TRADITIONAL HOUSEHOLD GARDENS OF THE PETÉN, GUATEMALA

By

Diane Ruonavaara

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Department of Resource Development

1996

ABSTRACT

TRADITIONAL HOUSEHOLD GARDENS OF THE PETÉN

By

Diane Ruonavaara

A large number of peasants are entering the Petén of Guatemala with agricultural technologies which appear inappropriate for the fragile soils of the tropics. Development organizations search for agricultural alternatives to satisfy the needs of peasant households while preserving the environment. In other tropical areas research suggests that traditional household gardens (THGs) have the potential to provide for household needs while conserving the rainforest. Yet in the Petén, THGs have been invisible or not seen to their fullest social and environmental extent. This study describes the bio/physical and social characteristics of THGs in the Petén. Local gardeners are recognized as have the fullest understanding of THGs, therefore, the study investigates THGs via gardeners' knowledge. A conceptual THG model is developed based on this perspective. Current garden promotion in the region is examined in the light of this model. Finally, implications for development organizations promoting THGs in the region are presented.

ACKNOWLEDGMENTS

This research is a culmination of not only an academic program, but an accumulation of knowledge, experience and assistance acquired from many sources. Most important among them are my great-grandmother, grandmother and mother who shared their plant and gardening knowledge with me and taught me to appreciate plants both in the forest and in the garden. My husband, Brian, added greatly to this study through his insightful comments and assistance in the field. Friend Howard Russell contributed generously of his talents in data analysis. My advisor, Prof. Scott Witter, provided valuable guidance and support. Dr. Norman Schwartz generously gave of his vast knowledge and understanding of the Petén. His support and friendship has been invaluable in carrying out this research. A fellowship from The Inter-American Foundation, a grant from Rodale Institute and institutional support from Centro Maya made this research possible. It is customary to thank those who participate in a study. However in this case mere thanks is not enough. The gardeners of San Jose and Santa Ana are the holders of gardening knowledge. It is only through their patience, trust and willingness to share their knowledge with me that this research took place. Mere words of acknowledgment and thanks are not an adequate recognition of their contribution. I hope that in the future I can repay them. For now I am humbly in their debt.

Table of Contents

List of Tables

List of Figures

Chapter 1

Introduction

1.0 Introduction

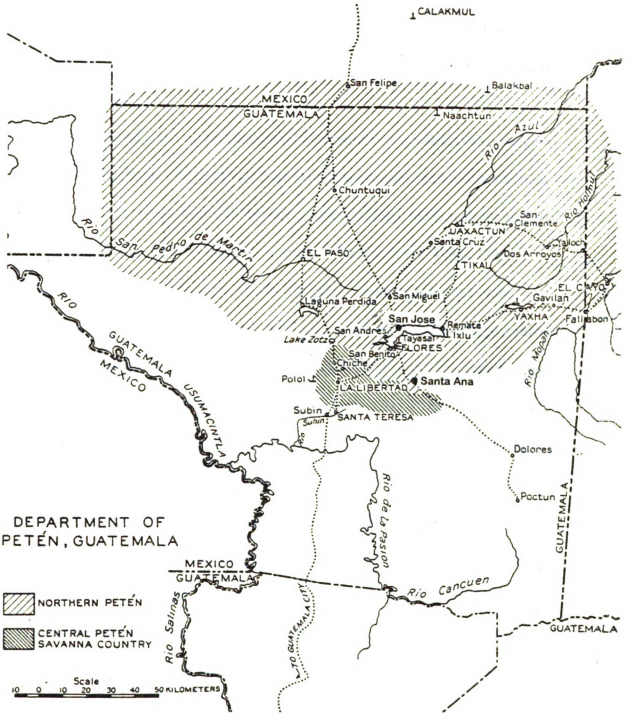
In the search for land and a new life, six hundred people per day are entering the Petén, the lowland rainforest of Guatemala (Figure 1). This northernmost department of Guatemala covers approximately one-third of the country's land area and is home to the largest tropical forest north of the Amazon. The verdant forests and seemingly abundant lands promise prosperity to the newcomers.

The colonists (migrants) have come to the Petén to escape the military and social violence which permeates the rest of the country (Perera 1993). This violence is closely related to the insecure and skewed land tenure pattern in the rest of Guatemala (Reining *et al.* 1992; Schwartz 1995). In 1990, it was reported that 65 percent of the land in the country was owned by 2 percent of the population (Carpenter 1990). This is the most unequal land tenure in all of Latin America (Gardner 1991).

The majority of the colonists entering the region are peasants from the eastern highlands, Pacific coast or southern areas who bring traditional agricultural technologies that are regionally specific and often inappropriate for the fragile soils of the lowland tropics[1] (Gomez-Pompa 1980; Reining *et al.* 1992; Thompson *et al.* 1994). Their slash and burn

[1] The colonists are not the only actors in the destruction of the rain forest. Cattle ranching and logging are among the forces which hasten deforestation. But given the sheer volume of colonists entering the region the importance of reducing their impact on the environment while at the same time assisting them in meeting their household needs is vital.

Figure 1. The Petén of Guatemala



Source: Adapted from Lundell 1937

milpa or corn-based agriculture destroys the forest and soon wears out the soils. This type of agriculture can produce successfully for a number of years as long as the fallow periods are long enough to restore soil fertility. But population, poverty and land distribution pressures reduce the fallow time and productivity is lost (National Research Council 1993).

Governmental and non-governmental development organizations in the region seek agricultural alternatives which can meet the needs of colonists, while at the same time conserve the forest environment. In other tropical regions, modern agriculture has provided resource-poor farmers with few answers (Chambers *et al.* 1985). Often resource-poor farmers are left worse off while tropical environments deteriorate (Chambers 1993; Harwood 1979; Serrao *et al.* 1993). Some researchers suggest ancient Mayan agricultural technologies as a sustainable model for present-day farmers in the Central American humid tropics (Gomez-Pompa 1987; Nations 1980). Yet, success is elusive for projects that have explored this alternative (Chapin 1988). In the Yucatan Peninsula of Mexico and the Petén of Guatemala, a few researchers (Caballero 1992, Gomez-Pompa 1987, Marcus 1982; Stravrakis 1978) suggest that traditional household gardens (THGs) have the potential to provide for household needs in ways compatible with the forest environment.

In the humid tropics, a traditional household garden is defined as a small-scale, low input and multi-layered agricultural production system located near the home dwelling. These gardens are developed by household members and are based on local knowledge and local resources (Cleveland 1991; Solteri 1991). THGs are generally

one component of a household survival strategy. As such, they provide a way to maintain household well-being in response to changing economic, environmental, political and social conditions. While traditional household gardens certainly do not offer a total solution to household well-being, they do offer a flexible and attainable means to meet a number of household needs (Cleveland 1991; Ninez 1990; Brownrigg 1985). Research in diverse world regions supports this idea, stating that traditional household gardens (THGs) offer a culturally, environmentally and economically appropriate means to meet a number of household needs (Cleveland 1991; Marsh 1994; Ninez 1986; Soemarwoto *et al.* 1991).

In the Petén, the traditional household gardens of native Peteneros[2] offer such potential. However, THGs have been invisible or not seen to their fullest social and environmental extent by researchers and development workers. A few researchers have supplied details regarding traditional household gardens of various Mayan groups in the Mexican tropical lowlands of the Yucatan Peninsula (Caballero 1993; Castro *et al* 1993; Flores 1993). However, these studies are from an *etic*[3] perspective, focusing on the environmental aspects of the gardens and are primarily descriptive in nature. The traditional household gardens of the Itza Mayan population of the Petén have received little attention from researchers or development workers. In addition, the THGs of *ladinos* have received little notice from either the researchers in the Yucatan or those of the Petén.

Despite the lack of research and accompanying understanding of THGs, "gardens" are viewed by development organizations in the Petén as a viable means to: 1) integrate

---

[2] Native Peteneros are both Itza Mayan and *ladinos* (mestizo) whose families have lived in the region for generations (Schwartz 1990).

[3] As viewed from outside a culture

colonist women into development projects, 2) improve nutritional well-being of colonist households; and, 3) generate economic benefits for colonist households. However, most governmental (GOs) and non-governmental organizations (NGOs) are promoting temperate gardens. These gardens are based on a model transferred from industrialized countries and are high input systems dependent on hybrid annual seeds, chemical fertilizers, and pesticides. In effect, they are reduced-scale conventional agriculture. Despite low adoption rates and high failure rates, development organizations continue to promote gardens based on this model.

2.0 The Purpose of the Study

This study helps fill the gap in theory and practice on traditional household gardens in a specific area -- the Petén of Guatemala. This thesis will describe and explore both the traditional household gardens of the Petén and their feasibility as an alternative and appropriate agricultural technology for recently arrived colonists. The overall goals of this investigation are to: 1) develop a conceptual garden model based on the THGs of native Peteneros; and 2) develop the theoretical and practical basis for creating an alternative approach to garden promotion, which meets the needs of newly arrived colonists in a socially, economically and environmentally appropriate manner for the Petén.

3.0 The Study Objectives

This investigation describes the bio/physical and social characteristics of traditional household gardens from the point of view of native Peteneros in two communities, San Jose and Santa Ana (Figure 1). In this study, local gardeners are

recognized as have the fullest understanding of traditional household gardens. Therefore, the study investigates THGs via the indigenous knowledge of gardeners. That is to say, an *emic*[4] perspective is utilized to gain an understanding of traditional household gardens. Additionally, garden projects promoted by NGOs and GOs in the region are examined to gain a fuller understanding of local traditional household gardens and successful garden promotion. The objectives of this study are:

1. to describe the bio/physical and social structure of the traditional household gardens of native Peteneros;

2. to develop a conceptual model based on an analysis of the bio/physical and social structure of the traditional household gardens of native Peteneros;

3. to describe and analyze current projects of garden promotion in light of the conceptual garden model, and;

4. to discuss implications of this research for garden promotion in the region.

These objectives make the following contributions. The first objective, that of describing the physical and social structure of THGs, makes a theoretical contribution by expanding what is known about small-scale, traditional and primarily women's agriculture, household survival strategies and indigenous knowledge. Objective two, the creation of a conceptual THG model, provides the means to step from the theoretical to application. Objective three, that of examining promoted gardens, provides a counterpoint to the local THGs and contributes to both theoretical and practical aspects of

[4] As viewed from inside a culture

development work. Objective four suggests how to improve garden promotion through the incorporation of the bio/physical and social dimensions of the local THGs.

4.0 Research Questions

Through a qualitative inductive process the following questions are addressed in this research: 1.) How are traditional household gardens understood by native Peteneros?; 2.) What are the primary categories of knowledge relating to traditional household gardens?; 3.) Who gardens, at both a community and a household level? 4.) What are the bio/physical and social attributes associated with traditional household gardens?; 5.) How do traditional household gardens of native Peteneros differ from gardens promoted by development organizations and extension workers?; and 6.) How can development workers improve their approaches to garden promotion by understanding local traditional household gardens?

5.0 Background

In-depth analysis occurred with twenty gardeners and their gardens, ten from each community of San Jose and Santa Ana. Visits to other gardens and interviews with other gardeners occurred through chain and opportunistic interviews. Information on garden projects promoted by NGOs and GOs was obtained from trips to six communities. In all, 40 gardens were visited during the process of this investigation.

Field work was conducted during a two month time period from mid-August to mid-October of 1995. Approximately one month was spent in San Jose and one month in Santa Ana. Visits to colonist communities where NGOs had begun household gardening projects occurred when the opportunity arose.

An extended stay in new colonist communities[5] had been planned as the final phase of research. However, military harassment of these communities culminating in a military massacre in a community south of the Petén precluded this portion of the research (Guerrero 1995). Interviews with extension workers stationed in these new communities and visits to established colonist communities substituted for this portion of the research.

6.0 The Methods

This research is both exploratory and descriptive in nature. It combines an ethnographic approach with qualitative inductive research. Ethnography contributes an *emic* perspective by focusing upon the indigenous knowledge of gardeners. Qualitative inductive methods provide a means of analysis, which builds garden theory through the development of theoretical concepts and categories. Quantitative methods are used to analyze the plant composition of gardens and to facilitate comparison between THGs.

Central to ethnographic methods, knowledgable gardeners provide the means to understand traditional household gardens from the perspective of the gardeners themselves. Participant observation complements unstructured interviews with gardeners and furnishes a means to observe management practices. Mapping techniques and a biotic survey furnish supporting data (Lok 1994; Lundell 1937). Descriptive statistics are done in FoxPro and Excel. A diversity index is developed to highlight differences in garden diversity between Itza Mayan and *ladino* gardens and between native Petenero and colonist gardens.

---

[5] By the end of 1982 an estimated one hundred and sixty-one thousand people had fled the Guatemalan military violence and escaped into Mexico (Williams 1986). Some of these people are being resettled in the Petén with the assistance of the UN.

7.0 The Setting

Guatemala is situated in Central America and is one of the world's richest areas of biological diversity. Most of this diversity is found in the lowlands of the Petén. The Petén covers approximately 36,000 sq. kilometers (13,900 sq. miles) and lies between 16° and 17° 90' degrees north latitude and 89° 25' and 91° west longitude. Elevation in the region does not exceed 400 meters (1312 feet) (Lundell 1937). The Petén has two seasons - dry and wet. The dry season extends from November to June or July, the rainy season runs from August through November. Rainfall averages between 1,200 and 1,500 mm/yr. (between 46.4 and 58.5 inches/yr.) , while the temperature can vary from 12° to 40° C (53.6° to 104° F), although it seldom drops below 18° C (64.4° F).

Generally, the soils are composed of clays whose internal drainage ranges from good to poor. These soils are easily compacted, highly subject to erosion, and often quite thin (Reining *et al.* 1992: 44). The upland soils are classified as Lithic Rendolls, while soil in lower areas are classified as Typic Rendolls (USDA soil taxonomy) (CATIE cited in Reining *et al.* 1992).

Phosphorous is often a limiting factor for agricultural production. The pH range is slightly acidic to slightly alkaline, ranging from 6.5 to 7.5. It has been estimated that only 13 percent of the soils in the Petén are both sufficiently deep and well-drained to support agricultural production (Kneib 1989 cited in Reining *et al.* 1992). These soils are located in the southern Petén.

Until the opening of an all-season road in 1970, the Petén was relatively isolated from the rest of Guatemala. Since that time, many thousands of colonists have entered the

region. Between 1960 and 1986 the population surged from 21,330 to an estimated 300,000. This influx of people triggered a number of rapid social and environmental changes.

In the midst of these changes are the native Peteneros. Native Peteneros, both Itza Mayans and *ladinos*, have acquired a deep understanding of their environment through close observation and experience. These groups have combined environmental knowledge with a willingness to adapt cropping techniques to produce an agroecological system that is responsive to regional ecological and social conditions (Reining *et al.* 1992; Schwartz 1990).

This agroecological system often includes a traditional household garden, a multi-cropped *milpa* and forest harvesting (Atran 1992; Reining *et al.* 1992; Schwartz 1990; Stravrakis 1978). In a typical Petén community the settlement pattern is one of a cluster village community that appears spatially as houses radiating from a central plaza. Bordering each house is a traditional household garden. Around the community, often at some distance from the homes, are the multi-cropped *milpas* of corn, beans and other crops. At a greater distance is the forest, which provides for multiple household needs including food, medicines, fuel, fodder, and forest products sold for income.

In contrast to the complex agroecological system of the native Peteneros, most new colonists depend solely on slash and burn *milpas* for income and subsistence. These newcomers plant and cultivate as they had in the coast or highlands and are able to produce a crop for two or three years until the soil looses its fertility and new land must be cleared (Reining *et al.* 1992; Thiesenhuesen 1993). Despite the difficulties of this

process, this type of agriculture as practiced by the new arrivals is familiar and provides food and income for their families. In any case, most newcomers have few alternatives. Monetary resources, technical assistance and markets are scarce (Reining *et al.* 1992). Over time some colonists adopt some of the mixed economic strategies of native Peteneros. However, with hundreds of colonists entering the Petén, the process of adaptation cannot keep pace with the destruction of the forest environment (Reining *et al.* 1992).

While colonists have found land on which to grow their crops, they have not entirely escaped from the violence that pushed them from their homes. The Petén has not experienced the same intensity of military violence as the rest of the country, nevertheless it has had its share. Disputes arising in the course of illegal logging, drug smuggling, smuggling of contraband materials out of the Mayan Biosphere Reserve and private feuds add another level of complexity to the adaptation process of the colonists.

One consequence of this violence is the partial break down of community ties and individual relationships (Perera 1993). Schwartz (1990: 281) discusses the effects of violence in the Petén, "It is as if having been defeated by the state, society has turned against itself." Although the incidence of violence has decreased during the 1990's, a wariness still exists within communities. The military presence is strong in the Petén. Conservation of the forest environment and the improvement of colonists' lives is enmeshed in this "endless civil-political violence" (Perera 1993; Schwartz 1990).

Chapter 2

Traditional Household Gardens in Context

(Literature Review)

2.0 Introduction

This chapter reviews pertinent literature from a number of related research fields: conventional agricultural development; alternative forms of agricultural development including Agroecology, Farmer First, and Beyond Farmer First; indigenous knowledge; and traditional and temperate gardens. This review develops a context for the study and grounds it in previous research. The section on conventional agriculture development briefly looks at the benefits of this approach and then examines how and why it has overlooked the needs of resource-poor farmers. The chapter then turns to various responses to this particular shortcoming of conventional agricultural development. An overview of Agroecology (Altieri 1983), Farmer First (Chambers *et al.* 1985) and Beyond Farmer First (Rhoades *et al.* 1989) highlight these alternative forms of agricultural development which includes resource-poor farmers and is based on traditional agricultural systems. This chapter culminates with a review of the most pertinent literature relating to traditional household gardening and garden promotion gleaned from sources which are scattered in distinct disciplinary areas.

2.1 Conventional Agricultural Development

One-fourth of the human race, about 1 billion people in Asia, 1.3 million in sub-Saharan Africa and 100 million in Latin America, live on marginal or fragile, mostly rain-

fed agricultural lands and are dependent on agriculture for their livelihoods (Wolf 1986). Yet, conventional agricultural development and technology transfer hold few answers for these farmers. (Adams 1990; Black 1991; Chambers 1989; Conway 1989; Harwood 1979).

Conventional agricultural development has tended to help farmers who have access to fertile land, water and credit (Harwood 1979). The focus of conventional agricultural development on increasing production of high-yielding varieties of key grain crops through high external input technologies (such as modern irrigation and chemical fertilizers) has favored "resource-rich" farmers (Chambers 1989; Francis 1988). Research priorities determined by Western-educated scientists and attendant technologies generated on research stations and in laboratories are transferred through extension services to these same farmers (Reijntjes 1992).

In general, the assumptions of this top-down transfer of technology has kept researchers from recognizing the achievements of marginal farmers (Reijntjes 1992). These assumptions have appeared in scientific literature as descriptions of local or indigenous knowledge as "primitive," "unscientific", or "wrong" (Thompson *et al.*. 1994). The overall objective of conventional agricultural development was to modernize traditional production systems. From this perspective farmers were seen as adopters or rejecters, not generators, of knowledge or technology (Thompson *et al.*. 1994).

The concept of farmers as adopters or rejecters of technology is central to the diffusion of technology model. Rogers (1983: 1) describes diffusion as "the process by which an innovation is communicated through certain channels over time among

members of a social system." Rogers identifies a distinction between centralized and decentralized diffusion systems. This distinction acknowledges the spread of innovations from various sources both internal and external to a society. Yet in practice, those who utilize the diffusion model are concerned with innovations introduced from the "outside." A diffusion process that is generated from within a society is said to be "spontaneous." In other words, farmers are not acknowledge as the source of knowledge or technology, but rather are viewed as irrelevant to the process of knowledge or technology generation.

In addition to ignoring resource-poor farmers, conventional agricultural development requires, in varying degrees, the application of agrochemicals, the use of machinery and introduction of modern methods of irrigation. In Guatemala, an emphasis on nontraditional crops for export (broccoli, melons, snow peas etc.) has resulted in extensive use of insecticides, herbicides and fungicides. Of the most commonly used pesticides, 23 percent are classified by the World Health Organization as extremely or highly toxic (AVANSCO 1992). The indiscriminate use of agrochemicals poisons farmers and the environment (Murray 1995), while machinery compacts and irrigation salinates soils.

In response to the detrimental social and environmental effects of conventional agriculture and a top-down approach to technology transfer, a move to develop alternative approaches to agricultural development has emerged. A central theme to these alternative approaches is a commitment to sustainable agricultural development.

2.2 Sustainable Agricultural Development

The concept of sustainable agricultural development is central to the search for alternative approaches to agricultural development. Three distinct elements are brought together under the rubric of sustainable agricultural development: environmental soundness, economic viability and social justice.

In this study, the definition of sustainable agricultural development is selected from criteria suggested by Gips (cited in Reijntjes 1992).

1.) *Environmentally sound:*
The quality of agricultural resources must be maintained or improved. Local resources must be used in a way that minimizes loss of nutrients, biomass and energy, and avoids pollution. Emphasis is on the use of renewable resources;

2.) *Economically viable:*
Farmers can produce enough for self-sufficiency and/or income, and can gain sufficient returns to warrant the labor costs involved. Economic viability is measured not only in direct farm production (yield) but also in terms of functions such as conserving resources and minimizing risk; and

3.) *Socially just:*
Agricultural resources are distributed in such a way that the basic needs of rural society are met and that rights to land use, adequate capital, technical assistance and market opportunities are assured. All people have the opportunity to participate in decision-making both in the field and in society.

Differing degrees of emphasis are placed on these elements depending on the ideologies and goals of its proponents (Buttel 1995).

2.3 An Agroecological Approach

Agroecology promotes the study of traditional agricultural systems to derive scientific knowledge for the development of more appropriate and sustainable agricultural systems. In the words of Miguel Altieri:

> "Traditional agricultural systems have emerged over centuries of cultural and biological evolution and represent accumulated experiences of interactions with the environment by farmers without access to external inputs, capital, or scientific knowledge. Such experience has guided farmers in many areas to develop sustainable agroecosystems, managed with locally available resources and with human and animal energy" (Altieri 1990: 552).

From this point of view, all ecological and social systems are seen as having agricultural potential, which is expressed through indigenous knowledge. These traditional farming systems are seen as dynamic, evolving through a constant interaction of local culture and local ecology (Reijntjes 1992). Indigenous knowledge is the medium through which these changes flow. While an agroecological perspective contributes a systems approach emphasizing traditional agriculture as understood by the farmers themselves, it does not provide an explicit definition of this knowledge.

2.4 Characteristics of Indigenous Knowledge

Various terms are used to refer to this knowledge: farmers' knowledge (Bebbington 1990), rural people's knowledge (Chambers *et al.* 1989), local knowledge (Waters-Bayer 1994), indigenous technical knowledge (Bentley 1989) and indigenous knowledge (Gadgil *et al.* 1993; Warren *et al.* 1994). Typically these terms refer to agricultural knowledge, although the study of indigenous knowledge has begun to spread to include urban groups and non-agricultural activities. The term indigenous knowledge

(IK) is used in this study because it appears to be sufficiently inclusive and it is currently the most frequently used term. Indigenous refers to the local nature of knowledge, not to ethnic identity.

Numerous authors have advanced an understanding of indigenous knowledge (Butler *et al.* 1990; Cashman 1990; McClure 1989; Norem *et al.* 1989; Reijntjes 1992; Warren 1991). In general, indigenous knowledge systems are local ways of knowing and looking at the world. These knowledge systems have evolved over years of experience and trial-and-error problem solving by groups of people and forms the basis for decision making when familiar and unfamiliar problems and challenges are encountered in their local environment (Cashman 1989; McClure 1989). Indigenous knowledge is passed on from one generation to the next usually through oral tradition (Norem *et al.* 1989). IK is dynamic, changing through indigenous mechanisms of creativity and innovations, as well as through contact with other local and international knowledge systems (Warren 1991). Indigenous knowledge and skills for adapting new ideas to local conditions form the basis for change within rural community (Reijntjes 1992).

How indigenous knowledge can be utilized has been discussed by Chambers (1989), Rhoades and Booth (1982), and Farrington (1989) under what can be termed a Farmer First approach.

2.5 Indigenous Knowledge from a Farmer First Approach

In a Farmer First approach, the problems of agricultural development appear in terms of a knowledge gap between farmers and researchers (Chambers 1985). This gap

can be bridged by acknowledging the value of farmers' knowledge and recognizing its role in developing sustainable agricultural systems.

Following a Farmer First perspective, indigenous knowledge must be studied and incorporated into formal research and extension practices in order to make agriculture and rural development more sustainable and successful (Thompson *et al.* 1994). In this approach development is seen in terms of a partnership and farmers' choices are seen as a rational response to environmental, social and political situations. Outsiders are seen as facilitators or catalysts of an open exchange of ideas and information among various participants (Richards 1985; Thompson *et al.* 1994).

By listening to farmers and valuing their knowledge, the often complex and diverse agricultural strategies of resource-poor farmers which were formerly invisible to outsiders (both researchers and development workers alike) become visible. Among the most invisible of these strategies have been what Chambers (1990) refers to as micro-environments which includes household gardens.

While Farmer First advances the study of indigenous knowledge and traditional agriculture, its critics point to a failure to address the social, cultural, political and economic dimensions of knowledge generation, transmission and use within both rural societies and scientific organizations (Thompson *et al.* 1994). The recognition of the importance of these factors in knowledge generation and transmission within society gave rise to Beyond Farmer First.

2.6 Indigenous Knowledge from a Beyond Farmer First Approach

Beyond Farmer First maintains the need for active farmer participation and poverty alleviation, but advocates a more comprehensive approach that recognizes the political dimensions of knowledge. Thompson and Scoones (1994) describe, knowledge is embedded in social processes that imply aspects of power, authority and legitimization. These factors are just as likely to reflect and contribute to the conflict between social groups as they are to lead to the establishment of common perceptions and priorities. This perspective applies not only to indigenous knowledge, but to scientific knowledge as well.

2.7 Convergence of Indigenous and Scientific Knowledge

From a Beyond Farmer First perspective the convergence of indigenous and scientific knowledge is viewed as a process involving negotiation. These two knowledge systems imply contrasting epistemologies produced within particular agroecological, sociocultural and politico-economic settings. The interaction of rural peoples' knowledge with current research and extension practices must address fundamental issues of power and equity in development (Thompson *et al.* 1994). The Beyond Farmer First perspective warns that any attempt to explain IK solely through existing scientific classifications abstracts from its cultural, economic, environmental and sociopolitical context and is likely to lead to critical inaccuracies in interpretation, assimilation and application (Thompson *et al.* 1994). Thompson explains:

> "Researchers and farmers use different frames of reference when thinking about agriculture. The researchers' thinking is 'out of time'; they have the luxury to run their experiments in controlled environments, even when conducting on-farm trials. By contrast, the farmers' performances can only

> occur 'in time,' where they are embedded in particular agroecological and sociocultural contexts that give rise to a plethora of changing conditions to which the farmers must make a series of rolling adjustments. For the researcher what counts is replication and comparison. For the farmer what counts, is fitting available resources to changing circumstances well enough to make it through the season" (Thompson *et al.* 1994: 61).

Beyond Farmer First adds a political dimension to the study of indigenous knowledge by recognizing issues of control and power. However, in this approach practical issues of application are not addressed.

2.8 Difficulties in Using Indigenous Knowledge

There are several difficulties in using indigenous knowledge systems to gain an understanding of traditional agriculture and to improve or transfer traditional agricultural systems: 1.) indigenous knowledge is usually not documented; 2.) it is usually unevenly distributed in a community and; 3.) indigenous knowledge is often unable to adapt to rapidly changing circumstances.

As oral tradition, indigenous knowledge may be implicit within practices, and actions, rather than a conscious resource (Reijntjes 1992). As Cernea writes to Box (1988), who was studying cassava cultivators in the Dominican Republic:

> "The farmers describe the cassava cultivation as sets of practical activities rather than as *patterns* and *rules* of cultivation. Immersed in *praxis*, in other words, involved with the mechanics of cultivation activities, the farmers were able to describe the sequence of their practical and empirical operations rather than abstract, extract and formulate in a *generalized manner* the *rules* of production embedded intrinsically in the sequence of their own acts" (Cernea 1987 cited in Box 1988: 72).

Indigenous knowledge is often restricted to what can be grasped directly, usually through observation, and understood within local concepts (Bentley 1989; Reijntjes

1992). Bentley (1989) found that Honduran farmers classified corn growth in ten stages and knew the name of virtually every plant species found in their field and around their homestead. Yet, these same farmers generally believed in spontaneous insect generation.

Uneven distribution of IK can be due to knowledge being held by diverse groups based on gender, age, economics or individual aptitude. Some individuals are recognized as experts in their fields by community or family members and are key in the transmission and interpretation of knowledge. This specialized knowledge may often be kept secret or known only to a select few, such as elders, midwives or healers (Reijntjes 1992). For example, a study of Afghan nomadic pastoralists shows that women possess remarkable ethnoveterinary knowledge about the milking, birthing, and care of sick animals and that many of those insights are unknown to men (Davis 1995). In a study of rural Ghana, women were able to name an average of 57 products that could be harvested or produced from a nearby forest; while men could only name an average of only 14 (Owusu-Bempah 1988 cited in Collins 1991).

Although writers cite IK as dynamic, it may not be flexible enough in the context of social, political or environmental change. IK may disintegrate when people are faced with an environmental crisis or external interventions (McClure 1989; Farrington 1988). In some countries ethnic genocide threatens to obliterate whole cultures and the knowledge they possess. "Modern" values and technology, education, religion, the marginalization of agriculture and other factors have led to the loss of IK. Indigenous management practices, crop species, plant uses, agricultural tools disappear. A study of household gardens being carried out in Nicaragua, Honduras and Costa Rica found that as

the younger generation turns to modern medicines, the knowledge and use of medicinal plants is diminishing (Marsh 1994). Ironically, given the current economic conditions in these countries and government cutbacks in health care, western medicines are becoming increasingly unaffordable for the majority of the population.

When farmers have moved or are moved to new land with different ecological conditions, their IK may not apply. The lack of knowledge of the local environment and appropriate farming practices may lead to misuse of the land (Reijntjes 1992). An example is seen at the headwaters of the Pataste River in Olancho, Honduras. Immigrant farmers, practicing their traditional agriculture, cut down the forest exposing the earth to the rains. The soil quickly washed away to bedrock. (Bentley 1994).

Much has been written about the efficacy of traditional agricultural systems and indigenous knowledge as a means to develop more sustainable and appropriate agricultural systems (Altieri 1990; Chambers et al. 1989; Rhodes 1989; Warren 1991). Yet some small-scale traditional agriculture systems, including household gardens, remain largely invisible to both researchers and development workers.

2.9 Traditional Household Gardens (THGs)

Within traditional agriculture, household gardens are a notable example of sustainability that has increased the food security of people for centuries (Budowski 1990; Hoogerbruggee 1993). Accounts as early as 1950 call for the study of THGs in Central America:

> "A consideration of these native gardening techniques ... suggest that some of the problems of tropical and subtropical agriculture might be solved by the judicious blending of aboriginal and modern practices. At a time when the disastrous effects of over-cropping in the New World are of national

> and international concern (Vogt, 1948 cited in Anderson 1950:102), these balanced and productive Indian gardens deserve more than passing attention. They conserve humidity, they reduce erosion to a minimum, and they keep up fertility. They certainly seem more similar to natural vegetation, more likely to produce a permanent agricultural pattern than do our clean crop methods" (Anderson 1950: 102).

Four decades later researchers are still pointing to the potential of traditional household gardens, yet without attention given to their real and potential contributions to improve household well-being.

2.9.1 Definition of a THG

Wide variation exists in how researchers define traditional household gardens. In this study a traditional household garden (THG) is defined as:

> *a small-scale, low input and multi-layered agricultural production system located near the home dwelling. These gardens are developed by household members and are based on local knowledge and resources.*

This definition is general enough to encompass the variation that exists within traditional household gardens, yet identifies specific features that distinguish it from other types of traditional agricultural production systems. Most prominent among these features are location, size, diversity, and function (Brownrigg 1985).

2.9.2 Location and Size

Most definitions distinguish household gardens, in general, from other agricultural systems by their proximity to the household dwelling. Agricultural systems such as the multi-layered *conucos*, which are cultivated in the forests of Venezuela, are

excluded as a household garden in this definition. However, not all research on gardens makes a distinction based on location when defining gardens.

The matter of size is more ambiguous due to differences in definition of gardens and/or lack of defined garden boundaries. Generally in rural areas, the consensus is that gardens are small-scale when compared to other components of the household food production system. Yet, traditional household gardens may be extremely varied in size in response to local variations in topography, soil type, drainage patterns, cultural preferences, individual preference, economic standing of the family, family size, and age patterns.

Drawing from the available literature, an idea of the range in traditional household garden size can be gained from various cultural and geographic areas. The area households dedicate to gardening in the Mayan community of X-uilub in the Yucatán Peninsula of Mexico ranges from 2500 to 6400 square meters (Castro *et al.* 1993). In Chunchucmil, Mexico they range from 800 to 4000 square meters (Ortega *et al.* 1993). In the Philippines, the gardens extend from 300 to 500 square meters (Sommers 1980). In Java, the gardens in the Citarum River Basin average 314 square meters, while in Bantarkalong the average is 1500 square meters (Soemarwoto *et al.* 1979).

2.9.3 Diversity

Traditional household gardens are recognized as diverse agricultural systems, but how diversity is defined differs. Some authors refer to diversity in terms of ecological complexity: that is, a complex organization of plants which is ecologically stable. Others take the definition further and specify traditional household gardens as having a mutli-

layered structure which resembles the surrounding forest and promotes ecological stability (Gliessman 1990; Soemarwoto *et al.* 1991). These multi-layered gardens are found in South East Asia, in tropical Africa and tropical areas of Central America (Anderson 1993a & b; Landauer *et al.* 1992). In the tropics, THGs tend to mimic the natural, multi-layered rain forest ecosystem and include annuals, perennials and tree crops together with small animals.

2.9.4 Function

The definition of traditional household garden is further qualified by function. Household gardens in general are defined as low-cost and low-risk household level production systems designed to meet multiple household needs (Cleveland *et al.* 1985). Anderson (1950) describes a garden in St. Lucia, Guatemala: "It is simultaneously an orchard, a vegetable garden, a medicinal garden, a flower garden, a bee yard, a garbage disposal unit and a compost heap." THGs can contribute to household level food security and cash income, and they provide a site for agricultural experimentation and *in situ* conservation of biodiversity (Ninez 1990).

2.9.5 THGs and Food Production

A number of researchers have found that THGs play an important role in household food production (AVRDC 1988 cited in Soleri 1991; Brownrigg 1985; Christanty 1990; Omohundro 1985 cited in Soleri 1991; Stuart 1993). In the Philippines, traditional household gardens produce from 50-58 percent of recommended daily allowance (RDA) for calories and 40-41 percent of RDA for protein (Christanty 1990).

The *pekarangan* gardens of Indonesia provide up to 40 percent of the total calories and 30 percent of protein (Brownrigg 1985).

Only a few studies document the actual dietary contributions made by THGs in Latin America. One recent study in a Mayan village in the Yucatan Peninsula of Mexico, provides important information. Stuart (1993), using 24-hour diet recall, found that when plant and animal production of THGs were combined, THGs provided 11 percent of the energy, 10 percent of the protein, 47 percent of the fat, 55 percent of the vitamin A, 73 percent of the vitamin C, 18 percent of the riboflavin, 16 percent of the niacin and from 5 to 10 percent of the calcium, phosphorus, iron and thiamin to household diets (Stuart 1993). This study documents the actual contribution of THGs to household nutritional well-being.

Some researchers suggest that the amount and type of food produced in THGs is dependent on what is being produced in the other components of the household food production system (Anderson 1993a; Marten 1992). Marten (1992) states that most families do not find it profitable to devote much home garden space to crops that are high in protein or calories, because other components of the food production system can produce these nutrients more efficiently. This assertion is supported by Anderson (1993a), whose studies in Malaysia found that THGs are seen as a complement to rice production and provide the food that is eaten with rice.

Gardens are promoted by development agencies to achieve specific dietary needs, particularly deficiencies of Vitamin A. Model gardens have demonstrated that theoretically, household gardens can produce large amounts of Vitamin A. A garden

model promoted by the Asian Vegetable Research and Development Center (AVRDC) produced between 82 and 125 percent of the Vitamin A RDAs for a family of five from a 13.5 square meters space (AVRDC 1988 cited in Soleri 1991). In 1992, Soleri reviewed the studies that had documented household garden impact on Vitamin A requirements. In Poland, household gardens of pensioners produced 21-34 percent of their Vitamin A RDAs (Kleer and Wos 1988 cited in Soleri 1991). While in Newfoundland, 42 percent of a households Vitamin A needs were met through the household garden (Omohundro 1985 cited in Soleri 1991). These projects and studies point to the actual achievements and potential of "gardens," variously defined, to help provide for household dietary needs.

2.9.6 THGs and Income

Information on income derived from household gardens is not well documented. Gonzalez-Jacome (1985), found that productivity of THGs in Central Mexico can exceed that of larger cultivated areas. In a comparative study of traditional household gardens and larger-scale irrigation agriculture, Gonzalez-Jacome found that although the size of THGs was twelve times smaller than that of irrigated plots, the earnings per square meter of cultivated land in THGs was almost 13 times greater. Ninez (1985) in a study in Lima, Peru, found that THGs saved a family an average of US$300 over a five months time period through the production of food which would normally have been purchased in the market place. Garden produce added an indirect income of approximately 10 percent to households during the five month growing season.

2.9.7 THGs as a Site for Agricultural Experimentation

Traditional household gardens offer a small-scale and relatively risk free environment for agricultural experimentation. Anderson (1993b) found that gardeners in Malaysia are willing to take risks within household gardens. Anderson (1993b: 7) observes that, "these sites have neither the solemn social and cultural importance of rice nor the critical economic survival aspects of cash crops." Although the parallels are not exact between Malaysia and the Petén, similarities exist. While rice is the main food crop in Malaysia, in the Petén, the corn-based *milpa* plays a critical cultural and economic role in the lives of the peasantry.

2.9.8 THGs as *in situ* Conservation of Biodiversity

Traditional crop varieties are conserved in THGs in many areas of the world. In West Java, Karyona (1981) found over 500 species in 351 gardens. In his study of gardens in Merida, Mexico, Flores (1993) found 79 species. In one Mayan garden in the old town of Merida he found fruit trees (*Couepia polyandra*) that had been considered extinct. The few studies that exist which document the number and type of species found in THGs suggest that they are biologically diverse. The role of gardens as sites for *in situ* conservation of biodiversity is not explored in any depth and needs further investigation.

2.9.9 Terms for Gardens

Various terms have been used for traditional household gardens. Some of these terms conflict with each other, some overlap, some are mutually exclusive. Typically, these terms are regionally or culturally specific, yet researchers often do not address this fact. The first task of a researcher is to specify the region where the term applies. The

second task is to utilize a term that has some relationship to the term for household gardens as it is used at a local level.

It is instructive to recall a gardening project in Egypt cited by Cleveland where development workers used an Arabic term for gardens which meant formal pleasure gardens. When this term was used to ask if a family had a household garden, interviewers received a negative response (Cleveland 1991).

Terms used in the English language for traditional household gardens generally refer to one or more of the following: location, use, structure or geographic location. These terms include: house garden (Deneven *et al.* 1980; Padoch *et al.* 1991), home gardening (Uduwawela 1983; Marsh 1994), home garden (Anderson 1980; Gonzalez-Jacome 1985; Soemarwoto and Soemarwoto 1979); dooryard garden (Anderson 1950; Gomez-Pompa 1987; Kimber 1973), kitchen garden (Brierly 1976; Stravrakis 1977), house yard garden (Wilken 1971), house plot (Igbozurike 1976), household garden (Cleveland 1987; Ninez 1985); yard garden (Barrera 1980), orchard garden, mixed garden (Sommers 1980), multi-storied garden (Wilken 1972), tropical garden (Brierly 1985; Pinton 1985), and tropical home garden (Gliessman 1990).

The terms used in Spanish include: *huerta* or *huerto* (garden) (Gonzalez J. 1982), *huerta familiar* (household garden) (Barrera 1980), *huerto casero* (household garden) (Ninez 1986; Lok 1994; Marsh 1994), *huerto mixto* (mixed garden) (CARE), and *solar* (Barrera 1980; Vara 1980). The term *solar* refers to the area around the house as a social space (Caballero 1992). According to Caballero, the *solar* is where the family dwells and the locus of the social processes which involve the domestic group.

2.9.10 Traditional versus Promoted Gardens

A further distinction can be made between traditional and promoted household gardens. Traditional household gardens are those that are indigenous to an area, while promoted gardens are those that are introduced through outside agencies. These promoted gardens are typically styled upon temperate gardens that are high input systems in comparison to THGs. These temperate gardens usually appear as vegetable gardens planted in monocultured rows or beds (Brownrigg 1985; Marsh 1994).

2.9.11 THGs as a Diverse Ecological System

THGs represent a diverse agroecosytem. As such, THGs mimic the diversity and spatial arrangements of the forest environment. Soemarwoto (1991) has studied the gardens of Java and describe them as traditional agricultural systems that stimulate natural succession; each stage creating the physical conditions (light/shade, soil organic matter etc.) needed by the next.

Javenese gardeners mix a large diversity of plant species in small plots. Within one village, up to 250 different species may be grown: annual herbs, perennial herbaceous plants; climbing vines, creeping plants, shrubs and trees (Reijntjes 1992). Wilkens found a similar diversity in Atlixo, Mexico where both vertical and horizontal space is utilized. Wilkens describes,

> "The plot displayed a seemingly random horizontal distribution but rather carefully arranged four-tiered vertical distribution of tall trees; numerous medium-height trees and shrubs; and lower layers of high and low field crops interspersed with flowers and medicinal and cooking herbs. Economic vines twined into otherwise unoccupied spaces. The whole garden is fenced with additional productive and ornamental plants. Chickens and turkeys patrolled between plants and contributed in their way to this productive, three-dimensional space" (Wilken 1987).

This diversity creates a system, which recycles nutrients, creates niches for beneficial organisms, suppresses weed growth, while producing various items for household consumption year-round.

2.9.12 Gender and THGs

In Latin America, women are typically regarded as the primary gardeners, while men manage field cultivation (Brownrigg 1985; Ninez 1990). However, this idea needs to be tested against local observations (Brownrigg 1985). Additionally, in Latin America, participation in household food production activities is typically shared by all members of the family. However, the degree and type of participation by gender varies widely with ethnicity and region (Deere *et al.* 1987).

The issue of gender is closely related to the distribution of resources within households. A common assumption made in research on resource-poor households is that resources are distributed equally within households (Wolf 1991). Nevertheless, evidence shows that inequalities exist (Denen 1993). These inequalities can translate into poor nutritional status of women and young children (Cleveland 1991). Studies suggest that as a subsistence cropping system, such as a THG, become a site for income generation, control is lost by women and taken over by the male head of the household (Baser 1988; Collins 1991). According to Collins, "The tendency of new market-oriented activities to make inroads into self-provisioning spheres is a highly gendered process. The expansion of the male domain not only marginalizes women, but it also simplifies the array of environmental management practices that is available. In a similar vein, Dewey (1981) reports that as the space and time allocated to women's subsistence production declines,

the quality of rural diets decline as well. In contrast, garden projects, which are directed towards women, can make the distribution of household resources more equitable by providing food and a new source of income which women control (Cleveland 1991; Stravrakis *et al.* 1978). In summary, an examination of which households garden and who within the household participates in gardening needs to be examined on a community by community basis. Gender roles must be taken into account when promoting THGs as a shift in gender related roles relating to agricultural production within the household may shift access to resources within the household and affect the well-being of women and children.

2.9.13 Mayan Traditional Gardens

For over 500 years in Central America, traditional household gardens helped sustain the Maya civilization (Marcus 1982; Stavrakis 1978) and continue to be an important component of Central American subsistence food production (Caballero 1992; Gliessman 1990; Ninez 1990). In the Yucatan Peninsula, Mayans utilize THGs as one component of a small-scale food production system that typically includes an agroforestry garden, a fruit orchard and a *milpa* (Alcorn 1984, Barrera 1980).

In both Malaysia and the Yucatan, Anderson (1993a) observes that gardeners have tremendous knowledge of the micro-environments of their plots and the cultural requirements for, and use of hundreds of plant species. Gardeners balance innumerable elements when making planting decisions including pest susceptibility, the benefit of each plant, likelihood of theft and other hard-to-compare factors (Anderson 1993a). The successful management of a THG is no small achievement.

2.9.14 Temperate Gardens

Development workers tend to promote gardens modeled after temperate gardens of the industrialized world (Cleveland 1991). These temperate gardens depend on external inputs, i.e. seeds, tools, labor, fertilizers, insecticides, marketing organizations and nutritional education, that are not generally available to resource-poor households in the Third World (Bunch 1982; Cleveland 1991). Roland Bunch of World Neighbors discusses these gardens and why they fail:

> "Seldom do the gardens last for more than one to two years beyond the end of the program. A vegetable garden involves the introduction of not just one, but as many as ten new crops, many of unfamiliar taste, with all their particular cultural practices and problems with insects, disease, storage, and cooking. The necessary supplies are usually in such small demand that they are not locally available, and seed, if available has frequently been gathering dust on store shelves so long it will no longer germinate. Often women, who tend the gardens, have heavier workloads than men. Lastly, vegetable gardens normally grow only during the rainy season, when villagers often have plenty of free herbs that grow wild in their fields, and are more nutritious than most introduced vegetables. Often, these overlooked native vegetables are precisely the crops we should be promoting" (Bunch 1982: 127).

These gardens often require more time, energy, water or land than resource-poor households can invest (Cleveland 1991). Adoption rates are low and seldom extend beyond the involvement of the development organization. Development organizations frequently attributed lack of adoption to some shortcoming in the local population or a lack of institutional development. Seldom is the environmental or social appropriateness of the introduced garden technology questioned.

2.9.15 Invisibility of THGs

In part, these misplaced development efforts can be ascribed to the difficulties development workers have in seeing the traditional household garden. THGs can be socially, economically, and physically invisible to researchers and development workers (Anderson 1993: Chambers 1990). This relative invisibility may be attributed to several factors. First, THGs are affected by the same biases a top-down approach to development holds towards other subsistence agricultural systems (Cleveland 1991). Development workers may have preconceived ideas of what a garden should look like. Temperate gardens are composed of tidy rows of vegetables. In contrast, traditional gardens can appear to be an unplanned mixture of plants and animals. They can appear planted in pots, in logs, scattered under trees or in gullies. Chambers (1990) states that the biases of conventional development "screen out" diverse and complex agricultural systems. Even when researchers recognize the value of diversity and complexity, it is usually through alley cropping or line sowing rather than random plantings and broadcast sowing.

The second factor contributing to the invisibility of THGs is the perception that they are not an important production component in the household food production system (Cleveland 1991), despite evidence to the contrary (Soleri 1991). The quantity of food crops harvested from THGs at any one time does not appear to be great, especially when compared to conventional agricultural production. However, THGs produce small-quantities of highly nutritious foods over an extended time period and the yield per unit of land can exceed that of conventional agriculture (Cleveland 1991; Soleri 1991). In addition, THGs serve purposes other than food production. Other use items such as

medicine, fuel, fodder, utensils, and artisan materials are produced in THGs. Furthermore, households use the THG as a social space for family and community interaction.

The third factor contributing to the invisibility of THGs, is that they are associated with women's work (Chambers 1990). Although women are recognized as participants in agricultural production in the Third World, women's interests and their knowledge are largely ignored in the formulation of agricultural development projects (Chaney 1985).

Finally, THGS may be neglected in areas where there is a dominant "cultural superfood" such as rice (Anderson 1993; Chambers 1990). A similar dynamic seems to be taking place in Central America where the *milpa* has been both the economic and cultural focus of subsistence agriculture. This relative invisibility of THGs can contribute to academic neglect of an important subject matter and contribute to the failure of garden projects based on culturally and ecologically inappropriate models or knowledge.

2.10 Summary

From the point of view of conventional agricultural development, traditional agricultural practices must be modernized and traditional agriculturists need to be educated. From this point of view, the traditional household garden does not exist or is so unimportant that it does not merit attention. Advocates of traditional agricultural development as a basis for sustainable development recognize the existence of traditional household gardens and acknowledge that they have a potential to increase household well-being and food self-sufficiency. Many of these advocates applaud the "sustainability" of traditional household gardens. But by and large this recognition

extends only to the point of advocating further research (Altieri 1990; Chambers *et al.* 1989).

The research that exists on traditional gardens and gardens in general is scattered throughout both the biological and social sciences. Little documentation in the literature exists that links traditional household gardens to development efforts. When this connection is made it is usually only in a general sense, and speaks of the potential of THGs to improve household well-being or household food security. Reports from the practitioners who have documented their experiences with garden promotion strongly suggest a need to understand local gardening practices. When this has not happened it appears that the lack of a clear understanding of existing traditional household gardens results in less than successful garden promotion.

Chapter 3

Research Design

3.0 Introduction

This research brings together several under-researched areas: traditional agriculture, women and agriculture, and indigenous knowledge. Chapter three develops a research design and addresses the relative lack of established methods in the literature for carrying out this type of research. Multiple methods are an important strategy in developing and carrying out research that is exploratory from both a topical and methodological perspective. These research methods are described in this chapter.

3.1 Methodological Framework

This research draws upon qualitative inductive research and ethnography. Rich description, which is a central element of ethnography, is delimited by the scope and practical focus of this research. The qualitative inductive approach is bounded by an *emic* perspective. Qualitative inductive analysis is based on categories and concepts that reflect the knowledge of traditional household gardeners and the goal of developing a conceptual model of the local traditional household garden. Quantitative analysis of plant materials provides supporting evidence. The criteria used to choose the proximate method, concept or category is that which leads to the of development of the conceptual THG model.

3.2 Research Design

Following a qualitative inductive approach, the research design evolved over time as the researcher developed an understanding of the research area and research topic. The decision of *when* and *which* method to implement became apparent as research

progressed. As Schatzman and Strauss (1973: 7) describe this process, the researcher is a "methodological pragmatist, who sees any method of inquiry as a system of strategies and operations designed - at any time- for getting answers to certain questions about events that interest him [her]" (cited in Burgess 1982: 163).

The combination of methods used in this study opens up "enormous opportunities for the three major phases of research - design, data collection and analysis" (Sieber 1991:177). Sieber (1991) believes that it is this combination of methods that produces a distinctly new style of investigation. This integration of research methods is appropriate if not necessary in an interdisciplinary field such as Resource Development.

On a practical level the multiplicity of methods was a necessity as well. In Guatemala, where uncertainty and ambiguity are the norm, the best laid plans often fail. To reduce the likelihood of failure, it was necessary to develop multiple methods, duplication, and contingency plans. Brewer and Hunt (1989:17) describe this approach as a strategy to "attack a research problem with an arsenal of methods that have non-overlapping weaknesses in addition to their complementary strengths." Flexibility to choose from the various methods was maintained in the field to respond to the reality of the research situation. The political uncertainty within Guatemala intensified this requirement.

The major methods used for this research included: a strategy for gaining entry; rapid community appraisal; mapping techniques both of the communities and of the gardens; non-probability and theoretical sampling; focused key informants; participant observation; in-depth and unstructured interviews, opportunistic and chain interviews;

focus groups; a biotic survey and garden visits; and qualitative and quantitative data analysis. An overview of methods is presented in Table 1.

Table 1. Research Methods

* Introduction to the Community	* Garden Visits and Biotic survey
strategy for gaining entry	participant observation
rapid community appraisal	photography
community maps	mapping
community zones	botanical tour
	plant identification
* Sampling Strategy Developed	
chain and opportunistic interviews	* Focus Group
focused key informants identification	verification of findings
access to focused key informants	
research and intellectual property rights	* Visits to Gardening Projects
reciprocity	six community visits
	four NGOs interviews
* Focus Unstructured Interviews	
	* Data Analysis
	qualitative inductive
	quantitative analysis of plant data

3.3 Overview of Research Methods

Gaining entry and sampling were the two areas which required the most flexibility and were the most difficult to gauge before entering the field. Rapid community appraisal occurred shortly after gaining entry. Opportunistic and chain interviews assist in the identification of focused key informants and occurred throughout the research period. In-depth and unstructured interviews were conducted with knowledgeable gardeners as focused key informants and with development workers. Mapping of each garden assisted

in understanding and interpreting each garden. Quantitative methods considered were a community survey and a biotic survey. The community survey was considered as a means to develop a profile of community gardeners and gardening activities, but was discarded as an inappropriate instrument (see section 3.4).

3.4 Qualitative Inductive Research

In this study, qualitative inductive research builds theory in the areas of traditional household gardens, indigenous mechanisms of knowledge diffusion, women and agricultural development and the integration of indigenous and scientific knowledge. In the process of discovering theory, the categories and concepts derived from the qualitative data to order and interpret observations were: indigenous concepts of gardening, plant names, plant uses, and management practices (Glaser 1967; Charmaz 1988).

The literature review provides the theoretical context in which the research takes place and suggests possible categories and concepts to explore. This is in contrast to what Glaser and Straus advocate in qualitative inductive research. They suggest going to the field without any preconceived ideas about the theoretical framework that informs the topic under investigation (Glaser and Strauss 1967:33). This advice seems to presuppose the ability of the researcher to reflect on and consult with existing theoretical ideas. For the beginning field researcher, especially those working in remote areas of the world, this is not always feasible.

3.5 Attitude

In this research of traditional household gardens, a reversal of behavior and attitude towards study participants was a prerequisite (Chambers 1994). The role of the researcher was one of student while the role of the gardeners was that of teacher. Underlying this premise was a respect for gardeners as people and a desire to learn from them (IDS Workshop 1989). In the past, attitudes generated in conjunction with a top-down transfer of technology (ToT) approach have precluded learning from rural people (Rajasekaran 1994). Often this is a reflection of an underlying conviction that the modern specialized knowledge of the outsider has a universal validity and application which should override whatever rural people know.

3.5 Site Selection

The loci of this research are the communities of San Jose and Santa Ana (Figure 1). These communities were selected as the site of study because they are both located in the same phytogeographic region considered the Northern Petén (Lundell 1937). Each community has a clear ethnic identity and there appeared to be a potential for traditional gardening activities and knowledge in both communities. Also, both communities are approximately the same distance from the regional market center.

3.5.1 San Jose

San Jose was chosen as the initial site for study because of its unique Mayan identity and lengthy history of settlement. San Jose is the only community in the Petén that identifies itself as Itza Mayan. Reina (1962 cited in Schwartz 1990) believes that San Jose may have been settled before the conquest. In fact, he suggests that many present-

day families are descendants of these early Itza Mayans. This identification offers some control over the often ambiguous issue of ethnicity. In the Petén, ethnic identity is a social perception (Atran 1992; Schwartz 1990). Choosing communities with clear ethnic identities ameliorates this complexity.

The length of settlement in the region implies a strong possibility of extensive agroecological knowledge in San Jose. This in fact, has been shown in other Mayan communities in the Yucatan Peninsula of Mexico (Alcorn 1984; Nations 1980; Redfield *et al.* 1934; Roys 1931). Although little research has been done on the Itza Maya, Atran (1992) has studied the agroforestry knowledge of this group. This knowledge is expressed through a complex plant taxonomy and detailed plant use. A number of the plants documented in Atran's study were encountered in traditional household gardens. Taken jointly, the Yucatan Mayan and Itza Mayan studies suggest that this agroecological knowledge may extend to THGs in the Itza Mayan community as well. Given this potential, San Jose forms the benchmark standard for comparison.

3.5.1.1 San Jose - A Community Description

The community of San Jose is situated on the steep northern shore of Lake Petén Itza and is the seat of the municipality of San Jose. Local businesses include a number of carpentry shops, a few small grocery stores, a bookstore and a welding shop. There is no central market in San Jose. The supplies for these businesses are purchased across the lake in the urban complex of San Benito, Santa Elena and Flores or in Guatemala City. Transportation to the neighboring towns is by launch or by bus. Launches leave periodically for the 3.5 kilometer trip to San Benito, Santa Elena and Flores and return in

the afternoon. The bus leaves for the 21 kilometer trip to the same communities in the early morning and returns in mid-afternoon.

San Josenos, in general, are proud of their identity as Mayan and are trying to protect this identity. Outsiders are not allowed to settle in the community. When colonists or other outsiders have asked for land they are sent to other *aldeas* or villages in the municipality. The community is composed of 504 households with a total population of 2,567 (*Direción General de Estadisticas* 1995). Most San Josenos are agriculturists and/or day laborers in San Benito, Santa Elena or Flores.

3.5.2 Santa Ana

The selection of Santa Ana as a site of study hinges on its clear *ladino* (*mestizo*) identity (Schwartz 1990). The *ladinos* of Guatemala are either descendants of Spaniards and indigenous people or are indigenous people who have adopted a non-Indian culture. Santa Ana was established between 1700 and 1710, when the Spaniards relocated Indians from Tipu, Belize, and various parts of the Petén (Soza 1990, 1992). As in San Jose, the length of settlement in the region suggests the existence of local agroecological knowledge. Evidence points to the existence of *ladino* THGs. A preliminary investigation of household gardens conducted by Schwartz and Soza indicates that diverse and complex *ladino* gardens exist in Santa Ana (Schwartz 1990; Schwartz pers. com. 1995; Soza 1990, 1992).

3.5.2.1 Santa Ana: A Community Description

Santa Ana is located about 18 kilometers south of Lake Petén Itza and is the seat of the municipality of the same name. There are several small grocery stores, a pharmacy,

a few small restaurants, a butcher shop and a saw mill in the community. Supplies for these businesses come from San Benito, Santa Elena and Flores or Guatemala City. Santa Ana is located on the main route to Guatemala City. There is daily bus transportation to and from Flores and Guatemala City. Generally, there is bus service to Flores in the morning and back in the afternoon, but the schedule is irregular.

The community consists of 1506 households with a total population of 6, 569 (*Direción General de Estadisticas* 1995). Colonists are welcomed into the community and are given land on the outskirts of town. Most Santecos and colonists are agriculturists and some work off-farm on cattle ranches, and/or by collecting *xate* (a plant exported to the United States and used in floral arrangements). Some people work in the urban complex of San Benito, Santa Elena and Flores as day laborers.

3.6 Gaining Entry

Gaining entry was a crucial aspect of this research. The strategy devised for gaining entry included introductions to NGOs with gardening projects in the region. It was also facilitated through association with a long-time researcher, who was a trusted friend to many in the region. The difficulty in establishing a relationship of trust can best be understood in examining the social divisions which exist between "insiders" and "outsiders" in the region. These divisions run along class lines and between native Peteneros and colonists. A quote from a native Peténero in Reining (1992: 66) illustrates this class division, "If you are not poor and rural, you are an outsider." A passage from *The Forest Society*, a social history of the Petén, explains the division between native Peteneros and colonists, "the importance of being *conocido* (known and familiar in a

given place) has been heightened by real and imagined threats from the large number of *colonists* to Petén, and sadly, by the political violence that became widespread in the region beginning around 1982" (Schwartz 1990: 222).

In the Petén, loyalties and obligations center around the household. Schwartz describes, " a man's first and major obligation [in the Petén] is the material support and defense of his household against the outside world, and a woman's is proper internal maintenance of that same unit" (Schwartz 1990: 230).

Personal relationships and networks were not the only strategy needed to gaining entry. A knowledge of the recent relational history between each community and NGOs in the region, combined with an understanding of the political division in each community, was imperative. In some instances the presence of NGOs had created or deepened community divisions. In other cases promises had been made but not kept, in others intra-household gender relationships had been challenged. It soon became apparent that the presence of NGOs in the region contributed to community divisions and accentuated community attitudes towards outsiders.

Despite these difficulties, these organizations were able to provide introductions to key community members. Given the distinct histories of each community relating to the above mentioned factors strategies for gaining entry differed by community.

3.6.1 San Jose: Gaining Entry Procedure

As a result of past interactions with NGOs and researchers, gaining entry in San Jose was problematic. During initial introductions, a community leader in San Jose revealed that the community was closed to new researchers. Without the endorsement of

individuals who were trusted in the community, research would not have been allowed. This closure may not represent a policy supported unanimously or with equal force by all individuals in the community. However, it highlighted the importance of affiliations with individuals who were known and trusted within the community. It also clarified the need to have an understanding of the political divisions within the community.

San Jose's experience with researchers and development organizations had produced two distinct consequences. The first related to an influx of monetary and personal benefits. The second related to intellectual property rights. The uneven distribution of benefits by researchers and development projects in the community created or widened existing political cleavages within the community. The issue of intellectual property rights in the form of ownership of knowledge was not as obvious and came to light only after several weeks in the community.

San Jose had been the center of much attention given its position as the last/only Itza Mayan community in the Petén. Within this context, research had centered on the Itza Mayan language, indigenous use of the forest and medicinal plant knowledge. Some members of the community viewed the research on these subjects as an extractive process. They believed that these researchers had returned to their home countries to publish books and profit monetarily from their publications. Whether this was accurate or not is not the issue. Rather some members of the community felt that it was *their* knowledge that had provided the benefits that had accrued to outsiders. It was communicated that neither the community nor the knowledge holders had received a share in these profits, nor had they been recognized as the owners of knowledge or

language. The small sums that key informants had received as payment for their work were welcome to those who had few resources. However, these payments only served to add insult when compared to the imagined sums earned by the researchers.

It was hard to judge how widely held these opinions were. But the discussions served to reinforce the need to clearly address the issue of intellectual property rights with each participant during the entry process.

Past events had created an environment where a carefully crafted and sensitive strategy for gaining entry was critical. A clear discussion as to the purpose of the research and who the beneficiaries were was imperative as was a consistent attitude of respect. The intent of this investigation - to benefit other Petén families who did not know how to garden - began to establish the preliminary basis for a partnership between knowledgable gardeners, new gardeners and the researcher. The focus on indigenous knowledge of gardeners with the gardeners as teachers and the researcher as student helped reassure participants that their intellectual property rights would not be violated.

3.6.2 Santa Ana: Gaining Entry Procedure

Gaining entry in Santa Ana was not as problematic. A brief visit to the mayor's office served as an introduction. Contact with the local Peace Corps volunteers and a local governmental organization provided introductions to some of the women in the community. To gain entry to individual participants, a brief introduction and explanation of the research sufficed.

Cultural differences between San Jose and Santa Ana were clear in this context. In addition, each community had had different experiences with outsiders. Santa Ana had

one of the first Peace Corp volunteers in the Petén stationed there in 1993. The volunteer's stay seemed to have been viewed positively by the community. Santa Ana had not received the interest of researchers, nor had many NGOs worked there.

3.7 Reciprocity

Packets of non-hybrid seeds of varieties appropriate to the humid tropics were given to participants during the first or second household visit. A concern that could not be resolved until research began was whether these seeds could alter the native germ plasma of the region. For this reason corn, which could readily cross-pollinate with existing traditional varieties in the region, were not included. Yet upon arriving, the issue of contamination seemed to be moot. Seeds from outside the Petén were available in the local markets and people obtained plant material in Belize. In addition, introduction of new varieties and species had occurred in the region since the time of the ancient Mayans. Not only were the seeds a welcome gift, but the gesture fit well with the established custom of sharing seeds and plants.

During the final days of the study in each community, families were asked if they would like photographs taken of family members. This was done as an expression of gratitude and to help solidify relationships for future research in the area. These photographs were sent to the communities after research had been completed along with letters of appreciation.

3.8 Rapid Appraisal

A rapid appraisal (RA) of both communities was used to gather preliminary data by walks through San Jose and Santa Ana during the first week in each community. This

method provided a fast and flexible means to obtain a general knowledge of the communities and develop preliminary hypotheses. Diversity of analysis through 'triangulation' or the use of several different methods and sources of information was an integral part of this RA (Conway 1990). Direct observation and unstructured interviews while walking through the towns revealed topography; layout of the town; water sources; waste disposal; house construction types; agricultural practices; income-generating activities; transportation systems; and the presence of markets, churches, and health care services. A more focused objective was a preliminary examination of garden types, location, and size. A rough map of each town with important features was drawn during the appraisal.

3.9 Establishing Zones

A zoning system was used in the selection of focused key informants. The zones represented distinct geographic areas which roughly corresponded to income levels. This zoning system draws from a housing composite index developed by Schwartz (1990) as a surrogate for income. Six zones were drawn in San Jose and seven in Santa Ana to represent different areas of the community based on distance from the central plaza and socioeconomic levels. Vara (1980) gives support for this method. In a gardening study in a Yucatec Mayan community, Vara found there was a direct relationship between structural diversity of gardens and distance from the center of the city.

3.10 Survey

A survey was developed to be administered during the first weeks of field research in each community, but was not used. The purpose of the survey was to establish

a demographic profile of gardeners. The basic questions asked by the survey were to be used to determine who gardens and why people do or do not garden. It was also designed to provide a preliminary description of the gardens in each community. Support for this method is given by Sieber (1991) who states that a survey can be used to complement field research to "develop a statistical profile of the population containing the units to be observed" (Sieber 1991:184).

The questionnaire was reviewed by colleagues at both Michigan State University and a Guatemalan development organization. It was translated by a trilingual Guatemalan women who is highland Mayan. It was expected that modifications would have to be made in wording of questions to conform to local Spanish.

Despite the care given to crafting the questionnaire, in the field it became obvious that it was an inappropriate research instrument. Shortly before leaving the United States, contact with researchers who had recently returned from the Petén revealed that in the recent years two major surveys had been done in San Jose. It seemed to these researchers that people had learned how to respond to surveys in ways that reflect what the researchers wanted to hear (Schwartz 1995 pers. com).

Initial field testing revealed that the questionnaire was culturally inappropriate and would not yield meaningful data. Not only were some of the questions culturally irrelevant, but there seemed to be no specific name for traditional household gardens. A survey could not be conducted about something that seemed to have no name (detailed in Chapter 4). Yet developing the questionnaire had not been a useless exercise. Many of the topics addressed in the questionnaire were appropriate such as who in the household

gardened, most common plants and their uses, sources of plants, problems encountered in gardening, etc. These were incorporated into unstructured interviews of focused key informants and participant observation.

3.11 Focused Key Informant

In this research, knowledgeable gardeners served as focused key informants. In traditional ethnography, key informants are used to understand the social and cultural patterns of a group. In applied research, focused key informants who have specific knowledge are interviewed when information on a particular topic is needed (Tremblay 1982). In this case, the setting is the traditional household garden, the purpose is to develop a basic conceptual garden model to guide garden promotion for new colonists..

Selection of focused key informants adapts the criteria used by Tremblay (1982). Focused key informants must exhibit:

- *Knowledge.* The informant has specialized information on traditional household gardens.
- *Willingness.* The informant is willing to participate in the study.
- *Communicability.* The informant is able to communicate his or her knowledge effectively to the researcher.
- *Impartiality.* Ideally the informant should be unbiased. If there are reasons for bias the effect it has on research should be examined and acknowledged by the researcher.

3.12 Non-probability Sampling

Focused key informanats were selected using a non-probability sampling technique in each community. Non-probability sampling demands a clear-cut definition

of the universe about which the sample is intended to provide information (Honigmann 1990). Focused key informants were selected from two main groups, Itza Mayans and *ladinos*. Selection of focused key informants was dependent on their having specialized knowledge in gardening or plant use.

3.13 Focused Key Informant Identification

Focused key informants were identified through referrals, and chain and opportunistic interviews. In San Jose, various local and regional development organizations provided a list of people with whom they had worked as gardeners or they knew to be either knowledgeable gardeners or people knowledgeable about native plants. Some gardeners and knowledgeable people appeared on more than one list. In Santa Ana, an international volunteer, a gardening group, and chain and opportunistic interviews provided a list of focused key informants.

The original research design had anticipated using women's gardening groups in both communities as a source of focused key informants and/or as a focus group. In San Jose, the groups had disbanded. Two NGOs had attempted to establish gardening projects, but they had withdrawn from the community. One was due to personal problems within the NGO which had nothing to do with the community. The other was due to political conflicts between the community and the development organization. In Santa Ana, the gardening group served as a source of referrals, key informants and as a focus group.

3.14 Sample Size

The number of gardeners involved in the study was dependent on the range of types of gardens found and willingness to be participate. Twenty gardeners comprised the sample group, ten in San Jose and ten in Santa Ana. Two additional gardeners and gardens were visited in Santa Ana. These visits served to verify that a theoretical saturation point had been reached. In other words, no additional data were found that added to the development of categories pertinent to the study or to the development of the THG model. Glaser and Strauss state that it is this saturation point that signals the time to move to new groups and/or new categories (Glaser and Strauss 1967).

Similar research on THGs indicates that the number of gardens included in a study varies widely. Caballero (1992) examined 60 traditional Yucatan Mayan gardens in ten different villages, Rico-Gray in a comparative study in two Mexican villages visited 42 gardens, a study in Honduras and Nicaragua included 20 household gardens in each country (Marsh 1994), while a study carried out in X-uilub, Yucatan included nine gardens (Castro *et al.* 1993).

3.15 Chain and Opportunistic Interviews

Chain interviews started with an interview or group discussion following the procedures described by Rocheleau, Wachira, Malaret, and Wanjohi (1989). The discussions often led to additional informants and sources of information. In this manner knowledgeable gardeners, specialists in the communities and a range of topics pertaining to gardening knowledge were identified. Opportunistic interviews occurred when the opportunity presented itself whether in the market, on the street, or in a field. As

Rocheleau, Wachira, Malaret, and Wanjohi (1989) describe, it is difficult to predict the type of information that can be obtained through these interviews. In this research the people interviewed in this manner functioned as peer group referrals and were asked who they consider to be knowledgable gardeners in their community. Again, other topics relating to THGs were also discussed.

3.16 Selection of Focused Key Informants

Selection of focused key informants was made from the lists developed through referrals, chain and opportunistic interviews. The selection of participants was designed to gain a cross section of key informants across socio-economic levels.

Selected gardeners were interviewed and garden visits conducted. The more knowledgeable the gardener the more she or he could contribute to the development of categories and concepts, similarly the more complex the garden the more it contributed to the emerging model. These more knowledgable gardeners and more complex gardens were visited more often.

Interviews were scheduled to correspond with the time of day when gardeners were least busy, after 10:00 a.m. when morning chores were done and after 3:00 p.m. when afternoon work had eased and visiting took place in the communities.

3.17 Gaining Access to Key Informants

In San Jose, it was soon apparent that an association with community groups and organizations was not sufficient to gain access to gardeners in the community. The first interviews were met with distrust and reserve. A local person was needed to act as a liaison to facilitate initial contacts. Two people, a man and a woman, were chosen to act

in this capacity. These individuals were well known in their community, could communicate effectively, were actively involved in community activities and showed an interest in the research.

The relationship with these individuals began on an informal level. General conversations about themselves, their families and their community helped establish rapport. A visit to their "gardens" served a dual purposes. The visit provided a mechanism to explain the research objectives and methods to these potential assistants. In addition, the visits offered an opportunity to field test methods and receive feed-back from each assistant.

3.18 Unstructured Interviews

Unstructured interviews, as used in this research, were governed by the objective of understanding local THGs. Structured questions in this context would have been too narrow. Tremblay (1982: 99) describes the interview process used with focused key informants as follows:

> "It [the interview] is structured in the sense that the interviewer ... has a framework of questions in mind. This framework, which gives an idea of the type of material sought and which limits the universe to be studied, is told to the key informant at the beginning of the interview in order to give him some orientation. If the informant's conversation is irrelevant to the topic or if he veers repeatedly from the main focus of the interview, the research worker interjects comments or questions to draw him back, but without forcing him to adopt a predetermined pattern of conversation."

This type of questioning, in the context of a methodology focusing on gardeners' knowledge, required broad, open-ended questions which allowed the interview to move to the areas deemed most relevant by the gardeners themselves. In order to elicit

discussion on traditional household gardens, specific reference had to be made to the *sitio* as a planting space, to plants, and to their cultivation and use.

3.19 Participant Observation

As knowledgeable gardeners and their gardens were identified in each community, observation of gardeners and various gardening activities occurred. Immersion in the garden setting allowed for observation of activities in context. A walk through the garden provided an opportunity for the gardener to introduce his or her garden. Later visits included a tour of the garden in which the gardeners described and discussed the plants in their garden and their uses. Management practices were observed and discussed during each of these visits. Utilizing both unstructured interviews and participant observations allowed for verification by comparing descriptions of gardening activities by gardeners with what was observed by the researcher.

3.20 Recording Data

In order not to arouse suspicion, only minimal notes were taken during the interviews which addressed sensitive issues such as family size, land holdings, employment, etc. Interviews were recorded as close to verbatim as possible after the interview had concluded. Notes were taken during garden visits and discussions of management practices. Photography was used as a means to record various aspects of the gardens; these included activities of gardeners, specific features of the gardens, plant location and unknown species. The photographs were used during data analysis for plant identification and as verification of garden mapping.

A map of each *sitio* noting location of plants, structures, water source and other pertinent information was made after each garden visit. A more participatory approach had been planned for drawing maps as suggested by Lightfoot, Feldman and Abedin (1994). However it was felt that working with gardeners to draw maps of their *sitio* would elicit more distrust than it would illuminate the research topic.

3.21 The Garden Visit

A garden visit took place during the first or second contact with each household. If the visit was not completed during the initial visit due to its complexity or special features it was completed during subsequent visits. In each instance, after the focus of the research was explained, the household selected the person they considered to be the primary gardener of the household. Questions were designed to allow gardeners to describe their gardens in their own terms. For example, gardeners were asked to point out the plants that were grown in the garden that had "use." When the gardener indicated a plant, he or she was asked what use or uses it served. As the visit progressed fewer prompts needed to be given as the gardeners became more enthusiastic in describing the garden.

3.22 *Sitio* Size

It was inappropriate for the researcher to measure the size of the *sitios* in either community. Therefore, most measurements are those given by the gardeners themselves, measured in *varas*[6]. Occasionally the measurements were not known by the household

[6] A vara is the distance from the tip of the middle finger to the edge of the breastbone, approximately 30 inches.

and were estimated by the researcher. Because the space in the *sitio* that was not occupied by a structure was a potential site for planting and utilization of the space was dynamic, the measurements given for the THGs in San Jose and Santa Ana represent the overall size of the *sitio*. The size does not take into account the space utilized for other activities nor does it take into account the area occupied by structures. "*Sitio* size" is therefore only a rough indicator of the space available for planting.

3.23 Plant Identification

Common names used by the gardeners formed the basis for scientific plant identification. Species were counted as indicated by the gardeners. The exception to this was mass-plantings of annuals. The gardeners did not want to estimate the number of plants and it was not efficient for the researcher to count each plant. These types of plantings tended to be of a similar size and were uniformly estimated as containing twenty-five individual plants.

Gardeners knew individual plant names in Spanish, in Mayan or in both languages. Prior to field research a study of 150 plants (Ruonavaara 1995) which have household use and are found in the Petén was completed by the researcher. This included information relating to scientific names paired with common names in Spanish and/or lowland Mayan, a botanical description of the plant, and where the plant was found, i.e. forest, *milpa* or garden. This study served as a means to match common names to scientific names.

A large number of technical and non-technical sources were consulted for this reference, including Millspaugh's (1903) work, *Plantae of the Yucatánae,* Cyrus L.

Lundell's (1937) classic, *The Vegetation of the Petén*, Atran's (1992) article, "Itza Mayan Tropical Agro-Forestry", Arvigo's (1993) work, *Rainforest Remedies*, on Mayan medicinal plant use in Belize and Simon Comerford's *Medicinal Plants of San Andres, Petén, Guatemala* (1995).

A visit to the Herbarium at the University of Michigan, which houses Lundell's collections, provided an opportunity to photograph various specimens. These were used to help familiarize the author with types of plant species commonly found in the Petén. Two local experts provided assistance in plant identification while in the field, a former *chiclero* and an Itza Mayan who was also a local botanical specialist. The *chiclero* is responsible for the supervision of experimental plots of native plants for a local development organization. He has an extensive knowledge of forest plants developed during many years working as a *chiclero*. *Chicleros* spend many months living in and off the forests while "cutting" chicle (the main ingredient used in making chewing gum). They are well known for their extensive knowledge of forest plants and their uses, especially medicinal. The botanical specialist maintains a botanical trail for a local development organization. A tour of the trail provided an opportunity to learn local plant names in Spanish and Itza Mayan and take photographs of 40 different species. These were later used as a cross-reference to assist in plant identification.

Identification of ornamental plants presented the greatest challenge. This is in part due to the lack of botanical studies identifying these plants and to the lack of a local name. Despite the lack of scientific or local names, these plants are counted as separate

species. Care was taken not to double count any of these species by taking photographs and written descriptions of species that were "unknown by gardeners."

3.24 Diversity Index

A Brillioun diversity index was used to compute and compare the diversity between *ladino* and Itza Mayan gardens and between colonist and native Peténero gardens. A diversity index combines both abundance or number of plants and richness or number of species into a comparable measurement. A Brillioun index is recommended when the community under question is completely censused such as in a biotic survey of a household garden (Magurran 1988). The index was calculated using the formula[7]: $HB = \ln N! - \sum \ln n_i! / N$ and rarely exceeds 4.5 .

3.25 Focus Group

During the final stage of research a focus group of gardeners was formed in Santa Ana. They served as a means to both clarify and verify the emerging THG model. The focus group consisted of four women who had participated in a communal gardening project in the community.

The women chose an afternoon meeting time. A cordial relationship had been established with the women during the earlier phases of research. A funnel discussion technique was used to gain an understanding of: 1) the women's experiences and problems encountered in the communal garden project they had all participated in; 2) their own traditional gardens, including problems, what they planted and why; and 3) the process of establishing a new *sitio*.

---

[7] N = total number of plants; n_i = number of plants per species.

3.26 Qualitative Data Analysis

Qualitative inductive data analysis occurred simultaneously to data collection. Patterns emerged, were analyzed and directed the researcher where to proceed next. As Burgess (1991: 209) describes, in this type of study "research does not occur in 'stages' and does not follow a linear path, but instead is a social process, in which overlap occurs, between all areas of the investigation."

In this investigation, analysis of data occurred both in the field and at Michigan State University. Ideally, qualitative inductive analysis occurs as the research evolves in the field. However, this was not always feasible. Coding was done on each interview, both while the interview was occurring and in a more formal process after each interview. Comparisons were then made between gardeners and gardens on what categories and concepts occurred most frequently.

Clarifying the cultural construct of "garden" and related terms dominated the first stage of research. The major categories of indigenous knowledge which emerged during field research included management practices, plant names and plant uses. The initial discovery process of local terms and concepts unfolded in the following manner. During the initial phase of research in each community (rapid appraisal, chain and opportunistic interviews) people were asked if they had or if they knew of any one who had a *huerto familiar, huerto casero* or *huerto mixto*. People uniformly answered negatively. People were then asked if they personally *planted* plants for home consumption or sale around their home. There was little response. Yet a profusion of flowering shrubs, fruiting trees and potted plants surrounded most homes and were clearly visible to any passerby. People

were asked what they called the place where they *had* plants. People responded to this question. They were then asked about plants that they *had* in this space and that had *use*. Utilizing this phraseology elicited a discussion.

The technique used to ensure that an inductive process took place in this process was multi-faceted. It consisted of: 1) a search for questions which gardeners were willing and able to answer; 2) visual clues to what gardeners did as a reflection of their knowledge; and 3) minimal direction of conversations in which gardeners were encouraged to talk about what was important to them.

3.27 Research Constraints

In Guatemala, the threat of violence for both researcher and research participants acts as a constant constraint on scholarly or journalistic inquiry in the region. A researcher must at all times be highly conscious of these underlying dynamics and shape their data collection methods accordingly. Modes of inquiry, lines of questioning and relationships with informants must be guided by an awareness of these constraints.

Chapter 4

Findings and Data Analysis

4.0 Introduction

This research provides a description of traditional household gardens in the Petén based on the knowledge of local gardeners and culminates in a conceptual THG model. On a theoretical level the study of traditional household gardens in the Petén provides a space for the examination of the bio/physical and social aspects of a small-scale traditional agriculture system. On a practical level the conceptual THG model serves as a guide for extension efforts to promote gardens among newly arrived colonist households.

The THG model emerges from: 1) a local concept of traditional household garden, which views gardening as an activity; and 2) the knowledge of local gardeners. The main categories of gardening knowledge include: plant names, plant uses and garden management practices. An analysis of this information provides a means to compare the gardens and gardeners in San Jose and Santa Ana along lines of ethnicity and origin. This comparison is used to determine if more than one type of traditional household garden exists in the Petén and to highlight the similarities and differences encountered between Mayan and *ladino* gardens and between colonist and native Peténero gardens. Gardens promoted by NGOs in the region are compared and contrasted with the local traditional household garden to provide further insights. From this research a conceptual model of the traditional household garden is detailed and the theoretical and practical implications for garden promotion are discussed.

4.1 Discovering Local Gardening Concepts and Terms

The local concept of a "traditional household garden" is a dynamic process of growing plants in the space called the *sitio* (the area surrounding the home). The planted space of the *sitio* is multi-layered, multi-specied and intensively planted. The process includes growing, using and exchanging plants and gardening knowledge. This process is dynamic in the sense that the composition of plants, complexity of the planting in the *sitio* and the knowledge relating to the growing of plants evolves over time.

The local concept of a "traditional household garden" has no specific name. When gardeners in San Jose and Santa Ana were asked if they had a *huerto familiar, huerto casero* or *huerto mixto*, the terms used by researchers and development workers to refer to gardens in general, they uniformly responded that they did not. To native Peteneros and colonists, a *huerto familiar* is a vegetable garden (i.e. temperate garden), *huerto casero* is an unfamiliar term, as is *huerto mixto*. Atran (1992) cites "house garden" in Itza Maya as *paj-jol-naj*. However, only a small number of Itza Mayan-speaking people remain in San Jose. Neither the gardeners interviewed in San Jose nor the general population of the community recognized the term.

Yet, research done on Mayan gardens in the Yucatan refer to traditional household gardens as *huertos familiares, huertos caseros* or *solares* (the Mexican term for *sitio*). Development workers in the Petén refer to traditional household gardens as *huertos familiares* or *huertos mixtos*. Yet, people of the Petén do not use any of these terms to describe their traditional household gardens. In anthropologic terms, *huerto familiar, huerto casero* and *huerto mixto* are *etic* concepts which do not "fit" the *emic* concept of

traditional household gardens. It is interesting that, development workers in the Petén, researchers in the Yucatan, and the literature on traditional gardens in general has not addressed the concept of "garden" or the terms used to refer to traditional household gardens from an *emic* perspective. Furthermore, development workers in the Petén are generally unaware of a parallel cultural construction of "garden."

This dissonance in garden and gardening terminology between local people and development workers or researchers may reflect a clash of two distinct views of "development." One represents an *emic* view of "development" from inside a community and culture; the other an *etic* "development" delivered from outside. The imposition of terminology and the attendant technology of temperate gardens by development workers or "outsiders" in the Petén carries with it a cultural interpretation and a relationship of dominance. This imposition onto an existing technology or system undermines the traditional meaning of garden and promotes the introduced temperate style of gardens. It would not be surprising to find resistance in the form of non-adoption of terms on the part of those on the receiving end of the imposed technology and attendant terms. Recognizing the potential for a "cultural clash" over basic definitions of terms and concepts has profound implications for development, as well as for research.

The significance of the lack of a specific name for traditional household gardens used by the gardeners themselves deserves discussion as well. A number of possible explanations exist. This namelessness may be the result of the multiplicity of use of the area, cooking, eating, washing clothes, wood cutting, playing, visiting, etc. No one activity takes priority over the other such that it has received a name in and of itself. It

may also indicate the integral part this planting system plays in people's lives, so much so that it is not separated from other activities. Or it maybe be that the gardens are seen as an extension of the surrounding environment - an extension of the forest. The society of the Petén has been called a forest society (Schwartz 1990). This connectedness to nature contrasts with the Western world view of humankind's separation from and domination of nature. Insufficient evidence exists at this time for a conclusive analysis of these issues. However, what is clear is that in Santa Ana and San Jose the "traditional household garden" is a complex set of activities which are carried out within the sitio.

4.1.1 The Sitio

The sitio serves multiple purposes. It is as an eating space; a place to wash clothes and bathe, to split wood, to socialize, and to prepare food; it is a play area for children; and a place to raise plants and animals. A portion of the *sitio* is occupied by fixed structures, i.e., house, outdoor kitchen and sitting area, the *pila* or wash basin, animal pens and a latrine. The remainder of the area is typically filled with plants. The size of the *sitio*, in part, determines the number of plants that can be planted. The average size of the *sitios* in San Jose and Santa Ana do not vary significantly (Table 4). The average *sitio* size in San Jose is approximately 4648 square feet, while in Santa Ana the average is approximately 5161 square feet. There is more variation in size in San Jose with a range from 1400 to 18,750 square feet, while those in Santa Ana range from 1200 to 10,890 square feet. The smaller areas are those located closer to the lake[8] (in San Jose) or center of town, (in Santa Ana) while the larger areas are on the outskirts of town. The two

[8] With the exception of the smallest garden in San Jose, which was a corner lot whose size was reduced when the roads were paved.

largest *sitios* in San Jose are newly established households on the outskirts of the community. Each family has been given two parcels of land. These areas are being planted as the *sitios* in town, but are distinct from these in-town *sitios* because of their size and location. If these two households are excluded from the sample as outliers, the average size of the *sitio* in San Jose is approximately 2131 square feet. This is significantly smaller than the *sitios* in Santa Ana.

It appears that the difference in *sitio* size between communities can be attributed in some degree to the topography or the difficulty in excavating a housing site in San Jose. In addition the actual size available in the *sitio* for planting is less in San Jose than in Santa Ana due to large multi-generational families. In San Jose, as a new generation matures and marries a new house is often built or an existing one expanded in the *sitio*. It is not unusual to find two or three dwellings in one *sitio*. This does not appear to be the case in Santa Ana. Although more than one generation often lived together as a household, additional housing is seldom built to accommodate increasing family size.

4.3 Who Gardens

Although no one has "a household garden" if asked in the terms used by development workers, most households in Santa Ana and San Jose garden or have multi-leveled plantings around their homes. At a community level, ethnicity and origin do not seem to be indicators of which households garden (Table 2). Both Itza Mayan and *ladinos* have "traditional household gardens" around their homes. Additionally, household origin, i.e. native Peténero or colonists, seems to have little impact on which households garden.

Occupation of the head of household or agricultural activity (if a household has a *milpa*) also does not serve as indicators of which households will garden (Table 2).

Table 2. Profile of Gardeners

SAN JOSE Garden	ethnicity	origin	gender	occupation*	milpa
1	Mayan	Peténero	F	agriculturist	yes
2	Mayan	Peténero	F	agriculturist	no
3	Mayan	Peténero	F	seamstress	no
4	Mayan	Peténero	M	mason	no
5	Mayan	Peténero	F	agriculturist	yes
6	Mayan	Peténero	M	day laborer	no
7	Mayan	Peténero	F	day laborer	no
8	Mayan	Peténero	F	day laborer	no
9	Mayan	Peténero	M	local gov't	yes
10	Mayan	Peténero	F	day laborer	no

SANTA ANA Garden	ethnicity	origin	gender	occupation*	milpa
1	Ladino	Colonist	F	mason	no
2	Ladino	Colonist	M	agriculturist	yes
3	Ladino	Peténero	F	pensioner	no
4	Ladino	Peténero	F	agriculturist	yes
5	Ladino	Colonist	F	agriculturist	yes
6	Ladino	Colonist	F	agriculturist	yes
7	Ladino	Peténero	F	healer	no
8	Ladino	Colonist	M&F	agriculturist	no
9	Ladino	Peténero	F	agriculturist	yes
10	Ladino	Colonist	F	agriculturist	yes

* head of household

4.3.1 Gender

Given that virtually all households with a space around their homes grow plants to one degree or another, a pertinent question to ask is, "Who *within* the household gardens?" Much of the literature on household gardens in Latin America refers to gardeners as women (Ninez 1988; Chaney 1987). Gender lines are not as clearly drawn in the Petén (Table 2). While the majority of the primary gardeners identified by households

who participated in the study were women, a few men were also identified as primary gardeners. In San Jose, seven of the ten gardeners were women. When the man was the primary gardener, his wife also gardened. In Santa Ana, eight of the ten gardeners were women. One man was identified by the household as the primary gardener and one couple shared equal responsibility and interest. Here too, when the man was the primary gardener the woman was also involved in the planting and care of the *sitio*.

4.3.2 Generational membership

Generational membership seems to be an indicator of who the primary gardener would be. In San Jose, most households are composed of three generations. It is members of the oldest generation, whether male or female, that garden. In Santa Ana households, the number of generations in a household are more varied, but here too, members of the oldest generation are the primary gardeners.

Only one household had a grandparent living with them who was not the primary gardener and he was not in good health. When his daughter, the primary gardener of the household, did not know the name or use of a plant she asked her father.

Members of the oldest generation are also the owners of the land. It seems the members of the younger generation become primary gardeners only through the death or incapacitation of the older members of the household or upon the establishment of a separate household.

4.3.3 Gardening as a Family Activity

Even though women of the oldest generation are typically the primary gardeners in both communities, gardening is a family activity. Husband, wife, children and often

grandchildren take part in different gardening activities. Some activities are shared such as plant selection, some are more gender or age specific such as weeding and harvesting. While men bring in plants from the forest, haul soil from the forest and weed, young boys harvest fruit from trees. Women harvest medicinal plants as needed, while young girls sell surplus fruit in the community.

4.4 Traditional Household Garden Structure

The gardens of San Jose and Santa Ana mimic the structure of the tropical forest. They are multi-storied, densely planted, and diverse in species composition. This stratified vertical structure consists of as many as five layers (Figure 3). The highest level (approximately 10-20 m high) in both San Jose and Santa Ana consists of coconut trees (*Coco nucifera*) and tall fruiting trees, such as *annonas* (*Annona* sp.), and *zapote* (*Achras sapote*). These trees provide open shade for the lower plantings and reduce the force of the rains. Below this level (approximately 5-10 m) are trees such as bananas *(Musa acuminata*), plantains (*Musa paradisiaca*), *cericotes* (*Cordia dodecandra*) and citrus (*Citrus* sp.).

The next level (approximately 1-5 m) is occupied by small trees and shrubs such as *guayas* (*Talisia oliveformia*), *chaya* (*Cnidoscolus acontifolius*), roses (*Rosaceae* sp.) and hibiscus (*Hibiscus rosa-sinensis*). At a still lower level (at less than 1 m) are plants such as peppers (*Capsicum annum*), tomatoes (*Lycopersicum esculentum*), *macal* (*Diosorea alata*), *zacate limon* (*Cymbopogon citratis*) and *hierba mora* (*Solanum nigrum*). From the trees hang vines, orchids and other epiphytes. Some vining plants such

as *huisquil* (*Sechium edule*) and *condiamor* (*Momordica charantia*) grow up trellises, fencing or trees.

Pots containing ornamentals, spices and medicinal plants such as ferns, *cilantro* (*Coriandrum satvum*), *hierba buena* (*Mentha spicata*?) and *oregano fino* (*Lippia alba*) hang in trees or are placed on shelves, flat rocks or by doorways. Surrounding the *sitio* are additional plants in living fences. These living fences contain a diversity of species including ornamentals and fruiting trees, notably *isote* (*Yucca elephantipes*).

The structure of traditional household gardens in the Petén does not vary greatly from the description of Mayan gardens in the Yucatan (Barrera 1980), nor does it depart significantly from Soemarwoto's in Indonesia (Soemarwato 1991). According to Barrera (1980: 117 author's translation), "the traditional household gardens of the Yucatan exhibit a structure that resembles the forest in all respects." The plant species that compose these multiple layers in the Yucatan are comparable to those in the Petén (Caballero 1992; Ortega 1993: 41-42). Soemarwoto describes the *pekarangan* or traditional household gardens of Indonesia as an agricultural system that simulates the structure of the forest. A number of the species found in the *pekarangans* are also found in the Petén. This seems to imply that the traditional household garden is environmentally appropriate in the humid tropics in general.

4.4.1 Horizontal Arrangements of Plants

Some researchers suggested that no specific horizontal arrangement of plants exist in THGs in the tropics (Anderson 1950; Barrera 1980; Rico-Gray 1990), while other studies have found distinct arrangements of plants (Stravrakis 1976) and planting areas

(Alvarez-Buylla 1989: 140; Castro *et al.* 1993: 22; Christanty 1981). In the gardens of San Jose and Santa Ana, the location of plants in the *sitio* appear to be dependent on various criteria: frequency of use and care, specific plant requirements and enjoyment. In some gardens these spaces often do not have well-defined boundaries and blend into one another, while in others low fencing or borders separate one area from another.

Plants that are used frequently or require more care are located closer to the dwelling. Plants that are considered attractive are located at entryways and the front of the house. Some ornamental species such as *siempre viva* (*Kalanchoe pinnata*) and *xate* (*Chamaedorea elegans* and *Chamaedorea oblongata*) are planted in containers filled with *tierra negra* (black soil) and arranged on shelves near the entry ways. Frequently used medicinal plants also appear in pots near back entrances. A few plants, especially delicate ornamentals and seedlings, are located in small areas surrounded by sticks or rocks to provide protection from humans and animals. Fruit trees and shade trees which require little care are dispersed throughout the *sitio*. Towards the back of the *sitio*, coffee trees (*Coffea arabica*) are often scattered in the shade of taller fruit and shade trees. Gardeners match specific plant requirements for light, water and nutrients with micro-niches within the garden. The amount of light entering an area is manipulated by some gardeners by trimming trees. At other times shade is produced by small latticed-type structures. Some plants such as *ruda* (*Ruta graveolens*) and *sabila* (*Aloe vera*) are placed in pots in the shade to protect them from the sun. Other plants, such as *macal* and *malanga* (*Dioscorea alata* spp.), are planted near a water source where run-off meets the plants' requirements

Figure 3. Horizontal Arrangement in a Typical Traditional Household Garden

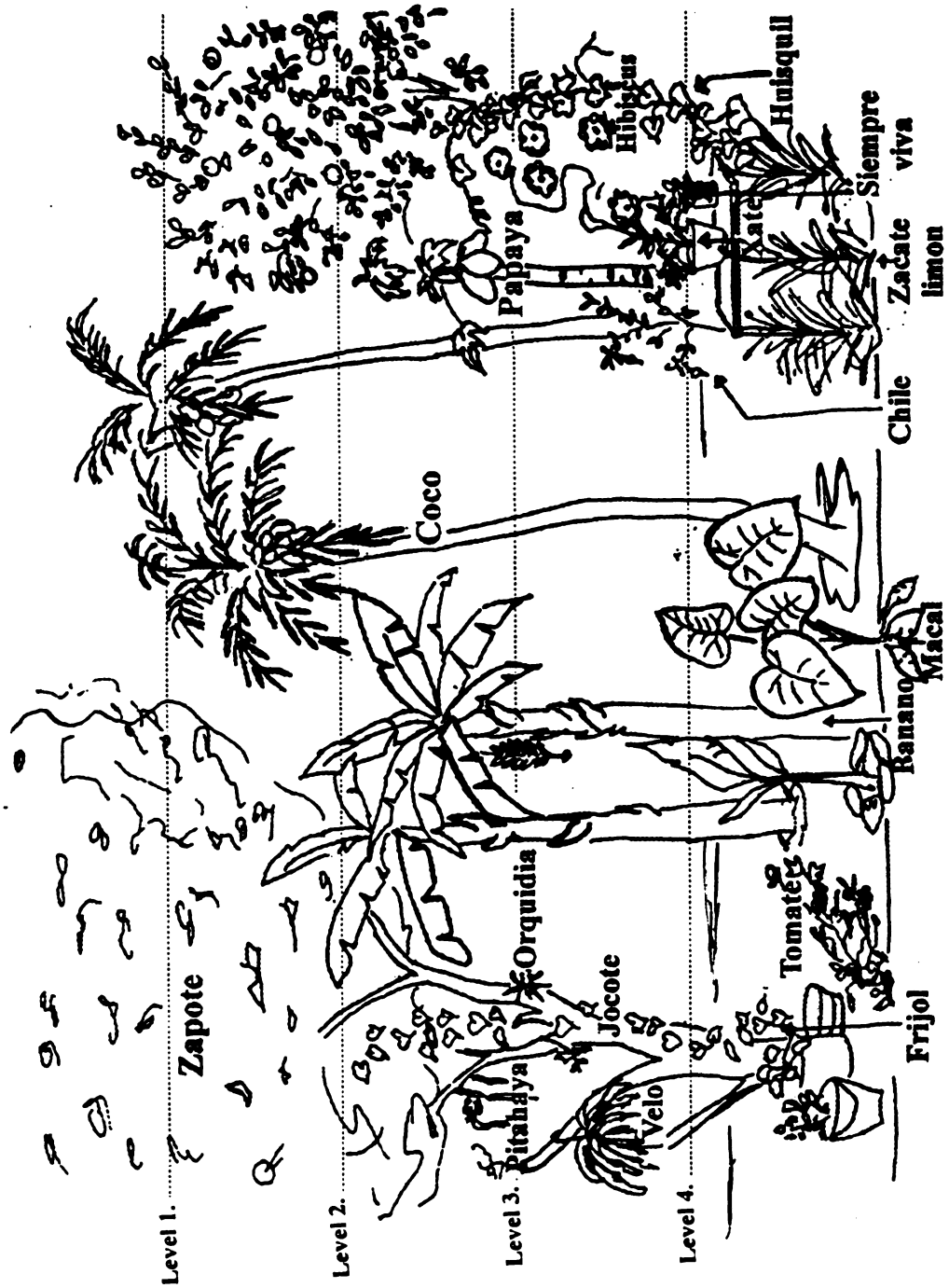


Figure 3. A Profile of a Typical Traditional Household Garden

for moisture. The horizontal and vertical arrangement of plants becomes more complex over time as plants are added to the *sitio*.

4.6 Garden Species Diversity

In the twenty gardens included in this study, gardeners identified 266 distinct species. Itza Mayan gardeners identified 150 species, while *ladino* gardeners of Santa Ana identified 180. The most frequently occurring species in THGs was peppers (*Capsicum annuum*) which appeared in every garden with a total of 85 plants. Coconuts (*Coco nucifera*) were present in sixteen gardens with a total of 80 trees. Sixteen gardeners had *isote* (*Yucca elephantipes*) with a total of 112 plants. Fifteen gardeners had hibiscus (*Hibiscus rosa-sinensis*) and bananas (*Musa acuminata*) totaling 75 plants of each species.

A diversity index provides a means to compare gardens on the basis of the number of species and the abundance of species in each garden (Table 3). An average diversity index is used to highlight the similarities in THGs by ethnic group and by origin. The average diversity index of Itza Mayan gardens is 2.5, while that of *ladino* THGs is 2.6. No significant difference in diversity exists between THGs of Itza Mayans and *ladinos*.

Comparing average diversity index between colonists and native Peteneros shows no significant difference in garden diversity between these two groups. The average diversity index of colonist THGs, all of which were located in Santa Ana, is 2.7. If only the THGs of native Peteneros in Santa Ana are averaged the garden diversity index is 2.5. If gardeners in San Jose are included in this calculation, the average diversity index of

native Petenero THGs remains the same at 2.5. It appears that over time, colonists have established THGs that are as diverse as those of native Peteneros.

Table 3. Characteristics of Garden

San Jose Gardens	sitio size sq. feet	# of species	# of plants	diversity index
1	1920	51	103	3.0
2	1400	16	30	2.0
3	1500	40	122	2.8
4	3750	75	152	3.2
5	1800	29	71	2.5
6	10688	24	51	2.2
7	18750	33	109	2.4
8	2450	32	54	2.5
9	2025	21	47	1.9
10	2200	33	49	2.7
mean	4648.30	35	79	2.50
standard dev	5675.20	17.03	40.1	0.41
95% conf. int.	3517.45	10.55	24.8	0.25

Santa Ana Gardens	sitio size sq. feet	# of species	# of plants	diversity index
1	6806	47	140	2.9
2	8168	39	82	2.7
3	1200	55	137	3
4	10890	65	723	1.6
5	2016	52	115	2.8
6	6806	43	86	2.6
7	1680	40	80	2.6
8	4356	52	145	2.6
9	2880	55	127	2.9
10	6806	40	124	2.5
mean	5160.8	49	176	2.6
standard dev	3223.7	8.48	193.78	0.39
95% conf. int.	1998.0	5.26	120.11	0.24

two tailed t		0.04	0.14	0.59
f values		0.05	.000006	0.86
table t = 2.26				
table f = 4.41				

4.9 Plant names

In San Jose, a number of plants are known by both an Itza Mayan and Spanish name. In Santa Ana, only a few names are known in Mayan. A few plants, such as *(ix)canan* (*Hamelia patens*), *b'ukut'* (*Cassia grande*) and *pitchiton* (*Phyllanthus glaucescens*) have no name in Spanish but are known only in Mayan. The *Capsicum* sp. is known by a number of local varietal names such as *chiltepe*, *paloma*, *habenero*, and *diente de perro*. These peppers are distinguished by size, color, and shape of fruits.

Many of the ornamentals and medicinal plants and a few of the plants used for food are species brought in from the forest. Some of these are called by a name with the phrase *del monte* attached to signify that it is from the forest. Most of the plants thus qualified are recent acquisitions or distinguishable from a domestic type. For example *papaya del monte,* has an inferior fruit or *isote del monte* has finer leaves than their domestic counterparts.

The gardeners in Santa Ana do not refer to plants in the living fences by a specific name, but rather refer to most of these plants as *monte* (scrub), except for *isote* which bears edible flowers.

In total, 39 plant species were not known by name in the THGs studied. Four gardeners in San Jose could not identify by name a total of 9 out of 181 species, while in Santa Ana, nine of the gardeners could not identify 39 out of 203 species by name. These unknown plants are overwhelmingly ornamental in both communities.

4.10 Plant Use

A total of 266 species were indicated by gardeners as having use in THGs in San Jose and Santa Ana (Table 4). The three main uses of plants are food, ornamental and/or medicinal. A total of 115 different species or 45 percent of all species are used for ornamental purposes, 83 species or 33 percent are used for food, and 64 species or 25 percent have a medicinal use. These numbers include species that have more than one use. In all, 38 species or 15 percent of the 266 species found in THGs in San Jose and Santa Ana are used for more than one purpose.

When the total number of plants are analyzed, 1159 plants or 57 percent are used as food, 675 plants or 33 percent are ornamental, and 229 plants or 11 percent have a medicinal use.

Table 4. Plant Use by Community

Plant Use	Total Species	San Jose Species	Santa Ana Species	Total # of Plants	San Jose Total # of Plants	Santa Ana Total # of Plants
ornamental	115	58	92	675	274	401
food	83	65	62	1159	439	720
medicinal	64	44	39	229	113	116
living fence	9	0	9	149	0	149
shade	5	4	2	6	4	2
wood	5	4	3	13	10	3
fodder	3	0	3	3	0	3
utensil	3	3	1	5	4	1
artisan	2	2	0	2	2	0
green manure	2	1	2	12	1	11
multiple use	38	24	19	230	85	145
Total**	266	181	203	2023	762	1261

* Food = food, food condiments; wood = building, furniture; utensils = bowls, toys; multiple use = more than one use.

**Total is less than the total sum due to plants with multiple use.

The major difference in species use by community is in the number of species used as ornamentals. Santa Ana gardeners have 92 species as ornamental plants, while

San Jose gardeners have 58. The number of species used for food is approximately the same in both communities, 62 and 65 respectively. San Jose gardeners have 44 species for medicinal purposes while Santa Ana gardeners have 39 species for this purpose.

When the total number of plants are compared by use, gardeners in Santa Ana have nearly twice as many ornamental plants and food plants as the gardeners in San Jose. It should be noted that the total number of food plants was substantially increased by Gardener # 4 in Santa Ana who had just planted 500 pineapple plants for future sale. The total number of medicinal plants in the two communities is approximately the same at 116 in Santa Ana and 113 in San Jose.

4.10.1 Ornamental Use

THGs are valued for their beauty and the enjoyment they provide. In San Jose, 58 species or 39 percent of total species in San Jose are ornamental while in Santa Ana 92 species or 51 percent of total species are considered ornamental. Of these, 9 species in San Jose and 8 species in Santa Ana have more than one use.

The importance of ornamentals in Petén communities seems to have a long history. In 1937, Lundell collected 243 plant species in the community of La Libertad, Petén. Of this total, 25 percent were ornamentals. Lundell states, "this gives an idea of the attention people give to flowers" (Lundell 1937: 106). The importance of ornamentals in 1995 seems to be much the same as in Lundell's time.

4.10.2 Food Production in THGs

Food use is the second most common use of plants in THGs. In all, 83 species or 31 percent of all species found in Santa Ana and San Jose are used for food. In San Jose,

65 species or 43 percent of the species found are grown for food. In Santa Ana, 62 species or 34 percent of the species found are grown as food. Among the most common species are peppers, coconuts, bananas, *jocote*, and lemons. Some food crops such as *nance* (*Brysonima* crassifolia) and *cerimoya* (*Annona squamosa*) are found only in San Jose, while others such as *achiote* (*Bixa orellana*) are found only in Santa Ana. The flowers of the *isote* (*Yucca elephantipes*) are eaten, but its abundance in Santa Ana is primarily related to its use in living fences.

Throughout the Third World food crops in THGs can supply a substantial part of the caloric and nutritive requirements of the local diet. In addition, THGs provided an almost continual supply of food. This is a function of a high diversity of plant species with different flowering, fruiting and cropping times.

4.10.3 Medicinal Plant Use

In all, 64 species are used as medicinal plants in THGs in San Jose and Santa Ana. In San Jose, 44 species or 29 percent of the plants and in Santa Ana, 39 species or 21 percent of the plants have medicinal uses (Appendix C).

Some plants with medicinal uses are found in both communities. For example, *sabila* (*Aloe vera*) is used in San Jose and Santa Ana as a remedy for skin rashes and burns, and is used as a purgative. Basil or *albahaca* (*Ocimim basilicum*) is used in both communities in different forms for stomach aches, intestinal parasites and earaches.

Some plants are found only in Santa Ana such as *achiote* (*Bixa orellana*) which is used primarily to give a red color to foods, but is also used to control diarrhea and

dysentery. Other plants are found only in San Jose. *Hierba del cancer*[9] or *hierba del gato* (*Acalypha arvensis*) as a remedy for various skin conditions, *cordoncillo* (*Piper amalago*) which is used as an herbal bath to ease body aches and *condiamor* (*Mordica charantia*) is used in the treatment of diabetes and kidney pains.

Some plants are found in both communities, but they are only used as a medicinal plant in San Jose while in Santa Ana they are viewed as ornamentals. In San Jose, *hibiscus* (*Hibiscus rosa-sinensis*) is both appreciated for its flowers and used to stem bleeding and to prevent miscarriages. It is also used for headaches. In Santa Ana, the plant is an ornamental for all gardeners except for the *curandera* (traditional healer). The same can be said for *flor del muerto* or marigolds (*Tagetes erecta*). In San Jose, the plant is used together with eight other herbs as a soothing bath for children. As a tea it is used to relieve fevers, stomach pains and headaches. In Santa Ana the plant is an ornamental.

4.10.4 Plants with Multiple Use

In total, 38 species have multiple uses in the gardens included in this study (Appendix C). More plants have multiple uses in San Jose (24 species) than in Santa Ana (19 species). The most common combination of use is food and medicinal use or food and ornamental use.

4.11 Source of Cash Income

THGs seemed to contribute only a marginal monetary amount to family cash income in San Jose and Santa Ana. In San Jose, it is reported that some people occasionally sell surplus fruits of *nance* (*Byrsonima crassifolia*) or *cerimoyas* (*Annona*

[9] Cancer used in this context is a local Spanish word which signifies a chronic, spreading and difficult to heal skin condition (Arvigo 1993).

squamosa) at the market in Santa Elena. However, none of the gardeners who participated in the study sold garden surplus in Santa Elena or in the small local stores in their own communities. It is more common for young girls from the communities to go door-to-door and sell fruit. One gardener in Santa Ana who participated in the study raises turkeys and pigs to sell in the community. Another gardener, again in Santa Ana, has just planted 500 pineapples in her *sitio* anticipating future sales.

The lack of a local central market in both communities may account for the small role sale of surplus garden crops play in these two communities. The relatively high cost in both time and money to get to the markets in Santa Elena may not justify selling surplus produce there. Before development organizations promote gardens for income generation the lack of access to viable markets must be addressed.

4.12 Site of Experimentation

The traditional household gardens of San Jose and Santa Ana offer a site of agricultural experimentation for assessing a new variety or species of plant and new management practices. A gardener in Santa Ana was observed growing two types of velvet beans (*Mucuna* sp.) in her garden. Velvet beans are being promoted by NGOs in the region as a green manure crop in the *milpas*. This gardener had heard that these plants could help improve the soil and had been given a few seeds by a friend. However, she was curious to see if they were edible and had experimented with different cooking techniques and recipes.

Gardeners also experiment with the cultivation of medicinal plants from the forest. A gardener in Santa Ana whose daughter-in-law was pregnant had brought a few

plants in from the forest that she knew were anti-abortifacients. She planted a small plot by the back door to see if they would grow where they would be close at hand. Another gardener in San Jose wanted to grow tomatoes during the dry season, so he had constructed a lattice-type shelter to shade them. He anticipated this would allow him to harvest tomatoes for a longer time period despite the intense summer sun.

Each of these efforts differ; each gardener has his or her own purpose in mind, yet each is motivated by a practical household need. Experimentation on a larger scale can involve risks that a household may be unwilling or unable to take. However, experimentation at the THG level requires little invested in time, money or other resources, therefore little risk is involved.

4.13 *In situ* Conservation

One of the overlooked qualities of THGs generally is their role in the conservation of genetic material of little known species, both those from the forest and domesticated varieties; of methods of cultivation; and of plant uses (Anderson 1980). Flores (1993), during his study of gardens in Merida, Yucatan, found a fruit tree species that had been considered extinct. Although no similar findings resulted from this research, a number of plants are being brought in from the forest to be cultivated in the gardens. This process is clearly seen in the practices of a gardener in San Jose who is transplanting medicinal plants from the forest to her garden. As she explains, "the walk to the forest is longer now, so I am growing medicinal plants from the forest in my *sitio*."

Traditional household gardens are being used as sites for the preservation of traditional varieties as well. An older gardener in San Jose is preserving traditional bean

varieties in his garden for future planting in the *milpa.* He has not planted a *milpa* for the past two years because of dry weather. This same gardener spoke of a traditional Mayan corn variety that he had planted in his *milpa*, but believes is now extinct. This type of corn could be stored for three seasons without loss of germination. It has been supplanted by hybrid varieties that give higher yields, but maintain an adequate germination rate for only one year. This loss is highly significant in a region where the uncertainties of weather can cause the total failure of a season's crop.

4.14 Mechanism of Knowledge Diffusion

In the communities of San Jose and Santa Ana, knowledge of traditional household gardens passes from one household to another in multiple ways: 1) during the exchange of plant material; 2) in the time of need or illness; and 3) through observation and visiting.

The exchange of plant materials occurs with family members, friends, neighbors and occasionally with people from outside the community who ask for cuttings or seeds. Along with this exchange, gardeners share their gardening and plant knowledge. When plant materials are given to friends, family members or acquaintances, information about how to propagate the plant, its cultivation requirements, its uses, and culinary or medicinal preparation are also passed along. Conversations often center around plants, where a particular plant can be obtained, what it is used for and specific cultivation requirements. For example, a woman shared cuttings from a rose bush with a friend with a new *sitio*. The cuttings were from her mother's rose bushes. The *mama* joined the conversation. She gave the names of the three type of roses and explained how she started

cuttings. The women then mentioned others in the community who had roses, the various varieties and who was willing to share cuttings. In this manner, THG knowledge is disseminated throughout the community and to a lesser degree, the region.

Knowledge of plant use is also exchanged when there is an illness. If no one in the household knows of a medicinal plant to use for a specific illness they know who in the community has the knowledge. This could be the local *curandera* (traditional healer), a neighbor or a friend.

Gardening knowledge also passes from one generation to the next. At times during a *sitio* tour, a child would relate the name of a plant and its use, or point to one he or she was growing. In Santa Ana, three little boys had been given a mango seedling by their neighbor. They were proud to show where they had planted "their" tree. In San Jose, a young girl had been given corn and bean seeds at school. Her mother had shown her how to build a small fence to guard the newly sprouted seedlings from the chickens.

Not withstanding these two examples, some of the gardeners remarked that the young people were less interested in gardening and knew less. The older people in San Jose said the younger generation was not knowledgeable or interested in plant names or medicinal plant use. One women described her own family, "My mother knows alot about medicinal plants. I know some. My daughter knows very little." In San Jose, a community effort is being made to "recapture" this knowledge. Plant names and uses are featured in community language classes of Itza Mayan. In Santa Ana, there is no such similar organized effort.

Knowledge also passes to newcomers through the process of plant exchange and observation. Colonists obtain cuttings or seeds from neighbors, along with cultivation and management information. This new information is blended with plant knowledge and management practices brought from their home regions. Additionally, community relationships are established between the two parties of the exchange. Eventually this process results in a THG that is indistinguishable from the THGs of native Peteneros. This research does not explore in any depth the process of community building which occurs through the exchange of plant material and gardening knowledge. But evidence suggests that community relationships are established and/or strengthened during this process.

4.14.1 Medicinal Plant Knowledge

A vast amount of medicinal plant knowledge exists in the Petén (Atran 1992; Comerford 1995). However this knowledge is not evenly distributed along lines of gender or ethnicity. When a man, as the primary gardener, conducted the tour of the *sitio* he deferred to his wife on identification of many ornamentals and on the medicinal use of plants.

Gardeners in San Jose identified plants as medicinal plants more often than gardeners in Santa Ana. This was not due to a lack of interest by the Santecos, but rather to a lack of knowledge of a plant's medicinal qualities. When gardeners in Santa Ana were told that gardeners in San Jose used the red flowering hibiscus, marigold and red rose as a medicine they wanted to know more about the specific medicinal uses of these plants.

There is also a different attitude towards medicinal plant knowledge in the two communities. In Santa Ana, there is a clear distinction made between knowledge relating to plants that "heal" or "cure" and "medicinal" plant knowledge. "*Plantas que curan*" or plants that cure is a phrase that is associated with witchcraft. In Santa Ana, several people cautioned against asking about "*plantas que curan*" because of this association. Rather they recommended, questions should refer to "*plantas medicinales*."

This concern was also expressed by the *curandera* in Santa Ana. She is an 83 year old woman and native Peténero. She mentioned several times that she was a *curandera*, not a *bruja* or witch. This woman was referred to by the pharmacist and several other community members as the most knowledgeable person in the community relating to medicinal plant knowledge. The *curandera's* skills were sought out in the community where a doctor's advice and medicine was expensive. Yet her granddaughter who lived with her was not interested in her grandmother's skills. Rather, the granddaughter stated she was embarrassed to admit to medicinal plant knowledge. Nor was any one in the community working with the *curandera* to acquire her skills.

In contrast, in San Jose, knowledge of medicinal plant use is more wide-spread does not appear to carry a social stigma as it does in Santa Ana. Members of the older generation are the holders of medicinal plant knowledge and are respected for this knowledge.

Additionally, medicinal plant knowledge tends to be gender specific. While many men, especially those who work in the forests, are knowledgeable about wild medicinal plants, women generally know more about the medicinal use of plants in the *sitio*.

Knowledge of medicinal plants is closely tied to the existence of traditional household gardens. While THGs serve as *in situ* conservation of biological diversity, gardeners are the holders of medicinal knowledge of these species. But this knowledge is being lost. Younger people show less interest in THGs and medicinal plant knowledge. While colonists adopt THGs over time, it appears they are less likely to acquire the knowledge of medicinal plant use.

4.15 Management Practices

In general, a casual approach is taken towards the management of traditional household gardens. Once a garden is established, little labor or time is needed to maintain it. The garden structure discourages weed growth and conserves moisture. Competition between species is controlled not by physical effort, but by the manipulation of plant species through intensive plantings and intercropping. The perennial nature of garden plants also contributes to a low maintenance system.

Despite the low maintenance of these gardens, a large store of gardening knowledge underlies management practices. This knowledge is best understood through an examination of specific management practices.

4.15.1 Site Preparation and Plant Selection

When a new household site is prepared, the area is cleared of all plants with a machete and ax. The clearing process is generally a male activity, while the plant selection process is shared by both partners.

After the site is cleared, plants are either planted or allowed to grow back. Selection is based on a plant's use value or ornamental value. Plants that are planted are

found in the forest, milpa or along roadways, are gifts from family, friends and neighbors, or are purchased in the local market.

A clear understanding of establishing a *sitio* planting was gained during a focus group discussion of women gardeners in Santa Ana. The gardeners were asked what they would plant first in a new *sitio*. They began to list fruit trees, but then laughed and said no they would first plant flowers and other ornamentals, then they would plant fruit trees. This was in fact what was happening in the newer *sitios* that were included in the study. In San Jose, a young family had been in their home only 15 days. The husband proudly showed the flowers his wife had planted in small raised beds near their home, explaining that these were the first plants they had planted. Another family in San Jose had lived in their home a year and had an abundance of zinnias, roses, hibiscus and other flowering shrubs for a total of 10 different species. In Santa Ana, a young family had also been in their home a year. Their *sitio* planting included 25 different species of ornamental plants. This reinforces the findings of this research relating to the importance of ornamentals for gardeners in the Petén.

Plants are acquired for the gardens in fairly informal ways. For example, one morning in San Jose, an eighty year old woman was observed walking down a village path. She reached down into the *monte* (weeds) growing along the path and pulled a plant out by its roots. Although almost blind, she had recognized an *apasote* (*Chenapodium ambrosiodes*) plant. In San Jose and Santa Ana, *apasote* is cooked with beans and is used for its anti-parasitic activity. When asked what she was going to do with the plant the woman replied that she was going to take it home and see if it would grow in her *sitio*.

Another women related that her son had found several plants in the forest that he thought she might enjoy. He dug them up and planted them in the garden.

Plants are also exchanged in both communities. It is not uncommon for a woman visiting friends or family to return home with cuttings or seeds from a plant she had admired. One measure of a woman's generosity is her willingness to share her plants with other community members. "She has one of the most beautiful gardens [in the community], but she doesn't share her plants. She wasn't even willing to sell me a cutting from her rose bush." Another woman is described as having many beautiful plants, "but she isn't very sociable, she doesn't like to have people visit her, she keeps to herself and doesn't share what [the plants] she has."

4.15.2 Planting

Perennials and fruiting trees that are native to the area or that have been introduced to the region over many years are of greater importance than annuals in the THGs (see Ortega *et al.* 1993 for species origin in the Yucatan).

Cuttings are taken of desirable plants and propagated in small black plastic bags containing *tierra negra*. It is not uncommon to see half a dozen or more of these bags containing cuttings tucked under shade trees or near the water faucet. These cuttings include lemons, oranges, grapefruits, *cericote* (*Cordia dodecandra*), cedar, allspice, roses and other types of woody ornamentals. Some species such as *guayaba* (*Psidium guayava*) and *almendros* (*Prunus amygdalus*) regenerate easily from seeds dispersed by birds or other wild animals. These seedlings are often transplanted to a more favorable location within the *sitio*.

Other investigators have reported that gardeners of the Yucatan plant by the cycle of the moon. This did not appear to be a common practice in San Jose or Santa Ana. Only two older gardeners spoke of this as a management practice they utilized. Nonetheless, when the oldest women in the Santa Ana focus group explained how she planted by the cycle of the moon, the younger women were attentive and asked a number of questions.

Rico-Gray (1990), in his study of household gardens in two communities in Mexico, found that there was no specific time of year for planting or introducing new plants species into the garden. In contrast, in the Petén transplanting and planting takes place after the rains began and there is sufficient moisture for plant growth.

Annuals played a minimal role in these traditional household gardens. This in part is due to: 1) lack of access to viable seeds and to appropriate species; 2) difficulty in germination of available seeds; and 3) difficulty in storing seeds from one season to the next.

Seeds, usually from the United States, can be purchased in the market in Santa Elena, but it is not uncommon for these packages to be past their expiration date. The type of seeds purchased by gardeners in San Jose and Santa Ana are flowers, especially marigolds and zinnia; cilantro; green peppers; and tomatoes. Seeds in bulk can be purchased at local agricultural supply stores in Santa Elena and San Benito. But these are seldom purchased for use around the *sitio* except by development workers who are promoting temperate gardens. Gardeners save seeds from their gardens from one year to the next or allow plants to self-seed.

From whatever source, seeds are either sown directly in soil beds or in containers. Soil is often brought in from the forest and placed in beds surrounded by rocks, logs or upright stakes or in containers. These containers are then placed in a protected environment. One gardener demonstrated a planting of tomato and cilantro seeds in old pots which were placed near her wash area and under a thatched roof. She indicated that in this location she could care for the plantings and had had good results with germination.

However, germination of seeds and seedling mortality is a problem for most gardeners in San Jose and Santa Ana and in general, for those promoting household gardens in the region. Several gardeners reported that seeds they direct seeded had not germinated or died shortly after germination. They blamed this on lack of moisture and poor or 'tired' soil.

4.7 Animals

All the households who participated in this study in both communities had small animals, primarily chickens and pigs, with one exception, a widow in Santa Ana. Chickens are the most common animals raised by gardeners. They supplied meat and eggs and their manure contributed to the fertility of the soil. Chickens and other fowl also help control insects as they wander through the garden. An assortment of other animals are present in small numbers including horses, dogs, cats, ducks, rabbits, doves, parrots, turkeys, bees, turtles, snails and deer. They provided transportation, safety, meat, eggs and income. Some animals are kept for enjoyment. Animals are also the primary cause of

loss in THGs, primarily pigs and cattle. Some gardeners have chosen not to raise pigs because of the damage they cause.

4.8 Fencing

Households that do not have adequate fencing to keep out the pigs have much less diverse plantings and fewer numbers of plants. Fences are composed of trees (notably isote), shrubs, rough sawn timber, branches, closely-spaced barbed wire or innovative combinations of all of these. The most effective fencing is made of closely spaced wood or barbed wire. In Santa Ana living fences are common. A living fence is a dense combination of trees and shrubs which in time produces an impenetrable barrier. These plants not only provide fencing and privacy, but also shade, food, fodder, fuel and building materials. The absence of living fences in San Jose appears to be related to the amount of space they require.

4.15.3 Soil Improvement Practices

In San Jose, gardeners classify their soils as either a white clay, the original soil of the site, or *tierra negra*, which is brought into the *sitio* from the forest. In Santa Ana the distinction is not as clear. The original soil in the *sitio* is *tierra colorado* or red soil. Gardeners did not perceive it to be a different type of soil from that of the forest. In San Jose, bringing in soil from the forest is a requirement, while in Santa Ana it is necessary only if a particular area of the *sitio* has lost its fertility.

Chemical fertilizers are not used in THGs in San Jose or Santa Ana. Organic fertilizers are seldom used, although leaf litter is left to decompose to enrich the soil. The most frequent use of soil amendments is seen around *Musa* sp., bananas, *guineos* and

plantains. Here wood ash, corn cobs and/or manure is used to improve the soil. A concentrated effort to fertilize these trees was made in four gardens, two in Santa Ana and two in San Jose. Dirt from ant hills is used occasionally as a soil amendment. This soil is used for new plantings and is reported to be quite beneficial for plants.

4.15.4 Weeding

As most garden plants are perennials, weeds do not present much competition in THGs. They, in fact, serve as a ground cover to protect the soil from erosion during the rainy season and help conserve soil moisture during the dry season. In both communities, weeds are cut periodically with a machete. Plant selection occurs at this time. Some weedy plants which are useful, such as *hierba negra* (*Solanum nigrum*) (leaves are eaten) or *hierba del cancer* (*Acalypha arvensis*) (used on skin eruptions) are allowed to grow where they have self-seeded.

4.15.5 Insect control

Little direct insect control is done in THGs save for *sampopos* or leaf-cutter ants (*Atta* sp.) which, in Santa Ana, cause significant damage to citrus plantings and can denude a garden in days. Various techniques are used to control this insect. The most frequently reported method is dousing a mound with gasoline, allowing the vapors to penetrate the nest and igniting it. Another practice is to purchase *veneno* (insecticide) and sprinkle it on the mound. This treatment has reportedly mixed results and seems to be related to the age of the insecticide. If a family is unfortunate to have a *sampopo* nest near their home, planting is useless until the ants are eliminated.

4.15.6 Harvesting

Harvesting does not occur at any one time period as it does in conventional mono-cropped agriculture. In THGs, harvesting is done as fruits and vegetables ripen or as food or medicines are needed. All harvesting is done by hand or with a long stick with a branch forming a hook on the end. Young boys typically harvest the fruit by either climbing or standing under the trees and using the pole to shake the fruit down.

4.15.7 Summary of Management Practices

The management of THGs in San Jose and Santa Ana can be termed a "nature intensive" management system (Falanruw 1990). These management practices contrast with the labor intensive practices characteristic of many traditional agricultural systems on the one hand and the high external inputs characteristic of conventional or industrial agricultural systems on the other. Gardener management practices focus on making efficient use of microniches and natural phenomena resulting from the vertical, multi-layered garden structure and the intense horizontal arrangement of plants.

4.16 Garden Models Promoted by GOs and NGOs

Further insight on THGs in the Petén can be gained by an analysis of gardens being promoted by NGOs and GOs in the region. The various models being promoted by these organizations provide a contrast to local THGs in both physical and social dimensions.

The gardens promoted by NGOs and GOs fall along a physical and social continuum. At one end of the physical scale lie the temperate garden, typically seen as a single-layered structure of introduced annual species. These are typically promoted only

for food and income purposes. At the other end of the scale are the *huertos mixtos*, an agroforestry garden combining native and introduced plant species. These gardens most closely resembled the physical structure of the THGs of native Peteneros. The social continuum ranges from a top-down approach dominated by development workers from outside the region to a participatory approach between the household members and local extension workers. Within the social continuum is the issue of gender.

4.16.1 Project # 1

In the first project visited, an international volunteer, in conjunction with a Guatemalan governmental organization, was working with a group of women on a communal gardening project. The garden was planted in a local *sitio* and surrounded by a sturdy fence. It was based on a temperate gardening model, a single-layer arrangement of hybrid plants in raised beds. The raised beds contained soil that had been rototilled and fertilized. The rototiller was the property of the governmental organization.

Plantings were hybrid varieties which included lettuce, tomatoes, sweet peppers, carrots, grain amaranth[10], onions, cucumbers, spinach, radishes and squash. These seeds had been obtained from two international organizations. Of the seeds planted only the lettuce, carrots and amaranth sprouted. The lettuce was too bitter to eat, the amaranth was not eaten due to lack of interest and knowledge of the plant and the carrots were not thinned and stunted. The women who owned the *sitio* pointed out two healthy plants growing in the communal garden, both native volunteers. One was a vining medicinal

[10] Although grain amaranth is native to Central America, its use was banned during the Spanish Conquest.

plant used to control diabetes (name unknown), the other a native *mil tomate* (*Pysalis philadelphica*).

The development workers were women from outside the region, one a North American, the other from Guatemala City. The relationship between the development workers and the participants was hierarchical. Directions on what to plant and how to plant passed from the development workers to the gardening participants. The women had not been consulted in the development of the project. They were not asked what they wanted to plant in the garden nor how they wanted to plant it.

Bordering this communal garden, just on the other side of the fence, was the THG of the woman who owned the *sitio*. She had 49 different plant species in her THG including fruit trees, vines, root crops, flowering shrubs, flowering annuals and medicinal plants. The other members also had THGs. Two of these were visited. These *sitios* were also planted with a myriad of plants. The development workers did not see these traditional household gardens nor did they consider the women to have knowledge about gardening.

Of the original six participants, two had quit, but those who remained were not discouraged. The women described what they would like to see in a gardening project. The women would have preferred planting in their own *sitios*. They also felt things might have grown better if they had had more freedom to choose what and where to plant.

The women wanted more information about management practices. This included information about germinating, saving and storing seeds. They realized that planting directly into the raised beds did not work. In their own *sitios* the women germinated seeds

in small containers or protected areas. However, the knowledge the women already had gained through their THGs was not transferred to the communal garden. The top-down approach used by the development workers made it difficult for the women to express their own opinions or share their considerable knowledge.

The women knew how to collect seeds from their native plants, but once seeds were collected, storage became a problem in the hot and humid weather. Seeds were wrapped in paper and stored until the next planting season. But when the planting season arrives, women would often find worms instead of seeds. The women wanted information on how to resolve this problem (see Cleveland 1990: 285-306). However, these problems were not addressed by the development workers. In fact, both the problems and the solutions were unknown to them.

The positive aspect of this project was gender related: women development workers worked with women community members. Nonetheless, the relationship was still top-down. The attitude held by the development workers was that gardeners needed to be educated about a more "modern way" to produce food in a garden setting.

4.16.2 Project # 2

A second NGO was promoting gardens in a small remote community. An international volunteer (a woman) and a Guatemalan extension worker (a man) were living in the community and working on the project.

The extension worker had planted a small demonstration garden. This garden was based on a temperate garden model. It had a single-layer, was planted in raised beds and consisted of hybrid annuals. Many plants, including cabbage, peppers, beans, and

tomatoes, were interspersed with brightly colored zinnias. One *cericote* (*Cordia dodecandra*) tree was planted in the center of the garden. But its presence did not signify a move to a multi-layered garden structure, rather served as a demonstration tree which the NGO was promoting in the community.

This demonstration plot was the only *huerto familiar* that had been planted in the community that year (1995). The previous year other gardens had been planted. However, none had been replanted. Traces of the gardens still existed with raised beds encircled by decomposing tree trunks. A few pepper plants, holdovers from last year's planting, still grew, but otherwise the beds were empty save for a few weeds.

No appraisal of existing household gardens or gardening knowledge had been done. It appeared from casual observation that the existing THGs in this community were not highly developed. However, there was some cultivation of native plants. Banana trees, orange trees, avocados, *zapote*, peppers, corn, squash, beans, and ornamentals were observed in several *sitios*. The development workers had not considered the option of expanding upon these successful local efforts.

Many of the same social issues confronting the first NGO were present in this project, however community relationships were more problematic. As with the first NGO, the development workers were from outside the community. However, the extension worker was from the Petén. Community input was provided by a community representative. This man met with the regional NGO representative and the development workers on a periodic basis and was able to contribute to the decision-making process.

But decisions on what problems to address and how to address them were made by the regional representative.

Gender relationships were problematic as well. The international volunteer was a woman, while the extension worker was a man. The extension worker had attempted to promote temperate gardens with the women in the community with little success. At the time of this research he was working primarily with men on other projects. While the international volunteer was a women, her status as an outsider made it difficult for her to communicate with the women in the community.

Political divisions in the community impacted the international volunteer's ability to proceed. The international volunteer was waiting to begin a communal gardening project. The project had officially started three months earlier. The volunteer had not been able to obtain a site for the garden. The mayor controlled the communal lands, and he did not belong to the group that worked with the NGO. If he allowed the garden to be planted on communal lands his opposition would benefit and elections were near. Because no land was available, no seeds or plants had been provided by the NGO. In conjunction with this, the women of the community were not particularly interested in a communal garden. Furthermore, the men of the community were not interested in donating labor to put up a fence or haul in soil from the forest for communal land without pay.

The positive aspects of this project were not as obvious as in the first NGO project, but they did exist. Both the extension worker and the volunteer had made a contribution in this regard. The extension worker had introduced an organic fungicide made from locally available plants that the participants had experimented with. This

introduction built on gardeners' willingness to experiment, had the potential to solve a problem identified by community members, and used locally available and low cost inputs. Secondly, the NGO was supplying *cericote* trees to project participants to plant in their sitios and along the streets. *Cericotes* are fast growing trees which provide shade, fruit, and wood for construction and furniture.

On a social level, the international volunteer had made some progress. She had planted some ornamental plants for her own enjoyment in pots outside her door. She had noticed women pausing to look at them. A few had stopped and asked what they were and where she had gotten them. Yet the volunteer had not recognized the opportunity this interchange had for promoting traditional garden practices.

4.16.3 Project # 3

A third NGO in the region had just begun projects in several newly established colonist communities. A work plan for each community had been designed by women extension workers and the women of each community. These plans included a gardening project, nutritional education, food preparation, and hygiene. The community women expressed a desire for information about agriculture. They were motivated by expectations of increasing household food security and potential income. The gardens were in the planning stage. However, little thought had been given by the NGO to the type of garden to promote nor the type of plants to include. These communities were situated in remote areas. Therefore, community members had little opportunity to participate in local garden knowledge or plant exchange. Furthermore, they were

unfamiliar with and somewhat frightened of the forest. Without effective guidance the forest did not offer a source of plant material.

The NGO's women extension workers were from outside the region as well. They had no gardening experience and no knowledge of the forest. They relied on male extensionists with training in horticulture and agronomy. Ironically this organization had a few employees with extensive knowledge of forest plants. However, given the hierarchical and compartmentalized structure of the organization, their role in community development projects and garden promotion was limited.

The positive aspects of this project were the inclusion of women extension workers, its integrated approach and participatory problem identification. The introduction of household gardens was just one of several activities that were being promoted to improve household well-being.

4.16.4 Project # 4

A fourth NGO was promoting a garden which physically resembled the traditional household gardens of the Petén and used a participatory approach. The gardens promoted by this NGO were based on an agroforestry model of multiple layers, with an emphasis on fruiting trees and other commercially valuable plants such as *xate* (*Chamaedorea elegans*), and *pimienta gorda* or allspice (*Pimenta diocia*).

While plants with food value were included in the gardens, the focus was on income generation. Several of the households participating in the gardening project received income from the sale of *xate* and *pimenta gorda*, and fruit tree seedlings.

This focus on income generation was in large part a result of gender relationships. In theory, household members and an extension worker were to draw up a development plan for each *sitio*. But the NGO had no women extension workers working on household gardens. Although the extension worker reported working with women participants in the garden project, what was observed was men working with men. The male gardeners had decided to cultivate plants with commercial value.

The negative impacts this could have are many. The social and economic value of women's activities and production may decrease as food crops are displaced. The nutritional well-being of the household may decline as well. Although the visit to these sites was too brief to determine if these processes had occurred, the potential for such negative impacts exist.

There are a number of positive aspects to this project. The project is based on an agroforestry garden model which is more ecologically appropriate for the Petén than those which follow a single-layer temperate garden model. Complementary to this approach is the use of native plants or introduced plants that are well suited to the tropical environment of the Petén.

Notwithstanding the gender relations involved, a participatory approach responsive to participants' needs and desires was used. The project built on the traditional practices and knowledge of each participant. The gardens incorporated plants traditionally harvested from the forest for income generation. Yet each of these areas was hampered by the lack of gender analysis.

4.17 Obstacles to Successful Garden Promotion

Obstacles to successful garden promotion can be addressed in both physical and social terms. The single-layer structure of a temperate garden promotes evaporation and exposes the soil to the heat of the sun. Heavy rains wash away seeds. No plant debris accumulates. The temperate garden in the tropics also requires intensive soil preparation often by mechanical means, weeding, watering, and fertilizing. Non-local plants, chemical fertilizers and pesticides must be purchased for the temperate garden in distant markets.

On a social level an absence of gender analysis by NGOs presents an obstacle to success. One ramification of this is seen in the rarity of women extension workers. This produces a dual process of gender selection. Local cultural norms dictate that men work with other men. Local women either elect not to participate in projects or defer to their partner's interests. If the partner's interests are to produce for the market, food crops and other household use items are displaced. Women may become further marginalized and disempowered.

A second obstacle on a social level is the attempt to promote "communal" gardens. These gardens are imposed on communities, do not fit the cultural of subsistence food production in the Petén and they are communal in name only.

"Communal" gardening may provide development workers with an efficient way to disseminate information, but are alien to predominant household-based garden practices and knowledge. As a household level survival strategy, a THG is responsive to a household's wants, needs and abilities. These introduced "communal" gardens require

individual inputs while benefits are shared by the group. The benefits derived from the communal gardens do not compensate individual households for increased demands on their time, their labor or their resources.

A third obstacle on a social level is the difficulty development workers face in recognizing and understanding the local garden practices. Given this difficulty, the knowledge of traditional gardeners is not recognized. The "disorderly" planting of trees, vines, shrubs, and flowers with chickens and pigs running about does not resemble the development workers' idea of a garden. If the gardens are invisible, development workers can not respond to the needs or problems of traditional gardeners let alone transfer traditional management practices to newcomers.

A fourth issue is more a lost opportunity than an obstacle. The importance of ornamentals to gardeners has been overlooked by development workers in the Petén and in the literature on gardens and Third World development generally. To do so is to ignore one of the important reasons people grow plants around their homes. For the gardeners of the Petén, a THG is not solely a place to grow plants with use value, but it is a place to plant beautiful and/or interesting plants. The incorporation of ornamental plants into garden promotion offers a means to interest people in establishing household gardens.

4. 18 The THG Model of the Petén

The development of a conceptual model based on the most salient characteristics of a traditional household gardens provides an opportunity to synthesize and summarize the most important features of THGs as an agroecological system and to present THGs as an appropriate agricultural technology for the region. The THG model for the Petén is based

on local THGs and contains both bio/physical and social characteristics (Table 5). The bio/physical characteristics emphasize garden structure and plant material, while the social characteristics focus on knowledgeable gardener identity, social relationships, knowledge diffusion and community building.

Table 5. Bio/Physical and Social Characteristics of Gardens

Temperate Garden	Traditional Household Garden
Bio/Physical Characteristics	**Bio/Physical Characteristics**
• Single-layer structure • Extensively Planted • For food and income	• Multi-layered structure • Multi-specied • Intensively planted • Small animals • Multiple use
Social Characteristics	**Social Characteristics**
• Vertical social relationships • Extension workers • Top-down knowledge transfer	• Knowledgable Gardeners • Plant material and garden knowledge exchange • Community building

Physically, the traditional household gardens of the Petén are vertical arrangements of multiple species in a multi-layered structure. Socially, the traditional household gardens are "horizontal" in the sense that social relationships are among relative equals. The physical and social structure of the THGs reverses those of the temperate garden model promoted by GOs and NGOs in the region. In the temperate garden model the physical structure is a horizontal layer of plants, while the social structure is vertically or hierarchically ordered.

4.18.1 Bio/Physical Characteristics of THGs

The multi-layer structure and multi-specied intense plantings of trees, perennials and annuals combined with small animals are the key physical characteristics of

traditional household gardens of the Petén (see Appendix C. for a listing of plants by layer).

The plants are either native or introduced species appropriate for the humid tropics. Planting is a dynamic process which occurs over time. First year plantings include fruit trees, ornamental plants, and easy to grow annuals and perennials. The planting of trees begins the replication of the multi-layered forest structure. Trees appropriate for first year plantings include coconut, citrus sps., cericote, zapotes and annonas. The annuals and perennials appropriate for planting in the first year include *huisquil, zacate lemon*, okra, various peppers, tomatoes, zinnias, cleome, cannas and marigolds. These plants are productive, easy to grow and meet immediate household needs for food, medicine and enjoyment.

Planting beds, trellises and shading are constructed from local materials and soil is brought in from the forest if needed during the first year. Animals, especially chickens, are a important component of a THG model and are easily incorporated into the THG during the first year.

The multi-layered garden structure creates an environment that maintains soil fertility, diffuses sunlight, minimizes erosion and reduces runoff. Decomposing leaves and twigs contribute to soil fertility and the ability of the soil to retain moisture. The upper levels, in diffusing light and humidity, create micro-ecological niches for plants in the lower levels. Gardeners place plants in these "niches" that correspond to the requirements of each species for light, water and nutrients.

There is no set horizontal arrangement of plants in THGs. However, the THG is intensively planted with a wide variety of species. The intense horizontal arrangement of plants maximizes the utilization of space and minimizes the need for external inputs. Closely spaced plants reduce weeds. Diversification and intercropping help minimize pests. Intercropping shallow rooted plants with deeper rooted species draws on different levels of the soil nutrients. The multi-layered structure and intense planting creates a highly diverse agroecological system

4.18.2 Social Characteristics

The key social actors in the establishment and perpetuation of THGs are the oldest women of each household. Among these women are individuals who are the holders of specialized gardening and plant knowledge. The structure of the social process which occurs between gardeners is basically a process of sharing and communication among relative equals. Knowledgeable gardeners share or exchange what they know and the plants they have with family, friends, neighbors and the occasional passerby. These interactions usually occur during the late afternoon when household chores are done and visiting in the community takes place. In the form of conversation, gardening knowledge is shared while cuttings, seeds or seedlings are exchanged.

Through this process of exchanging gardening knowledge and plant material, community relationships are strengthened or established. This is particularly important for colonists. The relative equality in which the exchange of gardening knowledge and plant materials occurs helps transcend social barriers, allowing colonists to establish relationships and develop community in their new homes.

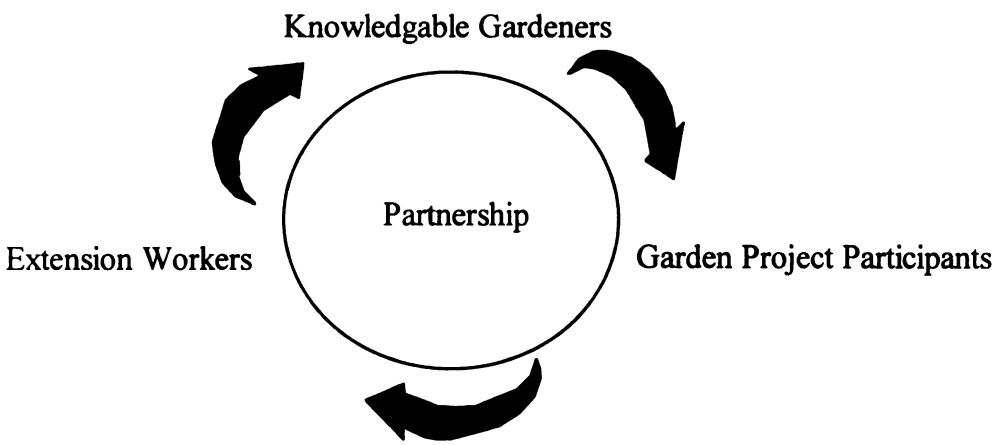
4.18.3 Implications for Development Workers Involved in Garden Promotion

In order for development workers to promote gardens based upon the THG concept model, they must: 1.) grasp the bio/physical and social nature of traditional household gardens; 2.) acknowledge that traditional gardeners have the fullest comprehension of THGs and therefore can provide the most complete understanding of local THGs; and 3.) recognize and remain sensitive to the complexity of gender relations in gardening.

4.18.4 A Partnership

To implement the THG model a true partnership between knowledgable gardeners, extension workers and garden project participants must be established (Figure 5). Each partner must have the respect for and willingness to learn from each other. In the Petén, where most knowledgeable gardeners are women and most new gardeners are women, cultural norms suggest that extension workers promoting gardens should also be women.

Figure 5. Partnership



In this partnership extension workers provide access to plant materials and knowledge developed in a scientific and controlled environment. They become the

facilitator or link between knowledgeable gardeners and gardening project participants. Knowledgeable gardeners contribute an understanding of THGs developed in a local context through practical experience. Gardening participants identify the specific household needs they want a THG to fill and combine varying degrees of practical experience with a willingness to experiment.

Chapter 5

Conclusions and Recommendations

5.0 Introduction

The objectives of this research are to describe the bio/physical and social structure of the traditional household gardens of native Peteneros; to develop a conceptual model based on an analysis of this bio/physical and social structure; to describe and analyze current projects of garden promotion in light of the conceptual garden model; and, to discuss implications of this research for garden promotion in the region.

5.1 A Description of Traditional Household Gardens in the Petén

Gardeners in the Petén understand their traditional household gardens as the activity of "having plants in the *sitio*." This activity has no local name which identifies the *sitio* as a space to grow plants or that identifies the activity of "having" plants in the *sitio*. The terms used by development workers in the Petén to refer to household gardens in general, *huerto familiar* and *huerto mixto*, are not terms that gardeners associate with the space where they have plants or with the activity of growing plants in the sitio. Rather, gardeners refer to the activity of having plants in the area around the home in terms of management practices, plant names and plant uses.

A definition of traditional household gardens in the Petén starts with this local concept. The traditional household gardens is a dynamic and synergistic process of gardeners interacting with the local environment to create a planted space around their homes. This process contains both biological and social elements. From a horticultural point of view the space is multi-layered, multi-specied and intensively planted. From a

sociological perspective the gardens consist of horizontally structured relationships among knowledgable gardeners, their extended families, friends, and acquaintances. The biological and social components each influence the other and are mutually sustaining. The process of gardening includes growing, using and exchanging plants and gardening knowledge. As a result of this exchange gardens are established and community relationships are strengthened or created.

Women of the oldest generation in each household are typically the primary gardeners in both communities, although some men are also primary gardeners. These primary gardeners involve other family members in various gardening activities.

The knowledge of this activity is expressed by gardeners through management practices, plant names and plant uses. The central management practice in the traditional gardens in the Petén is the establishment of a garden structure that mimics the local forests. This practice allows for "nature" intensive, rather than labor intensive or external input intensive, management practices. Gardeners are intimately aware of the environmental microniches in their gardens and manage their plantings according to the specific requirements of each plant.

Gardeners in San Jose and Santa Ana know the vast majority of plants in their gardens by name. Most plant names are known in Spanish, some are known in Mayan. A few plants, mostly ornamental, are not known by name in either community.

There are differences that exist in how the knowledge of gardening is dispersed along lines of gender and ethnicity. Women have more knowledge of medicinal and ornamental plants growing in the *sitios,* while men have more knowledge of plants

brought in from the forest. Some management practices are gendered as well, although the lines are not strictly drawn. Men bring soil in from the forest and young boys harvest the fruit from trees. Women harvest medicinal plants, while young girls sell surplus fruits in the communities.

The only significant difference in gardening knowledge is between the two ethnic groups of Itza Mayan and *ladino*. This difference is reflected in the knowledge of and attitude towards medicinal plants. In Santa Ana, in-depth medicinal knowledge is held by a few and knowledge of "*plantas que curan*" is associated with *brujas* (witches). In San Jose, even though there is some talk of *brujas*, medicinal knowledge is more evenly distributed and respected.

In the bio/physical aspects of the gardens there is no statistically significant differences between the THGs of Itza Mayans and *ladinos* or between those of colonists and native Peteneros in *sitio* size, garden diversity, plant uses, number of species, or number of plants. Colonists who participated in this study have lived in the Petén from twelve to twenty years. These colonists have established THGs which are indistinguishable from the gardens of native Peteneros.

5.2 Functions Of THGs

The planted space of the *sitio* fulfills multiple functions. From a bio/physical perspective the garden preserves biodiversity and provides an environment conducive to plant growth. The physical structure of the THG contributes both to the physical comfort of the household by providing protection from the sun and heavy rains and to the protection of plantings from wandering animals. From a social perspective the THG

provides privacy in closely settled communities and defines boundaries. It mediates neighborhood relationships. The THG contributes to "currency" for social exchange. This exchange is governed by norms of reciprocity established during the exchange of plant material and gardening knowledge. Culturally, the garden solidifies values relating to agricultural practices and the types of food eaten and shared. The THG contributes to the type of knowledge valued and exchanged. It contributes to the respect of elders who are the holders of gardening knowledge. The THG functions as a means to maintain a way of producing for the household and preserving local knowledge against outside influence. It ensures food diversity and security and the proximity of medicinal plants. Aesthetically the THG provides a space for enjoyment and the appreciation of beauty. Economically the garden offers a setting for small-scale commercial enterprises and a source of items for sale and/or exchange.

While it is important to understand the functions of the THG, this understanding alone does not solve the problems encountered by development organizations promoting household gardens in the Petén. Garden promotion must be compatible with both the bio/physical and social environment of the region. Promotion must also recognize gardening as an adaptive process.

5.3 THGs as an Adaptive Process

THGs are a reflection of a complex and interactive process of adaptation and change between humans and their environment. THGs provide a mechanism for household-level agricultural production in a way compatible with the tropical forest environment and the broader socio/political climate. This is an adaptive process which

changes over time and space according to household needs and resources and the larger environment. The THG is one component of a household-level agricultural strategies which help households cope with change and ensure survival.

5.4 A Conceptual Model of THGs in the Petén

The conceptual model of THGs in the Petén is based on an analysis of the bio/physical and social structure of the traditional household gardens of native Peteneros and colonist. Bio/physically, the THG can be viewed as a vertical and horizontal patterning of plants which evolves over time and space. This patterning creates microniches which are exploited by gardeners according to the requirements of specific plants and the needs of the household.

Socially, the THG is composed of horizontal relationships among friends, extended family, neighbors and other community members. These relationships are established through the exchange of plant material and gardening knowledge. Knowledgable gardeners, primarily women, but also some men, are pivotal in the diffusion of gardening knowledge and plant material within this social network.

Through the exchange of plant, seeds, cuttings and gardening knowledge, gardens are established. But equally important, although not as visible, community is built. Newcomers make contact with and establish connections to knowledgable gardeners through a process of exchange and reciprocity. Social barriers are broken and common bonds are created.

5.5 Garden Promotion

For various reasons, development organizations in the Petén are promoting gardens among colonists. These promoted gardens appear, to varying degrees, inappropriate for the Petén. The terminology used by development workers to refer to both promoted and traditional gardens is not recognized by gardeners in reference to their own traditional household gardens. The focus of the promoted gardens is typically on one or two activities: household food production and/or income generation. The other functions of a household garden are not incorporated into garden promotion. The single-layered and mono-cropped rows or beds of the temperate gardens promoted by most NGOs and GOs are bio/physically unsuitable for the humid tropics. The promoted agroforestry garden, despite its multi-layered structure, ignores gender dimensions of garden promotion.

The traditional household gardens are by and large unnoticed by development workers. Not suprisingly, knowledgable gardeners and the local mechanisms of plant material and garden knowledge exchange are not recognized.

Low adoption rates and alterations of intra-household gender relations may result from the inappropriateness of the promoted gardens and the inability of development workers to "see" and therefore appreciate, the existing THGs and local gardeners.

5.6 Implications for Garden Promotion

Reports from extensionists and research observations suggest that newer colonists and colonists in remote areas have not adopted THGs. The reasons for non-adoption may be that new colonists have few means to observe THGs or establish contact with

experienced gardeners. If this is the case, the traditional transfer mechanisms of gardening knowledge and plant exchange can not be expected to diffuse the THGs of the native Peteneros to all social groups or areas of the Petén within an efficacious period of time. Therefore, it is possible that some kind of garden promotion needs to occur to supplement or complement the traditional mechanisms.

Intervention by current NGOs and GOs could contribute to the diffusion of THGs. However, current garden promotion practices need to be re-evaluated. The THG model provides a means for extension workers to comprehend the actual achievements of Peténero gardeners and offers an alternative to current garden promotion.

In order for development workers to promote gardens, they must perceive the bio/physical and social nature of traditional household gardens. They need to acknowledge and value local gardeners and grasp the essential role they play in the establishment of traditional gardens. Adopting this approach, development workers will be more likely to recognize and remain sensitive to the complexity of gender relations in gardening.

5.6.1 A Partnership

In the Petén, the relationships among the various actors involved in the "development of gardens" need to be reformulated. A partnership among equals, between knowledgable gardeners, extension workers and garden project participants, needs to be established. Each partner should have the respect for and willingness to learn from each other. A process is established in which the knowledge of women as gardeners is on an equal footing with the knowledge of the development workers. In this partnership,

extension workers provide access to plant materials and "scientific" knowledge. They become the facilitator or link between knowledgable gardeners and gardening project participants. Knowledgable gardeners contribute an understanding of THGs developed in a local context. Gardening participants identify the specific household needs they want a THG to fill and combine varying degrees of practical experience with a willingness to experiment.

Garden promotion patterned after that of the local THG model, in both the bio/physical and social sense, is more likely to be successful from a developmental point of view and be sustainable in an environmental, an economic and a social sense.

5.7 Observations on Research

This investigation of THGs in the Petén occurred during a relatively short time period of two months. Gardeners readily shared the names of plants and plant uses during this time period. However, it was more difficult to elicit in-depth discussions of management practices. Management practices were observed during numerous garden visits of gardens in different stages of development. While this provided breadth to the information gathered, it did not provide depth. Further documentation of more detailed management practices remains to be done.

Related to this is the seasonal nature of management practices. It is likely that management practices vary by season. Research was carried out during the first part of the rainy season. Dry season management practices were not observed. Given the perennial nature of the majority of plants in THGs there is a degree of continuity in structure and type of species from one season to the next. However, a longer period in the

field would be necessary to develop a more detailed understanding of management practices in general and dry season practices in particular.

Visits to NGO and GO gardening projects were rapid assessments and not meant to be an in-depth analysis of gardening projects. Rather they served as a complement and contrast to the understanding of local THGs. These visits were supplemented by further discussions with extension workers. However, given the brevity of the visits to garden sites, this research does not give a complete picture of garden promotion. A more in-depth study of garden promotion could provide a fuller understanding of the complexities of garden promotion in the Petén.

5.8 Recommendations for Future Research

Researchers have focused little attention on THGs in the Petén. This research has made a contribution to this area, but a number of opportunities exist to expand what is known about this traditional form of agriculture in both its bio/physical and social dimensions.

This research investigated THGs in two communities. Expansion of this study to other communities in the Petén would contribute to our understanding of THGs in this region. For example, communities within the Biosphere Reserve and in the savanna region confront distinct ecological conditions and economic opportunities which may impact the bio/physical and social dimensions of THGs.

Additional studies which examine the ecological functioning of THGs from a systems perspective are needed. Systematic examination of the biological interactions that take place within the THG and what gardeners know of these interactions could provide

valuable information for agricultural development in the humid tropics. Although this study did not find knowledge relating to compatible species admixture, i.e. companion planting, further study may reveal such management practices exist.

This research has identified a process of continuous community formation which takes place along with the sharing of gardening knowledge and plant material. Yet, much remains to be learned about this process. Areas to explore include the type of relationships established during these exchanges and the strength of these relationships. A key question to ask is how can the process of building community relationships be strengthened during the promotion of THGs in new colonist communities?

An intriguing yet unexplored question which arose during this research regards ethnic differences in attitudes towards nature. The traditional household gardens is an arena where nature and society intersect. Preliminary evidence suggests that there is a difference in attitude towards nature between *ladinos* and Itza Mayans. This difference in attitudes seems to be reflected in their gardens. But further research is needed before any definitive statements can be made.

The methods used in this research can be adapted to the study of THGs in other geographic and/or cultural areas of the world. Within these methods, knowledgable gardeners are the key to understanding THGs from an *emic* perspective. This local perspective provides insights unavailable from an approach that relies solely on an *etic* perspective.

And ultimately a need exists in the Petén to develop a participatory research and development approach in which THGs are promoted within new colonist communities and existing THGs improved through various forms of partnerships. The challenge is for

development organizations to recognize knowledgeable gardeners and garden project participants as equal partners in the search for alternative and sustainable agriculture solutions for in the Petén.

APPENDICES

Appendix A.

Species List

Scientific Name	Common Name	Mayan Name
Acalypha arvensis	*hierba del cancer*	--
Acrocomia mexicana	*cocoyol*	--
Agave sisalana	*maguey*	*kij*
Allium sp.	*cebollin*	--
Allium sativa	*ajo*	*aajo*
Aloe vera	*sabila*	*saab'ila*
Alpina purpurata	*mariposa*	--
Amaranthus sp.	*tersio pelo*	--
Amaranthus dubius	*marbo*	--
Amaryllidaceae sp.	unknown	unknown
Ambrosia artemisaefolia	*altamisa*	--
Anacardium occidentale	*maranon*	*maranyon*
Ananas comosus	*pina*	*pinya*
Annona cherimola	*chirimoya*	
Annona purpea	*tuki (tucuy ?)*	*tuki*
Annona reticulata	*anona colorado*	*oop*
Annona muricata	*guanabana*	*(ix) k'an*
Annona squamosa	*anona blanca, saramuyo*	*tz'imul*
Annona testudinea	*anona del monte*	--
Anthemis noblis	*manzanilla*	--
Anthurium crassinervium	*oja de piedra, cola de faisan*	--
Antigonon leptopus (?)	*san diego*	--
Arachas hypogea	*manilla*	*kakawate*
Artemisia vulgaris	--	*tsin tsin*
Asparagus plumosus	*gamiesa, velo, velo de novio*	--
Aspenium formosum	*cola de quetzal*	---
Bauhinia candidans	*costa rica*	--
Begonia sp.	*begonia*	--
Bixa orellana	*achiote*	*ku xu'*
Bougainvillea glabra	*bouganvilla*	--
Bourreria oxiphylla	*roble*	*(aj)b'eek*
Brasica campestris	*mostaza*	--
Bromelia pinquin	*pinuela*	*mochan ?*
Brunfelsia nitida	*gallan*	--
Bryophyllum pinnatum	*hoja del aire*	--
Bursera aff.	*chacah*	--
Byrsonima crassifolia	*nance*	*chi'*
Cacteae sp.	*esceleto*	--
Calocarpum mannosum	*zapote mammey*	*(ix)chakaja' as*
Canna sp.	*bandera*	--
Capraria biflora	*pasmo*	--

Scientific Name	Common Name	Mayan Name
Capsicum annuum	*chile; chile dilla; habenero; paloma; chiltepe; diente de perro*	*ik; --;(ix)ab'a; u-koj; (ix)paloma; (ix)chiltep; (ix)ma'ax*
Capsicum Peténese?	*chile dulce*	--
Capsicum viscidum?	*chanico*	--
Carica papaya	*papaya, papaya del monte*	*put*
Cassia grandis	*bucut*	*b'ukut'*
Cassia occidentalis	*frijolillo*	--
Catharanthus roseus	*chula, chaltia, chata*	--
Cedrela sp.	*cedro*	*ku' che'*
Cercropia obusifoloa	*guarumo*	*(ix)k'o'och che'*
Chamaedorea elegans	*xate hembra*	--
Chamaedorea oblongata	*xate macho, jade*	--
Chamaedorea tepejilote	*pacaya, chibe*	--
Chenapodium ambrosiodes	*albuja, apasote*	*(aj)apasote*
Chiococca alba	*zorillo*	*pay che*
Chrysophyllum caintio	*caimito*	*kay(u)mito*
Citrullus vulgaris	*sandia*	*sandiia*
Citrus sp.	*lima*	--
Citrus aurantifolia	*limon acido, limon agria*	*limon*
Citrus aurantium	*naranja agria, naranja de chile*	*naraanja*
Citrus limonia	*limon*	*limon*
Citrus paradisia	*pomelo, toronja*	*toroonja*
Citrus reticula	*mandarina*	--
Citrus sinensis	*naranja, naranja dulce*	*naraanja, zutz pakal*
Citrus sp.	*limoncillo*	--
Cleome sp.	*caca chofla, china*	--
Cnidosculus chayamansa	*chaya*	*chay*
Coco nucifera	*coco*	--
Coffea arabica	*cafe*	--
Coleus blumei	*jardin, manto*	--
Cordia dodecandra	*cericote*	*k'opte*
Coriandrum sativum	*cilantro*	*(ix)kulantro*
Crescentia cujete	*jicara, moro*	*luch*
Crotalaria maypurensis	*chipilin*	--
Croton sp.	*barkito, colocho, arbolito*	--
Cucumis melo	*melon*	--
Cucurbit moschata	*ayote*	*k'uum*
Cymbopogon citratis	*te de limon, zacate limon*	*(ix)su'uk limon*
Dahlia sp.	*dahlia*	--
Dalbergia retusa	*rosul, tinta*	--
Dieffenbachia picta	*pinta*	--
Dioscorea alata	*malanga*	--
Dioscorea bulbifera	*papa del aire, papa voladora*	*(ix)pukak', (ix)chak*
Epiphyllum crenatum?	*pita' aya, tuna*	*(ix)pita'aya*
Erythrina rubrinervia?	*pito*	--
Euphorbia pulcherrima	*flor de pasqua del mon*	--
Fernaldia pandurata	*loroco*	--

Scientific Name	Common Name	Mayan Name
Gardenia jasminoides	*gardenia*	--
Gliricidia sepium	*madre cacao*	--
Gossypium hirsutum	*algodon*	*taman*
Gynura Sarmentosa	unknown	unknown
Hamelia patens	*bouquet*	*(ix)canan*
Helianthus annus	*mirasol*	--
Hibiscus esculentas	*okoro*	*okoro*
Hibiscus rosa - sinensi	*clavel, tulipan*	--
Hippeastrum puniceum	*canaga, lirio*	--
Hymenea courbaril	*cuapimole*	*pakay*
Impatiens sp.	*quince anos*	--
Inga paterna	*paterna*	--
Ipomoea batatas	*camote*	*kamut*
Jacobinia umbrosa	*copote de cambul*	*copote de cambul*
Jasminum sambac	*jazmin*	--
Jatropha curcas	*pinon*	--
Kalanchoe pinnata	*siempre viva*	--
Lagenaria siceraria	*chibola, tecomate*	*lek'*
Lagerstroemia indica	*jupiter*	--
Laguncularia racemosa	*mangle*	--
Lantana camara	*revienta muela*	--
Laportea mexicana	*chichicaste, ortiga*	--
Lilium coccinea ?	*asusena*	--
Lippia alba	*oregano, oregano grueso, castillo*	--
Lippia sp.	*oregano fino*	--
Lycopersicum esculentum	*tomate*	*p'ak*
Mangifera indica	*mango*	*maango*
Manihot esculenta	*yuca*	*tz'iim*
Manilkara acharas	*chicozapote, chohe, sapote*	*ya' jach-*
Mentha spicata	*hierba buena*	--
Merabilis jalapa	*maravilla*	--
Mimosa pudica	*dormilón*	*(ix) mutz*
Momordica charantia	*condiamor*	--
Mucuna sp.	*frijol abono*	--
Murraya paniculata	*limonaria*	--
Musa acuminata	*banano*	*box haaz*
Musa paradisiaca	*platano*	*box haaz*
Musa sapientum	*guineo*	*box haaz*
Nerium oleander	*narciso*	--
Neuroleana lobata	*tres puntas*	--
Nicotiana tabacum	*tobaco*	*k'uutz*
Ocimum basilicum	*albahaca*	*ca cal tun*
Optunia ficus-indica	*nopal*	*pak' lam*
Orbignya cohume	*corazon*	--
Orchidaceae sp.	*orchid*	--
Pachira aquatica	*zapote bobo*	*(ix)wakut'*
Pachrhizus erosus	*jicama*	*chi'kam*

Scientific Name	Common Name	Mayan Name
Parmentiers edulus	*guajilote*	*kat*
Pelargonium x horotorum	*gerenium*	--
Persea schiediana	*aquacate del monte*	*awakate*
Persea americana	*aquacate*	*awakate*
Petiveria alliaceae	*apacin*	--
Phaseolus vulgaris	*frijol*	*bu'ul*
Philodendron sp.	*telefono*	--
Philodendron sp.	unknown	unknown
Phyllanthus glaucescens	*pichiton*	--
Physalis philadelphica	*mil tomate, tomotillo, tomillo*	--
Pimenta diocia	*pimienta gorda*	*nab' aku' uk*
Pinus caribaea	*pino*	*okote*
Piper auritum	*obel*	--
Piper amalago (?)	*cordoncillo*	--
Piper peltatum	*santa maria*	--
Plumeria sp.	*flor de mayo*	*nikte'*
Portulaca pilosa	*amor de un rato*	--
Pouteria durlandii (?)	*pasin*	*pasin, ja' as che'*
Pouterias sp.	*zapote*	--
Prunus amygdalus	*almendro*	*almendra*
Prunus capuli	*capulin*	*pujan*
Psidium guajaba	*guayaba*	*pichi'*
Punica granatum	*granada, graizada*	*granaada*
Quina schippi	*quina*	--
Rosaceae sp.	*rosa*	--
Ruta graveolens	*ruda*	*sink-in*
Sabal morrosoana	*huano*	*bon*
Saccharum officinarum	*cana*	*kanya*
Saintpaulia ionantha	*violeta*	--
Salvia oficinalis	*salvia*	--
Sansevieria trifasciata	*curarina*	--
Sechium edule	*chayote, huisquil*	*(ix)wiskil*
Senna occidentalis	*frijolillo*	--
Sicydium tamnifolium	--	*pa' kil*
Sida rhombifolia	*escoba, malva*	*chichibe*
Simaruba glauca	*negrito, aceituna*	*pa' sak'*
Solanum nigrum	*hierba mora, hierba negro*	*(ix)chayuc,*
Solanum seaforthianun ?	*lagrima de virgen*	--
Solanum torvum ?	*lavaplatos*	--
Solanum wendlandii	--	*(ix)can*
Spondias purpurea	*jocote*	*ab' al*
Spondias sp.	*jocote de monte*	*(ix) ab'ache'*
Spondias sp. ?	--	*cha abal (chaba?)*
Stachytarpheta cayennensis	*vervena*	--
Swietenia macrophylla	*caoba*	*chakalte'*
Tagetes erecta	*flor de muerto*	*(ix) ti pu*
Talisia oliveformia	*guaya*	*wayum*

Scientific Name	Common Name	Mayan Name
Tamarindus indica	*tamarindo*	*tamarindo*
Thouinia paucidentata (?)	--	*cancunup*
Thuya orientalis	*cipres*	--
Urera baccifera	*ortiga*	--
Veronica deppeana ?	*siquepata ?*	--
Vicia faba ?	*haba*	--
Xanthosoma sagittifoliu	*macal*	--
Yuca elephantipes	*izote*	*isote*
Yuca elephantipes	*izote del monte*	*isote*
Zephyranthes citrina	*hacinto*	--
Zinnia sp.	*margarita, mulata, teresita*	--
--	*argentina*	--
--	*baranga*	--
--	*bouquet de novia*	--
--	*caluza de mico*	--
--	*camayon*	--
--	*carolina*	--
--	*catities*	--
--	--	*chic tan*
--	--	*chultec*
--	--	*cincuyo*
--	*con la suerte*	--
--	*confetti*	--
--	*corazon de leon*	--
--	*cuba*	--
--	*cucaracha*	--
--	*dinero*	--
--	*disiplina*	--
--	*enridadero*	--
--	*esparago*	--
--	*espuma*	--
--	*flor de la cruz*	--
--	*flor del montana*	--
--	*gilente*	--
--	*habilla*	--
--	*hoja de jardin*	--
--	*hoja de mico*	--
--	*oja del gato*	--
--	*hoja que puede*	--
--	*limoflor*	--
--	*liston*	--
--	*macuya*	--
--	*mangillo*	--
--	*manto blanco*	--
--	*manzano*	--
--	*orgulloso*	--
--	--	*pach' te*

Scientific Name	Common Name	Mayan Name
--	*palo de muneca*	--
--	*paracitos*	--
--	*pia nina*	--
--	*sobrina de monja*	--
(spider plant)	unknown	unknown
--	*vara, vara blanca*	--
--	*verdologo cheltoca*	--
(wandering jew)	unknown	unknown

Appendix B.

Plants with Multiple Use

SCIENTIFIC NAME	USE
Achras sapote	food, living fence
Aloe vera	medicinal, ornamental
Anthurium crassinervium	medicinal, ornamental
Arachas hypogea	food, green manure
Bougainvillea glabra	medicinal, ornamental
Caesalpinia pulcherrima	food, medicinal
Capsicum annuum	food, medicinal
Cassia occidentalis	medicinal, ornamental
Cedrela odorato	construction, medicinal
Chenopodium ambrosiodes	food, medicinal
Citrus aurantium	food, medicinal
Citrus autramtifolia	food, medicinal
Citrus limonia	food, medicinal
Coco nucifera	food, medicinal
Cordia dodecandra	food, shade, construction
Euphorbia pulcherrima	medicinal, ornamental
Gossypium hirsutum	medicinal, ornamental
Hamelia patens	medicinal, ornamental
Helianthus annus	medicinal, ornamental
Hibiscus rosa - sinensis	medicinal, ornamental
Kalanchoe pinnata	medicinal, ornamental
Lippia alba	food, medicinal
loroco	food, ornamental
Merabilis jalapa	medicinal, ornamental
Musa sp.	medicinal, ornamental
Ocimum basilicum	food, medicinal
Optunia sp.	food, medicinal, ornamental
Piper peltatum?	food, medicinal
Plumaria sp.	medicinal, ornamental
Prunus capulin	food, medicinal
Psidium guajava	food, medicinal
Punica granatum	food, medicinal
Simaruba glauca	food, medicinal
Solanum nigrum	food, medicinal
Spondias purpurea	food, medicinal
Tagetes erecta	medicinal, ornamental
Yucca elephantipes	food, living fence
unknown	medicinal, ornamental

Appendix C.

Plant Species by Layer

Scientific	English	Spanish	Maya	Use*
First layer - 10-20 m				
Coco nucifera	Coconut	*Coco*	--	f, m
Annona sp.	Annona	*Annona*	*Tuki, Oop, Tz'imul*	f
Achras sapote	Sapote	*Zapote*	*Ya'*	f
Second layer - 5-10m				
Musa sp.	Banana	*Banana*	*Box haaz*	f, m
Musa sp.	Plantain	*Platanos*	*Box haaz*	f
Musa sp.	--	*Guineos*	*Box haaz*	f
Cordia dodecandra	--	*Cericotes*	*K'opte*	f
Citrus sp.	Orange	*Naranja*	*Zutz pakal*	f, m
Citrus sp.	Lemon	*Limon*	--	f, m
Third layer - 1-5 m				
Talisia oliveformia	Guava	*Guaya*	*Wayum*	f
Cnidoscolus acontifolius	--	*Chaya*	*Chay*	f
Rosaceae sp.	Roses	*Rosa*	--	o, m
Hibiscus rosa-sinensis	Hibiscus	*Clavel & Tulipan*	--	f, m
Fourth layer - less 1 m				
Capsicum annum sp.	Pepper	*Chile*	*Ik, (ix)ab'a,* etc.	f, m, o
Lycoprsicum esculentum	Tomato	*Tomate*	*P'ak*	f
Dioscorea alata	--	*Macal, Malanga*	--	f
Cymbopogon citratis	Lemon grass	*Zacate limon*	*(Ix)su'usk*	m
Solanum nigrum	Nightshade	*Hierba mora*	--	f
Tagetes erecta	Marigold	*Flor de la muerta*	--	m, o
Zinnia sp.	Zinnia	*Margarita, mulata*	--	o
Fifth layer - vines; potted plants; epiphytes				
Sechium edule	--	*Huisquil*	*(Ix)wiskil*	f
Momordica charantia	--	*Condiamor*	--	m
--	Ferns	*Cola de quetzal*	--	o
Coriandrum satvum	Cilantro	*Cilantro*	*(Ix)kulantro*	f
Mentha spicata?	Spearmint	*Hierba buena*	--	m
Lippia alba	Oregano	*Oregano fino*	--	f, m

*f = food; m = medicinal; o = ornamental

Bibliography

Bibliography

Adams, W.M. 1990. Green Development: Environment and Sustainability in the Third World, Routledge, London.

Alcorn J.B. 1984. *Huestec Mayan Ethnobotany,* University of Texas Press, Austin

Altieri, M. 1990. "Why Study Traditional Agriculture?" in *Agroecology*, Carrol. C., Vandermeer, J. and Rosset: eds. McGraw-Hill, NY.

Altieri, M.1983. *Agroecology: The Scientific Basis of Alternative Agriculture,* University of California, Berkeley, California.

Altieri, M.1990. "Agroecology and Rural Development in Latin America" in *Agroecology and Small Farm Development* Altieri, M. and S. Hetcht: eds. CRC Press, Boca Raton, Ann Arbor and Boston.

Alvarez-Buylla Roces, M. E., E. Lazos Chaveros, J. R. García-Barrios. 1989. "Homegardens of a Humid Tropical Region in Southeast Mexico: An Example of an Agroforestry Cropping System in a Recently Established Community" in *Agroforestry Systems* 8: 133-156.

Anderson, E. 1950. "An Indian Garden at St. Lucia" in *Ceiba,* Vol. 1 No 2. Escuela Agricola Panamericana. Tegucigalpa, Honduras: 96-103.

Anderson, E.N. 1993a. "Gardens in tropical America and tropical Asia" in *Biotica: Nueva Epoca* Vol. 1, 1993: 81-102.

Anderson, E.N. 1993b. "Southeast Asian Gardens: Nutrition, Cash and Ethnicity" in *Biotica: Nueva Epoca* Vol. 1, 1993: 1-11.

Anderson, J. N. 1980. "Traditional Home Gardens in Southeast Asia: A Prolegomenon for Second Generation Research", in *Tropical Ecology abd Development* (Proceedings of the 5th International Symposium of Tropical Ecology, April 16-21, 1979 at Kuala Lampur, Malaysia), J.I. Furtado ed.: 441-446.

Atran, Scott. 1992. "Itza Mayan Tropical Agro-Forestry" in *Current Anthropology.* Vol 34, No. 5, December 1993.

Arvigo, R. and M. Black. 1993. *Rainforest Remedies*. Lotus Press, Twin Lakes Wisc.

Barrera, A. 1980. "Sobre la Unidad de Habitación Tradicional Campesina y el Manejo de Recursos Bioticos en el Area Maya Yucatanense" in *Biotica* 5 (3): 115-129.

Baser, H. 1988. *Technology, Women, and Farming Systems*. Studies in Technology and Social Change, No. 5. Technology and Social Change Program, Iowa State University, Ames, Iowa.

Bebbington, A. 1991. "Farmer Knowledge, Institutional Resources and Sustainable Agricultural Strategies: a Case Study from the Eastern Slopes of the Peruvian Andes" in *Bull. Latin Am. Res.* Vol 9. No., 2: 203-228.

Bentley, J.1989. "What Farmers Don't Know Can't Help Them: The Strengths and Weaknesses of Indigenous Technical Knowledge in Honduras" in *Agriculture and Human Values*. 6 (3 Sum): 25-31.

Bentley, J., G. Rodrigues, A.Gonzales, 1994. "Science and People: Honduran Campesinos and Natural Pest Control Invasions" in Agriculture and Human Values V 11, No 2&3, Sp-Sum 1994.

Box, L. 1988. "Experimenting Farmers: A Method for Adaptive Agricultural Research" in *Sociologia Ruralis* 1988, Vol. XXVIII-1: 63-75.

Brewer, J and A. Hunter. 1989. *Multimethod Research: A Synthesis of Styles*. Sage Library of Social Research Vol 175. Sage Piblications. London.

Brownrigg, L. 1985. *Home Gardening in International Development: What the Literature Shows*. The League of International Food Education, Washington DC.

Budowski, G. 1990. "Home Gardens in Tropical America: A Review" in *Tropical Home Gardens,* Landauer, K. and Brazil, M. eds., United Nations University Press, Tokyo.

Bunch, R. 1982. *Two Ears of Corn.* World Neighbors. Oklahoma City.

Burgess, R. 1982. "The Unstructured Interview as Conversation" in *Field Research: a Sourcebook and Field Manual*, Burgess, R.: ed. Routlage, Chapman and Hall, Inc. New York.

Butler, L. and J. Waud 1990. "Strengthening Extension Through the Concepts of Farming Systems Research and Extension (FSR/E) and Sustainability" in *Journal of Farming Systems Research-Extension* 1 (1): 77-98.

Buttel, F. H. 1995. "Twentieth Century Agricultural-Environmental Transitions: A Preliminary Analysis" in *Research in Rural Sociology and Development, Vol. 6 Sustaining Agriculture and Rural Communities*, Schwarzweller, H. and Lyson, T. JAI Press Inc. Greenwich and London.

Caballero, J. 1992. "Maya Homegardens: Past, Present and Future" in *Etnoecologia* Vol. 1, No. 1: 35-54.

Carpenter, B. 1990. "Faces in the Forest" *U.S. News & World Report*, 4 June 1990 V10 N22, 63-69.

Cashman, K. 1991. "Systems of Knowledge as Systems of Domination: The Limitations of Established Meaning" in *Agriculture and Human Values*. Vol VIII, No. 2. 1&2: 49-58.

Castro, N. H., A. Gomez-Pompa, L. Cruz Kuri, and J.S. Flores. 1993. *"Los huertos familiares mayas in X-uilub, Yucatan, Mexico. Aspectos generales y estudios*

comparativo entre la flora de los huertos familiares y la selva" in *Biotica, nueva época.* Vol 1, julio de 1993: 19-36.

Centro Agronomico Tropical de Investigacion y Ensenanza (CATIE). 1990a. Programa de manejo de recursos naturales. Proyecto de conservación para el desarollo sostenible en America Central. Taller Centroamericano de conservación para el dessarollo sostenible, 23-26 Junio 1990. Peten, Guatemala. Documento de trabajo, cited in Reining *et al.* 1992.

Centro Agronomico Tropical de Investigacion y Ensenanza (CATIE). 1990b. Principales programas para el manejo del pargue nacional "Biotopo El Zotz" (San Miquel/La Palotada), Peten, Guatemala. XIII Curso Anual de planificación y manejo de areas protegidas, Guatemala, 25 de Julio al 29 de Agosto 1990. Documento de trabajo. 134 pp., cited in Reining *et al.* 1992.

Chambers, R. and Ghildyal, B.1985. "Agriculture Research for Resource-Poor Farmers: The Farmer-First and Last Model" in *Agricultural Administration and Extension.*

Chambers, R., Pacey, A., Thrupp, L.A. eds. 1989. *Farmer First: Farmer Innovation and Agricultural Research.* Intermediate Technology Publications. London.

Chambers, R. 1990. "Micro Environments Unobserved" in *Proceedings of the International Symposium on Natural Resource Management for a Sustainable Agriculture.* Feb. 6-10, 1990. New Delhi, Vol. 2. Indian Society of Agronomy, New Delhi.

Chambers, R. 1993. *Challenging the Professions.* Intermediate Technology Publications. London.

Chaney, E. 1985. "Women's Component in Integrated Rural Development" in *Rural Women and State Policy: Feminist Perspectives on Latin American Agricultural Development,* Deere, C. and Leon, M. eds., Westview Press, Boulder and London.

Chapin, M. 1988. "The Seduction of models: Chinampa Agriculture in Mexico." *Grassroots Development* 12 (1): 8-17.

Charmazm, K.1988. "The Grounded Theory Method: An Explication and Interpretation" in Contemporary Field Research: a collection of Readings. R. Emerson: ed. Waveland Press, Inc. Prospect Heights Illinois.

Christanty, L. 1990. "Home Gardens in Tropical Asia" in *Tropical Home Gardens,* Landauer, K. and Brazil, M. eds., United Nations University Press, Tokyo.

Cleveland, D. 1987. "Household Gardens as a Development Strategy" in *Human Organization.* Vol. 46 No. 3: 259-70.

Cleveland, D. and Soleri, D. 1991. *Food From Dryland Gardens,* Center for People, Food and Environment, Tuscon, Arizona.

Collins, J. 1991. "Women and the Environment: Social Reproduction and Sustainable Development" in The Women and International Development Annual. Vol. 2. R. Gallin, A. Ferguson: eds.: 34-58.

Comerford, S. 1995. *Medicinal Plants of San Andres, Petén, Guatemala.* Tulane University, PhD. dissertation.

Conway G. 1989. "Community Appraisals Among Upland Farmers" in *Farmer First,* Chambers, R., Pacey A., Thrupp L.: eds., Bootstrap Press Intermediate Technology Publications, New York, N Y.

Dahlberg, K.1990. The Industrial Model and its Impact on Small Farmers: The Green Revolution" in *Agroecology and Small Farm Development.* Altieri, M and Hetcht, S.: eds. CRC Press. Boca Raton, Ann Arbor, Boston.

Davis D. K., 1995 "Gender-based Differences in the Ethnoveterinary Knowledge of Afghan Nomadic Pastoralists" in *Indigenous Knowledge and Development Monitor,* Vol. 3 Issue 1 April: 3-4.

Deere, C.D.and M. León. 1987. *Rural Women and State Policy.* Westview Press, Inc. Boulder Colorado.

Denen H. 1993. "Mujer Campesina y Commercializacion: Responsabilidades, Beneficios y Gastos de las Mujeres en Choluteca, Honduras" in *La Mujer Rural: Su Papel en los Agrosistemas de la Region Semiseca de Centro America.* Jan A.J. Kerremans, Ricardo Radulovich, and Rossana Lok: eds. CATIE , Turrialba, Costa Rica: 173-206

Dewey, K. 1981. "Nutritional Consequences of the Transformation from Subsistence to Commercial Agriculture in Tabasco, Mexico". *Human Ecology* 9: 151-187.

Direción General de Estadistcas. 1995. Anuario Estadisticas Guatemala: Dirreción General de Estadisticas.

Guerrero, G. 1995. "Massacre at Chisec: History Repeats Itself" in *Envio*, Nov. 1995: 14-18.

Falanruw, M.V.C. 1990. "The Food Production Systems of the Yap Islands" in *Tropical Home Gardens*, K. Landauer and M. Brazil eds., UNU, Tokyo.

Farrington, J. A., and Martin, A. 1988. "Farmer Participation in Agricultural Research: a Review of Concepts and Practices" in *Agricultural Administration Occasional Paper No. 9.* Overseas Development Institute, London.

Farrington, J.A. 1989. "Farmer Participation in Agricultural Research" *Food Policy* , Vol. 14, No. 2.

Flores J. S., 1993 "Observationes preliminarias sobre los huertos familiares mayas en al ciudad de Merida, Yucatan, Mexico" in *Biotica: Nueva Epoca*, Vol 1, 1993: 13-18.

Francis, C.A. 1988. *Internal Resources for Sustainable Agriculture.* International Institute for Environment and Development Gatekeeper Series No. SA8.

Gadgil , M. Fikert Berkes, and Carl Folke. 1993. "Indigenous Knowledge for Biodiversity" in *Ambio* Vol. 22, No. 2-3, May 1993: 151-156.

Gardner F., 1991. "Guatemala: A Political Ecology" in *Earth Island Journal* EPOCA/Earth Island Institute, San Francisco. W. 1991: 20-22.

Glaser and Straus 1967 cited in Burgess R. "The Role of Theory in Field Research" in *Field Research: A Sourcebook and Field Manual*, Routlage, Chapman and Hall, Inc. New York 1982: 209.

Gliessman, S.R. 1990. "The Ecology and Management of Traditional Farming Systems" in *Agroecology and Small Farm Development*, Altieri, M. and Hecht, S. eds., CRC Press, Boca Raton, Calif.

Gomez-Pompa, A. and F. Golley. 1980. "Sintesis, conclusiones y recommendaciones: Seminario de Trabajo sobre Estrategias del Uso del Suelo y sus Recursos por las Culturas Mesoamericanas y su Aplicación para Satisfacer las Demandas Actuales. *Biotica* 5: 43-51.

Gomez-Pompa, A. 1987. "On Maya Silvaculture" in *Mexican Studies*. Berkeley CA. 3 (1): 1-17.

Gonzalez-Jacome 1985. "Home Gardens in Central Mexico" in *Prehistoric Intensive Agriculture in the Tropics.* Farrington I.S. ed. Part ii, Bar International Series 232: 521-537.

Harwood, R.R., 1979. *Small Farm Development: Understanding and Improving Farming Systems in the Humid Tropics*. Boulder Colorado: Westview Press.

Hoogerbruggee, I. and Fresco, L. 1993. *Homegarden Systems: Agricultural Characteristics and Challenges.* International Institute for Environment and Development (IIED) Gatekeeper Series No. SA39.

Honigmann, J. 1982. "Sampling in Ethnographic Fieldwork" in *Field Research: a Sourcebook and Field Manual*, Burgess, R. ed. Routlage, Chapman and Hall, Inc. New York.

IDS Workshop 1989. "Interactive Research" in *Farmer First*, Chambers, R., Pacey A., Thrupp L. eds., Bootstrap Press Intermediate Technology Publications, New York, N Y.

Karyona, J. Iskander, O. Soeketjo, Priyono, H. Isnawan, H.Y. Hadikusumath, and A. Ramlan. 1981. Homegarden Structure in the Crarum River basin, West Java." Seminar on Home Garden Ecology, II. Institute of Ecology, Bandung cited in "Home Gardens in Tropical Asia" L. Christanty in *Tropical Home Gardens,* Kathleen Landauer and Mark Brazil, eds. United Nations Press, Tokyo. 1990.

Kimber, C. 1973. "Spatial Patterning in Dooryard Gardens: Implications of a Puerto Rican Example" In *Geographic Review* Vol 63 1973: 6-26.

Kneib, W.D. 1989. Usos de suelo e inventario de aptitudes intrinsicas del Peten, Guatemala. KREDITANSTALT FUR WIEDERAUFBAN-SEGEPLAN. Guatemala cited in Reining C.C.S., Robert M. Heinzman, Mario Cabrera Madrid, Salvador Lopez and Axel Solorzano. 1992. *Non-Timber Forest Products in the Maya Biosphere Reserve, Peten, Guatemala.* Conservation International Foundation. Wash. DC

Lightfoot C., Feldman, S. and Zainul Abedin M. 1994. "Incorporating Gender in Conceptual Diagrams of Households and Agroecosystems" in *Tools for the Field: Methodologies Handbook for Gender Analysis in Agriculture,* Feldstein H. , Jiggins, J., eds., Kumarian Press, West Hartford, Connecticut.

Lok, R. June 1994. *El Estudio de Caso.* Proyecto Huertos Caseros, CATIE. Turrialba.

Lundell, C.L. 1937. *The Vegetation of the Peten,* Carnegie Institute of Washington DC.

Magurran, A. 1988. *Ecological Diversity and its Measurement.* Princeton University Press. Princeton, New Jersey.

Marcus, J. 1982. "The Plant World of the Sixteenth- and Seventeenth-Century Lowland Maya" in *Maya Subsistence: Studies in Memory of Dennis E. Puleston,* Flannery K. ed. Academic Press Inc., New York.

Marsh, R. R. November 14-18. 1994. "Household Food Security Through Home Gardening: Evidence from Bangladesh and Central America", Presented at the Rockefeller Foundation Biennial Meeting of Social Science Research Fellows ILCA, Addis Ababa, Ethiopia.

McClure, G 1989. cited in *Indigenous Knowledge Systems: Implications for Agricultural and International Development*, Warren, M., Slikkerveer, L. and Titilola, S. eds., Studies in Technology and Social Change, No.11, Technology and Social Change Program, Iowa State University, Ames, Iowa: 1.

Millspaugh, C. F., 1903. *Plantae of the Yucatanae,* Field Colombian Museum of Natural History, Pub. 69, Botanical Series, Vol. III, No. 1. Chicago.

Murray, D.L. 1995. *Cultivating Crisis: The Human Cost of Pesticides in Latin America.* University of Texas Press. Texas.

National Research Council. 1993. *Sustainable Agriculture and the Environment in the Humid Tropics*. National Academy Press. Washington, D.C.

Nations, J. Spring 1980. "The Evolutionary Potential of Lacondon Maya: Sustained-Yield Tropical Forest Agriculture" in *Journal of Anthropological Research*, 36 (1): 1-31.

Ninez, V., 1986. "*El Huerto Casero: Un Salvavidas?"* in *Ceres*, 112: 31-36.

Ninez, V. 1985. "Working at Half-Potential: Conctructive Analysis of Home Garden Programes in the Lima Slums with Suggestions for an Alternative Approach" in *Food and Nutirion Bull.* 7 (3):1-5.

Ninez, V. 1990. "Garden Production in Tropical America" in *Tropical Home Gardens*, Laundauer, K. and Brazil, eds., United Nations Press, Tokyo.

Norem, R., Yoder, R. and Martin, Y. 1989. "Indigenous Agricultural Knowledge and Gender Issues in Third World Agriculture Development" in *Indigenous Knowledge Systems: Implications for Agriculture and International Development*, Warren, M., Slikkerveer, L., Titilola, S. eds.

Omohundro, John. 1985. Efficiency, Sufficiency, and Recent Change in Newfoundland Substance Horticulture in *Human Ecology* 13:291-308 cited in *Gardens and Vitamin A: A Review of the Literature.* VITAL International Science and Technology Institute Arlington, VA. Soleri et al. 1991.

Ortega, L.M., Sergio Avendano, Arturo Gomez-Pompa and Edilberto Ucan Ek, "Los solares de Chunchucmil, Yucatan, Mexico" in *Biotica, nueva epoca*, Vol 1, 1993: 37-51.

Padoch, C. and de Jong, W. 1991. "The House Gardens of Santa Rosa: Diversity and Variability in an Amazonian Cropping System" in *Economic Botony* 45 (2): 166-175.

Perera, Victor. 1993. *Unfinished Conquest: The Guatemalan Tragedy.* Univ. of Calf. Press Berkeley, Calif.

Pinton, F. 1985. "The Tropical Garden as a Sustainable Food System: A Comparison of Indians and Settlers in Northern Colombia" in *Household Food Production: Comparative Perspectives*, Ninez ed. International Potato Center: 25-28.

Redfield, R. and A.Villa Rojas. 1934. *Chan Kom: A Mayan Village.* The Univeraity of Chicago Press, Chicapg and London.

Reijintjes, Coen, Bettus Haverkort and Ann Waters-Bayer 1992. *Farming For the Future: An Introduction to Low-External-Input and Sustainable Agriculture,* MacMillian Press Ltd., Hong Kong.

Reining C.C.S., Robert M. Heinzman, Mario Cabrera Madrid, Salvador Lopez and Axel Solorzano. 1992. *Non-Timber Forest Products in the Maya Biosphere Reserve, Peten, Guatemala.* Conservation International Foundation. Wash. DC.

Rhoades, R. and Booth, R.H. 1989. "Farmer-Back-to-Farmer: a Model for Generating Acceptable Agricultural Technology" in *Agricultural Administration*, Vol. 11:127-137.

Rhoades, R.1989. "The Role of Farmers in the Creation of Agricultural Technology" in *Farmer First*. Chambers, R., Pacey, A., Thrupp L., eds., Bootstrap Press Intermediate Technology Publications, N Y, New York.

Rico-Gray, V.A., A. Gomez-Pompa and C. Chan. 1985. "Las selvas manejadas por los mayas de Yohaltun, Campeche, Mexico" in *Biotica* 10(4): 321-327.

Rico-Gray, V., J.G. Garcia-Franco, A. Chemas, A. Puch, and P. Sima. 1990. "Species Composition, Similarity and Structure of Mayan Homegardens in Tixpeual and Tixcacaltuyub, Yucatan, Mexico" in *Economic Botony*, 44(4): 470-487.

Richards, Paul. 1985. *Indigenous Agricultural Revolution*, Hutchinson, London.

Rocheleau, D., K .Wachira., L. Malaret, B. Wanjohi. 1989. "Local Knowledge for Agroforestry and Native Plants" in *Farmer First*, Chambers, R, Arnold Pacey, Lori Ann Thrupp: eds., Bootstrap Press Intermediate Technology Publications, New York, New York.

Roys, R. 1931. The Ethnobotony of the Maya. Tulane University, *Middle America Research Series*, No. 2, New Orleans.

Ruonavaara, D. 1995. "Plants Cultivated in Household Gardens of the Petén, Guatemala." unpublished.

Schatzman, L. and A. Strauss. 1973. *Field Research: Strategies for a Natural Sociology.* Englewood Cliffs, Prenctice Hall, NJ.

Schwartz, N. 1990. *Forest Society: A Social History of Peten, Guatemala*, University of Pennsylvania Press, Philadelphia.

Schwartz, N. 1995. Dept. of Anthropology, University of Delaware, Newark. Personal communications.

Schwartz, N. 1995. "Colonization, Development and Deforestation in Peten, Northern Guatemala" in *The Social Causes of the Environmental Destruction in Latin America.* M. Painter and W. Durham eds. The University if Michigan Press. Ann Arbor: 101-129.

Serrao Souza, E.M., Homma Oyama A.K. 1993 "Brazil" in *Sustainable Agriculture and the Environment in the Humid Tropics*. National Academy Press. Wash. D.C.: 263-351.

Sieber, S.D. 1991. "The Integration of Fieldwork and Survey Methods" in *Field Research: a Sourcebook and Field Manual*. R. Burgess ed. Routedge. London.

Smith, C. 1991. Maya Nationalism in *Report on the Americas*. Vol. XXV, No. 3 December: 29-34.

Soemarwoto, O. and G.R. Conway. 1991. " The Javenese Homegarden" in *Journal for Farming Systems Research-Extension,* Vol. 2, No. 3: 95-117.

Soemarwoto, O., I . Soemarwoto. 1979. "The Village Homegarden: A Traditional integrated System of man-plants-animals" Int. Conference on Human Environment: Methods and Strategies for Integrated Development, Arlon, Belgium cited in *Tropical Home Gardens,* Laundauer, K. and M. Brazil eds. UNU Press, Tokyo.

Soemarwoto, O., I . Soemarwoto. 1983. Homegarden: Its Nature Orgin and Future Development Ecological Basis for Rational Resourcce Utilization in the *Humid Tropics of South East Asia.* 130-39

Soemarwoto, O., I . Soemarwoto, E.M. Saekartadiedja, Karyono and A. Ramlan, na. "The Javenese Home-Garden as an Integrated Agro-Ecosystem" Institute of Ecology, Padjadjaran University, Bandung, Indonesia.

Soleri, D., Cleveland, D. and Frankenberger, T. January 1991. *Gardens and Vitamin A: A Review of the Literature*. VITAL, International Science and Technology Institute Inc. Arlington, VA.

Soza, Manzanero, C. A., C. Colby and N. Schwartz. 1990. unpublished field notes.

Soza, Manzanero, C. A., C. Colby and N. Schwartz. 1992 unpublished field notes.

Stravrakis, O. 1978 "Ancient Mayan Agriculture and Future Development" in *Culture and Agriculture: Bulletin of the Anthropological Study Group on Agrarian Systems.* Corvallis OR. 5: 1-8.

Stravrakis, O. and Marshal M.L. 1978 "Women, Agriculture and Development on the Maya Lowlands: Profit or Progress." Paper presented at the *Conference on Women and Food*, Tuscon Arizona: 1-17.

Stuart, J.W. 1993. "Contribution of dooryard gardens to contemperary Yucatecan Maya subsistence" in *Biotica, nueca época*, Vol 1 julio de 1993: 53-61.

Thiesenhuesen, W. 1993. "Guatemala's Maya Biosphere Reserve: Can it Be Protected?" in *CHOICES.* First Quarter: 26-27.

Thompson, J. and Scoones, I. "Challenging the Populist Perspective: Rural People's Knowledge, Agricultural Research and Extension Practices in *Agriculture and Human Values* V 11, No 2&3, Sp-Sum 1994.

Trembley M. 1982. "The Key Informant: a Non-Ethnographic Application" *in Field Research: a Sourcebook and Field Manual*, Burgess, R. ed. Routlage, Chapman and Hall, Inc. New York.

Vara, A. 1980. "La Dinamica de la Milpa en Yucatan: El Solar' *in Seminario sobre producción agricola en Yucatan*, eds. A. Hernandez and R. Padilla. Merida, Yucatan, Mexico, 1980: 305-341.

Vargas, R. 1983. "El Ka' anche': Una practica horticola Maya" in *Biótica* Vol. 8 No. 2: 151-173.

Warren, D. M. 1991. *Using Indigenous Knowledge in Agricultural Development.* World Bank Discussion Paper No. 127. Washington, DC: The World Bank.

Warren, K. 1994. "Language and the Politics of Self-Expression" *Cultural Survival Quarterly.* Summer/Fall: 81-86.

Waters-Bayer, A. 1994. "Studying Pastoral Women's Knowledge in Milk Processing and Marketing - For Whose Empowerment?" in *Agriculture and Human Values.* Vol. 11 No. 2 &3, Sp-Sum. 1994: 85-95.

Wilken, G. 1971. "Food-Producting Systems Available to the Ancient Maya" in *American Antiquity.* Vol. 36: 432-48.

Williams, R. G. 1986. *Export Agriculture and the Crisis in Central America.* The University of North Carolina Press.

Wolf, D. 1991. "Does Father Know Best? A Feminist Critique of Household Strategy Research" in *Rural Sociology and Development,* Vol. 5: 29-43.

Wolf, E. 1986. *Beyond the Green Revolution: New Approaches for Third World Agriculture*. Washington DC Worldwatch Institute.