. Vincent Bush, El Maranga
<i>Guazuma ulmifolia</i>	Bacedar, Bastard Cedar
<i>Haematoxylum campechianum</i>	Logwood
<i>Helicteres jamaicensis</i>	Blind Eye
<i>Leucaena</i> spp.	Wild Tamarind
<i>Mangifera indica</i>	Mango
<i>Mimosa</i> spp.	Mimosa
<i>Peltophorum linnaei</i>	Braziletta
<i>Pimenta dioica</i>	Pimenta
<i>Piscidia piscipula</i>	Dogwood
<i>Samanea saman</i>	Guango
<i>Tamarindus indica</i>	Tamarind
<i>Terminalia catappa</i>	Almond

Grasses

<u>Genus & species</u>	<u>Local Name</u>
<i>Andropogon pertusus</i>	Seymour Grass
<i>Cynodon plechtostachyus</i>	African Star Grass
<i>Panicum maximum</i>	Guinea Grass
<i>Panicum muticum</i> (purpurascens)	Brachiaria Grass
<i>Pennisetum purpureum</i>	Napier Grass
<i>Saccharum officinarum</i>	Sugar Cane

Table 12. Local Names and Botanical Names of Species Referred to in the Text and Tables (From Adams, 1972 and Jamaica Livestock Association, 1983)

Trees

<u>Local Name</u>	<u>Genus & species</u>
Almond	<i>Terminalia catappa</i>
Bacedar, Bastard Cedar	<i>Guazuma ulmifolia</i>
Bamboo	<i>Bambusa vulgaris</i>
Blind Eye	<i>Helicteres jamaicensis</i>
Braziletta	<i>Peltophorum linnaei</i>
Breadnut	<i>Brosimum alicastrum</i>
Bujgum, Beechgum	<i>Bursera simaruba</i>
Bullet Tree	<i>Bumelia nigra</i>
Cedar	<i>Cedrela odorata</i>
Coconut	<i>Cocos nucifera</i>
Dogwood	<i>Piscidia piscipula</i>
Fiddlewood	<i>Citharexylum fruticosum</i>
Figwood	<i>Ficus</i> spp.
Fustic Tree	<i>Chlorophora tinctoria</i>
Guango	<i>Samanea saman</i>
Huuk	?
Logwood	<i>Haematoxylum campechianum</i>
Mango	<i>Mangifera indica</i>
Mimosa	<i>Mimosa</i> spp.
Never Die, Grow Stick, Grow Tree	<i>Erythrina corallodendrum</i>
Orange	<i>Citrus sinensis</i>
Pimenta	<i>Pimenta dioica</i>
Quickstick, Quick catch, St. Vincent Bush, El Maranga	<i>Gliricidia sepium</i>
Sydney	?
Tamarind	<i>Tamarindus indica</i>
Trumpet Tree	<i>Cecropia peltata</i>
Wild Tamarind	<i>Leucaena</i> spp.
Yellow Sanders	<i>Fagara elephantiasis</i>

Grasses

<u>Local Name</u>	<u>Genus & species</u>
African Star Grass	<i>Cynodon plechtostachyus</i>
Brachiaria Grass	<i>Panicum muticum (purpurascens)</i>
Guinea Grass	<i>Panicum maximum</i>
Napier Grass	<i>Pennisetum purpureum</i>
Seymour Grass	<i>Andropogon pertusus</i>
Sugar Cane	<i>Saccharum officinarum</i>

Appendix A. Research Interview Guide

General Information about the Cattle Farmer

Area name:

Age :

How long have you lived here:

Elsewhere:

Did you have cattle at the previous location?

Household Composition and Time Involved with Tasks

You: Spouse (M/F): # of Sons: # of Daughters: Others:

Who works with cattle?

How much time do you/others spend with cattle when grass is available?

How much time do you/others spend with cattle during the dry time?

How much free time do you have during the day? On a seasonal basis?

Do you work elsewhere? Part-time or Full-time? Where?

What do you use for farm transportation?

Walk Donkey Bicycle Bike(Motor) Tractor Pickup Car Bus

Is this mode:

Borrow/Share/Pay

/GivePetrol/Own

General Cattle Information

How long have you been raising cattle?

Why ■ ■ ■ ■ ■ **?:**

Resettlement Incentive	Income	Genert'n	Inheritance	Interest	Project	Other

of cattle you started with?

How many now? Bulls: Cows: Bullkin: Heifer:

Pedigree of cattle: RedPoll JamaicanBlack Brahman Dairy

Last year during the drought how many died?

-> Why do you think they died?

For servicing, whose bull do you use? Own Borrowed Leased \$_____

How many of your (#) cows dropped during the past year?

-> Why do you think (# - those that failed to drop) did not drop?

To whom do you sell your cattle?

Neighbor Butcher --> Where? GreenPark Falmouth BountyHall Mobay _____

At what age do you sell bullkins?

What is the price/unit? /

Has the price recently: Increased Decreased

Can you make a living raising cattle?

-> If not, why?

Would you like to continue raising cattle for 5/10 more years?

-> If not, what would you like to do otherwise?

-> If so, what else would you like to do and what would you need to do that?

Fodder Resources

What do cattle eat when: A)there's enough rain? B)During dry time?

Code:

AS=African Star grass

BR=BRachyaria grass

GU=GUinea grass

NA=NApier grass

SE=SEymour grass

CT=Cane Tops

TR=TRee component

C=Cut

CC=Cut & Carry

Do you use outside inputs? MO=MOlasses BF=BagFeed Other:

-> Where do you get them?

-> What are costs?

-> Do costs and benefits balance? (Costs < = > Benefits)

Do you sell cattle to reduce herd size BeFore/DURING the drought in order to conserve fodder resources for the remaining animals?

Which grasses grow best when rainfall is adequate?

• • • • during the drier times?

Management of Paddocks and Cattle

Do you have improved grasses?

-> If not, why?

-> Did you at one time? -> What happened?

-> If so, how did introduce it into your paddocks?

Acreage:Tot: Forcattle: Lease: Squat: Share: Lease to Others?

#Paddocks: Condition: Rotate Cattle Every___days

Do you: FEertilize, IRrigate, WEedicide, CLean your pastures?

How often?

What medicines do you use for cattle? VAcinate DRench Tick Other

Code: #Times/yr AN=AsNeeded

You/VET

\$/head

General Tree Information

If You/Family cut/collect tree leaves/pods, how much is done by family members?

You: Spouse: Sons: Daughters: Other:

Where are the sources?

How long does it take to get there?

Have you planted trees on your land?(if others in family have, ask them)

What kind of trees?

-> Explain to me the process you went through in planting _____ trees:

-> Did you use any special treatment WHEN planting?

Dig w/

Tractor Fork Machete Pickax Stake None _____ (Depth _____ Width _____)

Water (with Bucket Hose Pan Irrigation)

Fertilizer (from _____)

Mulch (from _____)

Weedicide (from _____)

Protection from: Animals Rain Sun Wind

-> Did you use any special treatment AFTER planting?

Weed w/

Mulch Machete None _____ (Depth _____ Width _____)

Water(with Bucket Hose Pan Irrigation)

Fertilizer(from _____)

Mulch(from _____)

Weedicide(from _____)

Protection from: Animals Rain Sun Wind

Are there/have there ever been projects in area in which you participated?

-> Was outside funding involved (loan, formal or otherwise)?

Have you heard about or experienced plowing with animals?

Biophysical: Use of Trees If you use trees/vines, tell me their names, where each is found, how you use it or parts of it, when, & if planted.

		<u>Code</u>			<u>Code</u>
Spp. A	_____	_____	Spp. F	_____	_____
Spp. B	_____	_____	Spp. G	_____	_____
Spp. C	_____	_____	Spp. H	_____	_____
Spp. D	_____	_____	Spp. I	_____	_____
Spp. E	_____	_____	Spp. J	_____	_____

[illegible]

Codes: 01 Jan 02 Feb Natural Regeneration PLanted

Other Farm-Related Information

Do you or others in your family have other animals? (list using codes)

If not, did you at one time? Why not now?

Chicken Donkey Duck Goat Horse Pig Turkey _____

Do You/Family consume

- " share w/others
- " sell to others

(Code: B4=Before CU=Currently BO=Started B4 & Quit; Currently Raise)

Do you or others have a vegetable garden/raise crops? (list using codes)

If not, did you at one time? Why not now?

Calaloo Corn RedPea Pumpkin SugarBean Tomato Yam _____

Do You/Family consume

- " share w/others
- " sell to others

(Code: B4=Before CU=Currently BO=Started B4 & Quit; Currently Raise)

Are there other Vegetables/Crops that you would like to grow but cannot?

-> Why not?

Information about Other Animals

What do _____ eat when: A)there's enough rain? B)During dry time?

-> Species + Code

Do you use outside inputs? What are they?

-> Where do you get them?

-> What are costs?

-> Do costs and benefits balance? (Costs < = > Benefits)

What are the best feeds for _____?

What medicines do you use for _____?

Code: #Times/yr AN=AsNeeded

You/VET

\$/head

What do _____ eat when: A)there's enough rain? B)During dry time?

-> Species + Code

|||

|||

Do you use outside inputs? What are they?

-> Where do you get them?

-> What are costs?

-> Do costs and benefits balance? (Costs < = > Benefits)

What are the best feeds for _____?

What medicines do you use for _____?

Code: #Times/yr AN=AsNeeded

You/VET

\$/head

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