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Agroforestry Practice Adoption Among Solomon Island Women On The Island Of Malaita

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AGROFORESTRY PRACTICE ADOPTION

AMONG SOLOMON ISLAND WOMEN

ON THE ISLAND OF MALAITA

by

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ABSTRACT

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The goal of agricultural training is the adoption and diffusion of introduced agriculture techniques. New subsistence agricultural techniques have been introduced mainly to the male population in many developing countries, even though most subsistence farmers are women. Therefore, an understanding of how new subsistence agricultural techniques can be introduced and adopted by women would be important to achieve. This study focuses on women's adoption of agricultural techniques. It takes place on the island of Malaita, in the Solomon Islands. The study looks at the adoption of agroforestry and several other subsistence techniques that were introduced under a joint program by Peace Corps and the Malaita Agriculture Division between 1983 and 1989. Two Peace Corps volunteers were posted in North Malaita at Malu'u from 1983 to 1986. The Malu'u volunteers lived in the village of Karu for two and one-half years while introducing and teaching new agricultural practices. Two other Peace Corps volunteers were posted at the Dala Agricultural Training Center from 1987 to 1989, and worked

with the residents of the nearby village of Kakara. In 1991, a two-month survey was conducted in the areas where the Peace Corps volunteers were posted, as well as in an area that did not have any Peace Corps volunteers posted. The findings of this study indicate that adoption of new agroforestry techniques is based on several factors. Who introduced the technology, the farmer's wealth, and being able to obtain income from market vegetables and other identified factors improved a respondent's chances of adopting new agroforestry techniques.

(133 pages)

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CHAPTER 1

INTRODUCTION

The Solomon Islands consist of numerous island chains covering a land area of roughly 28,530 square kilometers. The islands are situated in the Coral Sea, just northeast of Australia and southeast of Papua New Guinea (Figure 1.1). Most of these islands were formed by volcanic activity and are very mountainous. The islands are covered with tropical rainforest, making the climate consistently hot and humid (Bureau of Public Affairs 1988).

At least three-quarters of the population in the Solomon Islands depend on agricultural products for their livelihoods (Jones, S. A. Fleming and J. Hardaker 1988). The majority of the people involved in the subsistence sector live in isolated communities. They grow staple crops through a shifting agricultural system using slash-and-burn techniques. A number of root crops constitute the bulk of the crops grown, and various other vegetable crops supplement these (Bennett 1987; Bureau of Public Affairs 1988). In coastal areas, people may supplement these gardening activities with fishing for both fresh fish and shellfish.

Background of the Problem

The island of Malaita is the second largest in the Solomon Islands, with an area of 4,540 square kilometers (Frazer 1987). Malaita has the highest population density (16 persons per square kilometer) and the largest population in the Solomon Islands (Jones et al. 1988; Statistics Office 1986).

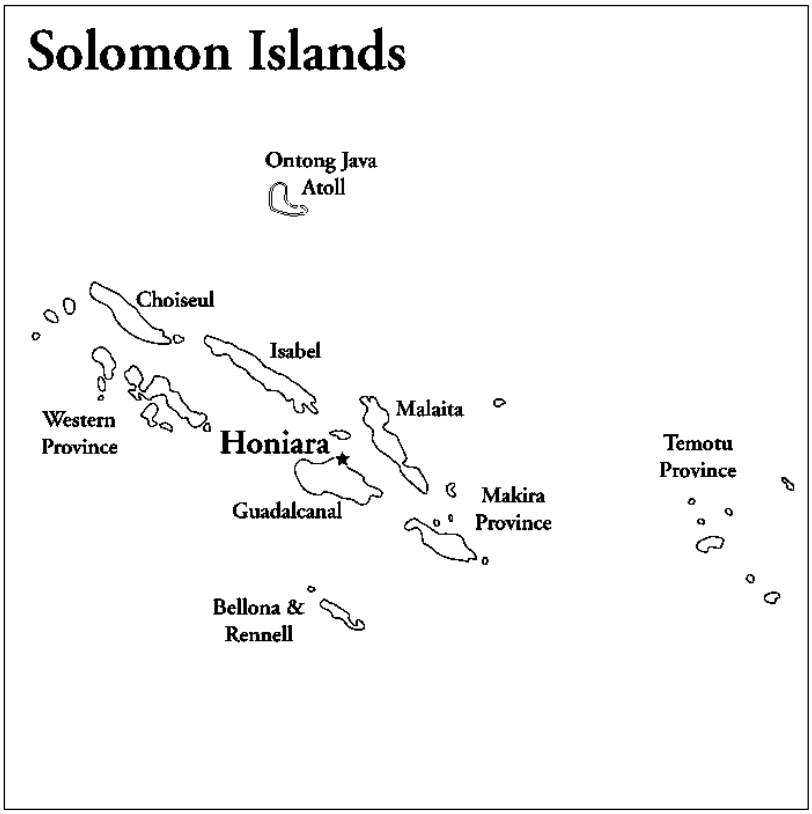

Figure 1.1 Map of Solomon Islands

In the early 20th century, several British and Australian firms began large-scale coconut plantations in a move to develop the Solomon Islands commercially. About two-thirds of the plantation workers came from the island of Malaita (Bennett 1987). Malaita has a high rate of emigration, with 16 to 20 percent of the population living in either Honiara, the capital city of the Solomon Islands, or other places where they have employment (Bennett 1987).

Because of this labor emigration, agricultural development on Malaita itself was slow. In the 1950's, a serious attempt was made to increase the cash incomes on Malaita by raising agricultural production. An extension service run by the Malaita government was set up to encourage cash cropping throughout the island. In 1958, an island-wide

campaign was set up for cocoa planting. In later years, coconut planting, cattle rearing and other cash crops were given more attention (Frazer 1987).

Malaita now contributes substantially to export production. Between 1975 and 1984, Malaita produced 18 percent of the national output of copra and 21 percent of cocoa (Frazer 1987). However, much of this agricultural development has not been evenly distributed throughout the island. Most of the early cash crop development occurred along the coastal fringes, where there was access to ships for the transportation of agricultural products. By 1969, a road system had been completed between the provincial capital of Auki and the northern reaches of Malaita. With easy access to markets and shipping, cash crop production was encouraged along the road. Except for a few feeder roads, most of the areas that benefited by the road in this increasing cash crop production were again along the coastal fringes (Saunders 1983).

The northern road has had a profound impact on agricultural as well as on social development in North Malaita (Saunders 1983). Almost all coastal fringe areas where the road is located have seen dramatic increases in population. As opportunities for a cash crop economy have increased, inland “bush” people have migrated from interior areas to settle along the road. Three areas of North Malaita that have seen more than a decade of development and population growth due to the road and immigration are Dala, Malu’u and Takwa. Dala has a Catholic mission, a former parochial school site, and a small clinic. It was the agricultural research center for the Solomon Islands until the early 1980’s. Malu’u is the site of the governmental administration offices for the northern part of Malaita and has a major inpatient clinic. Takwa has a Catholic mission, a small clinic,

and a parochial school located at the mission. Until its extension in the early 1980's, the northern road ended at Takwa.

As the population increased in these coastal areas, farmers became more engaged in cash cropping. As they increased their cash cropping, many of the farmers decreased the size of their subsistence gardening areas and increased the distance of the subsistence areas from the villages (Frazer 1987). In the beginning, cash crops were planted in the best available areas and there was little concern about the potential overuse of the land. As cash crops increased in area, land became scarce and disputes over land use for both cash cropping and subsistence cropping increased (Saunders 1983). Fallow periods between croppings decreased, putting environmental and social strains on the traditional slash-and burn farming system (Frazer 1987; Saunders 1983). Traditional root crops such as taro and yams need soils rich in nutrients to grow. As the soils near the coastal villages became exhausted of nutrients, gardening occurred farther away from the villages (Frazer 1985; Richardson and Sechrest, 1986; Saunders 1983). Many of these new garden areas are on steeply sloped hillsides prone to erosion and landslips (Richardson and Sechrest; 1986, Saunders 1983). Garden yields have decreased because of these changes (Frazer 1985; Jones et al. 1986).

Women are the primary subsistence farmers on Malaita and throughout the Solomon Islands. Women on Malaita do not own land themselves, but have land rights through their husbands. Women have little decision-making power as to land use, or what cash crops are to be planted.

Purpose of the Study

The present study is an extension of work conducted earlier by the researcher. A Previous study addressed the issues of low productivity of gardening lands, shorter fallow periods, and increased workload of women on the northern area of Malaita. Women are an appropriate choice for study, since they are the major subsistence gardeners in the Solomon Islands and have been underrepresented in research in the past.

An Agroforestry program was introduced in 1983, in an attempt to help alleviate the aforementioned problems. The purpose of this study is to determine whether, after six years, women in two areas of North Malaita, Solomon Islands have adopted Agroforestry technology in their own gardens, and if not, to determine what casual factors inhibited adoption.

Agroforestry methods were introduced during a three and one-half year period in Malu'u, Malaita, and during a two-year period in Kakara, Malaita. Ascertaining the specific factors related to adoption/nonadoption can be helpful in analyzing how the introduction of new technology and the unique situations of women in Malaita interact. Conclusions drawn from this longitudinal study can lead to recommendations for donors, agricultural government officials, researchers, or other Agroforestry project initiators. Locale-specific information can aid in the design and implementation of sustainable farming systems.

Conceptual Framework

This study will be based on a conceptual framework that assumes that introduced agricultural technologies are not culturally and /or gender neutral. Agricultural technologies must be designed to address the specific cultural and contextual aspects of the areas where they will be introduced. As in many island communities, cultural practices in the Solomon's can vary widely between islands. Land tenure issues and division of labor between gender groups are just two of any number of issues. Agricultural extension has tended to emphasize countrywide policies. However, such focus on national policies does not take into account the cultural biases existing within each island's distinct society. By addressing the cultural differences, agricultural policies can acquire a greater change of acceptance.

Although women comprise the majority of subsistence farmers, men are preferentially included in the process of agricultural technology introduction. If women are to be included in the introduction process, gender issues in agricultural policies must be addressed and women's roles in agricultural production must be recognized. The mechanisms for the introduction of agricultural technologies need to be modified to include women as direct beneficiaries. Thus, this study points its attention to women's agricultural practices.

Research Questions

The following general research questions will be addressed in this study:

1. Which of the Agroforestry methods introduced have been adopted in women's gardens?
2. For Agroforestry methods not being used, why were they not adopted?

3. Are there any differences in adoption resulting from active extension via the Peace Corps and no extension?

4. Was the overall Peace Corps Program successful?

5. Did the style of introduction of Agroforestry practices effect the adoption of Agroforestry?

These questions provide the main investigational framework for the present study.

Significance of the Study

This study can provide useful information on factors that affect adoption of Agroforestry in the Solomon Islands. There is a growing interest shown by the To'abaita, of North Malaita, in this type of farming system (Hancock 1987). However, women, although they are the major subsistence gardeners, are seldom consulted about the usefulness and possibilities of agroforestry. Therefore, the information from this study could facilitate agricultural extension and help project designers, economists, etc. in promoting agroforestry as a partial solution for dealing with the consequences of land shortages and low crop yields. Because women of Northern Malaita have the major responsibility for growing and harvesting food crops, it is important to target women agriculturists and identify constraints upon and factors that accommodate and facilitate adoption of new agricultural innovations.

CHAPTER 2

LITERATURE REVIEW

This chapter provides a review of the literature related to the transfer, adoption, and diffusion of agriculture technology in developing countries. Specific studies concerning the Pacific and Solomon Islands are cited when possible. Since women in most Pacific islands countries are the major subsistence farmers, special emphasis will be placed on women and the role they play in the agricultural sector. To give a broad overview of pertinent information, this chapter will describe the following literature: 1) the background of the transfer of agricultural technology, 2) the impact of new technology on women agriculturists, 3) the introduction of cash crops and land tenure systems, and 4) the diffusion and adoption of agricultural technology.

The Background of the Transfer of Agricultural Technology

Agriculture plays a major role in most developing countries. It enables many people in developing countries to help accomplish developmental goals, growth, and equity (Roy 1990). Food productions, and correspondingly food security, are central concerns in the field of agricultural development (Eicher 1984; Roy 1990). Food security is described by Siamwalla and Waldes (1984) as “the ability of food deficit countries or regions or households within these countries to meet target levels of consumption on a yearly basis.”

Planners have devised various strategies to increase food production in developing countries. Agricultural technology transfer is seen by many scientists and

proponents of food security as a central link in strategies to improve agricultural production. However, new technology development must be “appropriate” and oriented towards farmers (Hildebrand 1981; Shaner; Philipp and Schmehl 1982). Hildebrand (1981) defines appropriate technology as a practice that can be incorporated immediately under a farmer’s present socioeconomic conditions and that is acceptable to the farmer. Many scientists discuss the importance of understanding the farmer’s socioeconomic situation, depending upon agro-climatic economic, social, cultural, or other conditions, which determine whether a farmer needs, desires or is able to adopt a give change (Fliegel 1984; Hildebrand 1981).

Many technological packages aimed at helping Third World countries advance have not resulted in such expected outcomes as improved rural income, increased crop production, decreased physical burdens, employment, correction of income inequalities and other indicators of improved social and economic development (Charlton 1984; Kidd and Pimentel 1992; Parlin and Lusk 1988).

Volumes have been written on the negative impacts of the Green Revolution, which involved large-scale intervention in agricultural production in many developing countries around the world, with the main purpose of increasing agricultural yields. The Green Revolution, although successful in part, had numerous unanticipated and undesirable consequences. Most argue that with the introduction of high-yielding varieties, multi-cropping produced unanticipated pests and diseases, reliance on herbicides and pesticides, all of which resulted in increased dependency on purchased inputs (Arnon 1987; Moris 1981). Other effects of the Green Revolution have been shortages of cash inputs and money to buy the required items, lack of supporting

infrastructure and limited production potential (i.e., land, water, and favorable climate). According to Kidd and Pimentel (1992), the Green Revolution was not necessarily applicable to a large part of the developing world. Poor soils, slopes and marginal lands that preclude the use of large machinery, farm sizes that average less than a hectare and land that depends on hand cultivation are some of the reasons given why the technologies were not appropriate. The Green Revolution did, however, meet some of its intended goals. For example, it helped increase food production and kept food production in pace with population growth (Lusk 1991).

According to Eicher (1984), the rationale for technology transfer is based on two premises. The first premise states that, because of scarce resources, it is difficult to fund research in all countries on every commodity. Secondly, many scientists are needed to produce the new technology through basic science. Applied research is needed to a lesser degree.

Three phases of technology transfer have been identified by Ruttan (1988), according to their interrelated stages. First is material or direct transfer, where items such as seeds and mechanical items are transferred without necessarily any local adaptation. This phase takes place as a result of “trial and error” by farmers. The second is design transfer, where the transfer of blueprints, formulas, books, and computer software is carried over. Lastly is the phase called capacity transfer, which is the transfer of scientific knowledge, investment in libraries, laboratories and specialized equipment and the capacity to produce technology that is adaptable at the local level.

Several decades have seen numerous attempts to transfer high technology in generating and diffusing agricultural innovations into Third World countries. Despite

these efforts to increase per capita food output, Ahmed and Ruttan (1988), Kidd and Pimentel (1992) state there is still mass poverty and unemployment. In response, the capital-intensive and short-term approaches to development used in the past are being replaced by sustainable development approaches (Lusk 1991). For example, Farming Systems Research and Development (FSR&D) is one approach that is increasingly being used to help meet the needs of small-scale farmers in developing countries (Shaner et al. 1982). Kidd and Pimentel (1992) feel that lone-term sustainability can be reached in part by systems that are characterized by low energy use, small-scale, intensive use of labor, low use of chemical fertilizers and by combining trees and other crops. Agroforestry is one such system that can address these problems. Though not a panacea, these systems offer a sustainable alternative to the capital-intensive and short-term approaches to development (Kidd and Pimentel, 1992).

In rethinking methods for introducing technologies, Chambers, Pacey and Thrupp (1989) conceptualizes the idea of the "farmer first" strategy. They suggest that the old practice of technology "experts" giving their ideas to the farmers should be replaced with an exchange of information and ideas between the parties. Richards (1989) asserts the importance of understanding the indigenous technical knowledge that farmers have and can contribute to a project. The "farmer first" perspective looks at the situation of the farmer and what he or she wants and needs, and leaves it up to the individual farmer to decide on priorities, designs, and testing of new crops. Then, the "experts" can advise the farmers based on what the farmers indicate they need and want. Knowing a farmer's decision criteria and opinions, states Gladwin, Zabawa and Zimet (1984), are necessary to a team that wants to design adoptable technology. Parlin and Lusk (1988) discuss the

problems of unanticipated consequences when the project design does not look at the site-specific cultural and organizational environments. For example, when the government of the Solomon Islands wanted to encourage village growth, their intentions were to increase national output and at the same time raise the incomes of rural producers. The government's policy was successful, but it did not anticipate the restructuring of household production and the resultant problems that followed (Frazer 1987). According to Parlins and Lusk (1988), farmers' involvement in the planning, design, financing, management, and maintenance of a project helps keep the project rooted in its proper constituency.

The Impact of New Technology on Women Agriculturists

Appropriate technologies have been introduced with the expectations of improving the livelihoods of people. However, they have had negative impacts on the lives of women, especially in helping to lighten their workloads in food production, water and fuelwood tasks (Charlton 1984). Boserup's (1970) work on the influence of colonialism on women's status helped create an awareness of the negative impact that technology was having on women in Third World countries. Charlton (1984) argues that locally and nationally defines interests have neither acknowledged the role women play in the food production cycle, nor have they involved women in the decision-making process. According to Bourque and Warren (1987), women and their contribution to food and agricultural production have not been calculated by development planners. Consequently, women's contributions to the country's economy have been left out of the

calculations. Limited resources and cash make it difficult for women to use technologies that have the potential to help them.

In developing countries, women are a major part of the agricultural labor force (Arnon 1989), and perform at least 50 percent of the agricultural work in subsistence societies (Tinker and Bramsen 1976, cited in Sachs, 1983). For example, over 85 percent of the population in the Solomon Islands is engaged in mixed, subsistence farming, with women performing 60 to 80 percent of the work in subsistence food crop production (Rennie 1991). Despite the fact that women play a major role in agricultural production, planners of development programs continue to emphasize other projects such as health care, family planning, nutrition, child care and home economics programs for women in Third World countries (Sachs 1983). According to Sachs (1983), the cultural ideal of women's domesticity has been transferred from developed counties to women of developing countries, without knowledge of the role women play in agriculture in Third World countries. For example, Tuivaga (1988) explains how Fijian women's traditional subsistence roles in agriculture and fishing have diminished, because previous development programs have focused on teaching them how to sew, and have encouraged them to participate in other domestic skills.

The Introduction of Cash Crops and Land Tenure Systems

In most developing countries, emphasis has been placed on cash crops rather than food crops. This rationale is rooted in colonial policies that focused on cash crop production mainly for export (Roy 1990). Third World countries export more than three-

quarters of their primary products, and they import almost two-thirds of manufactured goods (Harrison 1987).

The effects of the introduction of cash crops have been widely discussed by critics. Roy (1990) states that the stagnation of food production in India during the colonial period was an effect of the emphasis placed on cash crop production. In many Pacific island countries, the best agricultural lands are devoted to cash crops (Vergara and Nair 1985). In Malaita, Solomon Islands, Frazer (1987) notes that land is dominated by the production of cash crops, consequently creating a shortage and placing food cultivation under tremendous pressure. In Tonga, almost all of the agricultural land is planted in coconuts. Consequently, Tongans must rely on imported goods (Rennie 1991), creating economic dependence on developed nations. In 1984, notes Rennie (1991), Tonga imported $T46,416,000 worth of goods. Of goods imported, approximately one-quarter of this total import expense went to food imports. In the Solomon Islands, up to 80 percent of the fertile land is planted in cash crops, removing that land from the subsistence garden cycle (Frazer 1987; Rennie 1991). Consequently, food imports are increasing at a rate of 11 percent per year (Rennie 1991). Some critics of cash crops in Third World economies argue that a lowered subsistence diversity and inability to respond to signs of degradation within the ecosystem become problems when dependence on an external system replaces the traditional system (Ahmed and Ruttan 1988; Bayliss-Smith and Feachem 1977). Moreover, because of insularity, isolation, and small size, many Pacific islands are disadvantaged from the start in their ability to compete on the world market (Richardson and Richardson 1986). Other critics of cash crop introduction question whether economic returns can be guaranteed for the future.

In many parts of the world, especially African countries (Rogers 1979, cited in Sacks 1983), land tenure systems have been altered with the introduction of cash crops (Charlton 1984), and with the colonial capitalist notions of male property ownership (Davison 1988). Understanding who has control over various rights to land, including the rights to own or inherit the trees planted on land, is an important step in the implementation of development project (Fortmann 1992). According to Fortmann (1992), agroforestry systems are complex systems, and in some countries, property rights in trees differ greatly from property rights in land. People may have secure tree tenure without secure land tenure and, in some cases, secure land tenure without secure tree tenure (Barker 1990; Fortmann 1992). It is particularly important to ascertain the distribution of property rights within the household, paying special attention to gender differences (Fortmann 1992). Vergara and Nair (1985) state that the clan type of customary or traditional land tenure system in agroforestry can be either negative or positive depending largely on population pressures on the land.

In the Solomon Islands, traditional land tenure is the most sensitive issue and a cause of much concern. Land disputes are becoming widespread as population pressures increase (Frazer 1987; Naitoro 1989). In North Malaita, Solomon Islands, as many as twenty court cases concerned with land tenure have been tried. Destroyed property and threats against land users have been the results of land disputes, along with frequent disruptions in work (Frazer 1987).

According to Rennie (1991), it has become fashionable in the Pacific to encourage cash cropping in the name of economic progress. Some researchers suggest that cash crops have created a dichotomy between men’s and women’s work patterns,

giving women less power (Davison 1988; Rennie 1991; Sachs 1983). Hardaker and Fleming (1990) reveal evidence that, in Tonga and the Solomon Islands, a progressive breakdown in the traditional division of labor is taking place. Tongan women are contributing more to agricultural production than was commonly believed. Women in the Solomon Islands are participating in cash cropping activities--previously considered a male activity. In both countries, women reportedly work longer hours, and for lower income than men.

On the island of Malaita, a road that connects the provincial capital to many isolated villages has been the focus of the provincial agriculture division's placement of cash crops (Frazer 1987; Ross 1978). Consequently, much of the flatter land once used for subsistence gardening has been taken up by cash crops, displacing the traditional gardening areas to more steeply sloped areas of land. Since women are the major subsistence gardeners, they must walk long distances to get to the steeply sloped areas now used for gardening (Richardson and Sechrest 1986; Saunders 1983). According to Hancock (1987), the introduction of cash crops has caused severe shortages of land for food production and a steady decline in soil fertility, and consequently lower crop yields. He feels that unless stringent measures are taken--either to control population growth, or to change the land tenure system--in the Solomon Islands, the declines in crop yields will continue unabated. A system such as agroforestry is encouraging, states Hancock (1987), as a way to help maintain soil fertility and prevent erosion. However, very little research has taken pace in South Pacific island countries to ascertain whether an agroforestry system will be acceptable to the local cultures.

The Diffusion and Adoption of Agricultural Technology

Before a new technology can be adopted, it must be preceded by the diffusion of the new technology (Arnon 1989). Rogers (1962:76) defines the diffusion process as "the spread of a new idea from its source of invention or creation to its ultimate users or adopters."

One of the earlier accepted models of diffusion was described by Rogers (1962). According to his model, a technology is first tried out by a small group of farmers called "the innovators." If the innovation is successfully adopted, then a second category of farmers, called "the early adopters," is identified. As the innovation spreads, the bulk of farmers who accept the innovations are identified as "the early and late majority," and the last to adopt the innovations are the "laggards."

Arnon (1989) says that diffusion of technology is the link between research, development, and adoption. In order to establish these linkages with farmers, a specialized function called "extension" has been developed (Moris 1981). "Extending," according to Moris (1981), is necessary when farmer involvement is required in any program. In most developing countries, technology is diffused to farmers by an extension service or an agency who shares a similar role (Shaner et al. 1982).

There is much literature addressing conceptual foundations for agricultural extension. Critics of past classical extension models argue that most of the models focused on the larger and more efficient farmers who were the "innovators" (Arnon 1989; Kidd and Pimentel 1992). Recommendations came from the top downwards, and feedback from the farmer, being at the bottom, traveled upwards (Moris 1987).

Gender division of labor is another consideration if extension is to reach the intended beneficiaries of a particular introduced technology. For example, women farmers may have access to very different markets than male farmers, and this difference may depend on the degree to which they accept or reject certain innovations (Flora 1987). In many countries, extension services not only give advice, but also function as conduits for inputs such as seeds, seedlings, implements, fertilizers, and credit (Fortmann 1992). In many developing countries, there are restrictions on interactions between women and men other than a women's own husband, a situation that makes the male extension workers inappropriate for providing advice to women agriculturists (Fortmann 1992; Gill 1991). In the Solomon Islands, for example, most farmers are women, while most of the extension workers are men. This situation, according to Hardaker and Fleming (1990), has inhibited the introduction of better farming practices. Gill (1991) states that even though agricultural research has adopted a "systems" approach, it might be more appropriately labeled "farmer systems" research, where one would read "male head of the household" for "farmer." Gill (1991) goes on to say that the problems of the farmer are not the same as those of the household, so gender conceptualization is important if extension is to reach its intended beneficiaries.

Most often, there is a backlog of new technologies produced by research, with inadequate resources available for the diffusion of these technologies (Shaner et al. 1982). One of the major weaknesses between development agencies and their potential clients is the lack of effective contact (Moris 1981; Pierce 1989). Even though an appropriate method of diffusion is essential, it is not a sufficient condition to create the adoption (Arnon 1989). Therefore, it is not only important to make the farmers aware of

the available technology, they must be convinced it is in their best interest, and they must be able to adopt the innovation (Arnon 1989;Rogers 1962).

Farmers in developing countries often do not adopt new technologies when they do not have sufficient resources to purchase the required inputs, the technology is not appropriate to their farming conditions, or when they do not know about the technology (Arnon 1989). Small farmers generally prefer known technologies. If they perceive the risk as too great, they will not adopt a new technology (Shaner et al. 1982). Hosier (1989) states that, for smallholder farmers to adopt agroforestry technologies, they must be convinced that the benefits will exceed the cost and that risk is low. Approaches such as FSR&D have tried to address some of the problems classical models have neglected, by directing more attention to the conditions and problems of the small farmer.

Understanding small farmers' physical, biological, economic, financial, and socio-cultural conditions, and making research relevant for them are major focuses of the FSR&D methodology (Shaner et al. 1982). Biological constraints, such as seasonal variations that farmers face, need to be understood and considered (Gill 1991; Ruttan 1988). For example, technology that interferes with critical timing of subsistence farming can create discrimination in the allocation of family income, family workloads, or both (Gill 1991). Other methods already mentioned, such as the "farmer first" perspective, focus on putting the farmers' agendas first and helping them to meet their own priorities. Farmers, NGO workers, extensionists, and agricultural researchers can specialize and support each other. However, it is the farmers and their networks that should be doing the most work, with the other people serving them (Chambers, Pacey and Thrupp 1989).

CHAPTER 3

COMMUNITIES STUDIED AND THE FARMING SYSTEM

This chapter will describe each of the communities studied with reference to their local economy, household, physical setting, and farming system. Each area shares a mutually intelligible dialect. Each area discussed will be occasionally referred to by its language group; Dala area representing the Kwara'ae, Malu'u area the To'abaita, and the Takwa area the Lau.

Physical Setting

Most of the island of Malaita consists of a rugged and expansive mountain chain running north/south the length of the island. Lightly dissected hills, narrow coastal terraces with occasional swamps and river valleys are found on either side of this chain (Wall and Hansell 1974).

The To'abaita homeland is located in the far northwestern part of the island of Malaita where this main mountain chain forms a high and steep-sided peninsula 15 kilometers long and 8 kilometers wide (Wall and Hansell 1974). Malu'u is located on the northeast side of this peninsula. The Malu'u area is mainly situated on coral terraces that begin at the coastal fringe. These terraces rise up from sea level to about 300 feet, where they meet steep hills. Land used for gardens in the Malu'u area is located on the coral terraces and steep hills. Malu'u is located roughly 70 kilometers north of the provincial capital Auki, Malaita (Figure 3.1).

The Dala land system is characterized by shallow soils and scattered coral outcrops. The Dala area has both flat coral terrace expanses and moderate to steep valley

slopes (Wall and Hansell 1974). Land that is used in the Dala area for gardening is bisected by the east-west Malaita road and Dala Provincial Farm. It is generally located on the flat coral terraces to moderately sloping land, and occasionally on steep-sided river embankments. Dala is located abut 50 kilometers from the Malu'u area by road and 20 kilometers north of Auki, Malaita, the provincial capital (Figure 3.1).

The Takwa area is located east and south from the To'abaita. The people of Lau are often referred to as the "saltwater" people and occupy the coastal fringes or live on offshore islands, either cays or artificial ones. The Takwa area is situated on the coastal fringe with a broad flat flood plain area going inland for some distance. Gardening lands are on uninterrupted flat to gently slopping surfaces.

Farther inland, the land develops into a series of moderately sloped terrace steps (Wall and Hansell 1974). Takwa is the least accessible area, since it is the farthest from the provincial capital. Takwa is located about 100 kilometers north of the provincial capital of Auki and 30 kilometers east of Malu'u by road. Funds for road maintenance often do not include the far northern reaches of Malaita.

Language

The To'abaita and the Lau are one of the five closely related ethnic groups found in northern Malaita; the others are the Baelelea, Baegu and Fataleka (Frazer 1987). The Kwara'ae, because of their proximity to adjacent language groups, have developed a dialect that is a combination of several languages. The To'abaita and the Lau have had great influence on the Kwara'ae language (Warmke and Warmke 1983). All Malaitan

languages are related, giving each of the ethnic groups the ability to converse; consequently, each culture shares many similarities.

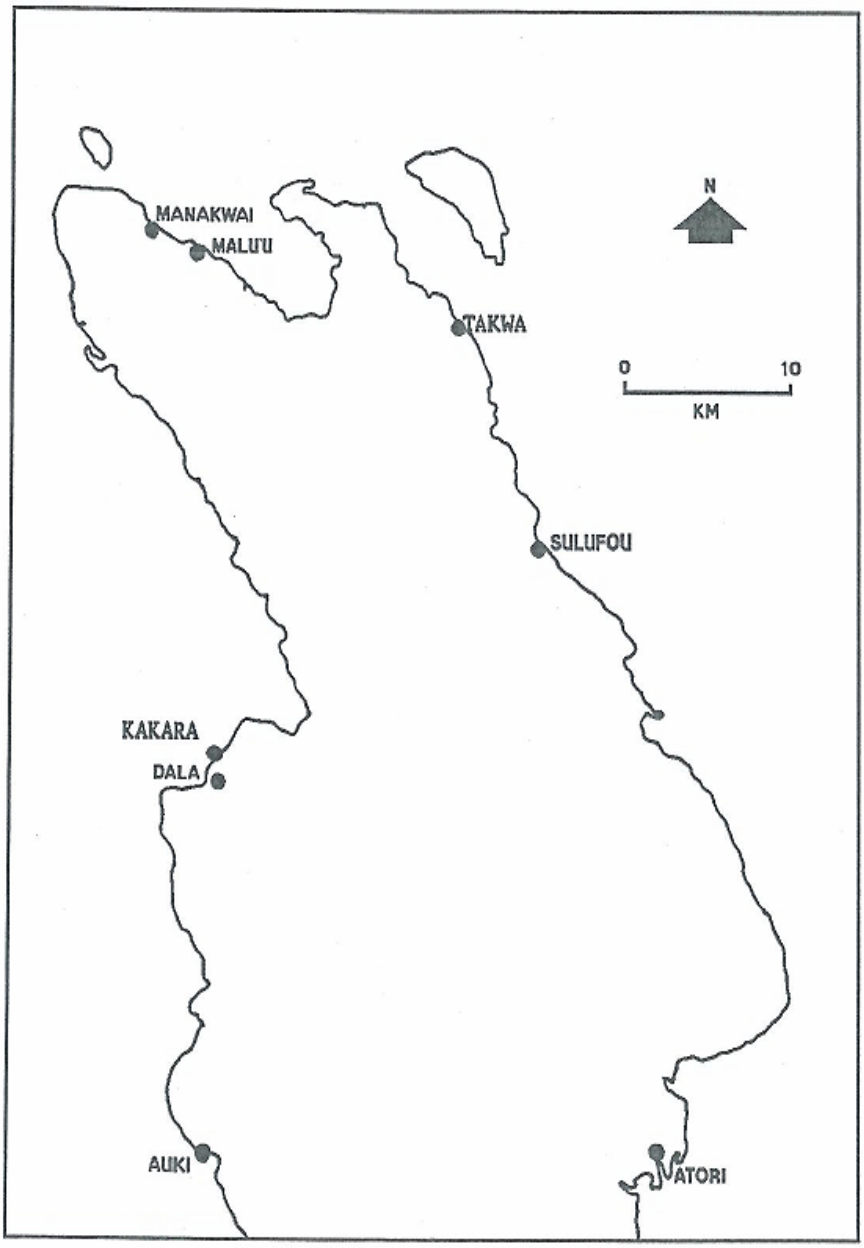

Figure 3.1 Map of North Malaita, Solomon Islands Research Sites

Local Economy

According to Frazer (1987), when the population was more evenly distributed in northern Malaita, it was more closely integrated through a well-developed regional economic system. The coastal "saltwater" people and the inland "bush" people had developed a form of subsistence specialization that was a means of trade. The "saltwater" people traded their fish for taro, a traditional root crop grown in the Solomon Islands that is grown by the "bush" people. Subsistence specialization still remains an important way of exchange in the three regions studied but with less emphasis on trade and more emphasis on the exchange of money. Markets of locally grown produce have expanded through the years. This expansion of market produce is especially strong in both provincial centers and Honiara, the capital city. Often people from the three study areas transport garden produce to these centers to sell for a higher price. More recently, people rely less on barter. Frazer (1987) states that this has occurred, "from a steady process of change closely related to the development of cash cropping."

Labor migration first brought the northern part of Malaita into contact with the cash economy. Even with this labor movement, the regional economy has remained basically unaffected. Local production, in the Dala, Malu'u, and Takwa areas has a stronger external orientation and a growing dependence on national and international economic ties with the growth of cash cropping. There is greater consumption of imported goods and foods with the people having more access to cash. Nutritional improvement has occurred with the introduction of imported foods, but studies have revealed a strong correlation exists between obesity and higher consumption of imported foods even though overall nutrition has improved (Statistic Office 1990).

Local markets are very active and the demand for locally produced food is strong. On the other hand, food production is competing with cash crop production because of the demand for land and labor. In the Dala area, market trucks transport people to and from Auki to sell local produce. It is very common for people from the Dala area to sell at the Auki market, since it is relatively near by market truck. A local market is held once a week in Dala at the provincial farm. In Malu'u, a local market is held three times a week where the "bush" and the "saltwater" people can bring their produce to barter or sell. The Takwa area has a local market once a week. The variety of local produce at Takwa is much more limited than at Dala or Malu'u. Residents at the Takwa market have less access to improved crops. With the recent cuts in the provincial agricultural budget, the Takwa area does not now have an agricultural field assistant. Takwa is the farthest away from Auki.

In addition to selling produce for cash, there are various forms of casual employment in all three areas, such as clearing the inside of a cash crop project of large brush, and the general maintenance of cash cropping areas. Building houses, selling leaf for construction of houses, building canoes, operating chain saws and building fences are other common income generating sources. Women are generally involved in the labor side of income activities, such as clearing the cash cropping areas, carrying the cash crops to a pick-up point, collecting the leaf to construct houses and carrying the trees to construct fences. Women generally do not receive cash for this involvement. In the Dala area, notes Warmke (1985), women's involvement in the exchange of money is limited to market garden produce. The Malu'u provincial station hires local men to work as laborers in and around the station as well as other posts at the provincial level. Some women are

hired at the Malu'u Clinic to cook or to clean and some work as nurses. At Dala, the provincial farm hires permanent and casual laborers and is the largest, single employer in that area. In addition to the provincial farm, the provincial agricultural extension division employs men for various provincial-level jobs. At the Takwa mission station, local people are hired to run the clinic, and a few provincial government posts exist, which are filled by men.

Households

In all three of the communities studied, the main production and consumption units are the households (Ross 1973). A "household" is defined as a group of people who normally eat, live, work, and sleep together. Households usually consist either of intact nuclear families, or of partial families. A partial family household can be a widow or widower with her or his children. Most households in the study groups were composed of nuclear families. Large extended families comprise a small part of the households studied.

In the patrilineal nuclear family, the senior male is the person who owns the household, and is the acknowledged head. This senior male is generally the father in the nuclear family. Availability of child labor depends on the age, number, and sex of the children, and whether the children are unmarried and still at home. Labor availability of relatives depends on age and sex.

Most households are involved in a range of activities such as food production, food marketing, copra production, cocoa production, pig rearing, business activities, full-time employment, and part-time employment (Frazer 1987).

Food production and domestic work, which includes cooking, cleaning, washing, gathering firewood, carrying and fetching water and caring for children, falls almost totally on women and young girls. Food marketing is also largely conducted by women, and is one of the limited ways by which they obtain cash. Frazer (1987) notes a 20 percent decline in food marketing from 1971 to 1985. This is due largely to a greater number and wider range of tasks that the household is involved in. Consequently, work for women has become more complex and difficult to manage. In addition to food production, food marketing and domestic work, women also participate greatly in the production of copra and cocoa; however, they are generally involved in the labor side of these activities. Most women's involvement in the exchange of money is limited to the marketing of food crops (Frazer 1987; Warmke 1985). It is common in both the Malu'u and Kakara areas to see women carrying large, heavy, bags of copra or cocoa. The bags are carried to a central pick-up point, often kilometers away from their original location.

Most women are not involved in business activities. However, some women do earn cash by sewing, selling crafts, or helping her husband manage a small village-level store.

Traditionally, reciprocal labor sharing was a common practice with other households when the labor demands became too great for a household to handle. This was a practice very often incorporated when a task required a large number of people. With work becoming more complex and difficult to manage, what is occurring now more commonly is labor hiring. Labor hiring, notes Frazer (1987), is becoming a regular feature of the local economy and is also an aspect of differentiation between households. Very often women from a local women's church groups, or other individuals who want to

earn cash are hired to do a range of tasks. These tasks may include, copra cutting, copra carrying, picking up, brushing paddocks, garden work, and childcare. Often men or young boys are hired to do house construction and house repairs; however, women do participate in the sewing of the leaf used for the roofs and sides of the houses. Women also help in gathering the leaf used for the construction of the house. Usually people hired to do these tasks are from low to middle income households (Frazer 1987).

Other activities, which form part of the work of the households, are unpaid community work such as volunteer work for the church, cooperative, kindergarten, school, or work for the village itself.

Cash Crops and Food Production

Producing foods for consumption is still an important activity of the Malaitan communities. However, a long-term decline in subsistence production is taking place (Frazer 1987; Jones et al.1988). This is brought about by stable settlements, large and rapid population growth, and the expansion of cash cropping.

The main source of the male smallholder's cash income is from cash crops, such as coconut and cocoa. Coconut is more widely grown and comprises the major crop in the planted areas (Jones et al. 1988).

Cash crop plantings have steadily expanded over the years in northern Malaita, and have helped in creating a shortage of land for subsistence agriculture. Planting coconuts and cocoa at the same time as food crops in new gardens is a practice that has increased since the late 1950's and has effectively removed that land from the garden cycle. The increase in population has also put additional pressures on the land.

Households now have smaller and less productive gardens. The more fertile lands for gardening are farther away. As land has become scarce, the land close to the villages is being cultivated much more intensively, lowering productivity through more intense cultivation. On the other hand, gardens that are farther away are more productive in terms of soil fertility, but the distance to travel to the gardens decreases the productive capabilities. Some women reportedly leave produce in the gardens to waste because of the long distance to travel and the burden of carrying the produce long distances.

Farming Systems

Malaitan society is divided into large, patrilineal clans. These clans claim land ownership over certain territories. The territories used by the people in the study groups, mostly coastal and mountain foothills land, are divided into numerous small plots and groves, or sub-territories, which are then used for gardening or planted with cash crops or both. Land to Malaitans is the paramount productive resource (Ross 1973). Land is owned and managed by all male members of a clan; women have rights to this land through either their husband's, father's, or son's clan. A member of a different clan may garden and cultivate an area but it does not imply ownership of the land. The gardener owns the crops he or she puts on the land but not the land itself. If a member of a clan plants trees on another clan's land, this gives him ownership of the tree crop for the life of the tree. However, with population pressure on the land increasing, this type of planting is strongly discouraged. The situation of using land, other than that of your own clan’s, for subsistence gardening, used to be a very common practice in all three-study sites. This

use of other clans' land has arisen because many residents along the coast have moved from the inland bush and do not have land close by that they may use for gardening.

Throughout Malaita, most gardens are cultivated using a form of shifting cultivation with a bush fallow period. The length of the fallow periods may vary from an optimum time of seven to twenty years, to as little as six months to one year, depending on the fertility of the soil (Rural Services Project 1989). Traditional digging sticks are used to cultivate. Gardens are developed almost exclusively with fire, steel bush-knives and steel axes. Rarely are tools such as hoes, steel cultivating forks or machinery used.

To begin preparing a garden area for planting, women first "brush" the area of all vegetation and undesirable trees. Trees such as Ngali nut (Canarium spp. L.), breadfruit (Artocarpus altilis), Sago palm (Netroxylon spp.), bamboo (Nestus spp.) and banana (Musa spp.) would not be removed from the gardening area, since they are valuable tree/food crops. Madafo (Hibiscus tiliaceus) and Sikma'a (Homolanthus novoguineensis) are girdled and left for later use as firewood (Warmke 1985). Vegetation is left to dry for one to two weeks. Next, the area is cleaned of any plant stubble and surface roots. Around the stumps of undesirable trees, litter is gathered and then burned at the base of the undesirable tree stumps. The burned areas are now divided into sections with sticks or limbs from trees. Most gardening boundaries are defined by a square pattern of sticks. Large mounds of soil are dug averaging about one meter in diameter for the planting of sweet potatoes (Ipomoea batatas), cassava (Manihot esculent) and Hibiscus cabbage (hibiscus manihot).

Agriculture in Malaita is a continuous process in which there is little seasonality, so that any or all stages of crop growth and management of crop growth may be carried

out at any time. However, certain crops are planted first in the newly prepared garden based on soil fertility. Generally, sweet potatoes are planted as a first crop. Pana (Dioscorea esculenta), taro (Colocasia esculenta) and yams (Dioscorea alata) may be planted as a first crop in very fertile areas. Pana and yams are generally mounded in a similar fashion as sweet potatoes and cassava. However, mound size may vary slightly from area to area. Taro is planted near or around "indicator" trees. Small vertical holes or "plugs" are dug, then the taro tops with stems intact are inserted into the holds. "Indicator" trees are species of trees that are recognized by the local culture as favorable taro growing areas. Smaller mounds are dug for tomatoes (Lycopersicon esculentum) onions (Allium cepa) and long beans (Phaseolus vulgaris). There are basically three types of spacing women use when planting food crops. These are "customary," "regular" and "recommended." A customary spacing type would show no discernible order in the garden plot. "Regular" spacing would be one in which a visible planting pattern is noticeable, and lastly, "recommended" refers to the adoption of a recommended pattern (Rural Services Project 1989). Since the greatest decline in production is between the first and second plantings of crops, cassava or a cassava/sweet potato mix is usually grown as a second planting. If a third planting is implemented, cassava is used exclusively.

It is common for women to clear new areas for gardening each month. Women generally work about two to six new gardens per month (Frazer 1987; Rural Services Project 1989; Warmke 1985).

Sweet potato is still the most widely represented and most important crop of all locally grown food. The other most commonly grown crops are taro, cassava, hibiscus cabbage, beans, tomatoes, and shallots (Frazer 1987; Jones et al. 1988). Taro is a

preferred food crop but is very susceptible to disease and does not grow well in poor garden soils low in potassium. Taro requires a longer period to mature and has a greater labor demand when grown on a large scale. Taro is starting to lose significance as a food crop among coastal resident, even though it is still a highly preferred root crop. Taro is still widely represented in gardens, but on a much smaller scale than sweet potatoes. Yams and pan are of much less importance than sweet potato and taro, and are mostly grown on a seasonal basis (July-February). Pana and yams are grown by a small number of families as supplementary root crops. One of the main advantages of yams and pana is that the tubers can be stored up to six months or longer. This is a real benefit when food harvests from gardens are low. The planting of pan and yams is still a family tradition among a small number of families.

Ngali nuts and breadfruit are very important seasonal tree crops. From August to December, Ngali nuts still feature strongly in market trading. Often, extra markets are organized during Ngali nut season. Ngali nuts now play an important role in Malaitan culture, and are used frequently in making a traditional pudding, which is a highly preferred dish, made for special occasions. Producers sell these puddings at all of the local markets during the nut season.

Hongkong taro (Xanthasoma sagittifolium), a newly introduced plant that is more disease resistant than C. esculent, is gaining in popularity in all areas. Cassava is still an important crop grown mainly for puddings. Cassava does better on poorer soils and can be left in the ground longer than other crops.

Food crops found in gardens may also include sweet corn (Zea mays), cucumber (Cucumis sativus), green pepper (Capsicum annuum), watermelon (Citrullus lanatus),

Chinese cabbage (Brassica chinensis), eggplant (Solanum melongen) sugar cane (Saccharum spp.), banana (Musa spp.), pawpaw (Carica papaya), and pineapple (Annunas sativus).

Smallholders often plant a complex mix of crops. Short-term cash crops and small areas of vegetables are typically scattered among food gardens. Tree crops play an important role both within cultivated gardens and in the fallow of former gardens.

Outside the garden, crops such as swamp taro (Cyrtosperma chamissonis), breadfruit (Artocarpus altilis), Ngali nut (Canarium spp.), mango, Malay apple (Eugenia malaccensis), several varieties of wild yam, and various citrus fruits are grown. Swamp taro is harvested during "hungry time." "Hungry time" is during and for a short time after the monsoon rains, when it is too wet and the soil is too heavily packed to work in the garden or to harvest sweet potatoes. During this time, rice is also used for those who can afford to purchase store commodities. Fishing activities increase for those close to the sea during "hungry time." However, fish is a main source of protein for those close to the sea. When fishers bring fish to the local markets, it usually is the first item purchased, since it is limited in quantity and many people desire to eat fish. The "bush people often start early in the morning by foot, to arrive at the local market so that they may purchase fish. Often the "bush" people and the "saltwater" people trade food commodities. The "saltwater" people desire taro, which the "bush" people grow on fertile soils far away from the coast.

CHAPTER 4

THE INTRODUCED TECHNOLOGIES

This chapter will describe the Peace Crops' overall program design and why the project was initiated. The types of extension methods used will also be discussed. The rationale for terracing, intercropping, non-burning of gardens, use of green manure, planting on the contour, use of fire ash on gardens, planting woodlots, kitchen gardens, and the planting of new crop varieties will be discussed as they relate to the project.

Program Description

In 1982, the Malaita Province, with assistance from the Peace Corps, established a program to aid in the rehabilitation of exhausted gardening lands and to introduce new gardening techniques including new or improved varieties of traditional crops. The goal of the Peace Corps program was to design an agricultural program to increase the productivity of the land. In order to accomplish this, the Peace Corps proposed plans to increase output, shorten forest fallow periods, and lengthen production cycles between fallow periods or some possible combination of these. Another closely related goal of the Peace Corps was to help women with their increasing burden of extracting declining yields from depleted soils (U.S. Peace Corps 1983). After attending an agroforestry conference, David Totorea, then with the Ministry of Agriculture and Lands, decided the goals of the project potentially could be met, in part, by using agroforestry techniques.

In the original planning of the project, information was first obtained on the Dala, Kakara, and Malu'u areas, respectively. The Peace Corps volunteers collected information on the existing social and economic situations through conversations with

members of the local community as well as with the formal (elected) and non-formal (traditional) leaders. Special emphasis was placed on women and information obtained from them because they are the major subsistence gardeners and one of the groups targeted. One of the major goals of the project was to introduce agroforestry methods that were as closely related as possible to the traditional farming systems in Northern Malaita. The agroforestry system designed was intended to be on a small-scale and to require low-energy inputs.

Implementation of the Project in the Malu'u Area

In the Malu'u area, several formal meetings were held with leaders and members of the local community. Community members agreed that an area used for demonstration purposes would be useful. As a result of these meetings, a site on customary land was selected for the agroforestry project. Customary land is an area that is communally owned by a tribe. This land is owned by all the male members of that tribe and used in accordance with traditionally accepted rules. There are, however, some areas in the Solomons where land is inherited through the female line and husbands have use of it through their wives. Non-customary land is land that is privately owned. However, eighty-eight percent of the land in the Solomon Islands is under customary clan land (Rennie 1991). Because the site was on customary land, many people had to be consulted before the project was started. Even after the site was established, the local community had to be continually assured that the area would remain as customary land. The demonstration site was selected because it was representative of the environmental and social conditions of that area. The site was situated on the Tamba'a land system with a

gentle to steep slope that had been fallow for less than three years. The project was started in 1983 using a one hundred dollar grant from the Malaita Province Agriculture Division. A local women's union was hired to clean the proposed site. Several men from the local Baptist church were hired to fell any undesirable tree species. After the site was cleared, it was left for a two-week period in order for the cut vegetation to dry out and begin decomposition.

From the beginning of the project, it was decided that the trees used in the agroforestry project would be used as soil stabilizers and fertilizers and not for wood products. Leaf material from the trees was used as a green manure mulch. At the onset of the agroforestry project, three villages in the Malu'u area were involved with the project along with several other people from surrounding villages in the Malu'u area. As a result of the project, several issued surfaced, one involving money. Several members of the community believed that some of the participants in the project would benefit by receiving money from the project coordinators or the province. Jealousy arose over why the Malu'u area was chosen for the site over other areas. As a result of these issues, a core group of only about 15 people continued with the project, out of the initial 35 that started out with the project.

Implementation of the Project in the Dala and Kakara Area

The Dala area was selected as a site for the agroforestry project because Dala is the headquarters of the Agricultural Extension Service for North Malaita and past research had already occurred. Consequently, Dala's land systems and population pressures were already understood (Warmke and Warmke 1983). Peace Corps volunteers

were posted in the Dala area in 1982. For six month, initial social and agricultural observations were made by the project coordinators in order to help form a database (Warmke and Warmke 1983). For the first year, Peace Corps project coordinators initiated trials that incorporated alley cropping: a system of intercropping with leguminous trees, green manuring, and the concept of not burning gardens. It was not until 1984 that an agroforestry demonstration site was established. The site was established as part of a training course conducted by the Peace Corps for senior agricultural field staff.

In 1986, the Peace Corps project coordinators left the Dala area, but the Malaita Province Agriculture Division felt that the project needed to continue to two more Peace Corps volunteers were recruited to replace the others. Kakara was chosen as the intervention village. Kakara is located about 1 kilometer north of the Dala area and is separated from Dala by the Malaita Provincial Research Station. Since the last Peace Corps volunteers were being replaced, much information was already known about the area, so less time was needed to obtain background information.

Agroforestry methods and demonstration sites were introduced into the Kakara area with funding obtained from UNICEF and the Cyclone Namu Rehabilitation Project. Tools and plant materials were supplied, in part, from Dodo Creek Research Station. From 1987 to 1989, eleven agroforestry sites were established throughout Malaita. The Peace Corps promoted alleycropping, using trees spaced three meters apart. A demonstration piggery was built, incorporating alleycropping using local hardwood species. Trees such as papaya were planted and used as part of the feeding regime for the

piggery. A kitchen garden was incorporated into the system, which demonstrated the rotation of peanuts, beans, tomatoes, and Chinese cabbage between the rows of trees.

The demonstration agroforestry sites in Kakara were not burned, and the cut vegetation was allowed to dry to demonstrate improvement of the soil from increased organic matter.

Rationale for Particular Recommendations

As was mentioned earlier, the Solomon Islands have rich natural forests, but much have been cut down to make way for cash crops and agricultural farms. The people continue to exert pressure on their land especially on Malaita. Malaita has the largest human population and the highest population density of all the islands (Jones et al. 1988; Statistics Office 1986).

Agroforestry systems are characterized by many features, but typically can be viewed as a system of greater species diversity than other agro-ecosystems (Stoney and Ihardja 1990). Agroforestry systems have the potential to enhance the income and food security of rural families because farmers do not have to depend on one single crop (Stoney and Ihardja 1990). Because of the farmer's need for continuous food production and the inherent desire for permanent land tenure, the integral, rather than the cyclical or taungya systems were employed for crop production.[1]

The integral system is aimed at simultaneously producing both annual and tree crops over an extended period of time. The desired annual and tree crops are planted simultaneously. In this system, the annual crops are the primary product, while tree crops are secondary.

Listed below are several reasons why the integral agroforestry system was recommended:

1. Improved land utilization is obtained by producing both annual crops and tree products at the same time.
2. Soil erosion is reduced through the use of trees as barriers to runoff.
3. Trees used in the system can act as nutrient pumps by concentrating these nutrients from deep in the grounds in their leaf litter.
4. Fallow periods can be rotated within the system.
5. Trees create microclimates that will protect the soil from the sun.
6. Trees act as barriers to pest and diseases.
7. Garden life can be extended so that other areas may be left fallow for longer periods.

Terracing was introduced in the Malu'u area because gardening occurs on steep slopes and may cause severe erosion. To establish natural terraces, contour lines were created by using a simple A-frame. Contour lines were placed four meters wide between rows and two meters wide between rows on very steeply sloped areas.

From the beginning of the project, it was decided that the trees used to establish the contours would be used as soil stabilizers and for green manure rather than for wood products.

Green and Cresswell (1976), notes verbal accounts of stone-walled terracing in the Western Solomon Islands. Although no empirical evidence has been located on Malaita, the researcher in personal interviews with older adults in the community

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[1] For a full explanation of cyclical or taungya systems, see MackDicken and Vergara (1990).

uncovered stories about their grandparents showing them areas where terracing had been used for both permanent yam and taro gardens. From this evidence, the researcher thought that terracing may be acceptable to the people of Malaita both culturally and technically. Leucaena was the tree selected to create the terraces because it was used extensively in Northern Malaita as a shade tree in Cocoa plantations, and was the tree recommended by the Provincial Agricultural Division in Malaita.

A mixture of L. leucocephala and Giliricidia sepium was used in alley cropping at the Kakara site. Alley cropping is used to create a contour hedge much like a terrace. Dala North and Kakara are dryer than the Malu'u site, so Giliricidia is recommended over Leucaena. Giliricidia is used more extensively on the Island of Guadalcanal. Parts of Guadalcanal receive much less rainfall than Malaita, so it was felt that Giliricidia would be the best choice.

Intercropping was a major component of the agroforestry system and was introduced in Dala, Kakara, and Malu'u. Food crops inter-planted with nitrogen-fixing trees such as Leucaena and Giliricidia are generally more productive than crops planted singly (Vergara 1982). Therefore, the researchers assumed that, as long as the trees did not crowd or shade the food crops, the agroforestry system based on legume trees would be more productive given the constraints the farmers were facing.

The importance of the accumulation of organic matter and nutrients during fallow has been studied widely and verified throughout the world by researchers, notes Vergara (1982). An attempt to improve the efficiency of fallow periods by speeding up the nutrient accumulation process was used through the introduction and use of fast growing tree species. An alternative approach to natural nitrogen and nutrient recycling is the use

of green manures or mulches from the leaf litter of these fast growing trees. Farmers in both areas were encouraged to prune the tree tops and branches and spread them among the food crops as a mulch and organic fertilizer. Separate experiments done in Hawaii and the Philippines showed that corn yields increased by about 100 percent over unmanured control crops when leaf litter from trees was used (Vergara 1982). During a harvest of potatoes that had green manure applied at the Malu'u site, women working with the project visually noted a higher yield of potatoes per plant.

Woodlot planting for fuelwood was strongly encouraged, especially in the Kakara and Dala area, where land pressures appear to be more intensified (Warmke and Warmke 1983). No demonstration fuelwood plots were established at either of the sites. However, in all courses taught through the Malaita Agriculture Divisions training programs, the planting of woodlots was stressed because of the problems expressed with fuelwood shortage.

The introduction of new varieties of food crops with an emphasis placed on obtaining higher yields and improved nutrition was encouraged in both areas. New varieties of sweet potatoes were demonstrated and tip cuttings were given to individuals willing to try them.

Wing bean, Psophocarpus teragonolobus, a prolific climbing perennial, was introduced in all treatment areas. It is a common vegetable in South East Asia. Every part of the wing bean can be eaten. Where other sources of protein are not available, beans are good sources of protein, with the wing bean being exceptionally good.

The "Kitchen" or "Home" garden was introduced as a way to teach families how to grow food crops for continuous production of food and to meet some the family's

nutritional requirements. Special emphasis was placed on growing vegetables and fruits in a small area attached or close to the house. Saunders (1983) suggests from evidence in Northern Malaita, that the practice of having small gardens close to the house may have been abandoned in the past, as villages grew in size and shifted from better lands found inland to less productive coral areas of shallow soils. The relaxing of formerly strict rules against the free ranging of pigs within villages may be another reason why kitchen or home gardens were abandoned (Saunders 1983). These gardens were intended to help eliminate the greater burden women face traveling to and from gardens. Frazer (1987) notes that in Manakwai, Malaita in 1971, more than one-half of the gardens were within 1.5 kilometers and all the rest, except one, were less than 2.5 kilometers away. In 1985, he found that twenty-eight percent were less than 1.5 kilometers away and thirty percent were over 2.5 kilometers away. Based on this data and similar findings, researchers along with other women from the villages felt that gardens close to the family home would help improve the family's nutritional status and eliminate some of the burden on women. "Mixed gardening" or agroforestry techniques were introduced as the method for establishing these kitchen gardens. The recycling of household waste products, kitchen refuse, and leaf litter from trees helps improve soil fertility for the maintenance of assorted vegetable and fruit crops. For example, one square meter of amaranth in full sun produced three kilograms of leaves in two months, note Oomen and Grubben (1977). A family of five requiring 500 grams of leaves per day needs no more than one bed of 100 square meters of amaranth.

The concept of not burning the gardens was introduced to help increase beneficial soil bacteria, to provide the slow release of soil nutrients over a longer period of time, and

to improve soil structure. No demonstration sites were burned. Protection from burning was encouraged in the kitchen gardens. The Dala site was largely an area used to investigate the beneficial or detrimental effects on yields and pests and diseases when using mulching or green manuring as opposed to burning the garden. Researchers wanted to determine if any increases in yields that resulted from such practices would be offset by damage from pests and diseases, especially fungal diseases, and if the increases in yields would justify the additional labor costs (Warmke and Warmke 1983).

CHAPTER 5

RESEARCH METHODS

This research was undertaken in three areas of Northern Malaita. These particular sites were selected because each area shares similar cultural and physical characteristics. Each site is located near a road that provides relatively easy access to the provincial capital. Agricultural field staff posts, under the auspices of the Malaita provincial agricultural division, are located in each area. The primary research factor was introduction of new agricultural technologies by Peace Corps workers[2] The two treatment sites were selected for the study because, initially, two Peace Corps volunteer consultants had been posted at each site for at least two years. Agroforestry methods were introduced in both areas by a single pair of Peace Corps volunteers. The third site, chosen as a control, did not have Peace Corps volunteers posted there. The Malaita Agricultural Division originally identified the northern regions of Malaita and the two areas chosen as treatment sites as places with agricultural problems.

Information from the researcher's three-and-a-half years as a participant observer, and a literature review, provided the basis for the development of the questionnaire, which was administered to women of the study groups. (See Appendix A for a copy of the questionnaire.)

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[2] Qualifying effects on the treatment factor, and other measurement issues and deviations from a pure experimental research setting will be discussed in a later section.

Formulation of Hypothesis

Seven main hypotheses have been formulated from the literature cited. The objective in setting forth these hypotheses is to explore whether the transfer, adoption, and diffusion of technology has occurred in the gardens of women who have been introduced to agroforestry methods by the researchers. The main research hypotheses are as follows.

Hypothesis 1. Intervention by the Peace Corps will result in higher adoption of introduced technologies.

Hypothesis 2. If the technology is economically rational, women will adopt the technology.

Hypothesis 2a. If women do not spend a large amount of time working with cash crops, they will adopt the technology.

Hypothesis 3. If the technology does not seriously deplete women's personal time and /or energy, women will adopt the technology.

Hypothesis 4. If their husbands have primary land rights, women will adopt the new technologies.

Hypothesis 5. If conflict does not arise with other people, women will adopt the technology.

Hypothesis 6. If the introduced technology is consistent with the belief/value system of the women, they will adopt the technology.

Hypothesis 7. If women understand the technology, they will adopt the technology.

These hypotheses have been measured by several variables, and/or by case study observations, that will be discussed in detail in the following chapters. There are also several demographic variables that provide a descriptive statistical picture of the areas under study.

The Sample

The three areas in the study population include one area in Malu'u, a second in Dala, and the third in Takwa. Malu'u, Dala, and Takwa all refer to areas in which numerous villages are contained. All three areas are located in the northern part of Malaita.

The populations of interest in the Malu'u area were the inhabitants of three villages, Takewin, Raubabatu, and Karu, and consisted of 33 households. The senior woman of each household was interviewed. Two senior women of the 33 households were not present, however, and could not be interviewed. The Kakara population included 30 senior women of the Kakara village. Six households in the Kakara village were away, living and working in the capital city, Honiara. Five women refused to be interviewed. Among the reasons for their refusal, three women commented: "Agriculture is always doing studies, but we never benefit from the studies or see any of the results. And, besides, why should we cooperate when you are probably getting paid to do this and we will not get anything?" The other two women said, "We are too old now to garden; we do not have anything to say." Thirty-two women from the control area, Takwa, were interviewed with four women from this area refusing to be interviewed. All four women who preferred not to be interviewed were widows, who reportedly did very little

gardening and felt that they could not contribute anything to the interviews. Two households were away, living and/or working in the capital city, Honiara. Residents of the Takwa area were selected by using the Takwa Mission as a starting point, going up the road about one-quarter of a mile and down the road one-quarter of a mile, and interviewing every senior woman from each household within that range. Households living in and around the Takwa mission were also included in the sample.

Dala North, Malaita, which originally had been selected as a treatment area for the study, was unable to be used as such due to three recent deaths in the village. Conducting work or related activities during the mourning of a death is strictly prohibited by local custom. However, ten interviews were permitted with selected women from the village. The ten women were chosen by a woman who had originally been involved with agroforestry project when it was introduced by Peace Corps volunteers. The Dala North sample will not be included in the statistical analysis, but reference to the Dala North area may be used when appropriate as additional descriptive date.

Respondents from all areas were interviewed while doing various activities at home and in their gardens. Table 5.1 lists the number of respondents in each group.

Table 5.1 Number of Respondents by Locality

Research Group	Population Area	Number (N)
Malu'u	Treatment Area 1	31
Kakara	Treatment Area 2	30
Takwa	Control Area	32

Data Collection

Interviews were conducted with women from each household from all three sites by the researcher and an assistant. One Malaitan woman was hired to help conduct interviews at the Dala North site, since the population was large (over 60 households). The Malaitan woman was also used as an interpreter in the event the respondents being interviewed by the researcher did not speak the national language, or the researcher could not understand the respondents' comments. The woman hired to help with the interviews was carefully trained; she accompanied the researcher on preliminary interviews in one treatment area before she conducted interviews herself.

In addition to the structured interviews with women, informal interviews with village chiefs, agricultural extension agents, Malaita provincial agricultural division staff, ministry of agriculture and lands officials and local persons were obtained. Finally, direct observations of people in the field and around their households, along with extensive field notes taken on the interviews, contributed further to the research data.

Two basic research methodologies were employed in this study: case study investigation, and statistical questionnaire analysis. Each of these will be presented in turn in the following chapters.

CHAPTER 6

CASE STUDIES

This chapter presents case studies from the Malu'u area where the author worked as a participant observer. These case studies are intended to give qualitative impressions regarding the adoption of new agroforestry techniques, based on household visits. The respondents are presented ranging roughly in order from high adoption to low adoption.

Case Study #1

Dinari is 31 years of age, and a mother of five children, all boys. Dinari's husband is a local carpenter and is not at home much to help with various chores. She lives in a semi-permanent material house with a water sealed toilet available near the house. Dinari lives in the village of her husband's father, and feels that village life is good. She likes living with only her immediate family, but often spends time helping her husband's parents. She helps them with work, since they are getting old By Melanesian standards, she and her family are relatively wealthy.

Dinari attended secondary school and finished her education at the form 2 level (equivalent to the tenth grade in the United States). She is one of the most educated women from this area. She would like to have worked at a job in the capital city, but she and her husband were forced to marry, because they were seen talking together, which is strictly prohibited by custom for unmarried boys and girls (unless they are in a social setting with other people around).

Dinari spends most of her time working in the garden, working with their farm of cash crops, and tending to domestic chores around the house. She enjoys going to the

Baptist church, which she is an active member of. For her, Sunday is a day to rest and interact with other women.

Although not active with the original group of women who worked to establish the first agroforestry demonstration plot, she and her husband did start their own terracing and use other agroforestry techniques.

> We have gotten good yields of potatoes from our terraced garden. We do not garden on one terraced site continually, but shift from one terraced site to another area, this lets the terraced site rest.

Dinari left one agroforestry site in 1991, in order for it to rejuvenate and is now using another gardening site. She has not yet established a new terraced area, but uses a garden that is cultivated in the traditional way. She would like to start another terraced gardening site, but feels she needs her husband's help on the initial establishment of it. Dinari learned about inter cropping in secondary school, but never tried it until after the author stayed in her village. She uses intercropping in her terraced garden as well as in the kitchen garden.

> The kitchen garden helps me so much on days that I work harvesting cocoa. I spend most of the day harvesting the fruit to sell the following day and when I need leafy greens and fruits to cook for my children, all I have to do is walk outside my kitchen door and get them. I learned about how to make the kitchen garden in secondary school but never used it until you came to my village. I watched you plant it, and used to come to your house to see how it was doing. I noticed that you harvested a lot of food from it, so then I decided to try it. My husband said I should do this too. I used the fire ash from our kitchen fire like you told us about, but it was too far to carry all the time to my garden. Sometimes I carry my youngest son on my back while going to do work in the garden, as I carried my other children and it is just too much work. Using the tree leaves on our garden works good, even my husband told me we should do this. When I work in my custom garden, I burn the garden first. Then, after I have planted the garden and I'm ready to weed again, I never throw the weeds out of the garden; I put them in a line (contour) following the hillside. I saved the wing bean seeds you gave us. I still plant them, because my children like them better than our custom beans. Many women ask me for seed, but I am not willing to give them

> any because they will just lose them then come and ask me for more. I do not have any of the tomato seeds you gave us. The birds ate the tomatoes and I did not get more seeds.

Dinari has never planted a woodlot, but feels that it is something that her children may need to do for future fuelwood needs. For now, Dinari is able to find enough wood.

The number of people living in the Malu'u area has increased. The population growth has caused a shortage of land; this is leading to intense struggles for control on clan territories. Dinari says that she feels secure with the land on which she gardens, because her husband has primary land rights. In fact, her husband's father, who is the village chief, has banned anyone from using the several terraces that were established in 1983.

> I know we are facing a land shortage because of people, but because my husband earns money from his carpentry work, we can buy rice and tinned meat when we want and need it. Some women do not have husbands that work and they have to grow all their food. I do not know what they will do in the future when there is no land available for their children.

Case Study #2

Thaona is probably in her mid-sixties, but she is not certain. She knows that she was born around the year Mr. Bell was killed (District Officer on Malaita, killed in 1927). She lives in the village with her husband, one of her children who has Down's Syndrome, and a granddaughter who belongs to her daughter. Reniuaa, Thaona's husband, is village chief and a well respected man. His clan is the primary landowners on the Namta'a land system. She lives in a permanent house and has a water seal toilet modeled after the one the author introduced. Nani, her granddaughter, is there to help her with gardening and other domestic chores. Thaona feels old and has problems with one of her legs. She has a

difficult time walking to the garden these days. Nani and Thaona's husband usually arrive first, then she comes behind. Thaona gave birth to eight children, six males, and two females. She is proud of her sons, because they all went to secondary school and have good jobs.

> My husband and I worked hard to find money for their education, but my husband felt that it was best if they got good educations. Our sons help us with many things now that we are old. We have good food when we need it. My husband and I have always worked together in the garden. It was he who encouraged me to join in with the group when you came to teach us about agroforestry. He attended all the meetings about the project and felt that our community needed to change our gardening ways. Land is starting to become scarce for our gardens. Our son uses the original terraces that were used for demonstration purposes. We have always gotten good yields from the terraced areas. My husband has stopped anyone from using the terraces; only our sons and their wives are allowed to use them. When we were living in the capita city of Honiara, we used terraces like you taught us how to do here in Malaita, but in our kitchen garden, since we did not have land on Guadalcanal. Many people were surprised how much food we got from our garden; soon others copied our garden. We used rock to make the terraces with them. It was hard to find Leucaena seeds in Honiara. We never burned our garden in Honiara, the soil there is so dry and no organic matter in the soil. We used to not plant our crops together, only yams, pana, and taro did we plant together. Now we always use the intercropping and especially the green manure, this really makes the soil nice. My husband tells me that land is going to be hard for our grandchildren. The girls that marry from our villages must go with their husbands to his land. Now you see some of our daughter's children and our sisters stay here in the village because it is close to our church, but when our grandchildren's daughters marry, they must leave the land. Now we barely have enough land for our son's children. We have not planted a woodlot because we can still find firewood. My son told me that now it is harder to find large pieces of wood to make fires for his copra dryer. I think our grandchildren will have to start planting woodlots.

Case Study #3

Sunarii, is 34 years of age. She has no biological children of her own. She and her husband have adopted a boy of her husband's brother. Her husband went to secondary school and worked for the agriculture division, so they have some money available when

they need certain things. They have a permanent material house and are considered fairly wealthy. Sunarii usually keeps several pigs for feast times. Her husband has primary land rights to the Namta'a land system, which is close to her village. Sunarii was involved with the initial agroforestry project. She and her husband built their own terraces on a steeply sloped area near their hut.

> I only went to standard three in school. I know I'm not very smart, but I learned how to do the things you taught me. Because I worked with you, I learned how to do something new. I have used the terraces since we first learned how to use them. We use all the methods that were introduced, except putting fire ash on the garden--which was a good idea, but most times, it was too far to carry from my house--and making a woodlot. I feel that there are enough small pieces of wood to gather to make fires to cook with. I have heard some of the men talk abut having a hard time finding enough big trees to use for making a fire underneath their copra and cocoa. My husband bought fertilizer from the agriculture division and we put it on our taro that we planted in the terraces. We sold it in Honiara and made almost three hundred dollars. I do not burn the terraced area but I still burn my custom garden. When we leave the terraced site to go fallow I will make another garden. I burn this garden like our custom way before. I do not want to burn the trees in the terracing, plus the soil is very good there. People still think it is odd that we do not burn in our terracing. They always say "What kin way nau?" Remember the landslides we had when the cyclone came? Many gardens slipped down the hill but our terracing and my husband's brother's terracing did not slip during the heavy rains. People here do not understand the problems we have now. Look at some of the women we worked with--they have gone back to their custom ways. One big problem with some of the women is that they cannot put terracing o my husband's land, but they could do it on their land in the bush. I grew wing beans for a long time but I gave all my seed away, now I have none. We still grow the three-month potatoes. They grow quickly and are good to plant right before rainy time. Our village is much better now that we have water sealed toilets.

Case Study #4

Dhalu'u, like Thaona, is not sure of her age, but she thinks she is probably near sixty. She lives with her husband who is sick. He is not well enough to help her in the garden but she says, "He is an honest man." Dhalu'u had six children, all of them living, but none of her sons help.

> They have taken the way of the white man. They have all gone off to work. They rarely send money to help me and my husband. I worked hard in the garden and making copra and now, they are too lazy to help us.

Her husband is not a primary land owner. His land is far away in the bush. Sometimes they go there and plant cash crops and taro in hopes that a road will soon be made to the interior bush. "Maybe some day we will move back to my husbands' land." Dhalu'u was an active member of the women's group that took over the demonstration agroforestry site. It was her idea to use the vegetables and potatoes from the project garden and sell them at the local market. The money from the sale of produce was then put into a fund for future use, as the women's group saw fit. Dhalu'u stayed an active member until the author left the site and members from the Namta'a land system banned anyone from using the terraced site.

> If our group was still together, I would be interested in continuing with the terracing. I'm not interested to do it on my own. My husband is too sick to help now and my sons are too busy with other things. Since we used terracing, I now plant on the contour. When the garden is cleaned, I use the brush and rope from the bush to put across the hill--like we did with the Leucaena when we made the terraces. Taro still grows the best when you burn your ground. I use the intercropping in my garden; however, I first heard of this from agriculture then you came and I saw that it really worked well. Now I always mix my vegetable crops. Now I do not burn the ground when I make my potato garden. I think it is best not to burn. It makes the ground so dry. Green manure really helps the garden to grow and the ground is not too dry when you put plant matter on the ground. With taro, it is best to leave the ground bare like we have always grown it. The fire ash that we carried up made our potatoes in the demonstration garden have a lot of fruit, but I never use the ash because it is too far to carry and I'm too old for that now. The kitchen garden was a good idea, but I feel too lazy and tired to do it. I lost all my seed from the wing bean. I think the rat that was in my hut ate them. I need to get a cat to stop that.

Dhalu'u later said that she really did not understand how to make a woodlot, but feels that when a road is built to the interior bush where her husband's land is, they will not have the same demand for wood as they do now. "The land in the bush has the best

trees and the ground there grows wonderful taro. She speaks fondly of the future. She feels that life near the road is not too good, because the land is exhausted, and that has caused her to rely on expensive store-bought goods.

> Our village is much too big now. We have no privacy from anyone and we do not have anywhere we can build another leaf house. Leaf is getting really hard to find. We had to repair our house last year. We had to walk to my husband's land in the bush to find the sego leaf to do the repairs. Leaf is really expensive now if you must buy it from the local land owners.

Case Study #5

Even though Didigna's husband does not have primary rights to the land they live on, she feels very good about her future and her children's future. Didigna is 49 years of age and has seven children.

> Now we can make money by selling coconuts and cocoa. Before these came to our islands. We had no way of making money. Our parents had to make a living only from the land. I still rely on my garden for most of our food, but we were given a small plot of land to put cash crops on. If the province puts the road in the bush, then maybe we will move there. But I like living close to the road here. If we move to the land in the bush, it will be hard to get fresh fish.

Didigna was actively involved with the demonstration agroforestry project. She says that if the group were still allowed to use the site she would probably still be involved.

> After you left (the author), we argued because some people wanted to join the group, and some people did not want to work anymore. Some of us felt that the women that wanted to join only wanted to join to get the money we had. We tried to continue with the original group of women, but we could not work out the problems, so we divided the money and we stopped working together. Besides, since some of our husbands are not primary landowners here we have no rights to use it. But the chief is very good and his clan has always let us garden here, since we all belong to the same church. I have never made terraces with trees because my husband does not have land right here and people would not allow it. There would be a big dispute about using land that way. I use the intercropping a lot. We always did some intercropping, but when you showed us how to mix many

> different vegetables, I started doing it that way. I tried not burning my garden, but the weeds comeback so fast and I'm not willing to weed too much. I like using the green manure with taro and vegetables. This really helps taro grow nicely and keeps the ground from being so dry during hot days. I never use this with my potatoes. I think it is best to follow our custom way with potatoes. The fire ash that you told us about works really good around my beans near the house, but it is too far to carry them to my garden. I only grow beans near my house. I tried to kitchen garden but the ground is too dry near the house. With the cocoa so close to my house, I use the old dead branches for firewood. I do not think we need to plant woodlots. I did not save any wing bean seeds. When I ask some of the women for seeds, they are not willing to give me any.

Case Study #6

Kara, not active with the original group is a twenty nine-year-old mother of five children. She says she spends five days a week in her garden and about once a week working with the small plot of cocoa they have. Their leaf house is in ill repair and leaks when it rains. By local standards, Kara and her family are not poor, but they have very little status in the community. Her husband is not a Christian and is looked down upon is this predominately Christian village.

> My husband does not work, only sometimes he carries copra bags for Erii. He does not help much in the garden or with our children. I have most of the work to do. Sometimes I leave potatoes in the ground because I do not have time to carry them down from the garden.

Kara says that it is very difficult to find money to get clothes for her children. Even though situations are hard, she says that village life is good. This is because she is able to work and the food she grows is free, unlike living in Honiara, where food is expensive, and you must buy what you eat. She likes her neighbors in the village, and feels like they get along well together. She would like to have belonged to the women's group that did the gardening at the agroforestry site, but mentioned time as the limiting factor.

> I saw the terraces that the group made, but did not try them myself because I thought they needed fertilizer so that the crops would produce. When agriculture introduces agricultural things here, they always use fertilizer, so that is why I thought I would need it too. Intercropping is something I use in my garden. I learned from my mother, but I do not mix the crops like you showed the women how to do. I thought it would make too much shade and the crops would not grow. The women told me that I should not burn my garden so sometimes I just move the small branches to the side and only burn the big stuff. When the sun is hot and it is dry, this is the best time to burn. Fire ash is too far to carry to our gardens. You know how far it is to walk there! There is still enough wood available so we do not need woodlots. The kitchen garden is the best idea for us women who have a lot of work to do. I have a kitchen garden now. I do not always plant one though. I did not get any of the seeds you gave the women and they were not willing to share them.

Case Study #7

Forty-one years of age and a mother of nine children, Diiari likes village life. She has a husband who helps her in the garden. She says the village chief is a very progressive man and has many good ideas that help the village. She completed standard four, but admits she did not like school too much.

> I had many things to do at home when I was a young girl, carrying water, cooking, looking after younger brothers and sisters, and working with my mother in the garden. When I finished school, there was much work to be done at home. I guess I was not very smart anyway.

Diiari's husband is a primary land owner. She spends one whole day a week harvesting cocoa and getting the wet bean ready to sell to a truck that comes up the road to buy them. She spends most of her time in the garden. Often, her husband goes with her.

> Providing enough food for my family takes most of my time. My oldest girls who are 20 and 18 are married so that is less two people to feed, but they helped me look after the other children and worked with me in the garden. I saw the terraces across the hill (contour) with intercropping and how you use the green manure, but I think it is best to follow our custom way. Agriculture always brings ideas to us that never work. Plus, they never teach us women how to do new things. I thought about using the green manure once but was afraid that it would cause rate to come in and eat our potatoes. We could not afford to lose our potato crop.

> Carrying all that ash up to my garden was too much work. I put it on my kitchen garden close to my house, but even the kitchen garden did not grow good because as soon as I planted it the chickens would scratch it up. People's pigs would also come and destroy my garden. One time I wanted to ask for compensation, but my husband said that we should keep the peace with our neighbors. We have a village rule that you must keep your pigs up, but nobody follows the rules. You must always burn your garden. It is not our custom to leave your garden in weeds and brush. People would think I'm lazy and make fun of me if I did not burn my garden. I don't think we need to plant trees for fuelwood. We have enough firewood for cooking. I did not receive any new crop varieties. I wanted some of those wing bean seeds, but no one would give me any. Only the women who worked wit you got any. Sometimes women here are not willing to share their things with us.

Customary ways are very important to Diiari. She felt that using the ways of "agriculture" would not produce good crops. Many of the introductions coming from the agriculture division have not been successful, in her view. She spends five days a week in her garden and another full day working with cocoa. Diiari spends many long days in domestic work; but seems to accept her role and basically feels that life is good.

Case Study #8

Erii's parents were some of the first persons in the area to become Christians. In her parents' Bible, was a record of her age. She is sixty-four years old and has been a widow for twenty years. She has five living children and three, which died of diarrhea. Erii was a very active participant of the women's group that worked with the agroforestry project. She attended a workshop in Papua New Guinea, with the author, on mixed gardening techniques. She was very enthused to bring the information back to share with the other women. Even though Erii was not wealthy by village standards, she was very progressive in thought. She was usually the motivator in getting women to work with the project. She does not do terracing on her own now.

> I'm just too old to start the terracing on my own. My husband was a primary landowner, but I do not feel like starting terracing. I as sorry the women stopped working with the terracing. The money we got from the sale of vegetables at the market helped me buy bread, sugar, and fish. Now I must depend on my son for any money. He does not work with the government so he does not have any money either, only what he gets from sewing leaf or carrying copra. Sometimes I plant a small garden with my daughter-in-law. I have taught her about intercropping. We intercrop our vegetables and potatoes together. My daughter-in-law always burns her garden. So, I do not say anything to her. Besides, she is afraid that the rats will eat her potatoes if she does not burn. The same with the green manure--rats will eat your potatoes if you leave too much trash on the garden. I still do not plant on the contour. It is much easier to follow our custom way. I'm not willing to change now. You now it is too far for me to carry fire ashes on my back to the garden. Look at me now. My hand shakes and I'm too weak. I have tried several times to pant a kitchen garden but the dogs, pigs, and chickens spoil my garden every time. I don't bother with it anymore. People will not listen to me when I complain about the animals in the village. I planted wing beans and tried to sell them at the market, but people did not seem very interest in them, so I stopped growing them.

Erii wanted to continue with the agroforestry garden, but said the other women really were not interested. She expressed dissatisfaction with part of village life. She said their chief pushes them too hard to do a lot of things, and then the other chief says to do something different. She expressed numerous times the feelings about being old, and how people do not listen to what she has to say. Her one son, who lives in the same village beside her, is not willing to help too much.

> My house leaked and rain would sometimes pour in. My house was still on the ground until last year, because I had no one to build one for me. I could not afford the leaf and wood to have one built. Finally, after I as sick with pneumonia and thought I would die, he built my house. He was afraid of my devil-devil--that is why he built it.

CHAPTER 7

STATISTICAL ANALYSIS

Operationalization of the Variables

Several variables of interest to the researcher were created by coding the responses to questionnaire interviews conducted with each study subject.

Income was measured according to whether there was some income or none from any specific source. To what sources(s) of income does the respondent have access? This question was operationalized by asking the respondent to list the various incomes to which she had access. If the respondent did not list her husband's income as a source of cash available to her, the interviewers probed further by asking the respondents directly if they had access to their husband's income.

Wealth was documented in several ways. One was to physically observe if the respondent had a house raised above ground level or a house with an earthen floor. Generally, houses are built above the ground. It appears that residents with houses that have earthen floors lack access to resources such as land or cash, and are unable to put their houses on stilts. The second measure of wealth was determined by asking or observing if the respondent had or was building a permanent house. A permanent house is one built of items that have a much longer life than that of local materials, such as leaf or bamboo. Many people in northern Malaita are building permanent houses because resources such as leaf and bamboo are in short supply, due to population growth (Frazer 1987). Wealth was also measured by observing if the respondent's house was in ill repair, which would tend to indicate the respondent lacked the resources necessary to maintain

the house. Other times observed as a measure of wealth were if the respondent owned a lantern, or kerosene light, and if the household had a water pipe accessible for use. Each respondent's "observed" wealth was then measured on a three-point scale of Low, Medium, or High.

The respondent's social status was measured as the husband's position. The various answers given to what the husband's social position was, were recorded. These included the respondent never having been married, the husband being dead, the husband at home without paid employment, the husband working at some paid employment, the husband being a religious officer and the husband as village chief.

Each respondent was asked if she had land planted in cash crops; and a yes or no response was documented. If the respondent answered yes to having land planted in cash crops, she was asked what types of cash crops she had planted. Then, the amount of time the respondent spent with cash crops was operationalized, by asking the respondent to recall how many times per week or month she had worked with each cash crop. Thus, if the respondent had answered "Yes" to working with cash crops, the interviewer then asked her how much time she spent working with each cash crop.

Age was operationalized by asking the respondent's age in number of years, and, if married, the husband's age in number of years. If the respondents were unable to recall their age, it was estimated using a local calendar of events that they were asked to recall. If the husband's age was unknown, that information was omitted and treated as missing data.

A dependency ratio was calculated for each case. The numbers of persons who were 15 years or younger and 65 years or older were summed to represent the dependents

of the household. This study following the standard criterion used to calculate the dependency ratio when appropriate. Respondent's comments were also read for each case in order to further define the dependency ratio. Girls who are eight years and younger were included as dependent, but not girls nine years old and older. Young girls contribute significantly to the household, carrying out many domestic chores at a very young age. Most boys are given the opportunity to attend school, and are generally dependents until they work and bring income into the household (Frazer 1987). The total number of workers in the household was then arrived at. Lastly, the dependency ratio was obtained by dividing the number of dependents by the number of workers.

The number and the age of the respondents' children were all measured by asking the respondents to give a numerical value for both. The gender of the child was reported with each age of the child. If the respondents could not recall the age of their children, a local calendar of events was used in estimating the children's ages.

Also, whether or not there were others living in the house was asked and recorded, as another possible indicator of dependents, or perhaps extra workers in the household.

Each respondent was asked how many days per week she goes to her garden(s). A numerical value (from 1 through 7) was recorded for this. Who helps the respondent in the garden was also asked, in order to get an idea of labor availability, and to have a better understanding of the respondent's available time for other tasks. She was further asked if she had any help in her garden, and if so, from whom.

The interviewer asked whether or not the respondent's husband possessed land rights, to get an indication of the respondent' access to land.

To ascertain whether a technology had caused conflict, the respondents were asked if it had. If the respondent answered yes to the question, she was then asked with whom it had caused conflict.

Five community-level satisfaction variables were asked of each respondent, and all answers were recorded by the researcher.

Religion was operationalized by asked the respondent's religious preference. Each response was documented.

Each woman was asked whether she had any formal education, and if so, what level in school she had achieved.

Questions were asked about the nine agroforestry practices that had been introduced at the two sites. The nine practices were used to measure degrees of adoption. Each of the nine variables were operationalized by asking the respondents if they had used the practice. Four possible choices were provided for each of the respondents: 1) "No, never adopted," 2) "Yes, once, but discontinued," 3) "Yes, some," 4) "Yes, all the time." After each response, the respondents were asked why they did or did not adopt each technology, and each answer was carefully recorded.

A Composite Practice(s) Adoption (CPA) scale was created for the nine dependent agroforestry technologies. The four categories measured for each of the nine dependent variables were reduced to two categories. The responses of "no adoption" and "tried but quit" were coded to a 0 value. The responses of "some" use and use "all the time" were coded to a 1 value. The variables were ranked from a simple to complex type of technology adoption. The rank order of practices for technology level is shown as follows in Table 7.1.

The variables for each practice were multiplied by their rank orders on the technology-level scale. These values were then tallied to create the CPA score. In the calculations for the CPA, woodlot adoptions were not used, due to the very low adoption rates associated with this variable.

Table 7.1. Rank Ordering of Agroforestry Practices by Technology Level

RANK	PRACTICE(S)	REASON
1	terracing, contouring, and kitchen gardening	Simple mechanical reshaping/controlling of the environment to achieve better yields.
2	intercropping, nonburning	Indicates concepts of soil depletion and soil conservation.
3	green manuring, fire ash use	Shows some knowledge of fertilization; simple chemistry understanding.
4	new crop varieties	Demonstrates a willingness to experiment with new plants and techniques.

A variable was created called Sources of Technology Information (STI). For each agroforestry practice, respondents were polled as to whether they had learned of this practice; and if so, what source(s) they had learned of it from. The sources of technology information included: 1) custom--they had engaged in the practice through what they perceived as tradition, 2) self--they taught themselves the practice or believed they had invented it on their own, 3) village--they learned of the practice through interaction with others in their village, 4) extension--an extension worker had exposed them to the practice, and/or 5) Peace Corps--they had learned of the practice through one of the Peace Corps workers.

A number of other variables were composed, in order to operationalize the demographic and hypothesized research factors. The scores for these variables were arrived at by coding the questionnaire responses, and from several of the direct observations that were made on the respondents.

The main causal model for this research study is depicted in Figure 7.1. Appendix B lists the full set of independent and dependent variables used in the analysis.

Univariate frequency runs were conducted on all variables used in the study. The frequency distributions were evaluated to arrive at the demographic compositions of the study groups, and to assess the overall characteristics of the dataset.
Observations of the univariate frequency distributions showed that many of the sampled variables did not appear to come from a normally-distributed population. It was therefore determined that it would be best to use nonparametric statistics for all further statistics employed in this study. Descriptive statistics such as means, percentages, and frequencies were employed to compare agroforestry adoption between treatment groups and the control.

Several Kruskal-Wallis one-way anova tests were run to measure relationships between the dependent variable CPA and the independent variables. These tests were valuable in looking at one-to-one relationships each variable had with the dependent variable CPA.

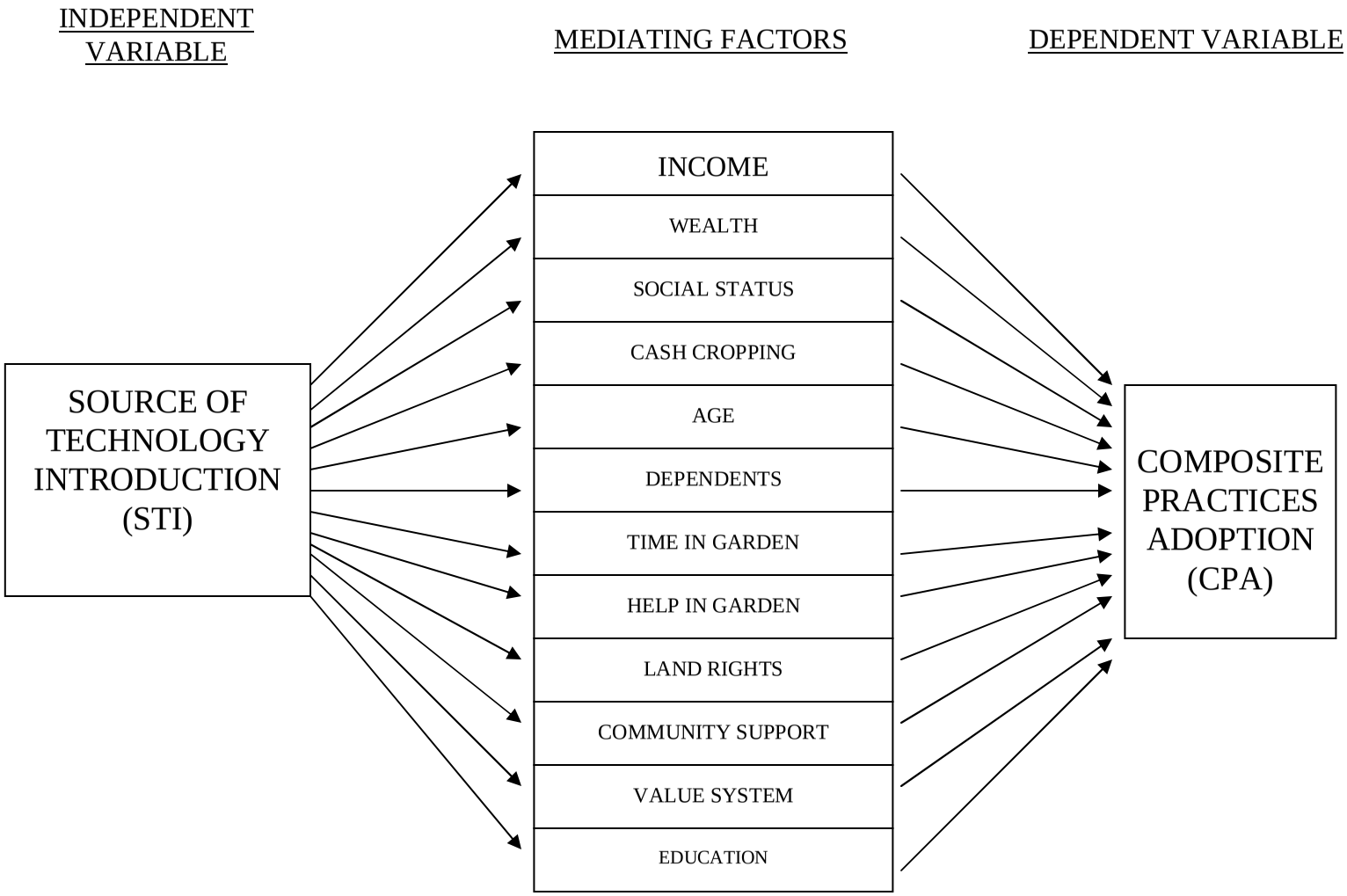

Figure 7.1 Causal Model for Solomon Islands Study

Logit Models

Nonparametric tests have been applied, since the dataset violates assumptions of parametric statistics. A log-linear logit model was used to analyze the relationships between variables.[3] The logit model is used as a causal model to make predictions about a dataset.

In order to conduct the logit runs, it was necessary to put the study variables into dichotomous form. Variables already being measured as dichotomies, such as possession of land rights (LANDRTS), which were either assigned a "yes" or "no" response, were simply left in their original form. However, other variables had to be made dichotomous. Variables such as husband's position (HUSBPOS), age (AGE), wealth (WEALTH), housing quality (HOUSEQL), number of children (NUMCHILD), number of days per week the respondent goes to garden (TIMEGARD), and dependency ratio (DEPRATIO) are all examples of the variables that had to be dichotomized. Most of the variables were assigned conceptual cutoff points. For example, AGE was divided between 29 and 39 years of age for the respondent. It was considered reasonable to assume that the majority of respondents would have finished childbearing and major childrearing after the age of thirty.

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[3] The logit model measures relationships between categorical dependent and independent variables by showing the effects of several categorical independent variables on a categorical dependent variable. Logit variables are analyzed in a multi-way cross tabulation by looking at expected cell frequencies (Knoke and Burke 1980). Logit models share similarities with ordinary regression; one variable is taken as the linear[3] The logit model measures relationships between categorical dependent and independent variables by showing the effects of several categorical independent variables on a categorical dependent variable. Logit variables are analyzed in a multi-way cross tabulation by looking at expected cell frequencies (Knoke and Burke 1980). Logit models share similarities with ordinary regression; one variable is taken as the linear function of the values of several independent variables (Knoke and Burke 1980; Norusis 1986). Regression parallels will be made when discussing the logit results. function of the values of several independent variables (Knoke and Burke 1980; Norusis 1986). Regression parallels will be made when discussing the logit results.

Other variables were thought about in the same way. Thus, for NUMCHILD, three or fewer children for the respondent was given a low coding, and four or more children was given a high coding. For example, the husband's position was recoded so that all unmarried cases were set to system-missing values, cases where the husband was either dead or a home sick, without work were coded to the low value and cases where the husband was employed all the way up to the husbands possessing a high social position were given a high value. Throughout the rest of the date, those variables that could be readily conceptualized in this manner were given conceptual cutoff points.

Other variables were more abstract, and required other techniques for dichotomizing them. This was true for the crucial variable CPA. Of the eight selected adoption practices, each had an adoption level from 0 through 3, as mentioned previously. Each practice was also ranked from 1 through 4. Each adoption level was multiplied by each rank, and then the adoption scores were summed over all of the practices, to give a rough scale of the amount of technology practices adoption. Although the total possible number of points on this CPA scale was 96, in practice, none of the cases studied actually demonstrated this high of a level of technology adoption. The highest actual score went up to 44. Therefore, it was decided to divide this variable at the median point based upon its observed frequency distribution. For the total sample measured (all 3 areas), the median turned out to be seven for the CPA variable. Thus, for the runs conducted on all areas, this was the median cutoff used. For the STI variable, the median was 10 for the total sample. This was used as the cutoff value for the STI for runs conducted on all areas. Furthermore, the median values changed when runs were done on smaller areas. For example, for Area 1, the median for CPA be came 11, and for STI, the

median was 15. These values were used as the cutoff values of the frequency distribution of the related areas for each area grouping that statistical correlations were done on. The median cutoff was used wherever the variables did not have evident conceptual cutoff points for the purpose of dichotomizing them.

Limitations of the Study

Time was an important factor limiting the present investigation. However, considerable care and thought was exercised to measure the variables objectively.

A second limitation was the inability to look at the communities at a macro level. All the variables measured micro situations. Variables that looked at macro level influences would have strengthened this study. For example, farmers may face constraints on a much large level than the present study analyzed. It is possible that provincial-wide or national-wide policies may hinder farmers from adopting the introduced technologies. Future research in these areas could focus on macro situations as potential limitations to adoption.

The data would have been more useful with variables that operationalize a concept of modernity. Measures such as mass media exposure, cosmopolitan attitude, and empathy would have been good to include in a study like this. All three measures would have created a useful modernity variable that might help explain farmers' willingness to adopt the technologies. This variable would have given insight into the farmers' knowledge of the scientific and mechanical aspects of the innovations.

Operationalizing and measuring wealth is problematic in the Solomon Islands. The culture is in transition from traditional wealth forms, which are measured by how

many pigs one had, how many gardens you had, and how large a feast you could hold, to a social valuation of wealth based on a cash economy. Instead of measuring wealth on a simple low-to-high scale as was done in the present study, individual wealth measures would have been more meaningful if documented and then a wealth scale created, rather than using them only for the low-to-high scale.

A higher apparent adoption of the terracing practice may have resulted overall if, in the original interviews, respondents in Treatment Two were asked about alleycropping, rather than terracing, which is a similar technique. Alleycropping is conceptually related to terracing and is appropriate on level to gentle slopes.

While operationalizing the number of respondents living in the household other than the immediate family, the study should have considered the people who do not necessarily live with the household but eat meals with them and often use resources of the household. The variable was meant to measure this. However, relatives often may not necessarily live in the household but eat meals and use economic resources from the household.

Intercropping was problematic in that some people reported learning it from the Peace Corps, some reported it was practiced traditionally, and some people reported never having heard of this practice. Intercropping needs to be investigated further and possibly measured differently so it more accurately addresses how the practice was learned.

Although great care was exercised when interviewing the respondents from all of the areas, another possible explanation for the extreme differences in the two treatment

areas, could be bias on the researcher's part. However, it is not obvious in what direction the bias could be in.

Lastly, the small sample sizes and variations within the sample groups prohibit drawing inferences from this dataset. Therefore, the findings can only lead to descriptive and suggestive conclusions. However, the results from this study are valuable in providing directions for future research. Furthermore, it could serve as guide for further studies and inquiries into the impact of agroforestry on Solomon Islands farmers, particularly women farmers. As was noted, this study's reliability could be strengthened by increased sample sizes. Generalizations about the findings would be strengthened by increased sample sizes also. Time and economic constraints were two items that prohibited having larger sample sizes. Having the use of other trained interviewers would have helped provide larger sample sizes and decreased the time involved in obtaining larger sample sizes.

CHAPTER 8

QUANTITATIVE RESULTS

The major findings of the study are discussed in this chapter. Both qualitative and quantitative data concerning the following topics will be addressed: 1) demographic characteristics of the study groups, 2) comparative adoption of recommended practices, 3) comparative nonadoption of recommended practices, 4) relationship between independent variables and composite practices adoption, and 5) quantitative factors leading to agroforestry practice adoption. Numerous tables will supplement the discussion.

Demographic Characteristics of the Study Groups

Demographic characteristics of the respondents were collected and analyzed. Table 8.1 shows that, overall, the respondents tend to be older women. The average age of women in Treatment One is 38.5 years, for Treatment Two is 39.5 years, and for the control is 40 years old.

Table 8.1 also indicates that women in Treatment One have an average of 4.6 children, while women in Treatment Two have an average of 4.7 children and 5.0 children in the control. From the literature review, it would seem that the number of children a woman has can directly affect her ability to adopt a new technology.

Women from Treatment One have an average of 2.4 years of formal education. Respondents from Treatment Two have an average of 1.7 years and women from the control have an average of 2.2 years of formal education.

Table 8.1. Demographic Characteristics of the Study Groups

Research Area	Population Number(N)	Women's Age (Years)	Women's Education (Years)	Number of Children
TRT 1	31	38.5 (30)	2.4 (31)	4.6 (31)
TRT 2	30	39.5 (31)	1.7 (28)	4.7 (30)
CTL	32	40.0 (29)	2.2 (32)	5.0 (31)

Note 1: TRT 1 = Treatment Area One,
TRT 2 = Treatment Area Two,
CTL = Control Area.
Note 2: Figures in parentheses are actual frequencies.

Table 8.2 shows the respondents' access to land rights. It shows that 74.2 percent of the women from Treatment One, 60.0 percent from Treatment Two, and 43.8 percent from the control indicate that their husbands are not primary land owners.

Table 8.2. Primary Land Owners by Treatment and Control Areas (in Percentages)

Research Area	Landowners	Nonowners
TRT 1	25.8 (8)	74.2 (23)
TRT 2	40.0 (12)	60.0 (18)
CTL	56.3 (18)	43.8 (14)

Note 1: TRT 1 = Treatment Area 1,
TRT 2 = Treatment Area 2,
CTL = Control Area.
Note 2: Figures in parenthesis are actual frequencies.

The literature review suggests that, when a new technology is introduced, if farmers do not have secure land or tree tenure, their ability to adopt an introduced technology is hindered. The present findings suggest that the majority of women in the two treatment groups do not have secure land tenure rights through their husbands.

As indicated in Table 8.3, women generally have more access to income from selling market vegetables than from any other source. Of the respondents in Treatment One, 87.1 percent sell vegetables for income, 62.1 percent of Treatment Two, and 75.09 percent of the control. These results are similar with the survey findings of the Rural Services Project on Malaita in 1989, where they found that 55 percent of the households surveyed reported incomes from the sale of food crops. The next most common means of obtaining income was from the maintenance or sale of cash crops. In Treatment One, 61.3 percent of the women reported obtaining income from cash crops, compared with 34.5 percent in Treatment Two and only 15.6 percent of the women in the control.

Table 8.3. Income Sources Reported by Respondents by Treatment and Control Areas

Research Area	Market Vegetables	Cash Crops	Husband	Crafts	Job	Other
TRT 1	87.1	61.3	16.1	0.0	3.2	12.9
TRT 2	62.1	34.5	0.0	6.9	3.4	17.2
CTL	75.0	15.6	6.3	3.1	3.1	37.5

Note 1: TRT 1 = Treatment Area 1,
TRT 2 = Treatment Area 2,
CTL = Control area.
Note 2: Figures in parenthesis are actual frequencies.

Most women reported little contribution of income from their husbands directly to them. Only 16.1 percent in Treatment One, none in Treatment Two and 6.3 percent from the control indicated that they received income from their husbands.

Women from both Treatment One (0.0 percent) and Treatment Two (6.9 percent) reported little or no income generation from crafts of any type. Only 3.1 percent of the women from the control report income from crafts.

Women having formal-sector, cash-employment jobs are rare in Malaita. Only 13 percent of the women in Malaita have this type of employment (Rural Services Project 1989). Only 3.2 percent of the women in Treatment One report having income from a job, 3.4 percent in Treatment Two, and only 3.1 percent from the control reported income from cash jobs.

Of the women in Treatment One, only 12.9 percent reported income from other sources, 17.2 in Treatment Two and 37.5 percent in the control. A possible explanation for higher reports of income from other sources by the control group may be because women lack other means of income generation. Many women reported making bread to sell at the local market, and collecting shellfish to sell at the local market as means of getting cash.

Comparative Adoption of Recommended Practices

Table 8.4 shows that, indeed, adoption did take place in the treatment areas, and is higher in both treatment areas than in the control. However, the control area shows adoption of some practices. Introduction of some practices occurred at the control site as a result of a women's organization that introduced kitchen gardens to women of the

Takwa area in 1990. A nation-wide campaign was launched in the Solomon Islands in 1986 by UNICEF to help alleviate the poor health of town dwellers (McCoy 1990). Kitchen gardens were introduced as a means to do this. Presently, various women's organizations are conducting workshops in rural areas o the use and planting of kitchen gardens (Ruth Earii, personal communication 1991). The use of intercropping, green manure, fire ash, no burning, and new crop varieties were introduced as techniques to compliment the kitchen gardens.

Table 8.4 shows that intercropping had a higher adoption percentage than any other practice, for all three localities. Adoption occurred 67.7 percent in Treatment One, 53.3 percent in Treatment Two and 46.9 percent in the control. Some intercropping was practiced traditionally, and as Table 8.4 shows, this practice was the most attractive of all introduced practices. Intercropping was introduced to women in the control area when kitchen gardens were introduced, and is a component recommended with the kitchen garden. The attractiveness of intercropping can be explained in that it is traditionally practiced to a degree, and is a known technology.

The second most attractive practice was the kitchen garden with 54.9 percent in Treatment One, 36.7 percent in Treatment Two and 43.7 from the control adopting this practice. Respondents frequently remarked that the kitchen gardens helped provide readily available leafy greens and fruits for their children. In most cases, the women's gardens are far from their homes, and require time to reach them. The mean time taken to reach food gardens from the household is .725 hours, with a maximum time of 1.00 hours (Rural Services Project 1989).

Table 8.4. Comparative Adoption of Recommended Practices (Percentage by Area)

Practice	(N=31) TRT 1	(N=30) TRT 2	(N=22) CTL	(N=61) TRT1&TRT2
Terracing	35.5 (11)	9.9 (3)	0.0 (0)	22.7 (14)
Intercropping	67.7 (21)	53.3 (16)	46.9 (15)	60.5 (37)
No Burning	25.8 (8)	23.3 (7)	6.3 (2)	25.0 (15)
Green Manure	38.7 (12)	43.4 (13)	18.8 (6)	41.1 (25)
Contouring	19.4 (6)	6.7 (2)	0.0 (0)	13.1 (8)
Fireash	13.0 (4)	26.7 (8)	12.5 (4)	19.8 (12)
Woodlot	0.0 (0)	3.3 (1)	0.0 (0)	1.7 (1)
Kitchen Garden	54.9 (17)	36.7 (11)	43.7 (14)	45.8 (28)
New Crop	42.0 (13)	13.3 (4)	6.2 (2)	28.1 (17)

Note 1: Figures in parentheses are actual frequencies.

As Table 8.4 indicates, terracing was adopted by 35.5 percent of the respondents in Treatment One and in Treatment Two, 9.9 percent of the respondents utilized this practice. No adoption of terracing occurred in the control. Higher level of adoption of terracing in Treatment One may have occurred because the topography in the area is much steeper than Treatment Two or the control. Therefore, terracing would be more practical in the Treatment One area.

Not burning the garden is a practice that 25.8 percent of the respondents adopted in Treatment One, 23.3 percent of the respondents in Treatment Two and 6.3 percent of the respondents in the control. As previously mentioned, the control may show some adoption of this practice from the more recent introduction of the kitchen garden into that area.

Green manure (Table 8.4) was adopted by 38.7 percent of the respondents in Treatment One, 43.4 percent in Treatment Two, and 18.8 percent of the respondents in the control.

Table 8.4 shows that amending the soil with a fire ash was a practice adopted by only 13.0 percent of the respondent in Treatment One, compared to 26.7 percent of the respondents in Treatment Two, and 12.5 percent in the control. Women in Treatment Two commented frequently that land used for both traditional gardens and kitchen gardens is exhausted. In some cases, they were forced to use it over and over for their crops, not giving the land time to rest. Women who commented about this problem also acknowledged the population pressures as a reason why they could not shift their gardens to other sites. Generally, respondents from Treatment Two felt that fire ash helped improve their crop yields.

Table 8.4 indicates that new crop varieties had a 42.0 percent adoption rate in Treatment One, as compared to a 13.3 percent adoption rate in Treatment Two, and a 6.2 percent adoption rate in the control.

Contour planting was adopted in Treatment One by 19.4 percent of the respondents, 6.7 percent of the respondents in Treatment Two, and no adoption occurred in the control.

Lastly, the planting of woodlots as a practice was not adopted by anyone in Treatment One or the control, and only 3.3 percent of the respondents in Treatment Two adopted. A possible explanation for low adoption of woodlots is that the majority of women in the treatment areas report that their husbands do not have primary land rights. Woodlots would suggest a permanent tenure practice and would not be acceptable for other people to plant under customary land tenure.

Comparative Nonadoption of Recommended Practices

In order to understand some of the reasons women farmers gave for nonadoption of agroforestry practice, the following nonadoption percentages from Table 8.5 are presented. Following that, Tables 8.6-8.8 provide some of the frequent reasons given for low adoption that help us better understand why the nonadopters did not find the practices attractive. The responses given in Tables 8.6-8.8 are from open-ended questions asked of all respondents. (Not all women interviewed, however, responded to all questions; and of the women interviewed, some gave multiple answers to the questions. The most coherent and consistent answers given were used to compile the descriptive

statistics presented here.) The discussion will follow a loose order from highest to lowest nonadoption rates by practices.

Woodlots had the lowest adoption of all practices. Table 8.5 shows that no woodlot adoption occurred in either Treatment One or the control area. In Treatment Two, 96.7 percent of respondents did not adopt. The village chief of the Malu'u area expressed that "people do not yet realize how great their problems are going to be, especially for the younger generation." As noted in two of the case studies, and also elaborated upon by the village chief, men who cut wood for use in copra dryers are having problems finding enough large trees to cut for firewood, and he felt that tree planting for fire and fuel was an immediate need. However, 64.5 percent (Table 8.6) of the respondents in Treatment One indicated that women could still find firewood for household use, and were not interested in planting woodlots.

Contour planting was not adopted by 80.6 percent of the respondents in Treatment One, 93.3 percent in Treatment Two and no one adopted contour planting in the control. The most common response given in Treatment One (60.0) was that "it is not our custom to garden this way." The most common response in Treatment Two for nonadoption of contour planting was that they "had never head of the practice" (71.4 percent), followed by 17.9 percent of the respondents who said they were "not interested in adopting the practice." The control area had 100 percent of the respondents saying they had never heard of contour planting at all.

Table 8.5. Comparative Nonadoption of Recommended Practices (Percentage by Area)

Practice	(N=31) TRT 1	(N=30) TRT 2	(N=32) CTL
Terracing	64.5 (20)	90.5 (27)	100.0 (32)
Intercropping	32.3 (10)	46.7 (14)	53.1 (17)
No Burning	74.2 (23)	76.7 (23)	93.8 (30)
Green Manure	61.3 (19)	56.7 (17)	81.3 (26)
Contouring	80.6 (25)	93.3 (28)	100.0 (32)
Fireash	87.1 (27)	73.3 (22)	87.5 (28)
Woodlot	100.0 (31)	96.7 (29)	100.0 (32)
Kitchen Garden	45.2 (14)	63.3 (19)	56.3 (18)
New Crop	58.1 (18)	86.7 (26)	93.8 (3)

Note 1: TRT 1 = Treatment Area 1,
TRT 2 = Treatment Area 2,
CTL = Control Area.

Note 2: Figures in parentheses are actual frequencies

Table 8.6. Reasons Given for Nonadoption of Agroforestry Practices--Area 1 (Percentage by Community)

AGROFORESTRY PRACTICE	Reason Given--Why No Adoption of Practice									
	Never Heard	Not Interested	Too Much Work	Too Risky	Don't Think is Good	Not Our Custom	Caused Conflict	No Access to Resources	Total Valid N	Total Responses
Terracing	25.0 (5)	15.0 (3)	30.0 (6)	20.0 (4)	5.0 (1)	5.0 (1)	20.0 (4)	0 (0)	20	24
Intercropping	50.0 (5)	0.0 (0)	0.0 (0)	10.0 (1)	0.0 (0)	20.0 (2)	0.0 (0)	0 (0)	10	8
No-Burning	12.5 (3)	0.0 (0)	0.0 (0)	33.3 (8)	0.0 (0)	41.7 (10)	0.0 (0)	0 (0)	24	21
Green-Manure Use	5.3 (1)	0.0 (0)	0.0 (0)	26.3 (5)	0.0 (0)	52.6 (10)	0.0 (0)	0 (0)	19	16
Contouring	8.0 (2)	4.0 (1)	4.0 (1)	0.0 (0)	0.0 (0)	60.0 (15)	0.0 (0)	0.0 (0)	25	19
Fire Ash Use	13.8 (4)	6.9 (2)	51.7 (15)	0.0 (0)	0.0 (0)	10.3 (3)	0.0 (0)	0.0 (0)	29	24
Wood Lot Use	16.1 (5)	64.5 (20)	3.2 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	31	26
Kitchen-Garden Use	7.1 (1)	0.0 (0)	28.6 (4)	50.0 (7)	7.1 (1)	0.0 (0)	14.3 (2)	0.0 (0)	14	15
New Crop Use	27.8 (5)	5.6 (1)	0.0 (0)	0.0 (0)	5.6 (1)	0.0 (0)	72.2 (13)	94.4 (17)	18	37

Note 1: Figures in parenthesis are actual frequencies.
Note 2: Responses were not mutually exclusive. Percentages are based on Valid N; may sum to more than 100%, due to potential multiple reasons given for nonadoption of each practice.

Table 8.7. Reasons Given for Nonadoption of Agroforestry Practices--Area 2 (Percentage by Community)

AGROFORESTRY PRACTICE	Reason Given--Why No Adoption of Practice: Never Heard	Not Interested	Too Much Work	Too Risky	Don't Think is Good	Not Our Custom	Caused Conflict	No Access to Resources	Total Valid N	Total Responses
Terracing	33.3 (9)	7.4 (2)	7.4 (2)	0.0 (0)	0.0 (0)	3.7 (1)	33.3 (9)	0 (0)	27	23
Intercropping	7.1 (1)	0.0 (0)	7.1 (1)	42.9 (6)	0.0 (0)	14.3 (2)	7.1 (1)	0 (0)	14	11
No-Burning	8.7 (2)	4.3 (1)	4.3 (1)	43.5 (10)	4.3 (1)	34.8 (8)	0.0 (0)	0 (0)	23	23
Green-Manure Use	17.6 (3)	17.6 (3)	0.0 (0)	35.3 (6)	5.9 (1)	17.6 (3)	0.0 (0)	0 (0)	17	16
Contouring	71.4 (20)	17.9 (5)	0.0 (0)	0.0 (0)	0.0 (0)	3.6 (1)	0.0 (0)	0.0 (0)	28	26
Fire Ash Use	40.9 (9)	13.6 (3)	27.3 (6)	13.6 (3)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	22	21
Wood Lot Use	72.4 (21)	6.9 (2)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	3.4 (1)	0.0 (0)	29	24
Kitchen-Garden Use	0.0 (0)	15.8 (3)	15.8 (3)	57.9 (11)	0.0 (0)	0.0 (0)	5.3 (1)	0.0 (0)	19	18
New Crop Use	27.8 (5)	5.6 (1)	0.0 (0)	0.0 (0)	5.6 (1)	0.0 (0)	72.2 (13)	94.4 (17)	18	37

Note 1: Figures in parentheses are actual frequencies.
Note 2: Responses were not mutually exclusive. Percentages are based on Valid N; May sum to more than 100%, due to potential multiple reasons given for nonadoption of each practice.

Table 8.8. Reasons Given for Nonadoption of Agroforestry Practices--Control Area (Percentage by Community)

AGRO-FORESTRY PRACTICE	Reason Given--Why No Adoption: Never Heard	Not Interested	Too Much Work	Too Risky	Don't Think is Good	Not Our Custom	Caused Conflict	No Access to Resources	Total Valid N	Total Responses
Terracing	100.0 (32)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0 (0)	32	32
Intercropping	82.4 (14)	11.8 (2)	5.9 (1)	0.0 (0)	5.9 (1)	0.0 (0)	0.0 (0)	0 (0)	17	18
No-Burning	56.7 (17)	0.0 (0)	3.3 (1)	10.0 (3)	3.3 (1)	30.0 (9)	0.0 (0)	0 (0)	30	31
Green-Manure Use	50.0 (13)	19.2 (5)	0.0 (0)	11.5 (3)	3.8 (1)	15.4 (4)	0.0 (0)	0.0 (0)	26	26
Contouring	100.0 (32)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	32	32
Fire Ash Use	92.9 (26)	7.1 (2)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	28	28
Wood Lot Use	100.0 (32)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	32	32
Kitchen-Garden Use	27.8 (5)	33.3 (6)	22.2 (4)	16.7 (3)	5.6 (1)	5.6 (1)	0.0 (0)	0.0 (0)	18	20
New Crop Use	93.3 (28)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	10.0 (3)	30	31

Note 1: Figures in parentheses are actual frequencies.
Note 2: Responses were not mutually exclusive. Percentages are based on Valid N; May sum to more than 100%, due to potential multiple reasons given for nonadoption of each practice.

The application of fire ash had fairly low adoption in Treatment One and Treatment Two, as indicated by Table 8.5. Of the women in Treatment One, 87.1 percent did not adopt, 73.3 percent in Treatment Two and 87.5 percent of the control. Table 8.6 indicates that 51.7 percent of the respondents in Treatment One indicated that the application of fire ash involved too much work, followed by 13.8 percent indicating that they had never head of the practice. In Treatment Two (Table 8.7), 40.9 percent of the respondents stated that they had never head of the practice, 27.3 said that it involved too much work, 13.6 percent said it involved too much risk, with another 13.6 percent stating that they were not interested in the practice. The overwhelming response to fire ash use in the control area (Table 8.8) was that they had never heard of the practice (92.9 percent).

From Table 8.5, it was shown that not burning the garden was not adopted by 74.2 percent of the women in Treatment One, 76.7 percent in Treatment Two and 938 percent in the control. The first most common response to not burning was that "it is no their custom to garden this way." In Treatment One (Table 8.6), 41.7 percent indicated that, "it is not our custom," followed by 34.8 percent of the responses in Treatment Two, and 30.0 percent of the responses in the control. The second most common response to not burning in Treatment One, was that "it involved too much risk," with 33.3 percent of the respondents expressing this. Risk was the most common concern in Treatment Two, as 43.5 percent said the no-burning practice was too risky. Responses such as "it could cause rodents or pest to destroy gardens," to the response "it might not grow well if they did not burn," were among the two most common apprehensions. Table 8.8 shows only 10.0 percent in the control said no-burning was risky. In the control, 56.7 percent of the respondents indicated that they had never heard of the practice of not burning.

Over 64.5 percent of the respondents in Treatment One did not adopt terracing, 90.0 percent in Treatment Two and no adoption occurred in the control (Table 8.5). Responses were varied as to reasons given for nonadoption of terracing. The two most common responses in Treatment One were "it is too much work" (30.0 percent) and they had "never head of the practice" (25.0 percent). The two most common responses in Treatment Two (Table 8.7) were that "they had never heard of the practice" (33.3 percent) and "it had caused conflict" (33.3 percent). However, in the control (Table 8.8), 100 percent of the responses were "that they never heard of the practice."

The application of green manure was not adopted in Treatment One by 61.3 percent of the respondents, 56.7 percent in Treatment Two, and 81.3 percent in the control. Of the responses in Treatment One, 52.6 percent indicated that it was "not part of their traditional custom," followed by 17.6 percent in Treatment Two, and 15.4 percent in the control. Risk was cited 26.3 percent of the time in Treatment One as a reason for nonadoption, 35.3 percent as the main reason in Treatment Two, and only 11.5 percent in the control. (Green manure was found not interesting by 19.2 percent of the respondents in the control area.)

New crop varieties were not adopted by 58.1 percent of the respondents in Treatment One, 86.7 percent in Treatment Two, and 93.8 percent of the respondents in the control. Of the explanations given for nonadoption of new crop varieties in Treatment One, a large number, 94.4 percent, of the respondents indicated that "they had not been given seeds or had no way of obtaining them," followed by 72.2 percent of the respondents stating that "it has caused conflict." Women often stated that "the women who did obtain seeds or root stocks were not willing to share." Three women commented

that "the other women are not careful to save seeds, then they expect us to give them new seeds every time they need them, they should be more careful with their seeds, the other women are lazy, they only want things for free and no work." Responses given for nonadoption of new crop varieties were varied in Treatment Two. Again, 94.4 percent of the respondents in Treatment Two said they had no access to the seeds 27.8 percent had never heard of new crop varieties and 5.6 said they were not interested in planting new crop varieties. Of the responses in the control, 93.3 percent indicated that they had never heard of new crop varieties or the new varieties were not available to them (10 percent).

Kitchen gardens were not adopted by 45.2 percent of the respondents in Treatment One, 63.3 percent of the respondents in Treatment Two, and 56.3 percent of the respondents in the control. As indicated by Tables 8.6-8.8, the responses are mixed as to reasons given for nonadoption of kitchen gardens. However, fully 50.0 percent of the respondents in Treatment One attributed to risk as an inhibitor, 57.9 percent in Treatment Two, and 16.7 percent in the control. The second most common reason supplied for not adopting kitchen gardens was that doing so involved too much work. In Treatment One, 28.6 percent said it involved too much work, followed by 15.8 percent in Treatment Two, and lastly, 22.2 percent of the responses in the control were that they kitchen garden involved too much work. (Also, 33.3 percent of those answering in the control area said they were not interested in the practice.)

Lastly, intercropping was not adopted by 32.3 percent of the respondents in Treatment One, 46.7 percent in Treatment Two, and 53.1 percent in the control. As mentioned earlier, intercropping seems to be practiced at some level, traditionally. However, 50.0 percent of the responses in Treatment One were that they have never

heard of this practice, 7.1 percent in Treatment Two had never heard of the practice, followed by 82.4 percent of the respondents in the control not hearing of it. The most common response to nonadoption of intercropping in Treatment One was that it was not customary (20.0 percent), and in Treatment Two, the most frequent explanation given was that it involved too much risk (42.9 percent).

Table 8.9 compares the average reasons given by respondents for nonadoption across the combined treatment and control areas for all practices combined. The most commonly mentioned response by Treatment One and Treatment Two (26.1 percent of the total responses) respondents' answers was that they had not heard of the practice. However, 81.2 percent of the responses in the control area indicated that they had not heard of the practices. (This was to be desired in selecting this area as a "control" or nonintroduction comparison area.) The control area responses of "never heard" have considerably larger percentages than either the Treatment One or Treatment Two areas. The next most common responses to nonadoption of all agroforestry practices by Treatment One and Treatment Two respondents, were that it involved too much risk (15.8 percent), it was not consistent with their custom (14.4 percent), they were not interested in the practices (12.1 percent), it caused conflict (11.4 percent), too much work was involved (10.3 percent), they had no access to the resources (8.8 percent), and they had tried it and found it was not good (1.6 percent).

Table 8.9. Reasons Given for Nonadoption of Agroforestry Practices--Combined and Control Areas for All Practices (Average Percentage by Community)

	Reason Given-Why No Adoption									
AREA	Never Heard	Not Interested	Too Much Work	Too Risky	Don't Think is Good	Not Our Custom	Caused Conflict	No Access to Resources	Total Valid N	Total Res-ponses
T1 & T2	26.1 (101)	12.1 (47)	10.3 (40)	15.8 (61)	1.6 (6)	14.4 (56)	11.4 (44)	8.8 (34)	387	389
C	81.2 (199)	6.1 (15)	2.4 (6)	3.7 (9)	1.6 (4)	5.7 (14)	0.0 (0)	1.2 (3)	245	250

Note 1: T1 & T2 = Treatment One and Treatment Two,
C = Control area.
Note 2: Figures in parentheses are actual frequencies.
Note 3: Responses were not mutually exclusive. Percentages are based on Valid N; may sum to more than 100%, due to potential multiple reasons given for nonadoption of each practice.

Relationships between Independent Variables and Composite Practice Adoption

Adoption of any innovation is a product of several factors. All these characters are generally measured simultaneously. Resultant associations with each character can provide useful information about how these factors influence adoption. Different effects are occurring in each of the areas as shown by the Kruskal-Wallis one-way ANOVA results (Tables 8.10-8.113). Data from the Treatment Two locality greatly "waters down" the strong effects seen in the Treatment One locality when data from the two are combined.

The control area cannot be viewed as a pure control, since other forms of intervention took place in the area, as indicated by Figure 8.1. This necessitated the

creation of the Source of Technology Information variable, in order to more adequately measure the effect of introduction of the technologies by the Peace Corps. Within the constraints of the date, some of the results will be compared by looking at combined samples from selected areas. Each area is compared separately, treatment areas pooled, then all the areas combined for comparison. Samples were combined as noted, for purposes of comparison, to create larger sample sizes for multiple classifications.

Figure 8.1 indicates that Peace Corps did have a strong presence in both treatment areas, but also that other sources of technology information were present. Figure 8.1 also shows why the control area can not be viewed as a pure control on the main research variable of technology introduction. In the Takwa area that was selected as the control, 25.69 percent of the respondents learned some of the agroforestry technology from Extension, 3.47 percent from custom, and 1.74 percent learned about at least some of the practices from their village. Introduction to the practices was also mixed with other forms of exposure in the two research areas. In the Malu'u research area, 13.64 percent heard of one or more of the practices from another source besides the Peace Corps workers. In the Kakara research area, 6.64 percent of the respondents heard of one or more of the practices from a source different from the Peace Corps. Therefore, the STI variable was constructed to indicate the degree of introduction by the Peace Corps.

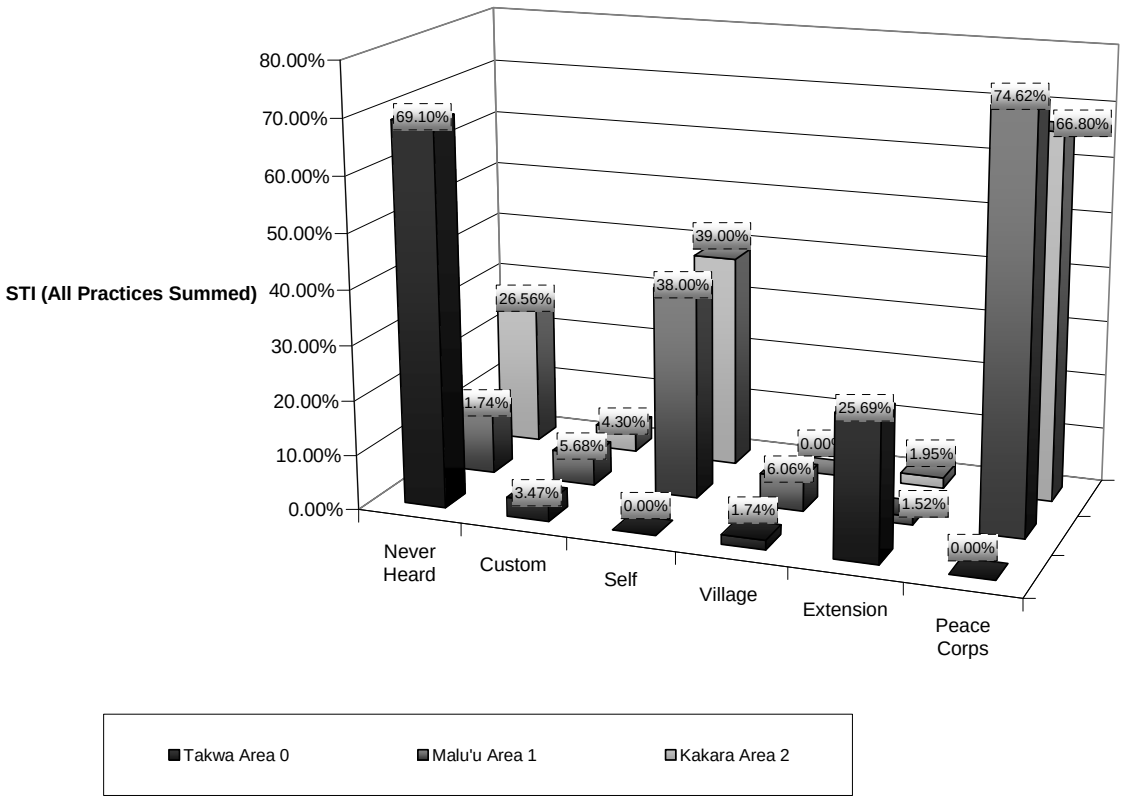

Figure 8.1 Sources of Technology Information (STI) Combined Practices by Area

Table 8.10. Kruskal-Wallis One-way ANOVAs for All Independent Variables Tried -- Area 1

(DependentVariable: CPA)

VARIABLE	DESCRIPTION	N	Chi-Square	p*	Sign**
AGE	Age of respondent	30	8.3595	.0038	+
SPSAGE	Age of respondent's spouse	19	4.2285	.0398	+
WEALTH	Wealth of respondent	30	.0192	.8897	-
HOUSEQL	Housing quality of respondent	31	5.2519	.0219	+
LANDRTS	Possession of land by respondent's husband	31	4.1522	.0416	+
HUSBPOS	Social position of respondent's husband	30	1.5137	.2186	+
WOMEDUC	Respondent's years of school	31	1.8325	.1758	-
MENEDUC	Husband's years of school	9	.0600	.8065	+
NUMCHILD	Number of children respondent has	31	2.8227	.0929	+
FEMCHILD	Number of female children respondent has	31	.3606	.5482	+
MLCHILD	Number of male children respondent has	31	1.3587	.2438	+
OTHRINHS	Number of others in household	31	1.2308	.2673	+
COCONUT$	Land planted in cash crop = coconuts	31	6.6975	.0097	+
COCOA$	Land planted in cash crop = cocoa	31	2.2008	.1379	+
OTHER$	Land planted in cash crop = other	30	n/a	n/a	n/a
COCONTM	Time spent growing coconuts	30	.1405	.7078	+
COCOATM	Time spent growing cocoa	31	4.2864	.0384	+
OTHERTM	Time spent growing other crops	31	n/a	n/a	n/a
TIMEGARD	Number of days/week respondent goes to garden	30	.0129	.9096	+
HUSBHELP	Help in work from husband	31	1.0847	.2977	+
CHILDHLP	Help in work from child/children	31	.7860	.3753	+
OTHERHLP	Help in work from others	31	1.0187	.3128	-
INCHUSB	Income from Husband	31	2.5256	.1120	+
INCVEG	Income from growing vegetables	31	2.1833	.1395	+
INCCRAFT	Income from making crafts	31	n/a	n/a	n/a
INCJOB	Income from paid employment	31	.3804	.5374	-
INCCC	Income from cash crop(s)	31	2.0271	.1545	+
INCOTHR	Income from other source(s)	31	.0140	.9059	-
RELIG	Religion of respondent	31	1.2325	.5400	n/a
TECHDISG	Disagreement over technology	31	3.0362	.0814	+
CS1RELH	Respondent's relations with husband	26	1.1452	.2846	-
CS2RELF	Respondent's relations with family	30	4.2670	.0389	-
CS3RELN	Respondent's relations with neighbors	31	.5659	.4519	-
CS4RELV	Respondent's relations with village	31	.8186	.3656	-
CS5RELC	Respondent's relations with chief	30	.1739	.6766	-
NUMDEPN	Number of dependents in respondent's household	31	2.5943	.1073	-
NUMWORKN	Number of workers in respondent's household	30	.0805	.7766	
LANDCASH	Sum of all land in cash	30	8.5056	.0035	+
TIMECASH	Sum of all time in cash	30	4.3110	.0379	+
HELPGARD	Sum of all help in garden	31	.7871	.3750	+
DEPRATN	Dependency ratio	31	3.1130	.0777	-
STI	Sources of Technology Information	31	.0018	.9662	+

*p = probability level of significance.
**Sign = direction of relationship.

Table 8.11. Kruskal-Wallis One-way ANOVAs for All Independent Variables Tried -- Area 2

(DependentVariable: CPA)

VARIABLE	DESCRIPTION	N	Chi-Square	p*	Sign**
AGE	Age of respondent	21	.0120	.9127	-
SPSAGE	Age of respondent's spouse	17	.3253	.5684	-
WEALTH	Wealth of respondent	30	.4268	.5136	-
HOUSEQL	Housing quality of respondent	30	.3231	.5698	-
LANDRTS	Possession of land by respondent's husband	30	.9218	.3370	-
HUSBPOS	Social position of respondent's husband	29	1.6369	.2007	-
WOMEDUC	Respondent's years of school	28	.0146	.9037	+
MENEDUC	Husband's years of school	21	.0114	.9151	+
NUMCHILD	Number of children respondent has	30	.3231	.5698	-
FEMCHILD	Number of female children respondent has	30	.1286	.7199	-
MLCHILD	Number of male children respondent has	30	.2940	.5876	-
OTHRINHS	Number of others in household	30	n/a	n/a	n/a
COCONUT$	Land planted in cash crop = coconuts	30	1.2341	.2666	+
COCOA$	Land planted in cash crop = cocoa	30	.4380	.5081	-
OTHER$	Land planted in cash crop = other	30	.2746	.6002	+
COCONTM	Time spent growing coconuts	30	.6391	.4240	+
COCOATM	Time spent growing cocoa	30	.4129	.5205	-
OTHERTM	Time spent growing other crops	30	.2746	.6002	+
TIMEGARD	Number of days/week respondent goes to garden	30	.5516	.4576	+
HUSBHELP	Help in work from husband	25	1.1506	.2834	+
CHILDHLP	Help in work from child/children	25	1.1848	.2764	+
OTHERHLP	Help in work from others	25	n/a	n/a	n/a
INCHUSB	Income from Husband	29	n/a	n/a	n/a
INCVEG	Income from growing vegetables	29	3.0477	.0808	+
INCCRAFT	Income from making crafts	29	.0302	.8621	-
INCJOB	Income from paid employment	29	.0582	.8094	+
INCCC	Income from cash crop(s)	29	.5148	.4731	+
INCOTHR	Income from other source(s)	29	1.0992	.2944	+
RELIG	Religion of respondent	30	.5327	.4655	n/a
TECHDISG	Disagreement over technology	30	n/a	n/a	n/a
CS1RELH	Respondent's relations with husband	29	.0678	.7946	+
CS2RELF	Respondent's relations with family	30	.1133	.7364	-
CS3RELN	Respondent's relations with neighbors	30	.3441	.5574	+
CS4RELV	Respondent's relations with village	30	.8939	.3444	-
CS5RELC	Respondent's relations with chief	30	.0553	.8141	+
NUMDEPN	Number of dependents in respondent's household	30	.0111	.9160	+
NUMWORKN	Number of workers in respondent's household	30	3.0240	.0820	+
LANDCASH	Sum of all land in cash	30	3.8787	.0489	+
TIMECASH	Sum of all time in cash	30	.0569	.8114	-
HELPGARD	Sum of all help in garden	25	n/a	n/a	n/a
DEPRATN	Dependency ratio	30	.4661	.4948	-
STI	Sources of Technology Information	29	.3836	.5357	+

*p = probability level of significance.
**Sign = direction of relationship.

Table 8.12. Kruskal-Wallis One-way ANOVAs for All Independent Variables Tried -- Area 0 (Control)

(Dependent Variable: CPA)

VARIABLE	DESCRIPTION	N	Chi-Square	p*	Sign**
AGE	Age of respondent	29	.0553	.8141	-
SPSAGE	Age of respondent's spouse	11	.0000	1.0000	n/a
WEALTH	Wealth of respondent	32	8.8294	.0030	+
HOUSEQL	Housing quality of respondent	32	.0063	.9368	+
LANDRTS	Possession of land by respondent's husband	32	.5697	.4504	-
HUSBPOS	Social position of respondent's husband	31	8.0944	.0044	+
WOMEDUC	Respondent's years of school	32	.3318	.5646	+
MENEDUC	Husband's years of school	19	.4546	.5002	+
NUMCHILD	Number of children respondent has	32	.4411	.5066	-
FEMCHILD	Number of female children respondent has	31	.2149	.6429	+
MLCHILD	Number of male children respondent has	31	.4986	.4801	-
OTHRINHS	Number of others in household	32	.5384	.4631	+
COCONUT$	Land planted in cash crop = coconuts	32	1.4335	.2312	-
COCOA$	Land planted in cash crop = cocoa	32	2.2122	.1369	-
OTHER$	Land planted in cash crop = other	32	n/a	n/a	n/a
COCONTM	Time spent growing coconuts	32	.0004	.9842	+
COCOATM	Time spent growing cocoa	32	.0004	.9842	+
OTHERTM	Time spent growing other crops	32	1.4736	.2248	-
TIMEGARD	Number of days/week respondent goes to garden	30	.1218	.7271	+
HUSBHELP	Help in work from husband	31	.0226	.8805	+
CHILDHLP	Help in work from child/children	31	.1955	.6583	+
OTHERHLP	Help in work from others	31	.0104	.9189	+
INCHUSB	Income from Husband	32	1.1468	.2842	-
INCVEG	Income from growing vegetables	32	1.2290	.2676	+
INCCRAFT	Income from making crafts	32	.0761	.7826	-
INCJOB	Income from paid employment	32	1.0991	.2945	+
INCCC	Income from cash crop(s)	32	.0447	.8325	+
INCOTHR	Income from other source(s)	32	.7964	.3722	-
RELIG	Religion of respondent	32	1.5398	.4631	n/a
TECHDISG	Disagreement over technology	32	n/a	n/a	n/a
CS1RELH	Respondent's relations with husband	26	.3401	.5598	+
CS2RELF	Respondent's relations with family	32	.6144	.4332	+
CS3RELN	Respondent's relations with neighbors	32	1.4736	.2248	+
CS4RELV	Respondent's relations with village	32	.0315	.8592	-
CS5RELC	Respondent's relations with chief	32	1.1109	.2919	+
NUMDEPN	Number of dependents in respondent's household	32	.0034	.9532	+
NUMWORKN	Number of workers in respondent's household	32	.2265	.6341	-
LANDCASH	Sum of all land in cash	32	3.3095	.0689	-
TIMECASH	Sum of all time in cash	32	.2688	.6042	+
HELPGARD	Sum of all help in garden	31	.3717	.5421	+
DEPRATN	Dependency ratio	32	.0004	.9846	-
STI	Sources of Technology Information	32	n/a	n/a	n/a

*p = probability level of significance.
**Sign = direction of relationship.

Table 8.13. Kruskal-Wallis One-way ANOVAs for All Independent Variables Tried--All Areas

(Dependent Variable: CPA)

VARIABLE	DESCRIPTION	N	Chi-Square	p*	Sign**
AGE	Age of respondent	80	2.9943	.0836	+
SPSAGE	Age of respondent's spouse	47	.9821	.3217	+
WEALTH	Wealth of respondent	92	3.6790	.0551	+
HOUSEQL	Housing quality of respondent	93	3.1643	.0753	+
LANDRTS	Possession of land by respondent's husband	93	.1911	.6620	-
HUSBPOS	Social position of respondent's husband	90	4.2581	.0391	+
WOMEDUC	Respondent's years of school	91	.3759	.5398	-
MENEDUC	Husband's years of school	49	.1882	.6645	+
NUMCHILD	Number of children respondent has	93	.1004	.7513	+
FEMCHILD	Number of female children respondent has	92	.3360	.5621	+
MLCHILD	Number of male children respondent has	92	.0890	.7654	-
OTHRINHS	Number of others in household	93	.5543	.4566	+
COCONUT$	Land planted in cash crop = coconuts	93	.8304	.3622	+
COCOA$	Land planted in cash crop = cocoa	93	.3032	.5819	-
OTHER$	Land planted in cash crop = other	92	.3024	.5824	+
COCONTM	Time spent growing coconuts	92	.1832	.6687	+
COCOATM	Time spent growing cocoa	93	1.0273	.3108	+
OTHERTM	Time spent growing other crops	93	.2994	.5842	-
TIMEGARD	Number of days/week respondent goes to garden	85	.3631	.5468	+
HUSBHELP	Help in work from husband	87	1.6301	.2017	+
CHILDHLP	Help in work from child/children	87	1.0625	.3026	+
OTHERHLP	Help in work from others	87	.7019	.4021	-
INCHUSB	Income from Husband	92	.8747	.3496	+
INCVEG	Income from growing vegetables	92	6.2944	.0121	+
INCCRAFT	Income from making crafts	92	.1180	.7312	-
INCJOB	Income from paid employment	92	.3194	.5720	+
INCCC	Income from cash crop(s)	92	4.1229	.0423	+
INCOTHR	Income from other source(s)	92	.5215	.4702	-
RELIG	Religion of respondent	93	6.2888	.3916	n/a
TECHDISG	Disagreement over technology	93	4.1539	.0415	+
CS1RELH	Respondent's relations with husband	81	.0686	.7934	-
CS2RELF	Respondent's relations with family	92	1.4137	.2344	-
CS3RELN	Respondent's relations with neighbors	93	.2412	.6233	-
CS4RELV	Respondent's relations with village	93	.9315	.3345	-
CS5RELC	Respondent's relations with chief	92	.2125	.6448	+
NUMDEPN	Number of dependents in respondent's household	93	.7439	.3884	-
NUMWORKN	Number of workers in respondent's household	93	.9981	.3178	+
LANDCASH	Sum of all land in cash	92	.7573	.3842	+
TIMECASH	Sum of all time in cash	92	4.2188	.0400	+
HELPGARD	Sum of all help in garden	87	.6046	.4368	+
DEPRATN	Dependency ratio	93	2.5064	.1134	-
STI	Sources of Technology Information	92	12.4909	.0004	+

*p = probability level of significance.
**Sign = direction of relationship.

The Kruskal-Wallis one-way anova relationship between age and CPA for Treatment One shows a strong, positive relationship, and is statistically significant at the .004 level. When compared with All localities, it remains statistically significant at the .084 level. Most of the women in the original group who participated in the agroforestry projects tended to be older women who had fewer responsibilities of child care and had older children to help with other household responsibilities. Interestingly, the number of children a respondent has was statistically significant at the .093 level in Treatment One, showing a medium, positive, relationship between the number of children.

A positive, significant relationship between female children was expected, since female children contribute significantly to the maintenance of the household. A negative relationship with male children and the adoption of the technologies was expected, since male children tend to be viewed as dependents. Correlation coefficients between female children and male children with adoption were not found to be statistically significant in the treatment areas, nor in the pooled sample for all localities.

Table 8.12 shows that the wealth variable and the adoption of agroforestry practices had a strong, positive, statistical relationship in the control (.003), Tables 8.10-8.11 show no such relationship in Treatment One (.8900) or in Treatment Two (.514). However, significance was found in the All Localities (.l055), as can be seen in Table 8.13.

The husband's position and the adoption of agroforestry practices (.004) showed a strong positive relationship in the control, and not in Treatment One (.219) or Treatment Two (.101). Significance was found in the All localities between adoption and the husband's position (.039). A reason for this relationship could be how the women's

organization selected participants for the workshops. It is appropriate to go through proper channels such as the village chief or a village religious leader for permission to do various activities. This situation may have permitted only women whose husbands have more status in the community to have participated in the workshop, since both the wealth of the respondent and the husband's position were statistically significant.

Housing quality showed a strong, positive, relationship with the CPA variable in both Treatment One (.032) and in the All localities pooled (.075). Housing quality may be measuring a part of wealth, since the housing quality of a respondent was one criterion used in the measurement of the wealth variable. Wealth on its own, was not unequivocally statistically significant for the area studied, as was discussed above. However, respondents who have permanent or semi-permanent material houses can generally be viewed as the wealthier farmers. This implies that, perhaps, stronger measures of wealth would have provided stronger results on this variable.

Permanent rights to land and the adoption of agroforestry practices shows a positive, statistically significant relationship in Treatment One at the .042 level, but no in Treatment Two (.337). This suggests that women in the Treatment One area, whose husbands are primary land owners are more likely to adopt the technologies.

Income from vegetables and the adoption of agroforestry practices had a strong, positive, statistical significant relationship in both Treatment Two (.081) and the All localities (.012). As indicated in Table 8.3, over half of the respondents indicated that they receive income from market vegetables and generally do not have access to other forms of income. The possible reasons that the respondents found the practices so

attractive, was that they were a way in which they could derive income that they had control over.

Land planted in cash crops and the adoption of agroforestry practices shows a strong statistical significance in Treatment One (.004) and in Treatment Two (.049). Possibly having land planted in cash crops is considered being modern and would indicate that the farmers have some knowledge of tree technology. Surprisingly, land planted in cash crops and adoption of agroforestry practices showed a negative correlation in the control area (.068). Spending a large amount of time in the production of cash crops was expected to have a negative, significant, impact on the adoption of agroforestry technology. Time spent with production of cash crops and the adoption of agroforestry practices was found to be statistically significant in both Treatment One (.038) and the All localities (.040). One explanation for adoption of agroforestry practices correlating with having land planted in coconut in the Treatment One locality, might be that farmers already plant crops under coconut trees and are already practicing a type of agroforestry under coconut trees. Farmers do not plant under cocoa trees, because cocoa's denser canopy provides too much shade for most crops. Time spent working with cocoa showed a strong, positive, correlation (.038) with the adoption of agroforestry practices in Treatment One. The results of the Rural Services Project showed that farmers gain more income from cocoa than coconut and spend less labor per workday with cocoa than coconut. Again, the relationship between time spent growing cocoa and adoption of agroforestry practices tends to indicate that women find this practice attractive because it is another means in which they can obtain income.

Labor constraints are a major problem in the socio-economy of smallholder agricultural farmers in the Solomon Islands (Rural Services Project 1989). Farmers report 82 percent of labor shortages on tree crop areas and only 10 percent of labor shortages with food crop areas (Rural Services Project 1989). The results of the Rural Services Project might show stronger results for labor constraints on food crop gardens if women and their labor constraints were looked at separately, since it is women who contribute most to the maintenance and harvesting of the gardens (Rural Services Project 1989).

Quantitative Factors Leading to Agroforestry Practices Adoption

As mentioned above, data from Treatment Two show very weak results and "waters down" the effects in Treatment One when the two treatments are pooled. The control cannot be viewed as a "pure control" since some intervention did take place by an extension group. For purposes of comparison, four different logit models will be presented in Table 8.14 to allow for comparison of the effects of selected independent variables on the dependent variable CPA for the different areas studied.

The first model will present Treatment One and the control, the second model will present Treatment Two and the control, the third model will compare results for pooled treatment areas one and two. The last model will show results for the All localities combines. Figure 8.2 presents a visual representation of the logit model comparisons.

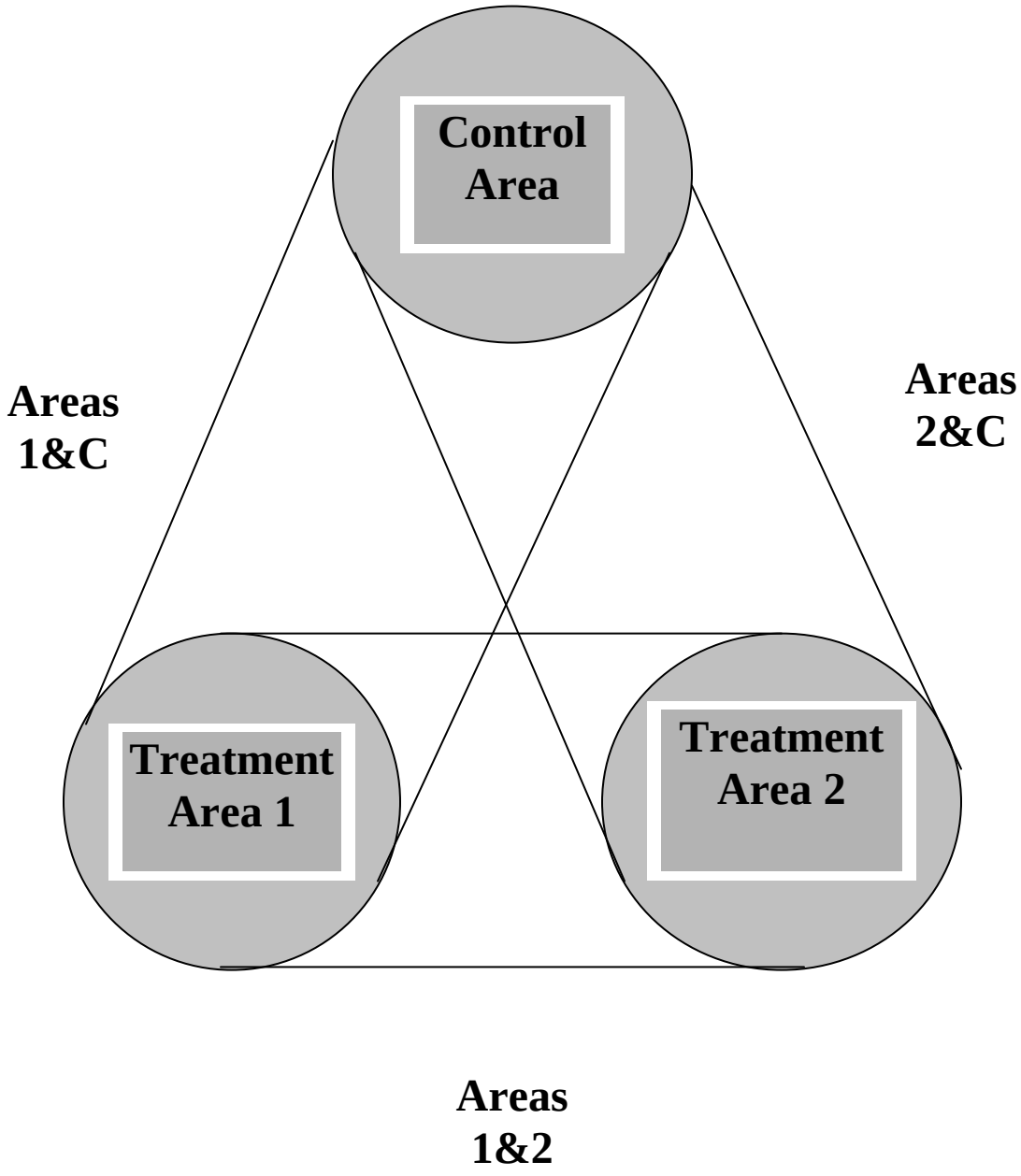

Figure 8.2. Conceptualization of Areas Studied for Logit Models

The first model in Table 8.14, Model 1, presents coefficients showing the effects of independent variables, age, time spent with cocoa, land planted in cocoa and wealth on the logged odds for composite practice adoption. The most important predictors of adoption for Model 1 are the respondent's age and wealth. For this model, age was an important positive factor. The older the woman, the greater chance she would have to adopt the practices. She was 3.011 times to one more likely to adopt the practices based on her age. For wealth, respondents are about 3.018 times more likely to adopt agroforestry practices than not. Respondents are 2.3 times more likely to adopt, based on the amount of time they spend with cocoa. However, the more land a respondent has planted in cocoa, the less are the chances of adoption by .082 to one. A chi-square of 4.026 shows a strong fit for the model. The probability is .673 that the research model differs from the actual date, showing a strong fit for this model.

The next model is Model 2, Treatment Two and the control. Having land planted in cocoa, income from cash crops, and income obtained from marketing vegetables all are important predictors of adoption. A respondent who has access to income from selling market vegetables is about 3.2767 times more likely to adopt agroforestry practices, while a respondent who has access to income from selling cash crops is approximately 2.411 times as likely to adopt agroforestry practices. Having land planted in cocoa decreased the chances of adopting agroforestry practices .539 to one. A chi-square value of 3.585 shows a strong fit for the model, with the probability of the research model being different from the actual date being .465.

Table 8.14. Logit Results for Solomon Islands Data

MODEL	VARIABLE	COEFFICIENT	STANDARD ERROR	LOG-ODDS	ODDS	Z-VALUE	P^
1 = AREAS 1&0	CONSTANT	.488	.261	.976	2.654	1.872	*
	AGE	.551	.199	1.102	3.011	2.764	***
	COCOATM	.436	.241	.873	2.394	1.809	*
	COCOA$	-.501	.260	-2.501	.082	-1.926	*
	WEALTH	.552	.234	1.105	3.018	2.358	**
LR CHI SQUARE		4.026					.673
		DF 6					
2 = AREAS 2&0	CONSTANT	.494	.176	.988	2.685	2.808	***
	COCOA$	-.309	.139	-.618	.539	-2.231	**
	INCCC	.440	.143	.880	2.411	3.073	***
	INCVEG	.593	.187	1.187	3.276	3.179	***
LR CHI SQUARE		3.585					.465
		DF 4					
3 = AREAS 1&2	CONSTANT	.402	.223	.803	2.232	1.803	*
	COCONUT$	.620	.182	1.240	3.456	3.406	****
	INCVEG	.679	.242	1.357	3.885	2.807	***
LR CHI SQUARE		.708					.400
		DF 1					
4 = ALL AREAS	CONSTANT	.759	.317	1.518	4.561	2.392	**
	COCOA$	-.394	.212	-.787	.455	-1.859	*
	COCONUT$	.444	.198	.887	2.429	2.238	**
	HUSBHELP	.408	.220	.817	2.263	1.856	*
	HUSBPOS	.401	.176	.802	2.230	2.281	**
	INCVEG	.920	.293	1.840	6.299	3.146	***
	STI	.555	.174	1.120	3.034	3.186	***
	TIMEGARD	-.404	.214	-.808	.446	-1.886	*
	WEALTH	.552	.248	1.104	3.016	2.226	**
LR CHI SQUARE		40.237					.634
		DF 44					

^ Probability rating as follows: * = significant at .10 level; ** = significant at .05 level; *** = significant at .01 level; **** = significant at .001 level

Logit coefficients for Model Three, treatment areas One and Two –the two research areas combined—are presented next. Income from vegetables is a very strong predictor of adoption. Respondents have roughly 3.885 chances to one of adopting agroforestry practices based on being able to obtain income from selling market vegetables. Having land planted in coconut indicates that the respondents are about 3.456 times more likely to adopt the practices. The land in coconuts variable has a z-value of 3.406, which is highly significant at the .001 probability level. This model indicated a good fit, with a chi-square of .7078, and the probability of this research model differing from the actual data being .673.

Model 4, the All localities, shows several results for the total sample studied. Income from vegetables is a very strong predictor of adoption. A z-value of 3.146 is obtained, and is significant at the .01 probability level for vegetable income variable. Women are about 6.299 times more likely to adopt agroforestry practices, based on being able to obtain income from selling vegetables. The degree to which the respondent learned the practices from the Peace Corps volunteers, the STI variable, Increased the respondent's chances of adopting by 3.034 chances to one. The STI variable shows a z-value of 3.186, which is significant at the .01 probability level. Wealth in this model improved a respondent's chances of adoption. Respondents who are wealthier are more likely to adopt agroforestry practices. The odds are about 3.016 times to one. Having land planted in coconut is also an important predictor, with a z-value of 2.238 that is significant at the .05 probability level. Having help available from the husband is predictive of adoption to a lesser degree, showing a z-value of 1.856 and significant at the .10 probability level. For all three variables, going by the odds values, respondents are

roughly over two times more likely to adopt agroforestry practices than not. Both time spent working in the garden and having land planted in cocoa somewhat decreased a respondent's chances of adopting agroforestry practices by around .446 and .455 to one, respectively. The probability rates of these last two variables are marginal, at the .10 level.

The chi-square for this model (40.237) is stronger (p = .634) than Model Two, but slightly less than the strength of Model One (p = .673).

The results of these models suggest that, overall; Solomon Islands women are more likely to adopt agroforestry practices when they have a source of income from selling market vegetables. The coefficients for income from selling market vegetables for most of the models indicate that respondents are more likely to adopt agroforestry practices when they have a source of income from selling market vegetables. This finding agrees with the qualitative results. Women from all areas reported that they obtained more income from market vegetables than any other source.

For Model Two, women who obtain income from cash crops are approximately 2.411 times to one more likely to adopt agroforestry practices.

For two of the models, women who are wealthier were more likely to adopt the practices. The wealth variable was strong for both model one (z = 2.358_ and Model Four (z = 2.226). Wealth also showed statistically significant differences in the Kruskal-Wallis one-way ANOVAs.

The Sources of Technology Information (STI) and the adoption of agroforestry practices (CPA) showed a z-value of 3.186 for the All areas (Model 4), and appear to be a very good predictor of adoption. It was statistically significant in the Kruskal-Wallis one-

way ANOVAs, both in Treatment One (p = .012) and the All localities (p = .0004). Although not statistically significant in Treatment Two, its effects were noticeable (p = .140). Apparently, the introduction of new agroforestry practices by the Peace Corps had a very successful impact on practices adoption and continuance.

Having land planted in coconut seems to be a mediating factor in the odds of women adopting the technology. It was strong for both Model Three (z = 3.406) and Model Four (z = 2.238). Although not statistically significant in Treatment Two or the All localities, as indicated by the Kruskal-Wallis one-way ANOVAs, it was statistically significant in the Treatment One area at the .009 level.

Having land planted in cocoa decreases the chances of adopting agroforestry practices for Model 1 (z = -1.926), Model 2 (z = -2.231) and in Model 4 (z = -1.854). In Model One, it decreases a woman's chances of adopting by roughly .082 to one, in Model Two by .539 to one and in Model Four by about .455 to one. Although the effects are not strong, it is an interesting effect. Model 1 shows an apparently contradictory finding of a positive effect from time spent on cocoa growing.

The husband's position (z = 2.281) is a strong indicator of adoption in the All localities. Women whose husbands have a high position in the community are around two times to one more likely to adoption agroforestry practices. The results from the Kruskal-Wallis results for the husband's position also are statistically significant for the All localities (p = .039).

CHAPTER 9

CONCLUSIONS AND DISCUSSION

The introduction of agricultural innovations has been targeted to only one segment of the population in the Solomon Islands. Traditionally, men have been the recipients of most of the agricultural innovations presented by Agricultural Extension. Little work has been done on the adoption of agricultural innovations by subsistence gardeners in the Solomon Islands. We have seen here that adoption of these agricultural innovations is a product of several factors. These factors can depend on who is targeted for the introduction of the innovations, how they are targeted, and the time frame-used. Who is the subsistence farmer is important. Traditionally, men and women had dual roles in subsistence farming, but in recent years, these roles have become almost exclusively the women's. Almost all agricultural extension work is done by men. Culturally, it is not acceptable for men to work with women (see Case Study #1). Because of this, the Ministry of Agriculture has over looked the role of women and concentrated on men. How extension has operated in the past is important. Generally, courses were given at training centers where participants were required to meet. Since women cannot travel to those centers due to household responsibilities, these courses have been targeted mainly towards men who are not affected by the same constraints as women. Lastly, the period is an important aspect of the introduction of new agricultural technologies.

Conclusions

As proposed by Hypothesis 1, intervention by the Peace Corps did result in higher adoption of the introduced agroforestry technologies. The quantitative findings affirmed

this. However, some of the specific practices in each of the treatment areas had very different adoption frequencies. Intercropping, overall, had the highest adoption of any practice for both Treatment One and Two. As mentioned, its attractiveness may be explained in that it is to a degree, traditional. The lowest adoption of any of the practices for both treatment areas was woodlots. Respondents from Treatment One commented frequently that, "wood for household use was still available." Adoption of woodlots was low in Treatment Two, but did show some adoption. Warmke (1985) states that in the Dala area, one of the most vocally expressed problems by women, was the lack of abundant fuel-wood sources. Warmke (1985) goes on to say that, the knowledge of how to plant and manage fuel-wood lots exists within the village, but because of on going land disputes it had deterred anyone from planting fuel-wood trees, because those who plant trees must own the land. Since the majority of respondents from both areas report that their husbands do not have primary rights to land, it is doubtful that wood lots can be adopted by farmers who do not own their land.

Adoption overall was higher in Treatment One, than in Treatment Two. The reason for this may be explained by how the practices were introduced. In Treatment One, practices were introduced in a participant observation style, where the researchers lived in the community, in similar conditions to those of the community members and joined in the normal economic and social lifestyles of the community for an extended period of time (Casley and Lury 1989). This kind of method bypasses the type of "gate-keeping" or local "influentials," that may control access of certain groups to information (Moris 1981). In the Treatment Two locality, Peace Corps volunteers did not live in the community where they worked. The volunteers were posted on the Provincial Dala Farm

grounds and worked with People in the Kakara village. Their physical proximity to the intervention village potentially influenced their success in introducing the technologies. Several respondents from Treatment Two commented that "the Peace Corps volunteers only worked with certain people, they worked with the people they liked; we did not know what they were doing because they did not involve us." Another respondent commented, "I heard that they gave out seeds, but only just a few of the women got them, they only gave them to the women they liked." Still another respondent commented, "that man and woman they cam here with agriculture, and agriculture only selects their wontoks (family relations) to give the good things to."

Of the reasons given for nonadoption of the agroforestry practices, the most common response for both Treatment One and Two was that "they had never heard of the practice." This result may have occurred because the study took place six-years after the practices were introduced and new members of the community, through marriage, were included in the study. It is possible that people have forgotten from where they learned this. For example, a woman could have learned intercropping from extension, taught this to her daughter, and then if her daughter were interviewed, her response may be that she learned the technology from custom or traditional sources.

Hypothesis 2 states that "if the technology is economically rational, women will adopt the technology."" The findings support this hypothesis. The findings suggest that women who gain income from selling vegetable crops are more likely to adopt the technology. It appears, because women have so little access to cash from other sources, that the agroforestry practices are an attractive means of gaining income over which they have control. These results appear to be the strongest indicator of the causal linkages

related to adoption of agroforestry practices. In the All localities, gaining income from selling cash crops and the adoption of agroforestry appeared to be a strong indicator of adoption. Once again, it appears that having control over income in which they obtain creates a strong relationship with adoption of agroforestry practices.

Conversely, the second most common response for nonadoption was that it involved too much risk. Women in the Solomon Island, as in many areas of the world, carry the responsibility of being food providers. With very little access to cash to buy imported goods, they must garden under assumptions of certainty. Numerous women felt that many of the practices would not produce enough root crops for their family and that not burning their gardens, green manuring, and intercropping would introduce pests into their gardens. Thus, if the new practices were perceived as threatening to the successful subsistence gardens the women were already maintaining, they were quite leery of taking them on.

Hypothesis 2a states, "if women do not spend a large amount of time working with cash crops, they will adopt the technology." This prediction cannot be supported. Rather, the data suggest that women who spend more time working with cash crops are more likely to adopt agroforestry practices. Cash crops are the second most common way--the first being from market vegetables--that women reported gaining income from. In a 1989 study conducted by the Rural Services Project, the study indicated that 18 percent of the farmers reported earning income from the sale of coca, while farmers only reported eight percent of their earnings from the sale of coconut. Further, farmers reportedly spend 6.6 work days per annum and earn seven dollars per work day working with cocoa, as opposed to coconut, where farmers spend 34 work days per annum and

only earn 2.33 dollars per work day. Cocoa is much less labor-intensive than coconut, and does earn more dollars per workday for the farmers working with it. This situation tends to indicate that, since women are earning income from cash crops, and cocoa requires less workdays per annum, and nets more dollars per workday, this is an attractive means in which to earn money, which they have control over.

Having land planted in cash crops and the adoption of agroforestry practices showed strong quantitative results in many of the statistical runs. Specifically, land planted in coconut and the adoption of agroforestry showed strong positive associations in Treatment One and two areas combined as well as in the All localities. Coconut trees deliver some shade, but allow enough light underneath to permit other plants to be grown near them on the same plot of land. Thus, they lend themselves well to the intercropping practice. Perhaps more generally, having land planted in cash crops is considered being modern and would tend to indicate that the farmers have some knowledge of tree technology.

Interestingly, this study suggests that having land planted in cocoa decreases a farmer's chances of adopting agroforestry practices. The cocoa tree creates considerable shade; therefore, it requires land to be fully dedicated to that plant. It could be the case that cocoa costs more to obtain and establish, and thus is a drain on other resources that growers have.

It is also true that spending time working with cash crops does not automatically equate with owning land planted in cash crops for these women. As stated before, the men are the one who hold primary land rights. The data shows that few of the women receive income directly from their husbands. Women do not need to have land rights in

order to obtain cash from selling cash crops. They may work in another person's paddock, brushing, harvesting cash crops, or other related labor activities associated with cash crops. Again, this tends to indicate that it is a source of income over which women have control, and find it an attractive means of obtaining income. Interesting relationships are occurring between land planted in cash crops and time spent with cash crops and with the adoption of the introduced agroforestry practices. It is possible that several other mediating factors need to be considered and operationalized. Further investigations are needed into these complex relationships that cash crops are having on the adoption of agroforestry practices.

Hypothesis 3 maintains that women's time and energy constraints must not be overtaxed if they are to adopt the technologies. The qualitative case studies provided support for this. Many of the women made comments to the effect that they felt they were too old and tired to take on anything new. However, at least for Treatment Area One, women's chances of adopting increased with age. Other statements from the case studies indicated that some of the women actually had more free time at the older ages that they were not burdened with care of small children. Thus, they were able to get involved in the new practices.

The expectation that farmers who have primary rights to land will adopt the technology, expressed in Hypothesis 4, is supported in part by the findings. Land tenure problems are a negative factor in the farmers' ability to adopt various practices. Practices that denote permanent or semi-permanent aspects will most likely not be adopted by farmers. The qualitative data also suggest that the lack of secure land tenure, as was mentioned by many of the women, was a factor in them not adopting some of the

agroforestry practices. As expressed by residents of both areas, one of the most worrisome concerns is conflicts over land rights. It is apparent from living in and visiting the areas, that farmers seem reluctant to make long-term investments into practices that improve their resources, because of the intense conflicts over land. The competition for land and land resources is becoming a major problem. According to Frazer (1987) food cultivation is under pressure and new planting of gardens is slowing down as a result of land shortages. Households now have smaller, and in some cases, less productive gardens. One situation that may help alleviate land tenure conflicts and one that had been discussed by the Malaita Province for years is to build feeder roads into the interior bush areas, opening up more productive land. Besides opening up more land, another method to maintain food production levels is through a system such as agroforestry, but more emphasis at the present time should be placed on those practices that are not contingent on land ownership, and practices that focus on more intensive cultivation of the land while improving the existing land resources. Under the present circumstances, if something is not done to help alleviate conflicts over land, it seems very unlikely that women will continue to adopt the practices that require permanent land rights.

Hypothesis 5 states that "if conflict does not arise with other people over the technology, women will adopt the technology." Correlation coefficients between technology disagreement and adoption were not found to be statistically significant; however, women often reported during the date collection that they had argued over whether to include other women with the initial project. Generally, women whose husbands did not have primary land rights said that they "could not use all of the agroforestry practices because it would cause arguments over the use of the land." Two

village chiefs stated that, "The land problems were so severe in the two treatment areas that this would be the last generation of children allowed to live on land that they did not have primary rights to." The Qualitative findings suggest that conflict is a potential reason for nonadoption of agroforestry practices, but the quantitative results do not support this hypothesis. Low variability of the conflict variable precludes drawing inferences.

Hypothesis 6 states that "if the introduced technology is consistent with the belief/value system of the women they will adopt." The findings from Table 8.9 suggest that 15.8 percent of the respondents felt introduced practices were not consistent with their beliefs or customs.

The last hypothesis, Hypothesis 7, states that "if women understand the technology, they will adopt the technology." There were not quantitative operationalizations made for this claim. However, the qualitative case study results indicated that the respondents did not state confusion about the practices among their reasons for not adopting the practices. Further probing would be needed to fully assess respondents' levels of conceptual understanding of the agroforestry technology practices.

In addition to the hypothesized relationships, some of the demographic variables proved to show correlations with the agroforestry practices adoption rates. Wealth and general socioeconomic status seemed to have a positive impact on adoption rates. The wealth variable and the husband's social status, in particular, shoed strong positive effects upon the adoption rate. Thus, the respondent's socioeconomic background, to the extent that it was measured in this study, played an important role in serving as a catalyst to the respondent's chances of adopting the new practices.

Discussion: Policy Implications

Ideally, female extension agents should be involved in extending new agricultural practices. As was previously mentioned, extension of new agricultural practices is often biased toward male agriculturists. Given the strong societal norms against men working and interacting with women (see Case Study #1), placement of married extension couples in the regions who can introduce these practices to the appropriate parties is encouraged. The results of this study demonstrated that active extension in the community results in overall higher adoption frequencies. As was observed in the control area, there was high adoption of kitchen gardens. Technologies were introduced by a women's organization at the village level. This method of extension, as the research indicated was an effective means of introducing the technology.

Malaitan, women farmers in the study group eagerly expressed interest in attending farmer-training centers to study agroforestry and other agricultural subjects. However, women cannot often attend these courses because of household duties and societal norms against men and women interacting on such a level. Courses should be held in the villages, specifically for women, and if possible, taught by women.

Income from selling market vegetables seems to be a motivating force in the adoption of agroforestry practices. It can be inferred from these results that when introducing new technologies, understanding differential gender uses of the farms resources is important. Income sources are an important factor to consider when introducing new technologies, especially technologies that are targeted for women. Markets in Malaita have grown tremendously since 1986, and appear to be a thriving economic base for women and men.

Two of the most frequent comments made by women were that one; "they were afraid of the risk involved in adopting the new technology, and two; "the new technology was not consistent with their custom." Perhaps future research should address these two issued so that women farmers can be more informed of the risks and benefits involved. Female farmers need to be sure that adopting the new technology does not jeopardize the family's food sources and that it is potentially in their best interest to adopt. New technologies that are not consistent with the belief and value systems of farmers do not have a high degree of acceptability in many cases.

It is particularly important that agricultural policies at the national level address the social and cultural situations of the farmers. Characteristics such as land tenure rights and laws, gender division of labor, social stratification, nutrition, etc., need to be considered. If these issues and others are addressed by national policies, small-scale, low-input, sustainable agriculture systems such as agroforestry may be more acceptable to the farmer, especially women farmers.

In order for technological advances to bring about positive change, the full range of social, political, and economic issued influencing the adoption need to be addressed. As Kidd and Pimentel (1992) suggests solutions to small-scale, low-input, sustainable agriculture are local, and improvements must be made in small units, but with "a strong group of skilled managers and technicians with exceptional sensitivity to human reactions to change and exceptional abilities to work with farmers," we can bring about positive changes." This study is offered in the spirit of promoting these positive changes.

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APPENDICES

APPENDIX A

Interview Guide and Checklist

AREA_____
GENDER_____
AGE (SELF) _____ SPOUSE _____
WEALTH _____

PERMANENT MATERIAL HOUSE (Y/N) _____
PRIMARY RIGHTS TO LAND Y/N _____
HUSBAND'S POSITION IN COMMUNITY _____

1. HAVE YOU EVER USED TERRACING?
   A. NO, NEVER DID.
      WHY? _____
   B. YES, ONCE, BUT DISCONTINUED.
      WHY? _____
   C. YES, A LITTLE.
      WHY? _____
   D. YES, FULL TIME.
      WHY? _____
   E. ADDITIONAL COMMENTS/PROBLEMS _____
      _____

2. HAVE YOU EVER USED INTER-CROPPING?
   A. NO, NEVER DID.
      WHY? _____
   B. YES, ONCE, BUT DISCONTINUED.
      WHY? _____
   C. YES, A LITTLE.
      WHY? _____
   D. YES, FULL TIME.
      WHY? _____
   E. ADDITIONAL COMMENTS/PROBLEMS _____
      _____

3. HAVE YOU TRIED NOT BURNING YOUR GARDEN?
   A. NO, HAVE ALWAYS BURNED.
      WHY?
_____
   B. YES, STOPPED BURNING ONE GARDEN SEASON.
      WHY?
_____
   C. YES, SOMETIMES. WHY?

_____

D. NEVER BURN.

WHY? _____

E. ADDITIONAL COMMENTS/PROBLEMS _____

_____

4. HAVE YOU USED GREEN MANURE ON YOUR GARDEN?

A. NO, NEVER DID.

WHY? _____

B. YES, ONCE, BUT DISCONTINUED.

WHY? _____

C. YES, A LITTLE NOW.

D. YES, ALL THE TIME.

E. ADDITIONAL COMMENTS/PROBLEMS _____

_____

5. DO YOU PLANT YOUR GARDEN ON THE CONTOUR?

A. NO, NEVER DID.

WHY? _____

B. YES, ONCE, BUT DISCONTINUED.

WHY? _____

C. YES, A LITTLE.

WHY? _____

D. YES, ALL THE TIME.

WHY? _____

E. ADDITIONAL COMMENTS/PROBLEMS _____

_____

6. HAVE YOU USED FIRE ASH ON YOUR GARDEN?

A. NO, NEVER USED.

WHY? _____

B. YES, ONCE, BUT DISCONTINUED.

WHY? _____

C. YES, A LITTLE NOW.

WHY? _____

D. YES, ALL THE TIME.

WHY? _____

E. ADDITIONAL COMMENTS/PROBLEMS _____

_____

7. HAVE YOU PLANTED A WOODLOT?

A. NO, NEVER DID.

WHY? _____

B. YES, ONCE, BUT DISCONTINUED.

WHY? _____

C. YES, ONE NOW.

WHY?_____

D. YES, ALL THE TIME.
WHY? _____

E. ADDITIONAL COMMENTS/PROBLEMS _____
_____

8. HAVE YOU EVER PLANTED A KITCHEN GARDEN?
   A. NO, NEVER DID.
   WHY? _____
   B. YES, ONCE, BUT DISCONTINUED.
   WHY? _____
   C. YES, ONE NOW.
   WHY? _____
   D. YES, ALWAYS PLANT ONE.
   WHY? _____
   E. ADDITIONAL COMMENTS/PROBLEMS _____
   _____

9. HAVE YOU PLANTED ANY NEW CROP VARIETIES INTRODUCED TO YOU?
   A. NO, NEVER DID.
   WHY? _____
   B. YES, ONCE, BUT DISCONTINUED.
   WHY? _____
   WHAT TYPES? _____
   C. YES, SOME NOW.
   WHAT TYPES? _____
   D. YES, ALWAYS PLANT NEW VARIETIES..
   WHAT TYPES? _____
   E. ADDITIONAL COMMENTS/PROBLEMS _____
   _____

10. EDUCATIONAL LEVEL _____

11. NUMBER OF CHILDREN _____

12. GENDER OF CHILDREN _____

13. AGE OF CHILDREN _____

14. NUMBER OF PEOPLE LIVING IN HOUSEHOLD BESIDES SELF AND IMMEDIATE FAMILY _____

15. DO YOU OR YOUR HUSBAND HAVE LAND PLANTED IN CASH CROPS? _____

16. HOW MUCH TIME DO YOU SPEND WORKING WITH CASH-CROPS?

_____

17. WHAT SOURCES OF INCOME DO YOU HAVE? _____
_____

18. DO YOU HAVE GARDENING RIGHTS TO THIS LAND? _____

19. HOW MANY DAYS PER WEEK DO YOU GO TO YOUR GARDEN?
_____

20. WHO HELPS YOU IN THE GARDEN? _____

21. DOES YOUR HUSBAND HAVE PRIMARY LAND RIGHTS? _____

22. RELIGIOUS AFFILIATION _____

23. DID THE TECHNOLOGY CAUSE ANY DISAGREEMENT?
A. NO _____
B. YES, WITH SPOUSE _____
C. YES, WITH NEIGHBORS _____
D. YES, WITH OTHER FAMILY MEMBERS _____

24. RELATIONSHIP WITH HUSBAND _____
_____
_____

25. RELATIONSHIP WITH FAMILY _____
_____
_____

26. RELATIONSHIP WITH NEIGHBORS _____
_____
_____

27. FEELINGS ABOUT VILLAGE _____
_____
_____

28. FEELINGS ABOUT YOUR CHIEF _____
_____
_____

APPENDIX B

List of All Variables Attempted for Solomon Islands Study

VARIABLE TYPE	VARIABLE NAME	DESCRIPTION	CALCULATED VARIABLE
INDEPENDENT	WHOTERR	Who/what introduced terracing technology	STI
	WHOINTER	Who/what introduced intercropping technology	STI
	WHONOBRN	Who/what introduced nonburning technology	STI
	WHOGREEN	Who/what introduced green manuring technology	STI
	WHOCNTR	Who/what introduced contouring technology	STI
	WHOFIRE	Who/what introduced fire ash technology	STI
	WHOWOOD	Who/what introduced woodlot technology	STI
	WHOKITCH	Who/what introduced garden technology	STI
	WHONEW	Who/what introduced new crop technology	STI
MEDIATING	INCHUSB	Income from husband	
	INCVEG	Income from growing vegetables	
	INCCRAFT	Income from making crafts	
	INCJOB	Income from paid employment	
	INCCC	Income from cash crop(s)	
	INCOTHR	Income from other source(s)	
	WEALTH	Wealth of respondent	
	HOUSEQL	Housing quality of respondent	
	HUSBPOS	Social position of respondent's husband	
	COCONUT$	Land planted in cash crop = coconuts	LANDCASH
	COCOA$	Land planted in cash crop = cocoa	LANDCASH
	OTHER$	Land planted in cash crop = other	LANDCASH
	COCONTM	Time spent growing coconuts	TIMECASH
	COCOATM	Time spent growing cocoa	TIMECASH
	OTHERTM	Time spent growing other crops	TIMECASH
	AGE	Age of respondent	
	SPSAGE	Age of respondent's spouse	
	NUMCHILD	Number of children respondent has	
	FEMCHILD	Number of female children respondent has	
	MLCHILD	Number of male children respondent has	
	OTHRINHS	Number of others in household	
	NUMDEP	Number of dependents in respondent's household	DEPRATIO
	NUMWORK	Number of workers in respondent's household	DEPRATIO
	TIMEGARD	Number of days/week respondent goes to garden	
	HUSBHELP	Help in work from husband	HELPGARD
	CHILDHLP	Help in work from child/children	HELPGARD
	OTHERHLP	Help in work from others	HELPGARD
	LANDRTS	Possession of land by respondent's husband	
	TECHDISG	Disagreement over technology	
	CS1RELH	Respondent's relations with husband	
	CS2RELF	Respondent's relations with family	
	CS3RELN	Respondent's relations with neighbors	
	CS4RELV	Respondent's relations with village	
	CS5RELC	Respondent's relations with chief	
	WOMEDUC	Respondent's years of school	
	MENEDUC	Husband's years of school	
DEPENDENT	TERRAC	Adoption of terracing technology	CPA
	INTRCROP	Adoption of intercropping technology	CPA
	NOBURN	Adoption of nonburning technology	CPA
	GREENMNR	Adoption of green manuring technology	CPA
	CONTOUR	Adoption of contouring technology	CPA
	FIREASH	Adoption of fire ash technology	CPA
	WOODLOT	Adoption of woodlot technology	CPA
	KITCHGRD	Adoption of kitchen garden technology	CPA
	NEWCROP	Adoption of new crop	CPA