CHILDREN'S ETHNOECOLOGICAL KNOWLEDGE: SITUATED LEARNING AND THE CULTURAL TRANSMISSION OF SUBSISTENCE KNOWLEDGE AND SKILLS AMONG Q'EQCHI' MAYA

by

REBECCA KRISTYN ZARGER

(Under the Direction of Elois Ann Berlin)

ABSTRACT

Knowledge of the biophysical environment is acquired through participation in cultural routines and immersion in a local human ecosystem. Presented here are the results of a study of the cultural transmission of traditional ecological knowledge (TEK) in Q'eqchi' Maya communities of southern Belize. Qualitative and quantitative methods provided means to describe learning pathways and distribution of subsistence knowledge and skills among children and adults. Data collection focused on situated learning and teaching of TEK during childhood, as very little research of this type exists. Subsistence strategies and local cognitive categories of flora and fauna were documented using methodological approaches from ethnobiology. Food production and preparation, harvesting of herbs, fruits, and medicines, hunting and fishing activities, and construction of household items were included in the domain of subsistence. Systematic behavioral observation, ethnographic interviews, and participant observation provided data about formal and indigenous educational systems. Learning and teaching processes are shaped by cultural belief systems, ecology, socioeconomic institutions, and gender roles. Methods for describing development of expertise in TEK during childhood included pile sorts, freelists, child-guided home garden surveys, and a plant trail in the primary research site. Children develop extensive knowledge early in life. By the time children are 9 years of age, they know 85% of Q'eqchi' names for plants near the household and 50% of plants elsewhere. Younger children categorize plants based primarily on morphology, and as they gain experience, utility and cultural salience are integrated. Significant and widely used species are learned first. Older siblings and cousins play an important teacher role for young children, in the course of caretaking and subsistence activities. Parents, grandparents, and other extended kin transfer knowledge of formalized tasks that require specific expertise. Overlapping work and play activities during childhood shape primary learning contexts. Intergenerational differences in subsistence knowledge and skills are shaped by social networks, socioeconomic opportunities, and changes in local ecology. The study integrates a focus on children and an activity-based approach to learning and distributed cognition with research in ethnoecology. Data are being implemented in biocultural diversity education initiatives in collaboration with local educators and parents.

INDEX WORDS: Learning, Cognition, Cultural Transmission, Traditional ecological knowledge, Ethnobiology, Indigenous knowledge, Indigenous education systems, Environmental education, Ethnobotany, Ethnoecology, Social networks, Folkbiology, Ethnography of childhood, Children, Socialization, Situated learning, Cross-cultural child development, Community-based conservation, Biocultural diversity, Subsistence, Agroforestry, Ecological anthropology, Anthropology of education, Psychological anthropology, Informal learning, Experiential learning, Belize, Maya, Q'eqchi', Kekchi, K'ekchi'

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REBECCA KRISTYN ZARGER

B.A., Wake Forest University, 1995

A Dissertation Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

ATHENS, GEORGIA

2002

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REBECCA KRISTYN ZARGER

Approved:

Major Professor: Elois Ann Berlin

Committee: Brent Berlin
Alexandra Brewis
Judith Preissle
Paula Schwanenflugel

Electronic Version Approved:

Gordhan L. Patel
Dean of the Graduate School
The University of Georgia
August 2002

DEDICATION

For my grandpa, Thomas G. Zarger, who shared his own love of plants
with me when I was small

and

the children of Toledo

ACKNOWLEDGEMENTS

This document was made possible through a network of collaboration and support that extends from San Miguel village to Knoxville, Tennessee and many places in between. It would be impossible to thank everyone who helped see me and the project through to this point, so I would like to extend a general note of appreciation to all contributed to this project along the way. Foremost, thanks to the communities of San Miguel, Big Falls, and Santa Teresa, and all the people of Toledo district who made me feel welcome, shared meals with me, joked with me, and made me feel a part of their lives. The field work portion of the project was funded by a dissertation fellowship from the Inter-American Foundation. I was generously supported during write-up by the Spencer Foundation. Thanks also to my Spencer Fellows 2001/2002 cohort.

In Belize, the support of the Department of Archaeology was greatly appreciated, particularly in granting a permit to conduct research. The Forest Department of Belize was also very helpful throughout my research. The curator of the national herbarium, Hector Mai, and Earl Codd, Natalie Rosado, and John Pineiro of the Conservation division all provided assistance. Thanks in particular for access to the herbarium resources and granting permits to collect botanical specimens. I am eternally indebted to Ramon Vargas, who spent many long hours in the Herbarium, assisting me with plant determinations and teaching me as much as he could about ethnobotany and systematics. In Toledo, the district manager of the Forest Department and officers of the Machaca station helped in many ways, and expressed interest in the ethnobotanical portion of the project. Bonefacio Tut assisted with his expertise in Q'eqchi' and Creole plant names and by always appearing over the top of the next hill in the Forest Department landrover when I was stranded by the side of the road when my truck broke down. Steven Darwin, Director of the Tulane University Herbarium, also kindly assisted with botanical determinations once I returned to the U.S. Thanks also to Darron Collins for sharing his data and experience with Q'eqchi' ethnobotany.

Nevia Quewell at the Central Statistical Office was extremely helpful in collecting information I needed from the Belize 2000 census. The staff at the SPEAR library and the Belize National Archives graciously assisted in locating documents and photocopying sources unavailable elsewhere. Thanks to Hipolito Contreras at the Land Information Centre, Ministry of Natural Resources for permission to reprint their maps. ESTAP in Punta Gorda also assisted with maps and other information relevant to the study.

The many non-government organizations of Toledo all expressed interest in the study and are to be commended for their continued struggle to better the livelihoods of people of the district. The Maya Leaders Alliance, the Toledo Maya Cultural Council (TMCC), Kekchi Council of Belize (KCB), Toledo Maya Women's Council (TMWC), and the Toledo Alcaldes Association (TAA), are defining the future for the Maya of southern Belize. I hope this document is helpful to them in their important work. Southern Alliance for Grassroots Empowerment (SAGE), Golden Stream Corridor Preserve, and Fauna and Flora International also provided me with the opportunity to lead an environmental education workshop with representatives from several communities. Special thanks to Pulcharia and Bartolo Teul of Big Falls for sharing their views and support. Thanks to TIDE for interest in the environmental education aspects of the project. Victor Cal, Dominga and Pedro Maquin of BITI were all extremely helpful during the study. Pedro and Mr. Baqui shared their knowledge of medicinal plants and invited me to participate with the Maya healers group. Dr. John Arnason also provided guidance in ethnobotanical collections. Joel Wainwright shared his extensive experiences and knowledge of Toledo with me, as well as my struggle to learn Q'eqchi' from the great master teacher of Coban, Oscar Macz.

I probably would not be where I am today without the Bardalez family and Don Owen-Lewis, who first welcomed me to Toledo with such openness. Don, thanks for sharing your unique perspective on life in Toledo and beyond and building a house with the best view in Toledo where I could make myself at home. It's happened, Toledo is "under my skin" and that won't ever change. Thanks for your visits and veterinary skills. Francisca, I can't express how much you helped make me feel like I was part of a family when I lived in Big Falls and I couldn't have done it with out you! You taught me so much about being a leader, cooking Belizean food, and being a wonderful mom. Thanks also to all the Bardalez boys: Jimmy, Ralph, Ritchie, Brian, and Edward, who always made me smile at the end of a long day. Keith Prufer deserves kudos for first introducing me to the Maya villages and taking me along on that trek "across" with Jimmy and Mr. Lewis where we saw the Harpie eagle. Others who were great support in Big Falls are the Coleman family, especially Perlene for special treats like cassava cake, all the Alemans for their support and friendship (and the occasional Belikin, or dance party). Delma Fajardo and her family were also good friends who were always generous and my most frequent visitors in Big Falls.

I would like to express gratitude to Juan Kus, Cresencio Cus, Roman Cus, and Pedro Kus who served as San Miguel village chairmen and alcaldes during the study. They all provided me the chance to live and work in their community and communicated with the entire community about different phases of my project. Thanks also the second alcaldes, police and village council members. I'm especially glad we were able to pull off the big independence day celebration before Hurricane Iris. All the families and especially the children of San Miguel made me feel at home, to all of you I am most grateful. You entertained my endless questions and humored me while I was trying to learn how to do everything in any way related to food, plants, or crafts.

There are many people in San Miguel who assisted with the research in formal and informal ways. The entire Cal clan shared their homes with me and made me feel like a part of their family–thanks to all of you. Gloria and Leonardo, I couldn't have done without you! Thanks for letting me be a part of everything and taking care of me. Rylia, Berris and Ivy, I'm glad I got to participate in your lives. Reynald Cal and Joanna Teul put in many hours on the intergenerational skills survey and assisted with the development of the interview questions. Jerritina Co, Graselia Cus, Guadencio Cus, Bernardino Choc, and Angela Coh all conducted interviews for the household survey early in the project. Good luck to all of you in school and other future endeavors. The Co family all helped me construct a map of the community, and shared their time with me.

Cresencio Cus and his entire family shared their knowledge of plants with me throughout my study. Cresencio, thanks for helping with the treks to collect plants and sharing your skills. Isadora and Nicolasa and all the other children also helped me collect plants and shared their daily experiences. Edwardo and Nicolasa Cus also provided insights valuable to the project. Thanks Edwardo and the rest of Top Star/ Xe' Tonil Son K'ekchi Maya Cultural Group for making the big trip to Athens and sharing your music and culture. That was an experience none of us will soon forget. I'm so glad that you all were able to meet my family and friends. The Choco and Cus families: Francisca and Mateo, Salvador and Maricia Cus, Terri and Nicolas Choco, and Teresita and Domingo Choco always made me feel welcome (thanks from **li waxiroo xan sak**). Thanks are due to all their kids who took a great interest in my study, especially Deon and Adelita who "checked" on the **samat** and the **ox** on the plant trail and watered them. Adolfo Cus helped with the plant trail, as did the children of Standards V and VI in 2001, the PTA chairman, Cresencio Cus, Bernardo Cus, and Santiago Bo. The PTA chairman, Sebastian Cus and Steve Boyer worked to create a community library, which was a great program while it lasted. We'll get it back again. Marcos and Maria Ack also shared their knowledge and household a great deal, as did Antonia Ack and her family. Sylveria, Clementina, and Louis Cus showed me Poite village and I learned a lot from their family. All the teachers and principals of San Miguel R.C. school assisted with the research on a regular basis, allowed me to observe and participate in their classrooms, and gave valuable insights into the formal education system. Mr. Benjamin Juarez, the district manager of R.C. schools also supported the idea of distribution of educational materials to district schools.

When I was developing this project, Rick Wilk and Melissa Johnson both generously shared their own perspectives on Belize. They both gave me great advice, some of which I took to heart right away, and some things I still had to find out the hard way. Thanks to both of you for treating me as a younger colleague and for your interest in the project. Melissa thanks also for inviting me to your wedding party, one of my first Belizean experiences that I'll never forget.

My committee has also guided and assisted me through the development of this project. Elois Ann, thanks for all your advice and suggestions over the years. I am especially grateful that you shared your passion for research and developing new questions and possibilities. Thanks too for the sympathetic ear, not to mention all the great dinners. Brent, thanks for your interest in my language acquisition process and belief in the importance of the research itself, as well as the muy fuerte café. Alex, thanks for sharing your experience in research design, behavioral ecology, and research with children. I appreciated your help with data analysis. Paula helped acquaint me with literature on development of expertise and child development. Jude, thanks for the unwavering support throughout the project. You introduced me to anthropology and education, supported me by coming to my talks at AAA, and asked good, important questions.

Finally, this dissertation wouldn't have been possible with out the love and support from family and friends. Thanks to the intellectual synergy of the Kuchka that sustained me during my time in Athens, you are all implicated in this project, too: Charles Peters, Rick Stepp, Felice Wyndham, Eric Jones, David Casagrande, Suzanne Joseph, and Mitch Pavao-Zuckerman. Thanks Felice for sharing your interests, ideas, and friendship. Suzanne, thanks for calling to check up on me and unfailingly encouraging me in the writing process (and sharing the experience). Eric and Dave thanks for your enthusiasm and support. Dave and Aaron, thanks for the tips on the joys of Anthropac.

My other student colleagues at Georgia also helped me grow in many ways over the years.

Rick, you've been an integral part of the last six years and this entire process. Thanks especially for all of your insights, suggestions, and help with the research, but also for sharing so many other things, like your penchant for creative diversionary tactics, appreciation of good music and barbecue, and your optimism. Erica, Beth, Karen and Terri have supported me through their friendship long before this project, and I know they will continue to do so in the future. Erica, I'm very glad you to came to visit me in Belize to share in the experience. My grandparents and extended family are always supportive and have been very interested throughout the way. Thanks also to assistance from Grandma Z., for her small grants program, always telling me how proud she is of me, and also caring to become friends with Gloria. Lastly I would like to thank my family. Mom, Dad, and Adrienne, this has been in many ways a group project. You were always there for me, whether it was to receive the, "well….my truck's in Deep River" phone call, or to share in the excitement when things were going well. Thanks for nurturing me, believing in me, and always keeping me laughing.

PREFACE

In October of 2001, during the last week of field research for this study, a category four hurricane hit the southern part of Belize. In the afternoon before the storm was forecasted to hit, I sat in a hammock in a friend's newly built kitchen, under a thatch roof supported with cement posts. We talked about where we could go during the storm, should the hurricane make it as far inland as San Miguel. I got up to leave, to go bag up all my research materials in garbage bags, just in case the storm took an unexpected turn to the south. The woman gave me some freshly baked bread and said as I walked away, "Who knows if we will see this kitchen or village again?"

Hurricane Iris did make that unfortunate turn toward the south, and by 11 p.m. that night, the kitchen I was sitting in that afternoon was destroyed. The storm made landfall on the coast and traveled directly over the Maya Mountains, bringing dangerously high winds and torrential rain. Luckily, there were very few Belizeans who lost their lives to the storm, perhaps because there was relatively little rain for a hurricane and it moved through rapidly. In the wake of Hurricane Iris, approximately 10,000 people were left homeless and the lowland forests and crops were completely demolished. The path of destruction wrought by the hurricane is 30 or 40 miles wide. The lush green forest and plantations near most of the Maya villages were devastated. Enormous trees over one hundred feet tall were broken off 25 feet above the ground from the force of the wind. Schools, churches, and homes were flattened, and many household possessions were lost.

Families now have shelter, crops have been replanted, and small green leaves are the sign that the forest is going to regenerate. Although a devastating experience which has changed life drastically in many Maya communities, who were hit the hardest, people have begun building back their lives. The forest, located so close the Caribbean coast, will recover from such a disturbance. However, the landscape of western Toledo has changed dramatically since I began this study. The living laboratory–the forests, farms, and rivers–that shapes the informal education system is in many ways different from the one I present in this manuscript, but the children and their families continue to persevere.

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CHAPTER 1

INTRODUCTION

Figure 1.1 A drawing by Carolyn Cus, 7, of San Miguel village, Toledo District. She is picking mangos while a friend swims in the river nearby.

Humans have developed many complex ways to represent and understand the biophysical world, a result of a dynamic interplay between the inner and outer worlds of cognition and behavior, perception and action. During childhood much of our knowledge of that world is learned, shaped by individual cognitive abilities, participation in daily cultural routines, and immersion in a local landscape. The experiences that young children have when immersed in the biophysical environment—learning about the way different organisms look, smell, and taste and how they are valued or used by the people around them—stimulate their imagination and contribute in a profound way to their development (Nabhan 1998). The research discussed here explores how environmental knowledge and skills are learned and distributed in Q'eqchi' Maya communities in southern Belize. The study focuses on two main processes: children's development of expertise about the biophysical environment and differences in knowledge and skills between older and younger generations of Q'eqchi' in one community.

Learning traditional ecological knowledge[1] (TEK) usually occurs outside of formal school and takes place in the reproduction of daily life, such as during work and play activities. Acquisition of ecological knowledge often relies on informal, experiential, and observational means of cultural transmission (Ruddle and Chesterfield 1977; Ohmagari and Berkes 1997; Hewlett and Cavalli-Sforza 1986; Lancy 1996). Children acquire expertise in the domain early in life, concurrent with language acquisition, and adult competency is often obtained by age 12 to 14 (Stross 1970).

A particular domain of traditional ecological knowledge–subsistence knowledge and skills–was selected so as to narrow the focus of this study. This includes food production and cultivation, the harvesting and selection of "wild" foods (non-cultivated foods such as herbs, fruits, and medicines), hunting and fishing activities, food preparation, and the making of traditional crafts, housing, and household items (Harris and Ross 1987). Subsistence-related knowledge, particularly food systems, is

[1] This type of knowledge is often glossed "traditional ecological knowledge", and in some cases may not be either truly ecological, or traditional, but is a culturally shared understanding of the non-human world. Here it refers to, "a cumulative body of knowledge and beliefs, transmitted from one generation to the next, about the relationship of living beings with one another and with their environment (Berkes 1993:3)."

fundamental to all human cultures and is often widely shared information. Previous ethnographic studies of Q'eqchi' lifeways have identified this as a culturally significant and salient body of knowledge (Berté 1983; Wilk 1991).

Table 1.1 briefly summarizes the fundamental questions that shaped the methods, theoretical framework and overall design of the research. Methods and research design are covered in detail in Chapter Two.

Figure 1.2 A boy paddles a **kayuk**, a carved wooden dorry, on the Moho river.

Table 1.1: Fundamental Research Questions

• How do children develop their knowledge and experience of the biophysical world?
• How do children's knowledge and subsistence strategies differ from adult knowledge throughout development?
• What are the primary ways children acquire and use this knowledge?
• Who do children learn different skills and knowledge from and in what settings?
• Who most frequently structures children's learning experiences, the individual child, parents, peers, or siblings?
• How does academic performance relate to children's expertise in subsistence knowledge and skills? Does school attendance have a negative impact on the acquisition of traditional ecological knowledge?
• How do socioeconomic indicators, gender, and religious or political affiliation affect patterns of expertise in subsistence knowledge and skills?
• How do individual social networks shape the distribution of TEK in the primary study community? How are these different across age sets or between generations?
• How is subsistence knowledge changing in Q'eqchi' communities over time, between and among generations? What factors may be causing knowledge loss or persistence?

Perspectives on Cultural Transmission, Socialization, and Informal Learning

This dissertation is an ethnographic analysis of how learning about the natural world is shaped by cultural expectations, socioeconomic activities, gender roles, local ecology, and modes of transmission. Theories and methods from a wide range of disciplines are integrated to address the fundamental research questions. Research from cross-cultural child development, cultural psychology, and educational anthropology is integrated with ethnobiology and ecological anthropology.

In the field of anthropology, relatively little attention has been paid to children, although they typically make up the largest portion of the population in societies that anthropologists have studied. Recently there has been a renewed interest in childhood studies and ethnographies of childhood (Mills and Mills 2000; Morton 1996). Ethnographic work by founding scholars in the field was concerned with enculturation in a broad sense (Mead 1930). Over the decades there have been times when research on child development and socialization flourished, but scholars primarily focused on parental expectations of child rearing and appropriate behavior, and was not concerned with children's perspectives (Whiting and Whiting 1975; Harkness 1992). In ecological anthropology, which focuses on human-environment relationships, children and cultural transmission have also been largely ignored (Hewlett and Cavalli-Sforza 1986; Ohmagari and Berkes 1997; Ruddle 1993). There are a handful of exceptions from the past three decades, including Ruddle and Chesterfield's research on traditional food procurement in the Orinoco Delta, Venezuela (1977); Hewlett and Cavalli-Sforza's work with the Aka in Africa (1988); Ohmagari and Berkes research in Northern Canada with Cree women's acquisition of bush skills (1997); and research on the acquisition of botanical terminology by Tzeltal Maya children by Stross (1973).

This project addresses gaps in existing scholarship, highlighting children's acquisition of local environmental knowledge, or "ethnoecological" knowledge. The study brings together disparate disciplines that have many overlapping concerns. Ethnobiologists have begun to realize the need to focus on acquisition of ethnoecological knowledge and changes in knowledge over time (Zent 1999; 2001). There appears to be a new interest in documenting the extensive knowledge of the biophysical environment that children in "traditional" societies share (Hunn 2002b; Ross 2002b; Zarger 2002). Many studies of children's categorizing of natural kinds have been conducted in the U.S. with English speaking populations (Waxman 1999; Johnson and Mervis 1997). However, leading figures in ethnobiology recently stated that one of the two main criticisms they can offer to scholars in the field is that they have tended to focus on "culturally competent adults rather than children" (Medin and Atran 1999:5). The fact that ethnobiologists have focused on the most knowledgeable people in traditional societies, particularly elders or specialists, is sensible given the goal of documenting human universals in classification. A better understanding of development of expertise during childhood will provide a more complete picture of how humans categorize living things.

In addition to the focus on children's knowledge, the project documents ethnobotanical and ethnobiological knowledge in a geographical area where limited research of this type has been conducted. Ethnobotanical collections and interviews also contribute data to the study of food and food practices. Of particular interest is information about the spectrum of "wild" foods and cultivated varieties that exist in

Maya communities. The project's emphasis on the importance of age and gender in determining intergenerational transfer of knowledge fills a gap identified by Etkin–that we need to know more about women's and children's foraging activities to better understand the people-to-plants continuum, both past and present (1994:5).

The global environmental crisis, including deforestation, climate change, and changing resource use strategies, is affecting traditional, indigenous, or local people in profound ways. The transmission and acquisition of ethnoecological knowledge is undergoing dynamic change as resource use strategies are also changing, concurrent with globalization. Drastic alterations to the source of that knowledge–the environment itself–provide challenges for scholars, scientists, and communities interested in bio-cultural diversity conservation. For this reason, more research needs to be conducted on the processes contributing to environmental knowledge continuity, change, and loss (Zent 1999).

Results of this study indicate that recent scholarship on informal learning can contribute in significant ways to building a model of childhood learning of traditional ecological knowledge. Research by Rogoff (1990), Lave (1990;1997), Hutchins (1991), Gaskins (1999), and Maynard (1999) exemplify an approach to informal learning grounded by ethnographic data collection. These studies illustrate how "informal[2]" learning is shaped by sociocultural and economic contexts. Research on children's play and work activities illustrates that these activities are critical in the socialization process

[2] The distinction between "informal," "formal," and "nonformal" schooling has been made by many researchers in the past. Often informal is characterized as learning taking place in an unstructured environment, with an emphasis on observational learning and participation, in the course of daily activities. Nonformal usually refers to nontraditional schooling such as adult vocational training, and formal learning normally is characterized by structured situations, outside the context of daily life, with an emphasis on verbal communication and meta level processes (Greenfield and Lave 1982; Wolcott 1997). Some researchers advocate abandoning the dichotomy between formal and informal schooling, due to the overlapping that obviously occurs. For lack of better terminology, informal will be used here to refer to learning that is actually a continuum of

(Lancy 1996; 1999). In this study I suggest that play and work are also critical to the process of learning ethnoecological knowledge. Daily life activities and cultural expectations overlay a universal human affinity for learning about and categorizing natural kinds.

Finally, ecological models of child development have influenced the design and methods of the study, such as the "developmental niche" of Super and Harkness (1992) and "developmental contextual view of human development" proposed by Lerner et al. (1995). Cultural learning is envisioned as occurring in the interface of social networks, parents, children, preferred child care customs, and natural environments (Gardiner et al. 1998). One weakness of these models, as well as many previous anthropological studies of socialization, is that the child is portrayed as a kind of universal recipient of cultural knowledge and expectations (Valsiner 1988). This project takes as a starting point that child development is a collaborative process. The transmission and acquisition of environmental knowledge involves dynamic interactions between the individual child and caretakers or peers. The other factors that shape the process are socioeconomic strategies, social networks, and local ecology. The role of individual experimentation and "self-education," as well as the role of older sibling "teachers" are also considered. Pathways of cultural information flow have been virtually ignored in previous studies of child development and environmental knowledge transmission (Maynard 1999).

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observational learning, verbal and bodily instruction, imitation, and guided participation (Greenfield and Lave 1982; Pelisser 1991).

Contributions of this Study

The proposed research addresses gaps in previous studies and emphasizes a contextual developmental approach to the acquisition and transmission of environmental knowledge. Research design includes both cognitive and behavioral data in an ethnographic analysis focused primarily on children aged four to fourteen. The study integrates theoretical frameworks on education, learning and cognition with research in the fields of ethnoecology and ethnobiology. Findings contribute to existing scholarship by examining the relationship between formal and informal education, particularly as regards to environmental education. The study highlights the important role that gender and social networks play in transmission and acquisition. An emphasis on situated learning and sibling teaching contributes microlevel analysis needed to advance scholarship in that field. Finally, the information collected in the study is used in the development of collaborative environmental education materials and programs. Reference materials that document Q'eqchi' ethnoecological knowledge are being created in collaboration with local teachers and parents.

Structure of this Manuscript

The manuscript is divided into six chapters. Chapter two covers research methods and design. It provides an overview of the theories and methods that stimulated the goals and structure of the present study. It also serves as a brief introduction to the field site, as rationale for selection of the research site is covered. Chapter Three describes the Q'eqchi' human ecosystem in the past and present. The human ecosystem concept from ecological anthropology structures the chapter, which focuses on ethnographic, historical, and ecological contexts of the study area. Chapter Four includes an ethnographic description of daily life in one community, a comparison of the informal and formal education systems, and discussion about the learning and teaching of subsistence knowledge and skills during childhood. In Chapter Five the ethnoecological data, including ethnobotany, categories of land use, and agricultural techniques, are presented. The chapter also describes the development of expertise in subsistence knowledge and skills from childhood to adulthood, and discusses intergenerational differences in knowledge. Chapter Six is a summary of the results of the study and includes a discussion of its relevance to future research. The chapter concludes with an overview of future environmental education initiatives in Southern Belize. Below is a small map of Belize to begin to orient the reader in time and space.

Figure 1.3 Political map of Belize.

CHAPTER 2
RESEARCH DESIGN AND METHODOLOGY

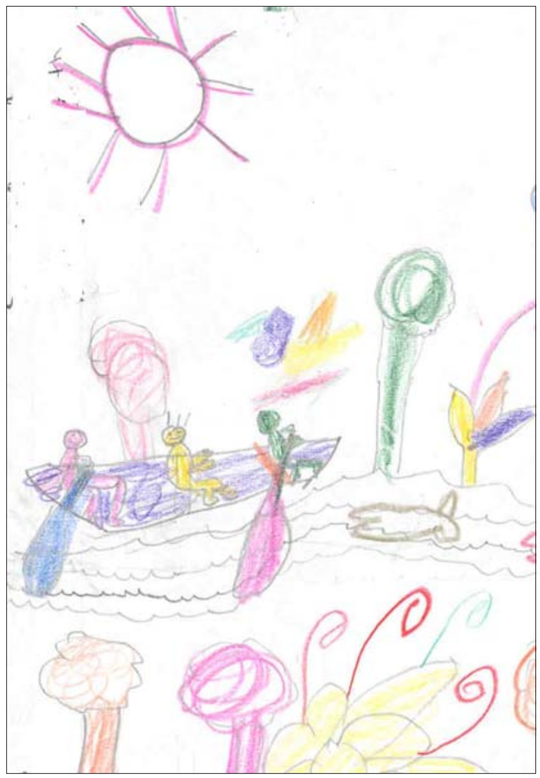

Figure 2.1 Three boys paddling down a river in a dorry.
Drawing by Pablo Jucub, 11, San Miguel village.

The research goals were to find out what children and adults know about the biophysical environment, how such expertise is developed during childhood, and how knowledge and skills may be changing over time. Conducting research on contexts for the acquisition and transmission of traditional ecological knowledge (TEK) requires weaving perspectives from several different disciplines and combining them in novel ways, because very little research of this type exists. In designing the study, approaches were drawn from ethnobiology, cross-cultural childhood development, cultural psychology, cognitive anthropology, and more traditional anthropological studies of socialization to focus on the *process* of learning TEK during childhood. Methods from previous studies of cultural transmission were used to describe knowledge change and loss over time, another primary concern of the study. As noted in the introductory chapter, few studies integrate research on learning and child development with ethnobiology and ecological anthropology. The present dissertation research was designed with this goal in mind.

The ethnographic field research component of the project consisted of two phases of data collection. The first phase of the project involved elicitation and documentation of Q'eqchi' traditional ecological knowledge (TEK). The use of a range of cognitive and ethnobiological data collection methods allow a framework for describing the ways Q'eqchi' conceptualize, categorize, and use local plants and animals. Subsistence knowledge and skills provided a smaller, more restricted domain of investigation, as opposed to attempting to complete a general ethnobiological inventory in its entirety, to enable the second phase of the project to be carried out. Phase two focused on childhood learning contexts, modes of acquisition and transmission, and differences in expertise between generations of Q'eqchi' in southern Belize. For a timeline of the entire study, see Appendix G.

Research design for phase one benefits from extensive research conducted in the field of ethnobiology, or "ethnoecology" as it alternatively known. This interdisciplinary body of research has become increasingly systematic and comprehensive since its inception in the 1950s. Ethnoecology was first proposed by anthropologists Harold Conklin and Charles Frake, combining theories in linguistics, systematic biology, and psychology to develop a better way to understand a particular cultural group's perceptions and classifications of the natural world (Conklin 1969; Frake 1962). The goal of "ethnoscience" as a subdiscipline was to develop a systematic way of gaining insight into the cognitive worlds of people from other cultures, thereby also better understanding their behavior and more objectively representing their culture (Fowler 1977; D'Andrade 1995). By the 1990s, over 300 ethnobiological studies from around the world were included in a comparative study of human universals in classifying plants and animals (Berlin 1992). Several studies conducted with Maya in Belize have treated certain aspects of TEK, but cognition and learning have never been the explicit focus of an ethnographic project with Q'eqchi'-speaking communities in southern Belize (Wilk 1981, 1991;Berte 1983; Steinberg 1998; Collins 2001)[1].

The first phase of research included ethnobotanical collections, cognitive tasks and elicitation techniques, such as pile sorts and freelisting, semi-structured interviews, and participant observation on all topics related to subsistence knowledge and skills. As much information related to subsistence was collected as possible. It was then grouped into the following categories: food cultivation, preparation, and harvesting; non-cultivated, semi-managed resources; forest products, such as craftmaking, house construction and materials; and hunting and fishing skills. After

[1] Steinberg (1998) conducted a study on changing agricultural practices and cultural traditions in Mopan Maya communities, primarily San Antonio, Toledo district, that complements in some ways this study of Q'eqchi' subsistence knowledge. Collins' (2001) recent ethnobotanical study in Alta Verapaz, Guatemala discusses differences in plant knowledge in highland and lowland Q'eqchi' communities and adaptation to new environments. Wilk also provides substantial documentation of Q'eqchi' agricultural practices and food resources in socioeconomic and ecological perspective (1981; 1991).

data were collected and collated, the second phase of the project could then formally begin–investigating the cultural transmission and acquisition of the knowledge and skills. In addition, during the first phase of the project, participation in daily activities and routines related to subsistence provided months of personal experience in diverse learning contexts. I became an active participant in an accelerated cultural learning process, as I was socialized by both children and adults to understand the local landscape and community members' interactions with the biophysical environment.

During the second phase of research, the methodological design enabled me to address hypotheses about childhood learning contexts for TEK (with an emphasis on subsistence knowledge) as well as changes in knowledge transmission, acquisition, and loss over time. Research focused on children between the ages of 4 and 14 and the flow of information among and between different generations, or age sets in some cases, of Q'eqchi' adults.

Few studies have addressed the way children learn about the biophysical environment. Therefore, methodologies and techniques for the study were drawn from diverse disciplines. The second phase of the study links research in ethnobiology with a research tradition in cross-cultural child development and cultural psychology on culturally structured, situated learning in informal contexts. Many of these studies have focused on the acquisition and practice of specific skills such as weaving, tailoring, and ship navigation (e.g., Lave 1997; Childs and Greenfield 1980; Hutchins 1995; Greenfield, Maynard, and Childs 2000), leading to a conceptualization of informal learning as similar to apprenticeship, as expertise is gained through guided participation in a particular activity (Rogoff 1990). Research in this tradition builds primarily on the work of psychologists interested in the role of culture in shaping cognition, such Vygotsky (1978) and Bronfenbrenner (1977).

Two recent studies with Maya populations in Mexico take a slightly different approach to socialization. Maynard's (1999) research on sibling teaching in Zinacantán, Chiapas, and Gaskins' (1999) work over the last three decades on Yucatec Maya child rearing resonated deeply with my own previous research on the ways children go about learning to understand and interact with the natural world. The two studies provide a more broadly conceived view of child development as the process of learning skills in the experience of daily life, helpful in conceptualizing the present study. Learning to make a living in the tropical rainforest requires more generalized sets of knowledge and skills than does the singular process of learning to weave[2]. The way individuals learn and are taught is also different depending on the type of skill or understanding to be acquired.

One study has linked education with subsistence strategies. Ruddle and Chesterfield's study of food procurement in the Orinoco delta of Venezuela (1977) provided excellent methodological models for the current research. Previous research on tropical agroforestry practices and subsistence strategies in Mesoamerica and beyond (cf. Alcorn 1981; Etkin 1994; Posey 1984; Nations and Nigh 1980) informed the ethnoecological component of the research. Gary Nabhan's work in the Southwestern US and Mexico illustrates how loss of TEK may be addressed by

[2] However, the apprenticeship model would be extremely relevant to a study of the development of Q'eqchi' traditional healer's (**eb' li ilonel**) expertise. For the purposes of this project, I excluded this type of specialist plant knowledge. For a discussion of specialist versus generalist knowledge of medicinal plants, see Garro (1986) and Nolan (2002).

indigenous communities and researchers through collaborative projects (Nabhan and Antoine 1993; Nabhan 1998).

During the past two years a small group of researchers in the field of ethnobiology have expressed a burgeoning interest in acquisition and transmission of TEK and have begun to present papers at meetings and publish results (see for example Zent 1999, 2001; Zarger 1999, 2002; Zarger and Stepp 2000; Hunn 2002; Ross 2002a, 2002b; Wyndham 2002; Collins 2001). However, the focus of most of this research is not on the process of learning *per se* as much as documenting the astounding depth of knowledge children have about the biophysical world in non-Western contexts (Hunn 2002) or investigating changes in knowledge over time for the same populations (Ross 2002a; Ross 2002b). These studies show that past scholarship about the way humans classify, think about, and name natural kinds has allowed us to begin investigating knowledge in transition and as a part of adaptation to new environments. Many of these studies use systematic research methods such as consensus analysis (Romney, Weller, and Batchelder 1986), forest plot interviews (Zent 1999), and sorting and listing plants or animals. Ross (2002b) focuses on perceived relationships between plants and animals of the Lacandon Maya in Chiapas, Mexico.

Traditional ecological knowledge, as used here, is treated as socially distributed and widely shared by individuals, throughout the lifespan. TEK is a dynamic body of knowledge, intimately tied to the local human ecosystem and means of production, and in some instances may also be responsive to ecosystemic changes (Rappaport 1968; Moran 1990). A substantial amount of research around the globe also indicates that indigenous peoples have sustained and managed biological diversity over many generations. Traditional cultivars or "landraces" are an excellent example of genetic heritage resulting from centuries, even millennia, of agricultural experimentation by humans (Posey et al. 1997:51). In the Maya region in Central America, the diversity of agroforestry practices that mimic the tropical forest itself have been documented among the Lacandon, in Chiapas Mexico and Itzá in Petén, Guatemala (Posey et al. 1997; Atran 1993).

Hypotheses Guiding Research

Guiding questions and hypotheses generated before the research was conducted were as follows:

What is the cultural knowledge of subsistence practices and skills?

Hypothesis 1: Knowledge of food resources and subsistence skills will be widely shared.

Hypothesis 2: The type of knowledge acquired will vary based on gender, age, and ecological context (*milpa*, forest, household gardens, etc).

Research has demonstrated that subsistence-based societies often have highly systematized and time-tested knowledge of their natural world, and there is consensus within a given population (Berlin 1992; Alcorn 1981; Atran 1990).

How is subsistence knowledge acquired at different ages, and when is adult-level knowledge attained? How do children's knowledge and adult's knowledge compare?

Hypothesis 3: Knowledge and skills are age-specific and will be taught primarily by an adult or sibling of the same gender (Ruddle and Chesterfield 1977).

Hypothesis 4: Adult-level knowledge is attained between the ages of 12 and 14 (Ruddle 1993; Zarger and Stepp 2000).

Hypothesis 5: There will be certain types of knowledge or skills that are considered the primary domain of children, such as wild snack foods or plants used as toys (Wilk 1991).

Who is most responsible for the transmission of subsistence knowledge: parents, siblings, peers, or grandparents? What types of information are more likely to be transferred by each "teacher"?

Hypothesis 6: Strategies for teaching and learning ("cultural routines") will differ between peer/sibling learning contexts and intergenerational/parental learning contexts.

Hypothesis 7: The type of information shared will also depend on the age, gender, and socioeconomic indicators of the participants. Past research and the ethnographic research currently being carried out has shown that gender roles and societal and parental expectations are fundamental in the acquisition and transmission process (Hewlett and Cavalli-Sforza 1986; Ruddle and Chesterfield 1977).

What is the relationship between formal and informal education of the biophysical environment? How does academic performance relate to children's expertise in subsistence knowledge and skills?

Hypothesis 8: Formal education relies more on verbal and written instruction in a structured environment, while informal education relies more on direct observation, participation, and experimentation in an unstructured environment.

Hypothesis 9: Learning tasks are most often situated in the place they are to be performed (Greenfield and Lave 1982; Ruddle and Chesterfield 1977).

Hypothesis 10: Cultural routines, or the structure and rhythm of everyday life, shape learning contexts (Lancy 1996).

Hypothesis 11: The national and local education system curriculum for environmental education is often comprised of information about places and living things from other locales and in a non-native language, while the traditional system is transmitted in Q'eqchi' and embedded in the *local* ecological context. This is based on preliminary research in Belize in 1998.

Selection of Research Site

I first visited Belize in July and August of 1998, to find a place to carry out my dissertation fieldwork. I did not have a particular part of the country or ethnic group in mind when I arrived, but wanted to conduct dissertation research in a community or region of Belize where there was some interest in the results of my study. I was particularly interested in collaborative education efforts emphasizing the importance of sustaining both biological and cultural diversity. Several interviews with educators, various conservation organizations, and an archaeologist or two later, I found myself sagging gratefully off a bumpy James school bus onto the dusty southern highway in the village of Big Falls, on the way to Punta Gorda Town, the southernmost in the country. The hills on either end of the village are steep, and the bus driver barely stopped in time to let me out before he passed through it entirely.

From the time I arrived in Big Falls, things fell into place rather quickly thanks to help from many people there and in Punta Gorda. For the most part, the greatest interest in the potential outcome of my project was from Maya community leaders and the chairman of the Toledo Maya Cultural Council at that time, the late Julian Cho, and so that was where I directed my efforts. I conducted preliminary interviews in Maya villages. I found that children and adults shared extensive ethnobiological knowledge and that Maya languages (Mopan and Q'eqchi') were still the first acquired during early childhood in most villages.

After I returned to the U.S., I decided that I wanted to focus the project on Q'eqchi' Maya communities in Toledo. There are many similarities between the lifeways of the Mopan and Q'eqchi' in Toledo district, so in some ways it is a false segmenting of the population of Toledo to focus only on one ethnic group or the other. Both share much history, as they migrated to southern Belize around the same time in the latter part of the 19th century–although their Maya ancestors migrated back and forth across what is now the Belize/Guatemala border for centuries–and the same biophysical environment. All Maya in Toledo have faced and continue to meet similar challenges in regards to land tenure, economic and educational opportunities, and ethnic identity. The choice was made because the Q'eqchi' are the largest indigenous Maya population in Belize (over 12,000 countrywide, according to the 2000 Population and Housing Census), and there are also a large number of Q'eqchi' speakers in nearby Guatemala (estimates are between 600,000 [Siebers 1999] and

700,000 [Collins 2001]). There are also some intriguing aspects of Q'eqchi' environmental history and migration patterns from highland Guatemala to lowland Belize that proved compelling for a study of changes in ecological knowledge over time. Additionally, Richard Wilk's study of Q'eqchi' household ecology (1997 [1991]), based on research done in the early 1980s, provided much needed ecological, historical, and economic information on which the research design for the present study could be based.

In August 1999, I made a brief trip to Belize to obtain permission to work in at least one Q'eqchi' community before I moved there for dissertation research. The chairman of San Miguel village graciously granted me preliminary permission to conduct research in that village the following year, explaining that I would have to seek the agreement of the entire community when I arrived. In the spring of 2000, prior to beginning dissertation research in Belize, I spent six weeks in Coban, Alta Verapaz, Gautemala, studying the Q'eqchi' language and orthography. I was engaged in learning as much as I could in that short amount of time about the mountainous area considered to be the geographical center of Q'eqchi' history, tradition, and culture. I have an average fluency in Spanish, as I spent two months studying the language in the Petén in 1997. I had before me the gargantuan task of learning one language by way of another in which I had only just attained a basic fluency. Once I got to Belize, I would be able to speak English to clarify what was said in Q'eqchi'. While I was studying in Cobán, I had little understanding of just how different the Q'eqchi' spoken in Belize is from that heard in Alta Verapaz.

My studies began with lessons with a private tutor who had been involved in writing the most recent orthography and grammar for the Q'eqchi' language. The workshop was organized by "Oxlajuuj Keej Maya' Ajtz'iib'" (OKMA), an organization in Antigua Gautemala writing orthographies for 20 of the Maya languages spoken in Gautemala (OKMA 1997). I also took lessons at the reknowned Escuela Muq' B'il B'e in Cobán and lived with a Q'eqchi' family in San Juan Chamelco, a hamlet close to Cobán.

Once I arrived in Belize in May 2000 I began to discover the differences and similarities in the variation of the Q'eqchi' language. After I recovered from the surprise that even the words for "thank you" and "how are you" were completely different from those used in Coban, I began to immerse myself in the language there. For the duration of the research, all semi-structured and structured interviews were conducted in Q'eqchi'. During interviews I was assisted by several local collaborators fluent in Q'eqchi' and English, who also helped with translation and transcribing. Informal interviews were carried out alone, in Q'eqchi' or a combination of Q'eqchi' and English.

Ethnographic research was conducted primarily in three communities in the Toledo District of Belize, San Miguel, Big Falls, and Santa Teresa (see Figure 2.3). Chapter Three covers in some detail the past and present biophysical and sociocultural environments of the Q'eqchi, the Toledo district, and the country of Belize. Briefly, the three villages are located on the eastern slopes of the Maya Mountains, where the most important staple food crop is corn, and cultural identity is strongly tied to its cultivation, preparation, and consumption. The landscape is

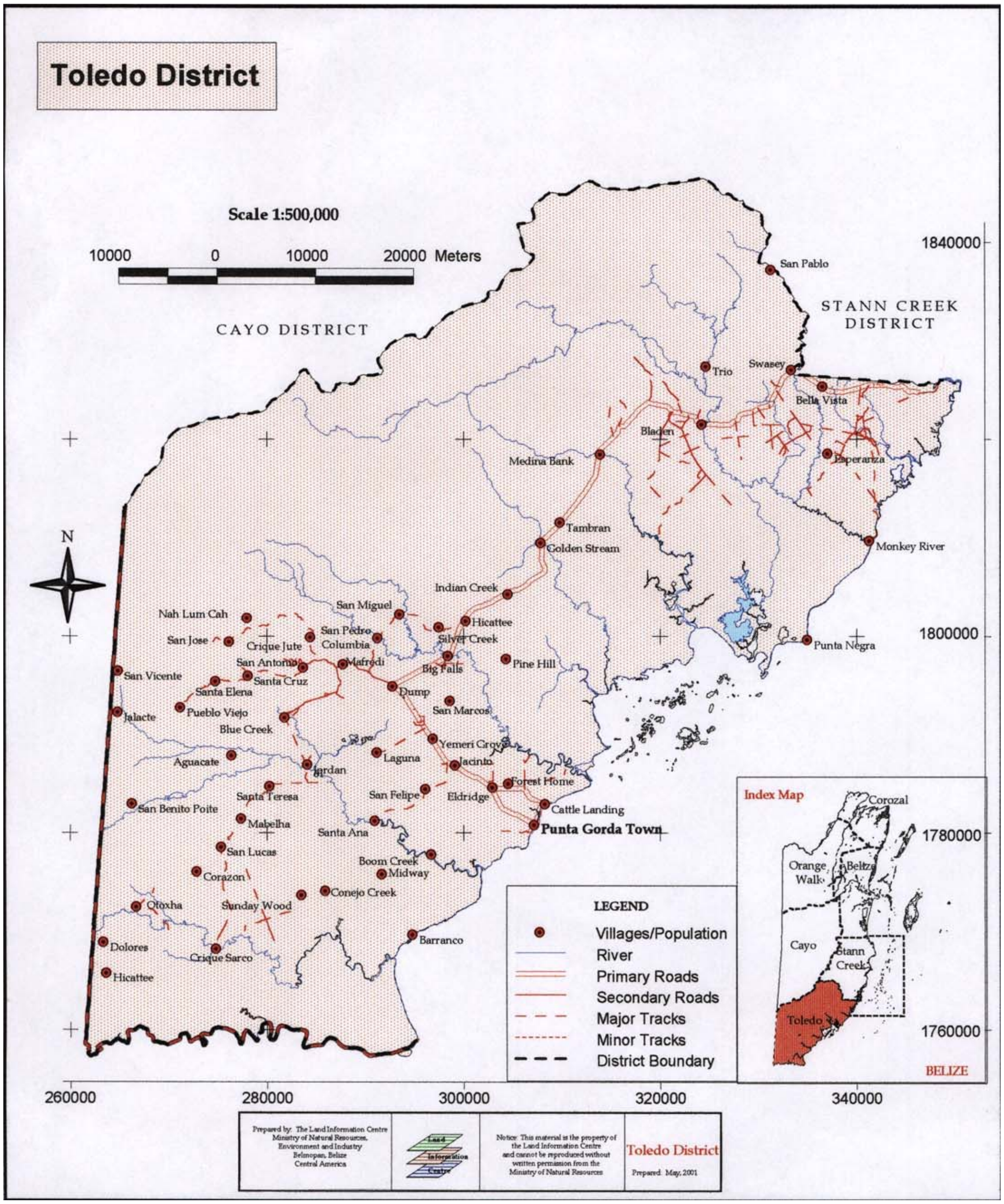

Figure 2.2 Political map of Toledo. Reprinted with permission of the Land Information Centre, Government of Belize.

dominated by tropical lowland broadleaf forest, punctuated by craggy limestone hills that jut up out of the flat coastal plain that stretches to the Bay of Honduras on the coast. Mopan and Q'eqchi' are the primary languages, English is the official language of Belize and taught in school, and Belizean Creole English is also often spoken.

The Maya are one of several ethnic groups living in Toledo, which is home to an incredibly diverse population. The Garifuna or Garinagu are descendants of Amerindians and escaped slaves from West Africa who later settled on islands and coastal areas in the Bay of Honduras in the early 1800s, established Punta Gorda Town. East Indians are descendants of laborers brought to work in the sugar cane fields of Toledo settlement, settled by ex-Confederate families from the southern United States after slavery was outlawed there. Creole Belizeans have also shaped the history of the district, descendants of former slaves and the British logwood cutters who claimed Belize for England. There are several Mennonite religious communities in Toledo as well. Mennonites often sell fruits such as watermelon and poultry in villages in the area. There are 36 Maya villages in the Toledo district, approximately 15,000 Q'eqchi' and Mopan people, 66% of the population residing in the entire district (TMCC and TEA 1997; Belize Population and Housing Census 2000). However, Maya are still considered a minority population in a cultural and socioeconomic sense, as that is how they are viewed throughout the rest of the country.

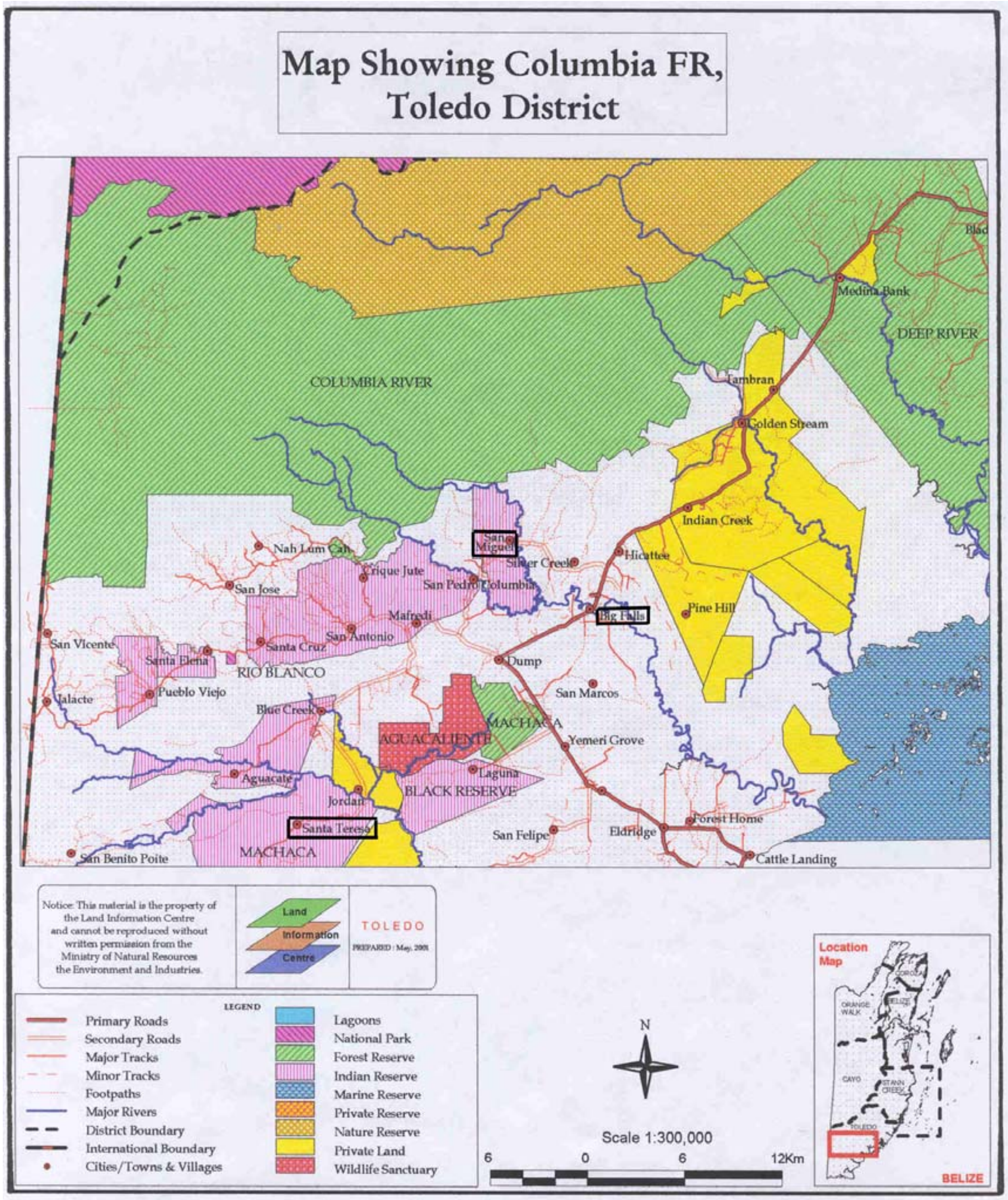

Figure 2.3 Map showing San Miguel, Big Falls, Santa Teresa. Land tenure is indicated on this map. Of particular interest are the white areas, which are National (government) lands and pink areas, which are Indian Reservations.The Columbia Forest Reserve is in green. Reprinted with permission from the Land Information Centre, Ministry of Natural Resources.

The majority of data collection was carried out in San Miguel village, a community of 439 people, approximately 85 households, settled in a landscape of steep limestone hills and valleys. There is a primary school, San Miguel Roman Catholic School, and San Miguel Catholic church sits atop one of the tallest hills in the village next to the school. Other structures include a community center, women's cooperative corn mill with a gasoline-powered mill, and a small health clinic that is seldom used. There are a half dozen shops, a football field, and a large cement area known as a "drying floor" for drying rice or coffee in the hot sun. Children attend school beginning at age 5 and are required by law to do so until age 14 or graduation from primary school. In San Miguel, Q'eqchi' is the language spoken almost exclusively in the home by people of all ages. English is used outside the home–in school, in business, or in social interactions with non-Q'eqchi'-speakers.

The Rio Grande River runs through the heart of the village, after rising to the surface at the mouth of a cave system to the north of the village, known as Tiger Cave. The river, **li nimha'**, by turns relatively shallow and brilliant blue-green in the dry season, and a deep, churning, muddy brown in the wet season, is a focal point of daily life (see Figures 2.4 and 2.5). There are hand pumps throughout the village as a water source for cooking and drinking. Electricity is now available for those who can afford it and a municipal water system was inaugurated in April 2002, after the completion of research. Most families depend on a combination of subsistence farming (corn and dozens of other cultivated, semi-cultivated, and wild resources); cash cropping (rice and beans); and wage labor (such as the citrus industry, sawmills, and shrimp farming) for their livelihoods. District wide, most Maya families survive on about $600 US per year (TMCC and TEA 1997).

Almost without exception, everyone in San Miguel speaks Q'eqchi', 98% as a first language (TMCC and TEA 1997). The other languages spoken are Mopan Maya (2%)[3],English (between 60% and 83%, depending on criteria used [TMCC and TEA 1997; Belize Population and Housing Census 2000]), and Spanish is spoken by a few, primarily older men who spent time or were born in Guatemala.

Figure 2.4 Women washing along the banks of the Rio Grande river.

[3] This figure indicates the percentage of the population who identify Mopan as their first language. The percentage of people who speak and/or understand "Maya" as it is often called is actually higher.

Figure 2.5 Rio Grande bank during rainy season floods. Both photos taken from San Miguel bridge.

Two churches are located in the village, one Catholic (60% of population attends services there) and one Protestant (at which 30% attend services) (Belize Population and Housing Census 2000). This is an anomaly in Toledo, considering the proliferation of different Christian or evangelical churches in many other villages[4]. Fewer churches made it easier for me, as an anthropologist and a foreigner, to participate in village life without having to account for as many socioeconomic and religious differences as are found in small villages with five to seven churches.

The other two villages are smaller (Santa Teresa , population 269) and larger (Big Falls, population 915), respectively, than San Miguel. Research conducted in

[4] The divisive impact of the proliferation of evangelical and other Christian churches and missionaries on what had historically been predominantly Roman Catholic Maya communities began in the late 1970s in Toledo. Palacio (1994) notes that churches began competing with one another for members in earnest by the early 1980s, stating that a brief survey in 1983 found 5 churches in a village with less than 250 people.

the other two communities was less extensive than in San Miguel, but provided data on regional human-environment relationships and contexts for acquisition of ecological knowledge. I resided in both San Miguel and Big Falls during my time in Toledo district, spending an average of one quarter of my time in Big Falls and the rest in San Miguel in any given week. I conducted informal interviews and participated in several community events in Santa Teresa during my stay. Big Falls is located on the only road into the Toledo District, the Southern Highway, an unpaved road stretching off to the north toward the Stann Creek district, and the town of Dangriga. There are Mopan, Q'eqchi', East Indian, and Creole households in Big Falls. San Miguel is located seven miles from the Southern Highway, and Santa Teresa is located farther away from this main thoroughfare, past the large Maya village of San Antonio closer to the western border Belize shares with Gautemala (see Figure 2.3). San Miguel and Santa Teresa are primarily Q'eqchi', approximately 98% or higher (TMCC and TEA 1997). Several families who originally founded San Miguel in 1951 migrated to that location from Santa Teresa, or **Se Pan**, as it commonly called in Q'eqchi'.

These villages represent three points on a continuum of integration into the regional and national Belizean economy and public services infrastructure. They also provide an example of a common pattern of geographical migration for Q'eqchi' households within the region over the past four decades: north and east, toward major roadways and recently uncultivated, arable lands (Wilk 1991). For these reasons San Miguel can be considered an "average" Maya village in Toledo in many respects. It is not extremely isolated because of seasonal flooding of unpaved roads, nor is it the most integrated into the regional economy and majority Belizean culture[5]. San Miguel is a community in transition, providing an interesting site to document changes in TEK and learning contexts[6]. I also visited most of the other villages in Toledo district on different occasions during my stay in Belize from May 2000 to October 2001.

An important consideration in choosing a research site was to take full advantage of previous research conducted in southern Belize, particularly among Q'eqchi' communities. There are many good, practical reasons to explain why anthropologists have not emphasized research with children, or cultural transmission of environmental knowledge. Children are not always easy to interview or understand, particularly when interviews are conducted in an indigenous language. Parents may not appreciate virtual strangers spending hours with their children. Learning episodes may be elusive and difficult to observe. Studying transmission and acquisition of knowledge implies a basic understanding of the lifeways of the group of people with whom one wishes to conduct research[7]. One practical way to ensure that my research would begin to address my guiding questions was to choose a

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[5] When discussing a topic such as "integration" into regional, national, or even transnational culture and political economy, it is very difficult to describe changes taking place without invoking the now rejected paradigm of "modernization" that often tended to represent the process affecting "corporate peasant communities" as a unidirectional transition, involving loss of "traditional" culture (Wolf 1982). The process is obviously more complex and chaotic, as the boundaries between local and global are blurred and reinstated on a regular basis, in Toledo and around the globe (Sachs 1995). This is discussed in more detail in Chapter 2. As Wilk explains in the Preface of his 1991 monograph on Q'eqchi' household ecology, economic and ecological transformations occurring in 1980, which continue to occur in Q'eqchi' villages in 2002, are common in many places around the globe, and may parallel similar patterns from other times in Q'eqchi' history (Wilk 1991: 6-7).

[6] For example, between August 1999 when preliminary permission was granted to conduct research and when the study began in May 2000, long-awaited electricity service became available to the village, providing a constant "fuel" for televisions and radios, previously powered by batteries or the one generator owned by a shopkeeper.

[7] I (perhaps foolishly) decided to ignore all of these difficulties and proceed anyway, with the attitude that the most fulfilling things in life are typically the most difficult ones.

community that had been previously studied, so as to provide a benchmark of information about ecological knowledge and subsistence practices[8].

For this reason, the community of San Miguel became a logical choice for the primary village under study. San Miguel has had the distinction, or perhaps misfortune, depending on your perspective, of having had three researchers, including myself, reside in the village since it was founded in the early 1950s. Two other researchers preceeded me, also conducting dissertation research in the village. The first was Colin McCaffrey, a doctoral student in education from the University of California, Berkeley, who arrived in the village not too many years after it was established in 1966. His topic was rural economic development. Nancy Berté, a student of Napoleon Chagnon, conducted research in 1979-1980 in San Miguel, investigating evolutionary perspectives on the shared labor system and agricultural production system (Berté 1983).

The research site was also chosen because of its close proximity to several protected areas and extant tropical forest. The Columbia Forest Reserve backs up to San Miguel reservation lands and those farmlands shared by agreement with neighboring San Pedro Columbia village. The Bladen Nature Reserve is also directly north of the village. Many Maya villages to the south are not situated as close to substantial tracts of forest, because there is a longer history of recent human modification in those areas. The southern portion of Toledo district is the area from which the Q'eqchi' population expanded in the early to mid 1900s. New areas of

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[8] Anthropologists all too often fall prey to the notion that they have travel to an exotic location where no one has ever gone before to conduct research, geographically or topically, not entirely dissimilar to characters in a Star Trek episode. On the contrary, probably most of the intriguing questions about

older secondary growth and some primary growth forest are brought into cultivation each year under the *milpa* farming system, on village reservation lands and surrounding areas. People use the forest for products such as craft materials, wild foods, hunting and fishing, and firewood and construction materials. At the same time, conservation of natural resources in protected areas is a concern to many residents, both Maya and non-Maya, particularly the Forest Department and several environmental NGOs based in Punta Gorda, such as TIDE (Toledo Institute for Development and Environment).

Finally, as I remarked previously, I wanted to work in a place with a collaborative interest in the findings of the project. It was important to me that the community members have a practical reason for me to be there, living with them, participating in daily life, and providing a service in the documentation of their traditional knowledge and culture. In addition, I also believed community interest was crucial in the development of local environmental education initiatives, in collaboration with schools, parents, and teachers. The goal of the project from the beginning was not only to contribute to academic scholarship but also to return the information I collected to the communities who create it, share it, and live it on a daily basis. Q'eqchi' and Mopan children of southern Belize should have educational resources that emphasize the value of their own cultural knowledge and traditions, and encourage them to spend time with elders in their villages, asking questions about whatever they do not yet know, before it is forgotten. Future sustainability of the local

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human nature have already been asked, but can be revisited and thought about in novel ways. Building on previously conducted studies may be one way to go about this endeavor.

ecosystem is also at stake in Toledo. Conservation initiatives there have gained national and international attention, and cultural traditions are integral to the issue.

The dynamics of the relationship between Maya in Toledo and the biophysical environment are complex and have become highly politicized over the past decade (TMCC and TEA 1997). Secure land tenure is desperately needed–even as land is becoming increasingly less available, the district's population is increasing at 2.7% (Belize Population and Housing Census 2002). Logging concessions to foreign-owned timber companies and the expansion of agricultural industries such as citrus are also a concern for local people, as valuable forest lands have been auctioned off to foreign investors by the Belizean government (TMCC and TEA 1997). Mediation is presently underway between the Maya Leaders Alliance (representatives of Maya NGO's) and the Government of Belize in response to an inquiry by the Inter-American Commission on Human Rights. This is subsequent to the signing of the historic "Ten Points Agreement" between the Maya of Toledo and their government (Berkey 1994) that took place in October 2000, during the study. These factors continue to shape the multifaceted landscape in which learning and teaching about subsistence knowledge takes place.

Methodological Overview

Research design incorporated cognitive and behavioral data collection techniques, analyzed using both qualitative and quantitative methods. Most of the data collected fall into one of three categories–ethnoecological, demographic, and educational. Unless indicated otherwise, the site of data collection is San Miguel village.

Ethnobotanical collections

Ethnobotanical collections were an ongoing part of data collection, so as to document Q'eqchi' names and uses for subsistence-related plants, as well as to record collection, harvesting, and management practices. Collections were obtained on the reservation lands and surrounding forest of San Miguel, San Pedro Columbia, and Big Falls villages. Scientific determinations have been made for as many of the plants collected as possible concurrent with the publication of this dissertation. (See Appendix B, "Q'eqchi' Ethnobotany: List of Collections" for a complete listing of all voucher specimens)[9]. Prior to collecting, a permit was obtained from the Forest Department of Belize, Conservation Division, in May of 2000. Over 250 voucher specimens were taken to the Belize Herbarium located in Belmopan at the Conservation Division offices, where many were identified using the collection housed there and the Flora of Guatemala volume four of *Fieldiana, Bot.*[10] Specimens were dried and frozen for over 48 hours and inspected and certified by BAHA and Forest Department Conservation Division before they were brought back to the U.S. for further identification by specialists. Four vouchers were obtained for each plant collected, following methods outlined in Martin (1995).

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[9] Future publications will contain any subsequently determined voucher specimens as they become available.

[10] Ramon Vargas very graciously assisted with identifications, and taught me a great deal in the process, including sharing his own ongoing research on Q'eqchi' ethnobotany. Hector Mai, Natalie Rosado, Earl Codd, and John Pineiro also provided assistance and support, particularly during the application for an export permit from BAHA, the Belize governing body for agricultural exportation.

One copy of each specimen collected will be mounted and deposited at the Belize Herbarium. Another copy will be used to create a "travelling herbarium," which will be deposited at the primary school in San Miguel for all community members to use, as a local repository of information (after Berlin and Berlin 1996). These vouchers will be coated in laminate and placed in a binder for ease of use by adults and children alike. A drying oven was constructed on arrival in Toledo, constructed from plywood with a mesh bottom and using five 100 watt bulbs as a heat source.

Plant collections were carried out throughout the 17-month study period to account for seasonal availability of subsistence resources. Certain resources may be only available one time during the year or ideal for harvesting at particular phases of the moon. Care was taken to obtain fertile specimens whenever possible. As is often noted, however, the nature of ethnobotanical collecting often dictates that a specimen is collected as it is identified by a participant in the study, whether fertile or infertile. The researcher must then try to collect a fertile specimen as the plant is located in inflorescence and/or with fruits (Martin 1995).

Collecting trips were a regular part of visits with different families to their farms or while gathering wild foods or firewood. I also hired two assistants to help with the major collecting done in forested areas further from the center of the villages. These individuals were chosen because of previous similar work experience with other researchers in the region, assisting with identifying, locating, and pressing local plants. They had worked along with the Forest Department, and/or logging operations, tagging tree species for selective extraction. Fourteen adults and 32 children served as informant collaborators during ethnobotanical collecting trips over the course of the study, in addition to the two assistants. Many plants collected were derived from food freelists, household surveys of forest products, and home garden inventories, described in detail later. An attempt was made to focus particularly on documenting semi-cultivated, protected, or wild species, frequently a part of the Q'eqchi' diet.

"Wild" resources have begun to claim more researchers' attention in recent years, but the continuum of human management of plants is an area about which more needs to be known, particularly as harvested and used by women and children (Etkin 1994:5). Different species of trees used for such purposes as firewood, house construction, and planting sticks were often collected. Dozens of plants commonly found in home gardens were also documented, as well as many plants considered as suitable only for "children's food", providing in-between-meal nutrition for the children of the community. Although recent research indicates that often many plants straddle an imaginary line between "food" and "medicine" in traditional pharmacopeias (Etkin 1994), this study emphasized collection of plants categorized as food, although any medicinal uses were also noted. The figure below is an excellent example of a food/medicine plant.

Figure 2.6 A girl opens up the fruit of the **yamor** (*Momordica charantia L.*), a popular snack food among children who suck on the bright red seeds but do not swallow them. The leaves of this plant are also widely used by all ethnic groups in Belize to aid digestion, as a tonic or antiparasitical tea.

Community members were overwhelmingly generous in sharing their knowledge of plants with me. Sometimes it may have been a source of comic relief to discover how interested I was in the most mundane of plants, asking question after question. I was often seen trekking back to my house in the village looking like a walking bush with arms as I, and invariably whoever I was collecting with, toted giant palms and other prickly items to be pressed between sheets of local newspaper and cardboard and set to dry in the little makeshift plant drying oven. As I was told on occasion, this was a ridiculous waste of a good newspaper—in a place where printed material was definitely not ubiquitous, while "the bush" that I was trying to preserve never stopped growing or providing. Children and adults often came to assist and observe this part of the process with rapt fascination. Interesting conversations would ensue about names and uses, which I very much appreciated, as we would go about pressing the plants.

In addition to plant collections, structured interviews were conducted with both adults and children, to begin documenting generalized ethnobiological knowledge and terminology (Atran 1990; Berlin 1992). The information was foundational to later portions of the research on comparing knowledge and skills between generations.

Demographic household survey

One of the first formal types of data collection during the project was to conduct a general household demographic survey in San Miguel, so as to provide some baseline socioeconomic data for the study such as number of households, family size, land use, land tenure, religious affiliation, and education. Interviews were conducted in Q'eqchi' and included a combination of structured and semi-structured questions, using a standardized written form on which answers were also noted in Q'eqchi'. The sample included 71 different households, 89% of all households in the primary study community of San Miguel. This represents the number of households in the village who agreed to participate in this particular set of interviews, as I wanted to interview every household in the village. The interview protocol was pre-tested to ensure relevance and appropriateness of questions. (See Appendix D for a sample interview protocol).

In addition to demographic and socio-economic data, the household interview included food resources freelists, questions on parental beliefs about how children learn subsistence knowledge and skills, and information about use and procurement of wild foods, hunting, and fishing. Either men or women were interviewed depending on who was home at time of the survey or willing to participate. The survey was completed during July 2000, with the assistance of five young adults from the community who were juniors and seniors at the Toledo Community College (TCC), a high school in the district capital of Punta Gorda[11].

I asked students to assist me in composing, testing, and writing interview questions, conducting interviews, and translating responses. High school students were chosen because they were available during the summer months, when many similarly qualified adults were either working elsewhere or at their farms during the day. The survey gave the students an opportunity to further their skills in writing their own language, which is not currently taught in any school in Toledo, or elsewhere in Belize for that matter. Most people only have experience with their first language in its written form from reading the Roman Catholic church hymnal of songs and prayers, *Qanimaaq xloq'al li Q'aawa':Eb' li B'ich Jo'wi' Eb' li Tij sa' Q'eqchi'*, or Catholic or Protestant versions of the Bible, often printed in Alta Verapaz and brought over by Cobañeros for sale, or parishoners who made special trips to Gautemala to purchase such items. I also thought it was important to involve as many youth in the study as possible.

[11] TCC is now one of two high schools in Toledo district, although in June of 2000 and for many decades before, it was the only one. The other is a new high school located at the intersection of the Southern Highway and the P.G.-San Antonio road (closer to many western Toledo villages than P.G.), which opened its doors in September 2000 and was inaugurated as Julian Cho Technical High School on Feb. 1, 2001, by Prime Minister Said Musa.

Freelists

Freelists of food resources were obtained from 71 adults–individuals over the age of 14–as the very first part of the demographic survey. This was done to avoid bias in the results of the freelists because participants had already answered questions related to the domain I was interested in. The adults represented 71 different households, 89% of the households in the primary study community of San Miguel. Adults were asked, "Can you tell me all the kinds of foods there are?" in Q'eqchi' and the responses were recorded and later translated into English and tabulated (Weller and Romney 1988). The results of data analysis are discussed primarily in Chapter Five, which details the application of the cultural consensus model and the use of the data analysis software program ANTHROPAC (Romney, Weller, and Batchelder 1986; Borgatti 1994). Freelists are useful in indicating the most salient, frequently reported items assigned to a particular domain of cultural knowledge, in this case, food resources. After freelists were elicited from each interviewee, information about the seasonal availability of each item on the list was recorded, as well as any information about location, harvesting, and preparation.

Several months after the freelist interviews were conducted with adults I repeated the procedure with children in San Miguel. Thirty-two randomly selected boys and girls ages 7 to 14 were interviewed in Q'eqchi' about types of foods and local fauna[12]. In addition to foods, interviewees listed as many animals, insects, and fish as they could name. Freelists of fauna were also obtained from 8 adults. These

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[12] Written permission was obtained from participant's parents, with the assistance of the school principal and teachers.

answers were recorded and compiled, providing the basis for the list of Q'eqchi' Fauna and Insects (see Appendix C).

Child-guided home garden inventories

Child-guided home garden surveys or "tours" were conducted in 20 households in San Miguel. Children were identified using a stratified sampling technique, totaling 43 participants between the ages of 4 and 14. Children of these ages within selected households were each asked to identify all the plants growing around their house, **chi rix li kab'l**. This information was then checked against a resident adult's knowledge of the plants and their uses. It was assumed that there would not be any plants for which children knew a culturally "acceptable" name, which adults did not.

The garden surveys were a means to ascertain children's knowledge about different plants in their immediate landscapes and for the researcher to begin to understand the development of expertise throughout childhood in a given family. I am not aware of another study that has used this precise method. However, the idea arose from conclusions drawn in a study of Tzeltal Maya children's botanical terminology by Stross (1970) and from follow-up research to that study that I conducted with a colleague in Chiapas, Mexico, in 1999 (Zarger and Stepp 2000). Stross describes a widening sphere of experience with the botanical world that begins in infancy, in the home, and gradually extends outward to encompass the wider world. This idea led to an interest in determining what knowledge children of different ages in the same household have about their own home gardens. This set of interviews also allowed me to simultaneously conduct inventories of home gardens, useful for understanding the spectrum of local food resources and average species diversity.

Figure 2.7 A boy shows me **map** (*Acrocomia aculeata*), during a home garden interview. This palm nut is a favorite non-cultivated snack food for children, similar to peanut butter in taste and nutritional value.

Pile sorts

Q'eqchi' knowledge of local ecology consists of layered taxonomies that are similar in many ways to the Linnean system of scientific nomenclature and classification in other traditional societies (Berlin 1992). Pile sort interviews are a tool researchers have developed to document how people perceive some plants or animals to be similar to one another in some way. These similarities and differences result in living kinds being grouped taxonomically in ethnobiological systems of classification (Weller and Romney 1988). They have also been used to determine the amount of agreement informants have about a particular domain of knowledge and to identify subgroups within populations (Nolan 2002; Boster and Johnson 1986). Items in a particular domain are usually written on cards, or depicted in photographs and drawings. These are sorted by participants into piles or groups, based on their similarities to one another. The piles can be predetermined by the researcher, a “constrained” pile sort, or are determined by each person who is interviewed, an “unconstrained” pile sort.

Pile sort interviews were conducted with 32 children randomly selected between the ages of 7 and 14. The same set of interviews was also conducted with 6 adults in the community. The interview task consisted of 60 cards with color photographs of local flora laminated for durability. Color photographs have been used less often than terms written on cards, but work well if reading cards is difficult for informants, as it is for young children.

Boster and Johnson (1989) used photographs and illustrations of fish when comparing expert and novice classification of Atlantic coast fish species. Johnson argues elsewhere that visual stimuli can be used systematically in a wide variety of studies and are particularly useful with children (Johnson and Griffith 1998). Children have not been the focus of pile sort studies as a rule. However, one study by Roos (1998) on children’s food categories and meanings is an exception, and provided a guideline for methods and data analysis. To my knowledge, no study has carried out pile sorts of plants with children prior to this one. Additionally, no other study has compared sorting agreement of local plants between adults and children, as is discussed in Chapter Five. However, a large body of research exists on experts' and novices' categorization of other natural kinds, such as dinosaurs and shorebirds (Johnson and Mervis 1994; Johnson and Mervis 1997) using a variety of stimuli.

Care was taken to produce high quality photographs clearly illustrating each plant when in fruit or flower. Pictures were taken in and around San Miguel village. On each card was also the name of the plant in Q'eqchi', for clarification. For the very young and very old, who were unable to read the names, I would read each name aloud to them as they flipped through all of the cards, and then they would begin to sort them. The plants used in the task were selected from 71 freelists of plant resources previously collected in interviews with adults. A representative sample of the plants named in the freelist task was obtained. The goal was to provide systematic variation among cultivated plants, non-cultivated, and wild species, as well as those more and less widely known. The pile sort interviews were completed during June, 2001, so by that time I had a year's worth of experience and familiarity with local names and uses for plants before it was decided which species to include. A list of plants used in the pile sort task can be found in Table 5.3.

Pile sort data were analyzed using ANTHROPAC data analysis software (Borgatti 1994). Data were recorded on which cards each respondent placed together, entered into similarity matrices, and then represented graphically using a multi-dimensional scaling technique (MDS) (Boster and Johnson 1989). Each participant was asked to perform three sorts with the same 60 cards. The first sort was an unconstrained sort. I asked participants to place those cards together that “seemed to go together” or were similar in some way (“**K’iru wankeb’ juntaket**?”). This was continued until all cards were sorted into piles, or left to form its “own” pile of one because it was not similar to any other plant. Rationales for creating each pile were recorded and analyzed for common themes across participants. After the first sort was completed, all adults and a subsample of half of the children were asked to perform one of two further constrained sorts of the cards. The first constrained set was based on the Q’eqchi’ conceptualizations of cultivated (**tintoo ta’wow, awimk**), semi-cultivated (**joq’ejak ta’wow**), and non-cultivated or wild (**muku ta’awow**, **namok**) plants. For the second set, participants sorted the cards into piles based on edibility and who might eat fruits, flowers, or other plant parts. The categories were: inedible (**muku tatkuxta**), “everyone eats them” (**re li kristian**), “adults eat them” (**re li yuwaeb’, re li yawaeb’**), and “children eat them” (**reheb’ li kok’al**). The goal was to find out if certain types of foods are considered primarily children’s (or adult’s) food. (Wilk 1991) previously noted that there were certain wild foods that are primarily children’s foods and indeed this was borne out in the results. Data for these last two sorts are analyzed in the same way as the first round. Pile sort tasks provide a concrete way to document the ways individuals compartmentalize the natural world, enabling comparison of inter- or intra-population similarities and differences.

Plant trail

Children become increasingly more knowledgeable about the biophysical environment as they mature. But the specific transformations in ecological knowledge that occur during childhood are not fully understood. In Chiapas, Mexico in 1969 Brian Stross constructed a “plant trail” as a part of his dissertation research on Tzeltal Maya acquisition of botanical terminology during childhood (1970).[13] The method is a deceptively simple, but insightful way to compare individual knowledge of plants, particularly at different ontological stages. The interviews are conducted individually. The researcher and participant walk along a set path and the participant is asked to identify tagged plants. The trail includes a wide variety of plants to reflect local plant distribution and cultural significance or insignificance. In July and August 1999 I carried out a thirty year follow-up study to Stross’s original study in Chiapas with a colleague (Zarger and Stepp 2000), conducting a plant trail experiment in the same Tzeltal community. The plant trail design has been revived by a few other researchers recently, most notable and relevant is Collins’ (2001) research with Q’eqchi’ in Guatemala[14]. After positive experience using the plant trail method in Chiapas, I decided to construct one in Belize.

The plant trail “experiment” provides quantitative data on children’s development of expertise in naming plants. This allowed me to quantify in approximate terms children’s knowledge variation and compare competence on the plant trail with performance in formal schooling. This addresses one of the research goals–to investigate the impact of time spent in formal school on TEK.

In San Miguel, 119 plants were tagged along an existing trail, winding through varied successional stages of vegetation in easy reach of the center of the

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[13] Stross focused on plant naming ability as a concrete domain representing the larger process of language acquisition (1973).

village and the school. Children were asked the name of each plant and its use. Repsonses were recorded and later coded based on the culturally "correct" answers for each plant. See Chapter Five for a detailed discussion of the plant trail results.

The trail took approximately an hour and a half to two hours to complete. The length of the trail was gauged an optimal balance between the highest possible number of plants and avoiding boredom and distraction among the participants to ensure accurate answers (Collins [2001] notes a similar trail length and number of plants as optimal). Twenty-three children (10 girls and 13 boys) and 6 adults (3 men and 3 women) were interviewed before the experiment was dramatically ended by hurricane Iris in October 2001.

Many children and parents assisted with the design and construction of the plant trail. Some cultivated species were planted along the trail to provide a continuum of human-managed and wild species and more or less widely known plants. Several times it was necessary to replant the cultivated species, so preparing the trail also took many months to complete. The wanderings of pigs and the occasional harvesting or weeding of plants meant continual vigilance to keep the trail maintained in consistent shape. The trail was covered with up to ten feet of water during major floods in the rainy season of 2001, from tropical depressions that passed over the area. Ultimately, the plant trail was destroyed in the hurricane. This was particularly distressing because the plan developed with parents, teachers, and children in the community was to permanentize the trail for the community and school to use. I had obtained metal botanical labels to display local and scientific

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[14] The results of my plant trail will be comparable to Collins data set. A comparative study would provide documentation of the variation in plant knowledge in three Q'eqchi' communities across the

names and uses for all plants. The trail will have to be reconstructed as vegetation recovers from the disturbance of the hurricane, and an interpretive educational booklet for use in the school will be designed to accompany the trail, as originally planned[15].

Figure 2.8 Two girls help transport plants for replanting, the way women traditionally carry loads, on the head.

Figure 2.9 Boys assist in planting **teb'** (*Plectranthus amboinicus*).

entire region.

[15] We had also made strides toward instituting similar plant trail projects in other Maya villages in Toledo, and had garnered interest in the project from several NGOs and an agricultural development agency for the project before the hurricane struck. Future research projects will revisit the feasibility of this idea.

Informal agricultural interviews and farm inventories

Informal interviews on agricultural topics, such as planting and harvesting corn, beans, and other cultivars, were conducted throughout the study. The ongoing interviews helped account for seasonality of crops and labor investment strategies. Participation in "cultural routines" of daily life (Lancy 1996) often meant accompanying different family members to their farms or on collecting trips to **wamil** (secondary growth) areas, and learning, as quickly as I could, to contribute to the task at hand. I picked red kidney beans, broke corn, tried the seeds of the **yamor** (*Momordica charantia*) that winds between corn stalks in the **k'al** (plantation, or farm), and learned when to **pokok kala'** (harvest the young shoots of "jippy jappa", *Cardulovica palamata*). Inventories of species under cultivation were recorded during these visits. Agricultural endeavors were frequent topics of conversation and featured prominently in daily life. Many discussions also took place over meals and in the evenings after work was completed.

Q'eqchi' place names and community map

During the course of informal interviews throughout the research project, I recorded Q'eqchi' names for local geographical features and places. Historically, geography and land formations were a foundational aspect of the Q'eqchi' Catholic-Indigenous belief system. There are said to be 13 hills in Alta Verapaz that represent the homes of the 13 **Tzultaq'a**, who are the gods of the hills and valleys, keepers and protectors of all the animals. Humans seek their blessings and avoid chastisement in the form of poor crops or illness (Thompson 1930; Wilson 1995; Carter 1969).

Religious ceremonies were performed in sacred caves or outside altars, as is practiced in several other Maya religions (Wilson 1995; Sapper 1985 [1936]; Thompson 1930; Howard 1975). These traditions were brought in some form with settlers to southern Belize and applied to the smaller, though no less rugged hills of Toledo. The degree to which the traditional belief system is practiced or professed varies widely in Q'eqchi' communities in Toledo District.

I also was interested in how young people perceive and visualize their own communities, so I worked with teenagers to design a map of San Miguel. The map was also useful for creating random samples. All households were represented on the map, so I constructed samples by interviewing someone every third or fourth house on the map depending on the desired sample size.

As a part of data collection in the local school, I worked with teachers to incorporate a drawing and writing activity into their schedules. This became known as the "landscape" activity, as this was a concept already found in the national curriculum for science and social studies. In each class in San Miguel school, I gave a small introduction to the concept of "landscapes" and the ways human modify or impact the biophysical environment. The introduction was geared toward students of different ages. Then I asked students to think of their favorite place in the community in as much detail as possible and to think of what activities might be taking place there. Then they were asked to draw that place or activity and write a short essay about it. The two youngest classes were not able to do the writing exercise, so I went to each student and asked them orally what was depicted in the drawing and recorded the responses. The drawings were analyzed by themes, which were then used to structure the “ethnography of childhood” component of the dissertation (see Chapter Four). The “landscapes” that provide learning contexts for children were derived from their own conceptualizations. A sample of the drawings appears at the head of each chapter throughout this manuscript. Common themes depicted in the drawings were: activities at the river such as washing, swimming, or fishing; playing by their house; visits to the farm or cave; church; school; playing in trees or picking fruit, and playing football (“soccer”).

Informal interviews: environmental change, migration, and personal learning histories

Changes in ecological knowledge may be linked to changes in the local human ecosystem over time in Q’eqchi’ communities. To understand landscape and land use changes over time, I conducted informal interviews with the majority of villagers on these topics. These conversations frequently occurred over dinner, as I was constantly invited to eat the evening meal with different families. Personal migration histories and patterns document ecological changes in the community over time. I typically asked what the area surrounding the village looked like at certain points in time, or asked people to describe the location of their childhood homes and farms to get a glimpse at changing land use patterns. The two studies previously done in San Miguel are also helpful in reconstructing land use strategies. I also asked men and women to tell me as much as they could recall about how they learned subsistence knowledge and skills as children–or as adults. People recounted some learning “episodes” with surprising detail. These were recorded in field notes each night, based on brief “jotted” notes during the conversation to ensure greater accuracy. The informal interviews provided rich background information that made it easier to interpret and analyze the quantitative data.

Parental beliefs on child development

To explore parental belief systems about child development informal interviews were carried out with 15 families, complementing participant observation. Adults were asked questions about how children learn subsistence knowledge and skills, what knowledge children should be a competent adult member of the community, and the ages by which this occurs. As noted previously, this type of information was also part of the structured household survey, providing an *n* of 71 adults interviewed about the topic. Considering parents' theories about child rearing and development gives insight into individual and cultural expectations for behavior. It also provides a window into adults' theorizing about processes of transmission and culture change (Harkness and Super 1996; Gaskins 1999b). Sigel and Kim (1996) argue that such notions are often particular to different knowledge domains, so this was one area I was interested in exploring.

Participant observation

One of the most important aspects of data collection was to attempt to learn ecological knowledge the same ways the children I was studying did: closely observing and participating to the level of my ability in daily life. Trips to farms or to visit relatives in neighboring villages; assisting with household chores; birthday parties and baptisms; PTA fund raisers; and providing transportation to health care providers all allowed me to become involved in community life in Toledo. During the 17 months of field work, special attention was paid to the unique concerns of working with children and attempts were made to spend as much time as possible engaged in activities with children, as individuals and in peer/play groups. Children's interactions with their parents and grandparents were another primary focus of the study. All interviews and tasks conducted with children were carried out with permission of parents or guardians and tailored to be interesting for children of different ages (Holmes 1998).

Children were also welcome in my house, and usually came to play nearby, or simply to watch *me*, an engrossing activity even if all I was doing was reading a book. So, it should not have surprised me when 8 year old Carmelita, one my closest "friends" who lived next door, told me one time in an interview that I was one of the people who taught her the most about the forest. This was before I quickly clarified and said, "I mean, before I came to the village, who taught you?" I often felt that children were my greatest teachers in learning about daily life. The time I spent with them was invaluable to the study. The children would continually tell me new Q'eqchi' words, tirelessly repeating them until I got them correct. There was no hesitation when it came to showing me all the good fruit trees nearby or trying earnestly to answer any question I asked them. I was also a big hit when I helped them with their chores and joined in their play in the process. Play and work are often interspersed in such a way as to be inseparable when children are not under direct supervision of adults. I am grateful for their accepting me into their world as much as I was able to participate in it.

Structured interviews on cultural transmission and intergenerational differences in subsistence skills

By framing traditional ecological knowledge in theoretical and methodological terms as information transmitted through participation in daily activities, it is helpful to not just think of TEK as “knowledge”, but to focus on the behaviors associated with this knowledge too– the practical “skills” associated with expertise. The two are closely intertwined and have not been the focus of research on socialization, which primarily emphasized attitudes, values, and affect (Whiting 1963; Scribner and Cole 1973). Tracking expertise in culturally important skills was a key component of two previous studies of transmission of TEK: Hewlett and Cavalli-Sforza’s (1986) research with Aka in Africa and the work of Ohmagari and Berkes (1997) with Cree women’s bush skills. These studies quantified cultural transmission by recording individual competency with a specified set of skills and tracking variation in skills by gender, age, or schooling. In the case of Cree women, this involved fur preparation, making clothing, or hunting, and for the Aka, making a crossbow and finding honey or vine water.

These two studies provided guidance in developing a similar interview protocol for use in Belize, with an explicit focus on subsistence skills and tasks. Structured interviews with 45 adults (20 men and 25 women over the age of 16) were conducted using a standard interview form (see Appendix E). All interviews were done with one of two collaborators from San Miguel, a man and a woman, who assisted with translation and transcription. The set of skills was derived from informal interviews and freelists with adults for "things children should know how to do" by the time they are grown. The list contains gendered tasks and gender-neutral tasks, with a degree of overlap, ranging from extremely simple to more complex. I intentionally included some tasks that very few people still know how to do, so as to document at what ages shifts in knowledge and ability occurred. Tracking competency, teacher, and age learned for the set of 52 skills allows comparison across generations and age sets for men and women.

Formal educational data

Formal and informal learning are often placed in a polarized relationship to one another (Greenfield and Lave 1982). However, research has demonstrated that this may be a false characterization of learning environments, which often contain elements of both, depending on the domain. Therefore, although the explicit focus of this project is informal learning, research was conducted in schools in addition to more informal, or "traditional" environments. I visited primary schools in San Miguel, San Antonio, Corazon, Big Falls, and in the district capital, Punta Gorda. In San Miguel village I observed in the school an average of 3 hours a week over the course of the study, documenting the information presented on the biophysical environment, and noting how TEK, Maya culture and traditions, and land use was presented at each grade level. From time to time I was asked to give presentations to the students and assist with some environmental studies activities. I conducted informal interviews with educators of all descriptions, from primary school teachers, to principals, to faculty of Belize Teacher's College, which grants accreditation certificates. The focus was on environmental education, which is subsumed under science or social studies in the classroom and in the national curriculum[16].

Qualitative data resulting from interviews were recorded in daily field notes. The principal of San Miguel R.C. School also graciously provided me with information from school records on student performance that I included as a part of the plant trail study.

Archives and library research

Archival research was carried out in the National Archives of Belize, in Belmopan, as well as at the library of the Society for Promotion of Education and Research (SPEAR) in Belize City. Time spent there was useful in locating "gray literature" and other hard to find materials, such as colonial minute papers and government and development agency reports related to history of Maya in Belize, land use changes, colonial/historical attitudes toward Maya and their land use strategies, and agricultural or environmental education.

Field notes

During the study field notes were recorded daily. I used field notes as a way to organize brief notes taken during the day in informal interviews, record observations of learning contexts, and describe events and situations relevant to the study. Each entry was coded based on an ever-expanding list of topics, to be analyzed for

[16] Throughout the time I was in Belize, the national curriculum was under revision, beginning with first grade (Infant I) and working up. Ecology, environmental issues, and conservation are to be integrated into the new curriculum, consistent with the government's focus on promoting ecotourism and protected areas as promising economic development for Belize.

recurrent themes and patterns (LeCompte and Schensul 1999). Hundreds of pages of notes provide rich details about daily life and conversations I took part in or observed, grounding my interpretation of the quantitative data.

Conclusion

Research design for this study incorporates cognitive and behavioral data collection about learning environmental knowledge during childhood. Field research was divided into two main phases: documenting local subsistence knowledge in Q'eqchi' communities and describing the processes of acquisition and transmission and intergenerational differences in knowledge. There is an integral link between subsistence strategies, religious, political and economic institutions, and changes in land use patterns over time. For Q'eqchi', migration and establishment of new communities, associated with the need to cultivate new lands, have been extremely important in shaping past and present sociocultural and biophysical environments. The next chapter provides a glimpse into the past and present of Q'eqchi' human-environment relationships.

CHAPTER 3

THE Q'EQCHI' HUMAN ECOSYSTEM: BIOPHYSICAL AND SOCIOCULTURAL CONTEXTS OF SOUTHERN BELIZE

Figure 3.1 Drawing by Rueveira Teul, 12, San Miguel Village.

Human Ecosystems and the Multiple Environments Perspective

Carrying out extended field research, one of the hallmarks of the discipline of anthropology, means that researchers are often engaged in experiential learning. The daily life of fieldwork provides a rich tapestry of sights, sounds, smells, and feelings of a particular place that are foundational to the ethnographic enterprise. Personal experience, typically over a period of a year or more, enables researchers to begin to understand the complexity of people's lives in ecological context–how they shape their environment and are shaped by it as well. Human-environment relationships are the primary concern of ecological anthropology as a subfield, the broader discipline in which this dissertation is grounded. A review of that field is well beyond the scope of this manuscript, but I would like to briefly introduce one of the foundational approaches within ecological anthropology–the "human ecosystem" concept–because it provides the theoretical framework for contextualizing the present study in terms of ecology and human history.

Viewing human societies and behavior from an ecosystems perspective allows a holistic conceptualization of human-environment relationships. Biophysical environments (such as local ecology and geology) and sociocultural environments (such as religious belief systems and sociopolitical organization) overlap and interact in a human ecosystem. Although these are somewhat arbitrary boundaries, and it is difficult to begin to describe a phenomenon as complex as an "ecosystem", as many ecologists have argued, the attempt at holism presented here does provide a multi-faceted, interactionist perspective on human-ecological relationships. In Figure 3.2, these environments are separated into four spheres, and can also be thought of as an evolutionary arrangement. Such a view disavows the dichotomy between humans and nature, and allows human societies to be conceptualized as having input and output environments, which consist of physical, biological, social, and cultural factors[1].

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[1] This framework was developed by the Human Ecosystems Group at the University of Georgia, also known as H.E. Kuchka, comprised of Rick Stepp, Charles Peters, David Casagrande, Eric Jones, Suzanne Joseph, Mitchell Pavao-Zuckerman, Felice Wyndham, and Rebecca Zarger. It has been published and further explicated in the first and fifth volumes of the *Journal of Ecological Anthropology*.

The multiple environments concept is used to provide a theoretical framework for the contextualization of the study, situating the communities where I conducted fieldwork in ecological time and space. An brief introduction to Maya peoples of the past and present and the country of Belize is followed by a focused discussion of biophysical and sociocultural environments of southern Belize, describing major changes in the human ecosystem over time, particularly as relevant to Q'eqchi' Maya.

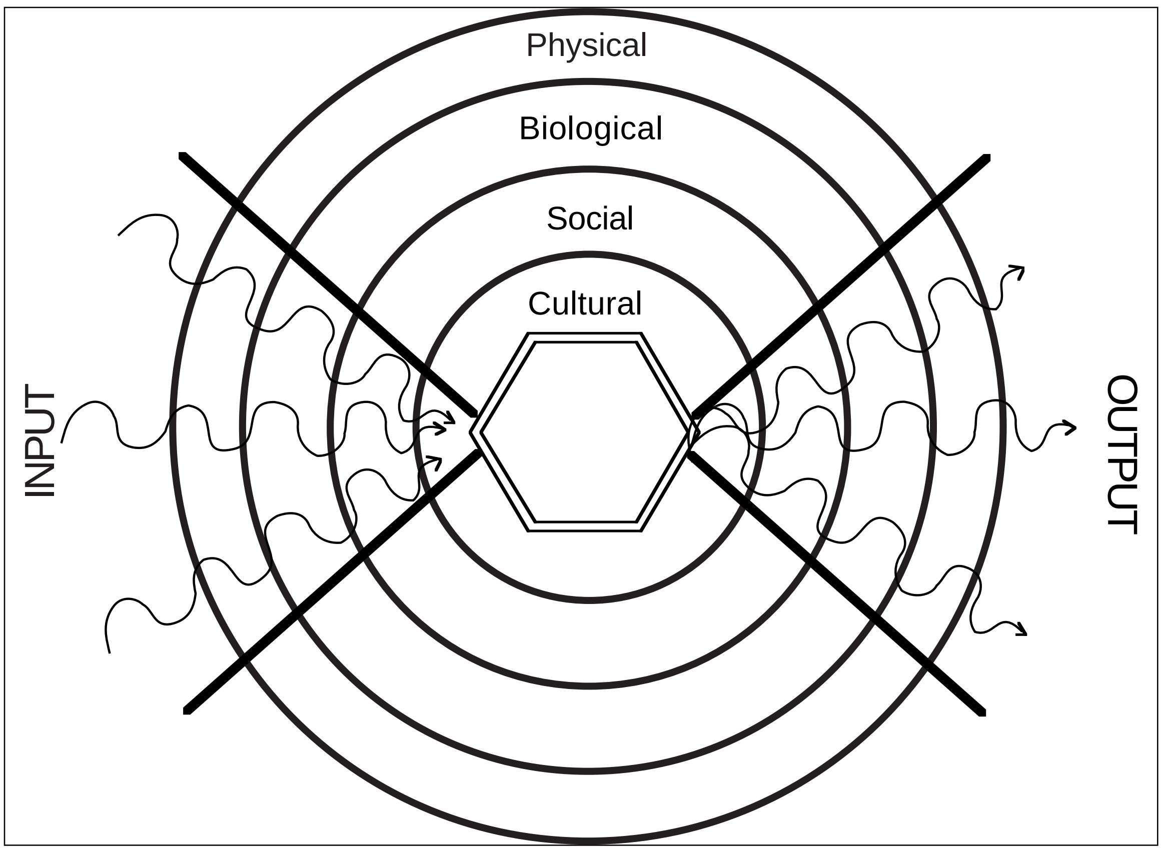

Figure 3.2 Multiple Environments of Human Ecosystems (Stepp 1999).

"Maya", Past and Present

The biophysical and sociocultural environments of what is often termed the "Maya lowlands" in archaeological and historical literature have been influencing one another since humans settled in the region. For Belize, researchers estimate human occupation at approximately 9000 BC (Hammond 1991). Ancient Maya political organization, the construction of monumental architecture, and intensification of agricultural techniques began in the Late Pre-Classic, from 500 BC to 200 AD. The Classic period began around 250 AD, with different Maya polities rising and falling from increased power and control over local trade routes and scarce resources, such as water (Sharer 1994; Scarborough 1996; Voorhies 1982; Willey 1981). The collapse of most of the largest polities and ceremonial centers began around 800 AD and continued for the next century until 900 AD (Sharer 1994). Population either declined or, more likely, dispersed in many areas and stelae and other significant cultural symbols were destroyed. Most people returned to small-scale agricultural life, based on *milpa* farming (Abrams et al. 1996). Between the time of collapse of the ancient states and the arrival of the Spanish, there were centuries of migrations from the central area of the Peten outward to major river drainages (Atran 1993; Rice et al. 1995). In the Late Post-Classic the Spanish arrived and began enforcing tariffs and duties on people living in the region, spreading Christianity–often militantly–and introducing new crops, sheep, and horses (Jones 1989; Schwartz 1992). As a result of the dominance of the Spanish during colonial times, Maya peoples were often circumscripted in areas of marginal land, taxed and forced to purchase goods from the Spanish at exorbitant prices, prohibited from practicing their religious beliefs (sometimes upon threat of execution), and were forced to labor in the plantations, mines, and other extractive industries of the colonial machine (Wasserstrom 1978; Jones 1982).

A brief glimpse at the history of the Maya lowlands–what is now Belize, northern Gautemala, eastern Chiapas, and the Yucatán peninsula–reveals a "mosaic of landscapes which were perceived and managed in various ways in different places and times, often in response to changing political, as well as economic, pressures (Fedick 1996: 14)." A long view of human-environment interactions in the region, which has guided the present study, allows a divergence from widely held, often contradictory views of indigenous peoples in tropical areas. At various times researchers have viewed indigenous peoples as either protectors of a pristine jungle landscape, or as a recent source of burning and destruction of that landscape due to swidden agriculture (Atran 1997; Nations 2001). Neither extreme is true, and subsistence strategies that characterized ancient Maya civilization are not necessarily the same as those that Maya living in the same landscape practice today, although there are similarities in species used and some cropping techniques (Voorhies 1996; Abrams and Rue 1988; Freter 1994; Beach and Dunning 1995). For example, ancient Maya used terracing techniques in many locales, although this technique is not used today. There is evidence for drained agricultural fields at Cerros, Altun Ha, and other sites in Belize (Scarborough 1991). Beach and Dunning (1995) suggest that ancient Maya techniques might be usefully employed in supporting a rapidly growing Maya population. On the other hand, agroforestry techniques demonstrate continuity in many Maya areas, as research on intercropping in home gardens and managed forest plots has shown (Nations and Nigh 1980; Alcorn 1981; Atran 1997; Caballero 1992).

At times popular writers and scholars have referred to "The Maya" of the past and present as if there is seamless continuity between the society which constructed the ancient ruins of Tikal and Caracol and those who live in the internationally promoted "Mundo Maya" today. This is an extremely politically charged topic, as it relates in many cases to land tenure claims and cultural or socioeconomic autonomy (Nations 2001; TMCC and TEA 1997; Wilk 1997 [1991]). Archaeological, historical, and ecological evidence indicates that there have been many changes over the centuries that humans have inhabited the region. Populations speaking 32 different Maya languages have migrated, divided, and merged, and a few have disappeared. But, most have not, and whether or not they practice certain agricultural techniques, speak a certain Maya language, or wear traditional dress, they continue to shape the human ecosystem of the highlands and lowlands of Central America today.

There are an estimated 5 to 7 million Maya living in Guatemala, Belize, and Mexico (Lovell and Lutz 1994). Maya societies in the 21st century are a complex amalgam–a legacy of ancient civilizations, the colonial experience, and nation-states of the 19th and 20th centuries. "The Maya," whether they see themselves, individually or communally, as a part of a Pan-Maya identity,[2] are shaping the futures of the nation-states and trans-boundary protected areas (such as the Maya Biosphere Reserve) of which they are a part. From the Zapatista movement in Chiapas (Collier 1994), to *el Movimiento Maya* in Guatemala (Fischer and Brown 1996; Wilson 1995), to efforts to

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[2] The question of whether or not Q'eqchi' have historically seen themselves as being "Maya" is a topic of discussion in several ethnographies (see for example Wilson 1995; Siebers 1999). In Belize, Mopan and Q'eqchi' in Toledo have begun over the past several decades to construct a unifying Maya and Belizean identity, one that reflects common heritage and struggles for similar goals of autonomy and land rights. This overshadows that they speak two different languages with few common loan words and may have competed in the past for the same resources. In some ways the movement is both in resistance to, and

secure a Maya Homeland in southern Belize (TMCC and TEA 1997), overlapping concerns include land scarcity and diminishing access to natural resources, land tenure, poverty, and space to exercise personal freedoms and cultural belief systems.

Figure 3.3 Southern Belize and the Petén and Lake Izabal regions of Guatemala. From a satellite image of Central America produced by NASA, used with permission.

capitalizes on, the co-opting and promotion of such an identity by government and private tourism based industries. An example is the widespread promotion of eco-cultural tourism throughout the country.

Belize

Belize, formerly known as British Honduras, is one of the smallest countries in Central America and is enriched by cultural and biological diversity. Belize is a multi-lingual country, and most Belizeans speak several languages fluently, often switching from one language to another many times during a given day. The primary ethnic minorities in Belize include Garifuna (or Garinagu), Creole, “Spanish”, East Indian, Taiwanese, Chinese, as well as Yucatec, Mopan, and Q’eqchi’ Maya. 85% of the population speaks English or Creole English. English is the language taught in schools. However, many people in Belize are bilingual or trilingual. 51% speak Spanish as a first language, which reflects Belize’s status as an immigration destination for populations elsewhere in Central America (Central Statistics Office 2001).

The area of the mainland and cayes (offshore barrier reef islands) is 22,960 square km, extending to 280 km long and 109 km wide (G.O.B. 2002). The ecosystems of Belize are extremely varied within a small geographical area, including tropical rain forest, montaine cloud forest, mangroves, wetlands, pinelands and savanna, and coral reefs and atolls (Hartshorn et al. 1984; Iremonger et al. 1994). The highest point in Belize is Doyle’s Delight in the Cockscomb mountain range, at 1124 meters above sea level (G.O.B. 2002). Belize has an extremely large number of protected areas, approximately one third of the country’s land area. The country has 3408 known species of vascular plants, representing 1219 genera and 209 families (Balick et al. 2000), and over 700 species of mammals, birds, and reptiles (Iremonger et al. 1994). The climate of Belize is subtropical, and there are pronounced wet and dry seasons, with dry season being the winter months of November to April or May, and wet season during the summer months of June through September.

Finalized independence from Britain and recognition of nation status was gained in 1981. Belize is a parliamentary democracy with a two party political system and primary governance lies with the Prime Minister and Cabinet, but an Attorney General represents the titular British monarchy as well. Primary industries for the country are tourism, sugar, citrus, shrimp aquaculture, and bananas. Tourism has grown exponentially over the past three decades, and on average 225,000 tourists arrive in Belize each year, ostensibly lured by diving, offshore cayes, Mayan archaeological sites, and the rain forest. The bulk of the rest of the economy is derived from agricultural exports. Belizeans have a long tradition of importing a large proportion of foods and manufactured goods, from the U.S., Mexico, Guatemala, or Europe. Estimates are that one quarter of all food items are imported, and this proportion was much higher in the past (Barry 1995). The majority of Belizeans are not farmers, which stems from extractive colonial land use policies concerned primarily with exportation of logwood and mahogany and from limited accessibility of interior portions of the country only reachable by major rivers for centuries (Shoman 1994)[3]. The majority of food crops that are not exported are produced by Mennonite farmers, who provide most of the poultry and dairy products, and Maya farmers, who provide red kidney beans, rice, and corn.

The total population of Belize as of May 2000 was 240,204 (Central Statistical Office of the Government of Belize, 2000). As measured from the previous census

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[3] There are several excellent histories of Belize that explore how the diverse country came to be what it is today. See for example Shoman (1994); Bolland (1986) for general overviews. For a history of ethnic

reports from 1991, the population's growth rate is 2.7% a year, up .1% from the previous decade (Central Statistical Office of the Government of Belize, 2000). However, Belize has the lowest population densities of any nation in Central America, approximately 8.5 per square mile (Merrill 1992). Until the 1980s, over 50% of the Belizean population resided in one of eight major cities, with 30% living in Belize City alone. By 1990, population distribution had begun to shift, and 51% of the 191,000 Belizeans lived in rural areas (Merrill 1992). The reasons for the trend to settle in rural areas are an increase in emigration of Belizeans to the U.S. during the 1980s, concurrent with a massive influx of immigrants (many refugees) from neighboring Central American states (Salazar et al. 2000). There may be more Creole Belizeans living outside the country, mainly in the U.S. cities of Los Angeles, Chicago, and New York, and in parts of Florida and Texas, than there are living *in* Belize. This is a result of the large scale outmigration that began in the 1940s and continues to the present (Vernon 1988; Stone 1994).

Belize is unique in Central America, because it is in many ways a young Caribbean nation, shaped by English colonial rule, and yet Mestizo culture and language have become a silent majority in recent years. The influence of the English colonial system is still present in many of the institutions, national holidays, and governance of the country, and yet 51% of people in Belize speak Spanish as a first language. It is difficult to convey the sheer diversity of humanity living in the small nation of Belize, simultaneously creating individual, ethnic, and national identities. Belizeans sometimes call it "the Jewel." If you take a walk down any street in the country, a dusty road in

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groups in Belize see Wilk and Chapin (1990), and Jones (1989) explores indigenous reactions to colonial

Punta Gorda or a hot paved sidewalk in Belize City, there will be 4 or 5 languages swirling around you. The shouts of children float from open windows of clapboard houses leaning on wood stilts, and a radio is loudly playing the song, “Good morning Belize and good morning, how are you this morning…?” The smell of “fry chicken” and tortillas baking assaults your nose–and maybe a fish rotting in the gutter–and it’s only 6 a.m. Some new juxtaposition of people, colors, and culture always awaits you in Belize.

History of the Q’eqchi’ Human Ecosystem

The Highlands Alta Verapaz, Guatemala, have been the historical and geographical focal point for speakers of the Q’eqchi’ language for centuries. However, the present population has shifted significantly since 1550 when most speakers were found near Cobán, San Pedro Carchá, Lanquin, and Senahu (Sapper 1985 [1936]). Settlement of Q’eqchi’ families now extends to include a massive area in the lowlands, as far north as Lake Petén Itzá, east throughout the southern portion of Toledo district in Belize, and the entire Lake Izabal region of Guatemala to Livingston on the Caribbean coast. Figure 3.4 outlines the Q’eqchi’ region. The Q’eqchi’ (**Q’eqchi’eb’**) are one of the largest Maya populations in Guatemala. Estimates range between 600,000 [Siebers 1999] and 700,000 (Collins 2001). Two dialects of the language are geographically divided into Eastern (Lake Izabal and Belize) and Western (Alta Verapaz) zones, although Q’eqchi’ has less dialectical variation than many other Maya languages according to *Oxlajuuj Keej Maya' Ajtz'iib'* (OKMA 1997). Still, the vocabulary and pronunciation of the language

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incursion.

are quite different depending on whether one is trekking through cloud forest outside of Cobán or walking through the village of San Pedro Columbia, Belize.

Figure 3.4 Areas settled by Q'eqchi'. The darker line is simply a rough outline of the area based on ethnographic accounts. Based on (Wilk 1997); Schackt (1986); Siebers (1999); Atran et al. (1999).

Until the 1970s, relatively few ethnographical or historical studies of the Q'eqchi' existed, particularly in Guatemala. This has changed in the intervening years. Charles Sapper's (1985) cultural history of the Q'eqchi' area from the 1890s until the 1930s is one of the earliest scholarly works available and covers many of the scanty colonial records. Carter's (1979) study of the agricultural techniques of farmers who had migrated to the lowlands was followed by work on the resurgence of Q'eqchi' Maya identity and religious beliefs by Wilson (1995). Siebers (1999) provides a look at Q'eqchi' history, religious transitions, and social institutions from the perspective of modernization. Most recent is Collins' (2001) dissertation research on the adaptation of the Q'eqchi' ethnobotanical system to highland and lowland environments.

In southern Belize, J. E. S. Thompson (1930) visited Toledo and recorded dozens of folk tales, described agricultural practices, and took many brilliant photos, although the primary focus of his visit was the Mopan Maya of San Antonio. A flurry of ethnographic research occurred in Belize in the mid 1970s to mid 1980s, beginning with Howard (1973), and then Wilk (1981), Schackt (1986), and Berté (1983), who conducted studies in three different Q'eqchi' villages during that time. Osborne (1982), a rural sociologist, prepared an insightful report on agricultural labor and practices in light of a large development project, one of many past and present, focused on mechanized rice production, the Toledo Research Development Project (TRDP). All provide different information on Q'eqchi' relationships with the biophysical environment, particularly agriculture. Wilk (1997) provides an excellent detailed history of Q'eqchi' colonial history and migration, as does Siebers (1999). For this reason, this brief overview of Q'eqchi' population history is limited to events particularly relevant to local human ecology.

Q'eqchi' Migration History

The large scale Q'eqchi' migration into lowland areas is the result of a similar set of historical, socioeconomic, and ecological factors that have also forced other Highland Maya groups such as Tzeltal and Tzotzil to settle in Lowland areas in eastern Chiapas (Collier 1994). The Alta Verapaz was long considered an isolated area to Spanish colonial administrators, priests, and other representatives of the colonial enterprise in Central America, and Q'eqchi' were viewed as a militant group (Sapper 1985). Most scholars indicate that the "pacification" of the Q'eqchi', as it is often termed, began in 1537 as the Dominican Friar Bartolomé de las Casas led a campaign to conquer the Q'eqchi' by "peaceful" religious and political economic subjugation (Sapper 1985; Wilk 1997). The Church held centralized power in the new Alta Verapaz for the next two centuries, and forced the indigenous population living in dispersed settlements of family groups across the hillsides into towns so they could be taxed and more easily controlled (Wilk 1997). Incidentally, the English were intermittently concerned with coercing Q'eqchi' in Belize to do the same thing three centuries later (Bolland 1987).

After recovering from a population loss of 77% with the invasion of the Spanish, the population rose during the 1600s and 1700s (Wilk 1997). Inhabitants of Alta Verapaz were basically subjects of a Dominican religious elite through taxation and labor policies. The situation became much worse in the mid-1800s, when German coffee barons bought up huge tracts of land for coffee plantations. Q'eqchi' were then forcibly coerced into a feudal system of slave labor. The highly valuable international trade in coffee was controlled by four main families by the 1890s (Wilk 1997). Leaving Alta Verapaz and the unbearable living conditions, fleeing ever further into the largely unoccupied lowlands to the north and east, became the only escape for many Q'eqchi'.

Q'eqchi' in Belize

From the 1870s on, Q'eqchi', and Mopan who were already settled in the lowlands, began moving into what is now southern Belize. Q'eqchi' primarily followed the watersheds of the Temash and Sarstoon rivers (Schackt 1986; Osborne 1982). The founding of the Cramer Estate in the 1890s was another cause for Q'eqchi' to settle in the region. Located around what is now Dolores, it was owned by two brothers with ties to German families in Alta Verapaz, and they grew and exported coffee, nutmeg, and cacao among other things. A census report from 1891 provides one of the first known population counts of Q'eqchi' in Belize, 254 people, including one school teacher (BHAR 1891:40 in Wilk 1997). Meanwhile, Pueblo Viejo, the first Mopan village, was established by approximately 100 Mopan in 1886, who then moved to found San Antonio which had 448 people by 1891 (TMCC and TEA 1997; Wilk 1997).

Q'eqchi' speakers are the largest indigenous Maya population in Belize, numbering 12,000 in 2000 (Central Statistical Office 2001). In 1966 Q'eqchi' comprised 3% (3,280) of the population of Belize (McCaffrey 1967), and now make up 5.3% of the total population (Central Statistical Office 2001). Many Belizean Q'eqchi' speakers believe that they have lost some depth of expression in the language as a result of distance in time and space from Alta Verapaz. Dozens of people remarked to me, "Across [in Guatemala], that's where they speak the real Q'eqchi'; we here speak a 'Creole' Q'eqchi'". Others expressed concern that they do not want to see their language disappear and are worried that young people might soon lose either interest or ability to speak it. This is beginning to happen in multiethnic villages such as Big Falls, but most Q'eqchi' children speak their language at home, and whenever possible throughout the day, unless they are prohibited during school hours, which may often be the case. After leaving primary school, young people may speak English more often than not if they attend high school or seek work outside their home village, which has become increasingly common over the past 5 to 10 years.

Maya migration history has become a very politically charged topic over the past decade in Belize, as the Inter-American Commission on Human Rights investigated and brought forth a case for human rights violations by the Government of Belize. Maya leaders who initiated the claims seek to establish a homeland in southern Belize, restrict logging operations by foreign firms, and promote future sustainability of the local environment and Maya culture (TMCC and TEA 1997). As Wilk relates in the preface to a new edition of his book, portions of his earlier research on Q'eqchi' settlement patterns and history were used against the Maya in a statement issued by the Belizean government related to the legal battle that has been ongoing since 1997. They indicated that Maya of Toledo should not have any special land rights because they arrived in Toledo in the 1880s (1997:xi). This was used to bolster an argument that Maya of Toledo were distinct from ancient Maya populations who have been living in what is now Belize for millennia.

Regional archaeological and ethnohistorical data indicates that Maya populations moved back and forth across what is now the border between Guatemala and Belize for many centuries (Graham 1989; Dunham 1996; Lovell and Lutz 1994). Groups who speak a Maya language should, logically, be able to exercise claim to lands in the region, particularly if they established farms in unsettled areas. Furthermore, ethnographic and historical documents indicate that there were Chol and other Maya groups living in southern Belize at the time of conquest (Thompson 1930; Bolland 1987). What transpired in the area in the 1700 and 1800s is generally not known (Wilk 1997). Thompson (1930) and Sapper (1985) both indicate inter-marriage or merging of Q'eqchi' and Chol societies may have occurred prior to that time, when the Chol were supposedly either "eradicated" or moved to Chiapas, Mexico. This would explain the high number of Chol loan words in Q'eqchi'. From an ethnobiological perspective, Sapper notes that Q'eqchi', "use Chol names for many plants and animals of the lowlands that are unknown in the highlands" (1985 [1936]). The **Chol Winq**, "Chol Men", well-known in both Q'eqchi' folklore and traditional dance, are men who live hidden in the forest, can transform themselves into jaguars or other animals, and grow bountiful cacao (Schackt 1981; Howard 1975). They also attended fiestas, disguised as regular men, before priests came to the area. In stories they often are encountered deep in the forest, when a farmer or hunter becomes disoriented. The Chol Winq impart some sort of lesson, and the man is returned to his village, usually with the assistance of a small boy (Schackt 1981). The Chol Winq also perform as part of the **Cortes** Dance, which was presented in Santa Teresa for three days during Easter, 2001. The **Cortes** Dance is a reenactment of the Spanish conquest. The men in black costumes were referred to as **Chol winq** by some villagers. In Figure 3.5, the man in white is one of the two **kareser**, the tricksters, and the red figure in the large curved hat is the **koxol**, or "Maya king", the focal point of the dance who resists conversion by the priest, or **par** but is ultimately converted.

Figure 3.5

In 1924 the government began to establish Indian “reservation” lands in Toledo, in keeping with a version of the Spanish *alcalde* system (Bolland 1987). Under this system farmers had to pay a fee of $5 Bz a year to the alcalde for use of a plot of land, but no titles would ever be granted, either communally or individually, for those lands. One effect of this system is that even today, most of the land on which Maya communities are situated and the majority of their farmlands are government lands, to do with as the G.O.B. chooses at any time (Berkey 1994).

The reservation lands system has been evaluated and re-evaluated over the past twenty years and parties on all sides admit that the current system is not working and does not offer a long-term solution. In 2001, a new push to get Maya to sign up for parcels of leased land (privately owned) parcels was again underway (Osborne 1982). Land management reform has also been called for at the national level, stimulated by

> the absence of any clear or authoritative policy on the use and management of land in Belize, insecure land tenure, excessive political control of the land management process, inequitable allocation of National [Government owned] land and national resources, poor administration, and lack of sufficient information on land issues and the development process (LAND 2000).

The Land Alliance for National Development (LAND) was formed in 1999 by concerned NGOs, including the Society for Promotion of Education and Research (SPEAR), the Belize Audubon Society (BAS), and five NGOs based in Toledo district: Toledo Alcaldes Association (TEA), Toledo Maya Cultural Council (TMCC), Toledo Cacao Grower’s Association (TCGA), the Toledo Ecotourism Association, and Plenty International (Belize). A survey of land-related laws of Belize was prepared for LAND in November

2000 (Gonzalez), ostensibly to fill a gap in available sources in already existing legislation, but this provides an inventory of existing laws, not an overall land policy.

Aside from the history of the past several centuries, it is obvious that the Maya living in Toledo today have been there quite long enough to be able to document "improvements" on the land they settled, a requirement within the Belizean free-hold system of land tenure. One recent contribution to the debate over land tenure is a statement made in the *Regional Development Plan for Southern Belize* that recommends because the Maya reservation systems is "currently becoming debased",

> Agencies involved in the…protection of reservations, as well as communities, should be given an assisted chance to prove that the concept is workable. This should be accompanied by a commitment, on one hand by Government that a workable system will be honored and, on the other hand, by the relevant Maya organisations that any doctrines of exclusivity will be dropped (ESTAP 2000).

The last bit of this statement, regarding "doctrines of exclusivity" relates to tension and resentment on the part of other ethnic groups in Belize that the Maya are requesting special consideration for land rights due to their status as indigenous peoples. The situation is due in part to the fact that "The Maya" (as an overarching term applied to people living in three different countries speaking 30 different languages) have gained such widespread recognition in the international indigenous rights (and tourism) arenas since the 1980s. Such attitudes have also arisen from the perception that by requesting that a "Maya Homeland" be established in southern Belize, Maya leaders are seeking to establish a separate mini-state or seek land privileges that are not granted to other ethnic groups in Belize. Some of the resentment may also arise from the fact that in some respects, Maya have gained more attention from development agencies and conservation organizations over the years compared to the other 5 ethnic groups living in Toledo. Part of this is simply a numbers game, as Mopan and Q'eqchi' make up 65% of the population in the district (Central Statistics Office 2002). This issue is complex, and I have only scratched the surface in this brief treatment. From the Maya point of view, there is not necessarily a desire to achieve separate status, but to achieve equal status, to be treated as any Belizean in matters involving land tenure. 1999, Pio Coc, then programme director of the Toledo Maya Cultural Council (TMCC), wrote a letter to the *Belize Times* stating,

> All we want is to see that all Maya enjoy right to the lands they cultivate, hunt and live on and do not have to live in fear that any day, they might be seized from them by some private company or governmental project. Is that too much to ask? (*Belize Times*, 14 November 1999).

The signing of the Ten Points Agreement between the Maya of Toledo and the Government of Belize in October 2000 engendered some hope among Maya leaders and activists that compromise could begin and steps taken towards secure land tenure (See figure 3.6). One of the "points" of the agreement concedes that, "The Maya People have rights to lands and resources in southern Belize based on their long standing use and occupancy." The agreement was in many ways an unprecedented move toward recognizing land rights for Maya in Toledo. But to date, most aspects of the agreement signed by Prime Minister Musa and representatives from 5 Maya organizations have yet to be enacted. Mopan and Q'eqchi' have demonstrated over the past several decades that the only way to achieve shared goals was to work together, particularly to create a joint Maya identity. This is also illustrated by the formation of the Maya Leaders Alliance subsequent to the signing of the Agreement. Still far from resolved, land tenure and the representation of their views to the Government will continue to be a key issue for all people of Toledo in the future.

Figure 3.6 Said Musa gives a speech during the ceremony to celebrate the signing of the Ten Points Agreement.

Biophysical Environments of Southern Belize

The southern portion of Belize is dominated by the Maya Mountains, which range up to 1000 m in elevation, rising up from the coastal plain that stretches to the Bay of Honduras, now a Marine Reserve. The geology of the Toledo district is characterized by "Toledo Beds" of sandstone, mudstone, and limestone, and the jagged hills that dot the coastal plain were formed in the Cretacious period (King et al. 1986). Vegetation types found in the region are broadleaf forest, transitional broadleaf forest (known locally as 'broken ridge'), pine forest and orchard savanna (known as "pine ridge"), mangroves, and freshwater swamps (ibid). Most of the Mopan population traditionally settled in western "Toledo Upland" areas, which consist of well-drained soils on hills and rolling plains that are ideal for maize agriculture. The majority of Q'eqchi' migrated into lowlands (and now even coastal plain areas), where the soils are not as well drained and contain more clay that becomes waterlogged, and is therefore less suitable for maize agriculture (Osborne 1982). However, some Q'eqchi' who had begun to intermarry with Mopan before migrating into Guatemala also settled in upland areas (Wilk 1997). This pattern has continued today and there are many "mixed" Mopan and Q'eqchi' villages. Throughout the past century, Q'eqchi' families have tended to move frequently, within village sites and between villages, or to establish new villages near newly farmed areas. The pattern was to explore land for new **k'al** for a year or two, to ascertain soil fertility and viability and then move the whole family or patrilineal kin group to the new site–usally four or five houses to start out. These settlements grew into new villages as word spread that soil was good and crops plentiful, or if the land proved unfertile, families returned to their original village. The search for new land was often spurred by poor production in existing sites, inter-familial tensions because of politics, religion, or lack of available land (Osborne 1982).

Rivers loom large in the biophysical landscape of Toledo (just as they play a key role in the sociocultural environments). There are four major rivers that flow down from the Maya Mountains and three major rivers to the south that originate across the border in Guatemala (King et al. 1986). These are: Monkey River, Deep River, Golden Stream, Rio Grande, Moho River, Temash, and Sarstoon. The rivers provide fish and alluvial soils, and are often main arteries of communication to areas where no all weather road exists. Hundreds of caves, waterfalls, and sinkholes dot the landscape. Toledo district receives the most rainfall for the entire country, and the rainy season lasts longer there than anywhere else. The average yearly rainfall in Punta Gorda is 4064 mm, with 166 days of rain per year (Campbell et al. 1997). January and February are typically the driest months, with March through May fairly dry as well, until the rains begin in May or June. August through October are the wettest months in Toledo and are punctuated by the threat of frequent tropical storms, depressions, and hurricanes.

Flooding of major roads such as the Southern Highway occurs frequently during the wet season, as flash floods form quickly in the karst landscape and low wooden bridges are covered with churning water. During the time I was in Belize, these severe floods damaged or destroyed houses close to water courses several times in certain villages, such as Golden Stream. Waters can recede quickly if rain stops falling, in several hours or several days if rains continue. Flooding isolates the main population of the Toledo District from the rest of Belize, causing a hiatus in key services such as gasoline and grocery deliveries for days at a time. People plan ahead during the rainy season, and anticipate flooding as best as they can[4]. Some years are drier than others, as was the dry season of 1999-2000 prior to my arrival. The dry season during the bulk of fieldwork conducted in 2000-2001 began relatively late, with rain continuing through the middle of January, and beginning again in May, marking the year a rather wet one.

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[4] Anticipation of floods is a skill that must be quickly perfected, as I found out the hard way when my field vehicle was caught in floodwaters of Deep River in July 2000. As one woman told me, "Everyone knows you never leave a vehicle between Mango Creek and Deep River."

Sociocultural Environments of Southern Belize

There are 36 Maya villages in Toledo, 24 Q'eqchi', 6 Mopan, and 6 mixed Mopan and Q'eqchi' (TMCC and TEA 1997). Figure 2.2 includes all of the Maya villages, which are primarily located in the western half of the district. Villages today are governed under two systems working in tandem, though not always in concert with one another, the alcalde system and the village council system. Toledo district is the only part of Belize in which the alcalde system still functions. The alcalde is viewed as the traditional system, although it was not established until the 1920s (Bolland 1987). An alcalde, or **alcalt,** is assisted by the second alcalde, secretary, and five to seven village policemen. The **chinam**, who is a respected elder in the church, is responsible for planning religious celebrations and organizing the labor to provide food at certain religious services such as at the Stations of the Cross each Friday during Lent. The **mayordomos**, a set of 6 couples, are also representatives of the church and assist the **chinam** and his wife (Schakt 1986). This system was historically similar to political organization in other Maya areas, with a closely linked sociopolitical and religious hierarchy with a basis in the practice of Q'eqchi' Catholicism (Schackt 1986).

Alcaldes are elected officials who serve largely to keep the peace in the village, administer punishments for infractions of community agreed-upon norms, and enforce fines. The alcalde has authority to place individuals who break the law (either community law or national law) in jail, what used to be called the **cabildo** (Bolland 1987). In one of the communities where I lived, I stayed in a municipial building that was unused most of the time, except for community meetings or alcalde's court cases that were held there. A few times a smaller side room was used as a temporary jail[5]. Alcaldes are typically men above the age of 35 or 40 who have attained a certain status within the community and they are expected to call **fajinas**, or village work days in which all men in the village are required to "clean" the village every two or three months. This mainly involves keeping growth of "bushy" areas to a minimum on roadsides and by the school.

Alcaldes now have considerably less power than they have had in the past, due to the country-wide establishment of the village council system of municipal governance. A village chairman is now elected in each village, and he is assisted by a council including the secretary, treasurer, vice-chairman, and council members who are now responsible for a variety of civic related "portfolios" such as education and sanitation (personal comm., Edwardo Cus, Rural Community Development Officer). The village council system got off to a slow start in the Maya villages, who found difficulty in having two leaders who might or might not be in agreement about key issues. Conflicts often arise in decision making. During 2001, a sustained effort was made to hold elections and training workshops in all of the villages in Toledo, to ensure that the village council system runs more consistently in the future.

The other major social institutions in the lives of Q'eqchi' in Belize are schools and churches. Both of these institutions were discussed in Chapter Two. Many villages historically had only one Roman Catholic Church, and most primary schools in Toledo

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[5] I later moved my things into the smaller room that had served as a jail, to allow permanent space for community meetings which often took place in the evenings after electricity was installed in December 2000. After that, it became a joke with people when I left their homes that "I was headed back to jail" as I walked home. Unfortunately, the museum building where the community graciously allowed me to live during my time in San Miguel was left roofless after Hurricane Iris.

were established by Jesuits in the first half of the twentieth century (Shoman 1994). The majority of schools in the district are administered by the district manager of Roman Catholic Schools in Punta Gorda. The teachers are entirely lay people. Priests are in short supply, and an effort is made to say mass in each community once a month. There are also a handful of government schools and schools run by methodists or evangelical churches in the newer villages (TMCC and TEA 1997). Most Maya parents believe that education is extremely important for young people to improve their lives in the future–although this view was not always so widely held (Osborne 1982). Schooling and the formal education system are discussed in more detail in Chapter Four.

Christian evangelism has had a significant impact on many aspects of social and cultural life in Toledo, as it has throughout Central America. As noted before, there are often several churches in even the smallest villages, and some mobility and transition occurs as preachers and missionaries come and go. The 1980s seem to have been one of the worst times for the "competition for souls" among different Protestant churches, the majority of representatives of these institutions hailing from North America (Palacio 1984; Osborne 1982). This has caused a great deal of factionalism within communities, who, in the past century at least, have engaged in communal labor as a way of life. The divisions heavily affect communities which place a high value on everyone getting their fair, and therefore equal, share of any resources available or work that is to be done (Schakt 1986; Cayetano 1986). The new churches changed all the dynamics of this system, because members were no longer required to follow the leadership of the alcalde who was historically closely linked to the leadership of the Catholic Church. Q'eqchi' continue to adapt to this relatively new situation as they have other divisive experiences over the past 400 years.

Q'eqchi' land use and subsistence practices

The *milpa* system, a subsistence strategy based on the cultivation of maize in swidden plots, enriched by chopping and burning, or mulching and planting nitrogen-fixing legumes, is a way of life for all Maya in southern Belize. Diet and subsistence practices are much more diverse than usually noted, however. The classic characterization of Mopan and Q'eqchi' diets as based on corn, beans, and rice, does not account for many important forest and farm-based resources, such as wild palms and mushrooms, or greens and tubers that families consume regularly. The three main staple crops do provide the foundation for nutrition, and community politics and daily life are focused on the planting, harvesting, and preparation of these cultivars (Johnson 1984). Subsistence is provided from a combination of maize farming, which is either intercropped or consists of monoculture assisted with fertilizers and herbicides, gathering non-cultivated resources, hunting, fishing, and cultivating diverse home gardens that contain an average of 34 different varieties of plants[6].

Within Maya communities, the system of land tenure is considered "communal", but individual leased land parcels are becoming increasingly common in some villages. Wilk suggests that Q'eqchi' communal land ownership may have begun during the 1870s with the domination of the coffee barons in Guatemala as a strategy to keep land from falling into the hands of foreigners (1997:51). Prior to that time, dispersed hamlets were dominated by individual extended families or kingroups who controlled parcels of land.

However, as Osborne (1982) points out, and Wilk also notes, simply calling the land "communal" is somewhat misleading. Access to plots of land for the **k'al**, or milpa plantation, is determined by a combination of usufruct rights by chopping high secondary growth or primary forest, previous cultivation on the same land by patrilineal kin groups, and demarcation as reservation land, leased land, or government land. Communal lands or common property regimes are often perceived to follow the example used in Hardin's "tradgedy of the commons" (1968), in which communal land tenure means unrestricted, overuse of resources, when in reality access rules and mores for communal land use are often quite complex and may reflect an understanding of local ecology as well (Berkes 1999; Ostrom 1990).

Views on how reservation lands and leasehold lands should be managed differ widely. In one of the study communities, a heated debate was started among the village council members when it was rumored that the alcalde was going to seek leasehold title to farm lands falling within the boundaries of the reservation area. This was seen as endangering community property and violating existing mores for land management. Leased land normally borders reservation land. Those farmers who have leasehold parcels tend to utilize the matahambre (mulching) system more widely, as they are faced with using the same piece of land over and over again instead of moving the farm each year to new, more arable lands. The benefit of leased land is that these parcels are usually closer to the village center than those on either reservation land or unoccupied government land.

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[6] The figure of 34 average plants in home gardens is from data collected in San Miguel village.

The Q'eqchi' have been the subject of critiques for their land use and management practices in several articles in recent years on cognitive models of land use and behavior in the Maya lowlands (Nations 2001; Atran et al. 1999; Atran 1999). The perception that Maya in Toledo are "burning down the rain forest" is also widely espoused in Belize, goes back several decades, and often reflects a lack of understanding of the agricultural system and the ways population growth and land tenure are changing these practices (Osborne 1982; Wilk 1997). This is another complex issue, and variations in land practices from one community to the next, or in different regions that are settled by Q'eqchi' are usually not taken into account.

In an essay on indigenous peoples and conservation in the Maya Biosphere Reserve, Nations observes,

> Highland Maya communities are expanding into the lowland forest in Chiapas, the Guatemalan Petén, and southern Belize, carrying the banner of Pan-Mayanism and a questionable historical claim that, because the Classic Maya once occupied all this territory, it should be open to any Maya peoples today (2001:467).

He argues that the only groups who have historical claim to access the Maya lowlands are the Lacandon, Itzaj, and Mopan. Nations does not mention the fact that the migrations were for the most part forced by governments or unbearable living conditions, the result of colonial and nation-state policies (Collier 1994; Sapper 1985; Wilk 1997). By his line of reasoning, Mestizo farmers, as well as Q'eqchi', who have been living in the Petén for centuries and have developed their own complex knowledge of local ecology (Atran et al. 1999) are not worthy of access to land either. Satellite images do illustrate the massive impact that rapidly increasing migration and clearing has caused in the Peten department of Gautemala since 1960. Atran notes, "Remote sensing confirms rapid and extensive deforestation along Q'eqchi' migration routes into Petén whereas Itzaj are regenerating plant and animal stocks depleted by others (1999:7599). The image in Figure 3.3 visually augments the present discussion.

When Nations mentions southern Belize in the preceeding excerpt, it is combined with other areas that experienced the bulk of migration by Highland Maya in the past 30 to 40 years. This ignores the fact that Q'eqchi' and Mopan have been living side by side for nearly the same length of time in southern Belize, over 100 years, and employ similar land use practices. Most of the major migrations to Belize occurred in the 1880s and 1890s. Though economic and social ties extend on either side of the border, to my knowledge the massive influx of highland families each year that is taking place in the Petén is not occurring in Belize. Furthermore, as stated earlier, Q'eqchi' and Mopan began intermarrying in the San Louis Peten area well before migrating into southern Belize, or even northern areas of the Peten (Wilk 1997; Atran et al. 1999).

As the satellite image in Figure 3.3 illustrates, there are obvious differences in forest cover and land use practices on either side of the Belize/Guatemala border. The demarcation line (itself still under dispute) is almost visible on the western border of Belize. On my first trip to Jalacte in 1998, one of the large communities near border, the obvious differences in land use on the Belizean and Gautemalan sides is one of my most salient memories. Many interviews during that field season focused on why these differences exist. Furthermore, within southern Belize a marked difference exists between the areas directly adjacent to the border and villages further to the east. When travelling over the gravel roads which lead to these villages "to the back" as they are called in Creole, I observed a different system at work. This contrasts with villages closer to the district center of Punta Gorda that are more socioeconomically integrated with Belize, because of much easier access to the southern highway. Along the border, there are few patches of secondary forest left, and large tracts of land have been abandoned for use as pasture for cattle because they cannot be used for anything else. One of the driving factors of this damage is the intensive cropping of corn for cash sale across the border in Guatemala. One time when I was there, several men had three or four mules heavily loaded with 75 lb sacks of corn to take across the border for sale. Goods and services are also much more affordable on the Gautemalan side.

There are several key differences between the sociopolitical and ecological situation in Petén and that of southern Belize. For one thing, most households in Belize do not produce corn for sale as a cash crop. Some do so but they are in the minority. The villages where this is an exception are closest to the border with Guatemala. Another explanation for the differences are the protected areas found in Belize, as well as lower overall population density. The average family size is smaller in Belize (5.5) than in Guatemala (7.1) (Forth and Grandia 1999:89 in Nations). Perhaps the most striking difference between Q'eqchi' in lowland Belize and Q'eqchi' in lowland Gautemala is the greater personal, religious, and economic autonomy that Belizean Maya enjoy compared to Maya in Guatemala. Length of time residing in southern Belize may be a key factor in different emphases in land use strategies. That Q'eqchi' in communities in the Peten are essentially closed off from the other local ethnic groups, while Maya in Belize often live in the same community or have close kin in other ethnic groups may also explain the differences in Q'eqchi' agroforestry practices described in Atran et al. (1999) and those I documented during my research in Belize.

> For Q'eqchi', a densely connected social structure favors communal and ceremonial institutions that organize accountability…But…In the absence of socially assimilable and ecologically relevant information **[because they are essentially newcomers]**, this implies that institutional monitoring of access to resources, cooperating kin, commensal obligations, a vibrant indigenous language, and familiarity with the land and its species do not suffice to maintain the community's common-pool resources (Atran et al.1999:7603, insertion in bold mine).

Many Maya farmers in Belize have a few opportunities to secure wage labor of some kind at different points during the year and ethnohistorical research has established that this trend goes back to the 16th century (Wilk 1997). Some families earn enough cash to employ Guatemalan short-term laborers who come across the border to take advantage of the high rates of pay on the Belizean side, "chopping bush" and other agricultural work[7]. The average days' wage in 2000 was between $15 and $20 Belize. Cost of living in Belize is high considering the economic opportunities available, especially when compared to Guatemala where a wider variety of manufactured goods and service are available than are found in Punta Gorda Town.

Presently, cash cropping is limited to district markets for most products other than rice and red kidney beans, which are shipped to the rest of the country, supplying much of the country's needs for those two staple food items. The sale of pigs was a large source of cash income in the 1950s to 1980s, but this is no longer the case, as were bananas prior to that time (Wilk 1997). Rice cultivation and cacao are the only major crops that Maya farmers in Toledo are currently engaged in, and rice is usually of the unmechanized

[7] Coincidentally, when these workers cross the border they are often greeted with some interest by family members with whom they are working, and are often asked many questions about the Q'eqchi' who live "across", such as differences in the language, dress, and goods and services available there.

variety[8]. Large-scale mechanized rice operations were attempted in the low-lying areas of western Toledo beginning in the late 1970s and early 1980s with the TRDP project with a rather extensive base of operations in Blue Creek village (TRDP Final Report 1986). This project was abandoned by the mid 1980s and, if judged by the lack of widespread use of mechanized rice at the present time, largely unsuccessful, aside from the high wages paid to local workers during the duration of the project and the promotion of the use of macuna or kudzu as nitrogen-fixing agents (Osborne 1982; informal interviews with former laborers in San Miguel). The main cash crop is cultivated in on a relatively small scale; usually each farmer might plant a few acres of rice a year.

Figure 3.7 These men are planting sakiwa or matahambre corn in the month of October.

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[8] Cacao is an exception here. The Toledo Cacao Grower's Association is under contact with Green and Blacks's of the UK to produce and export organic cacao seeds for their "Maya Gold" chocolate bars (Ellicott 2000).

Primary Research Site: Sociocultural and Biophysical Environments of San Miguel

Briefly described in Chapter Two, San Miguel village was the primary research site for the dissertation. Approximately 85 households are in the community. A vista of rolling limestone hills, dominated by cohune palm (*Attalea cohune*) greets the eye as one arrives in the village on the gravel road. Four hundred and thirty-nine people call the village home, living in a combination of thatch, wood and concrete buildings on the hillsides. A primary school, San Miguel Roman Catholic School, and San Miguel Catholic church, sit atop one of the tallest hills in the village next to the school. Figure 3.8 is a photo of the village taken from that hilltop, while Figure 3.11 is an excerpt from a government topographic map with land uses indicated.

Village infrastructure includes a community center of cement block, a women's cooperative corn mill with a gasoline powered mill, and a small, seldom-used health clinic. There are six or seven family-operated shops which provide staples such as wheat flour for baking flour tortillas, "tinned meat," frozen poultry and pork, sardines, and packets of chicken bouillon. Other household items are usually stocked as well, depending on the size of the store, including cookware, pens and paper, and "ideals", which are frozen treats that children consider the ultimate treat. There is a football field, and a large cement area known as a 'drying floor' for drying rice or coffee in the hot sun. Everyone in the village speaks Q'eqchi', but English or Creole is used outside the home, at school, and in business with non Q'eqchi' speaking people.

As described in Chapter Two, the Rio Grande River runs through the center of the village and forms the focal point of daily life. Throughout the day, women, men, and children are at the riverside bathing, washing dishes or clothes, or fishing. Different groups of families, normally based on patrilineal kin groups who live near one another, are found in the same location of the river everyday. Because everyone has their "spot" on the riverbank, this is also one of the places where talk flows quite freely, about what others might be doing down the river bank, or about a good story someone heard. It took a while for villagers to become used to my being there at the riverside, too, bathing or washing, but once we all adjusted, it became one of the best areas for observing children's play and work activities, spending time with different families, and hearing what was a topic of discussion on a particular day.

Figure 3.8 A view of San Miguel village from the schoolyard, July 2000.

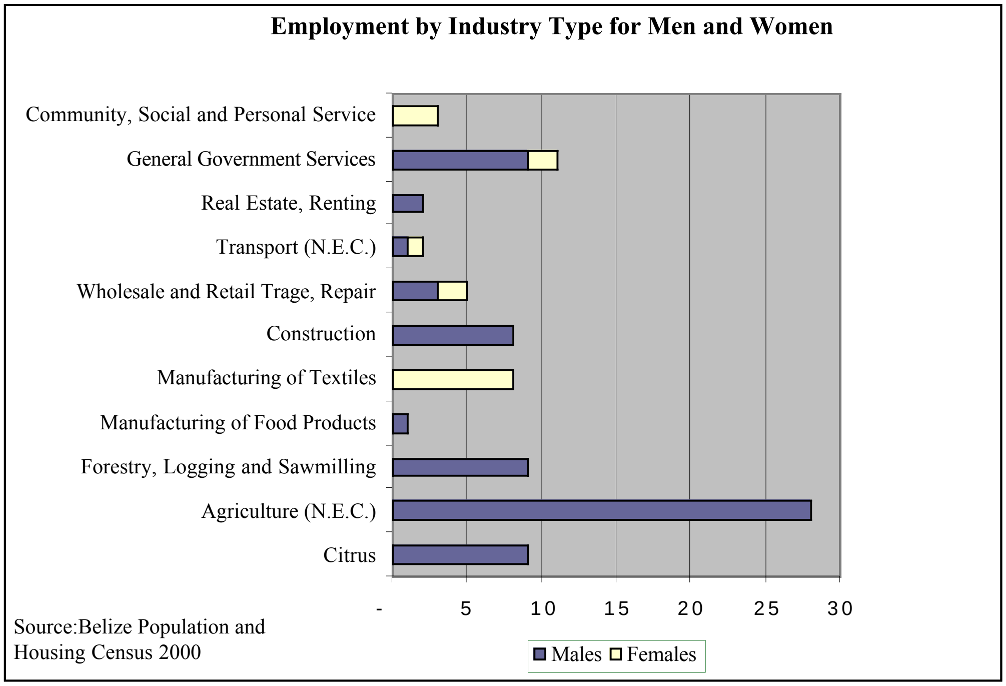

Figure 3.9 Types of employment by industry for men and women in San Miguel. NOTE: This represents 42% of the total population over the age of 14 in the village.

Drinking and cooking water was drawn from the river or smaller creeks in the past, but now most families use water from hand pumps. Electricity is now available for those who can afford it, and a municipal water system was recently inaugurated, although I have been told the well went dry during the dry season this year. Most families depend on a combination of subsistence farming (corn and dozens of other cultivated, semi-cultivated, and wild resources); cash cropping (rice and beans); and wage labor (such as the citrus industry, sawmills, and shrimp farming) for their livelihoods (See Figure 3.9). District wide, most Maya families survive on about $600 US per year (TMCC and TEA 1997).

Almost without exception, everyone in San Miguel speaks Q'eqchi', 98% as a first language (TMCC and TEA 1997). The other languages spoken are Mopan Maya (2%), English (between 60% and 83%, depending on criteria used [TMCC and TEA 1997; Belize Population and Housing Census 2000]), and Spanish is spoken by a few people, primarily older men who spent time in Guatemala. There are two churches located in the village, one Catholic and one Church of Christ (Belize Population and Housing Census 2000). As Figure 3.10 illustrates, the majority of people in San Miguel are Catholic.

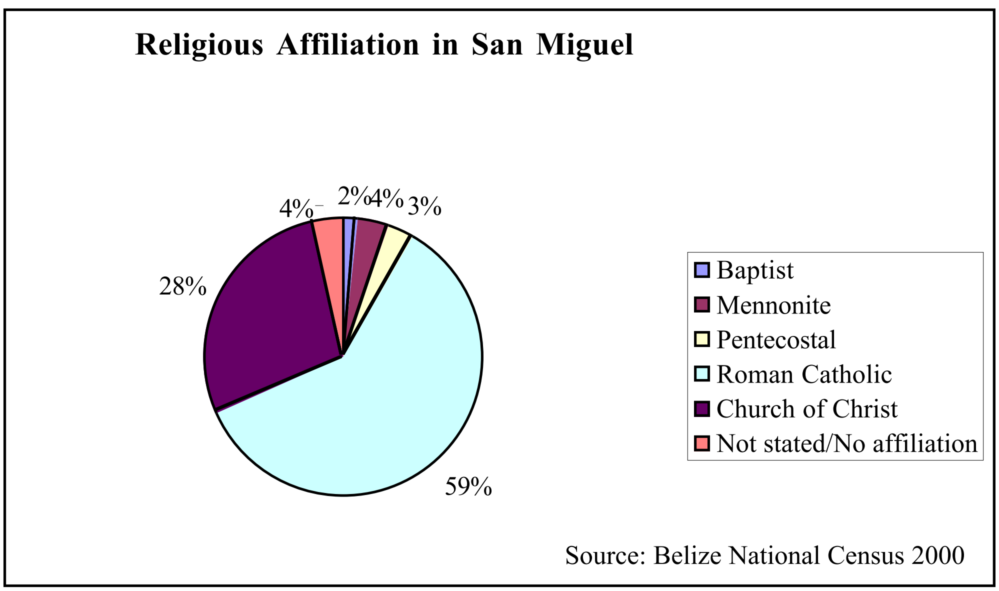

Figure 3.10 Religious Affiliations.

As was true in Guatemala, the political and church leadership of the village were closely linked in new Q'eqchi' settlements in Belize. When Protestant missionaries became commonplace in Toledo in the 1970s, this structure began to change. Presently, village politics are closely linked to several overlapping sociopolitical spheres, some of which operate solely at the community level, but others extend to national and even transnational relationships. Religious affiliation plays a role in structuring social relations and networks. However, district and national politics now shape the way different families within Maya communities relate to one another, at times overlapping with social networks based on religious affiliations[9]. Wage labor, ecotourism, logging, construction, citrus, cacao, and **xiyow** (annatto, *Bixa orellana*) farming have all meant an increase in the cash economy in most recent decades.

Communal labor groups are still central to life in all Maya villages. However they function a bit differently than they may have in the past, structured in part by religious and political affiliations, as well as kinship. Ethnographic accounts attest to the fact that at one time, shared labor workgroups included the entire community (Thompson 1930; Schakt 1986, Osborne 1982; Wilk 1997). During corn planting season, the village would work together, participating in a rotating schedule, sowing one man's field every few days over a period of weeks. This required planning, organization, and a communal belief–often linked with spiritual beliefs– in the system itself. Groups of men were responsible for planting, chopping, or thatching roofs, while their wives, daughters, and mothers were responsible for preparing a ritual meal for the male workers, eaten at noon. Berte (1983) focused her dissertation in San Miguel on the structuring of labor groups from a sociobiological perspective, as she was interested in the composition of labor groups based on kinship or other relationships. She observed,

[9] In San Miguel, the two-party political system of Belize is a powerful force in the governance (and also infrastructural development) of the community. The PUP, People's United Party, is currently in power in Belize under the leadership of P.M. Said Musa. A UDP, United Democratic Party, Prime Minister served for just 5 years in the term prior to Musa's election in 1998. Prior to that were decades of PUP leadership, even before independence in 1981. It is commonly believed that political ties may have an affect on the

> Food and labor in-kind is reciprocated or altruistically dontated….Milpa cultivation involves more traditional transactions, while rice cultivation includes exchanges that are more exacting, equivalent and sometimes cash oriented, more akin to transactions in western market systems (1982:9).

Now labor groups are not composed of the entire community. This is as much a function of the larger size of communities as it is determined by social networks. Labor groups are still comprised of groups of 10 to 25 men, based primarily on kinship, compadre relationships, and whoever the individual assisted with group labor in recent months or years (Schackt 1986; Wilk 1997). J.E.S.Thompson describes a similar system in his ethnography from the late 1920s (1930), as does Sapper in turn of the century Guatemala (1985). Work took place throughout the week at times when serious inputs of labor were involved such as planting or harvesting. However, because many men are not in the village during weekdays because they are "working out", almost all group labor is scheduled to take place on either Saturday or Sunday. This puts real time constraints on the communal labor system. Some aspects of clearing land, sowing rice, or weeding crops may now be relegated to hired laborers, either from the village, surrounding communities, or from Gautemala. To my knowledge, people still plant their own corn even if they work outside the village for weeks at a time. This remains a foundational aspect of community and family life, and decisions about agriculture are viewed with seriousness, because the difference between a good and bad crop of corn still means the difference between having enough to eat and not being able to feed your family acceptably.

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services that reach particular villages, such as electricity, all-weather roads, and the construction of community centers or health clinics.

When a labor group is required, work begins at dawn, and both men and women place a premium on working quickly and efficiently, maximizing the group effort during the task at hand. Watching this take place, from my own point of view, is like watching a complex choreography of varying roles and contributions based on age and ability. Whether it is baking tortillas or planting corn, the participants work together, taking advantage of socially distributed knowledge and understanding of the task at hand. This happens without having to give directions or comment on the activity itself[10].

At the meal, which is held inside the man's home who's fields were planted, certain foods are served, and each person who provided labor is provided with a meal. In times past, the hosts would say prayers to God and/or the **Tzultaq'a** (Schackt 1986; 1984; Thompson 1930; Carter 1969; Siebers 1999). An offering of a bowl of **caldo** (turkey or chicken brothy stew) and **poch** (corn dumplings similar to tamales without the meat) was made at the family altar inside the home. In San Miguel, at least, most families do not have altars inside the home, but a few families continue the traditional prayers, fasting, and sexual abstinence that accompany the planting. Most said they did not, although it's impossible to evaluate whether this was entirely true, or was due to the fact that they did not choose to reveal it to me, for various reasons. It is considered "old fashioned" for Catholics, and forbidden for Protestants.

After this ritual, the workers are served in order of their respect or esteem in the community, normally based on age or office held. Women and children are served last, often eating in the family's kitchen area, while the men lunch inside the house. **Cacao uuq** "drink" is served in shallow bowls made from **jom** "calabash", (*Cresentia cujete*), passed around to all present. The drink is made for special occasions by mixing a paste made from ground cacao seeds which have been dried and roasted, a pinch of **ik** "chile", **q'em** "ground corn" or *masa*, and sometimes **che' tzi' b'ik** "vanilla" (*Vanilla pfaviana*). The paste is mixed with water by stirring with the hand, a special skill that girls learn when they are 10 to 12 years old.

For this system to work, community cohesion must be fairly high, whether it is based on religious or political leadership. Osborne observed that the number of houses in a community did not often exceed 30 (1982). Beyond that number, villages usually began to splinter off, moving in the direction of uncultivated lands (Wilk 1997). Furthermore, distance to farmlands also constrained the sizes of communities. Farmers find it unreasonable to walk more than 3 to 5 miles to their farms each day[11]. I found this distance to be still approximately the same, if not slightly lower. In southern Belize the overall migration pattern was to move toward the north and closer to the Southern Highway and Punta Gorda. The older the village the more stable the population, because land and food security become greater the longer an area is established, up to the point that overproduction of the land occurs (Osborne 1982; Schackt 1984). Some of the more newly established villages on the Southern Highway experience a great deal of migration in and out of the community, which has an obvious effect on village unity.

The founding of San Miguel illustrates the trend of migration and establishment of villages throughout Toledo. Villages can often be traced backward in time, along a

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[10] That is, unless there is an anthropologist around, putting a wrench in the system trying to learn to participate in the task herself.

[11] Experience with muddy trails during the rainy season Toledo makes it painfully obvious why this might be case, since the mud can be several feet deep in some places, or flash floods can occur leaving farmers stranded overnight.

chain of migrations to new lands. San Miguel was founded by families from Santa Teresa, who discovered good soil in the area and access to the Rio Grande River and began to grow corn there. Eventually they moved their families and started a new village between 1951-1953 (McCaffrey 1966; Berté 1983). Some indication exists that the priest resident in Toledo at that time also supported the move north to more settled villages (McCaffrey 1966; Howard 1977). Santa Teresa village itself was founded when families split off from Auguacate and Dolores in 1933 (TMCC and TEA 1997). Dolores is the one of the first villages to which Q'eqchi' migrated in the 1880s. In 1970, a split occurred in San Miguel, as a large number of families moved east, closer to the main highway and established Silver Creek village (Berté 1983; Osborne 1982).

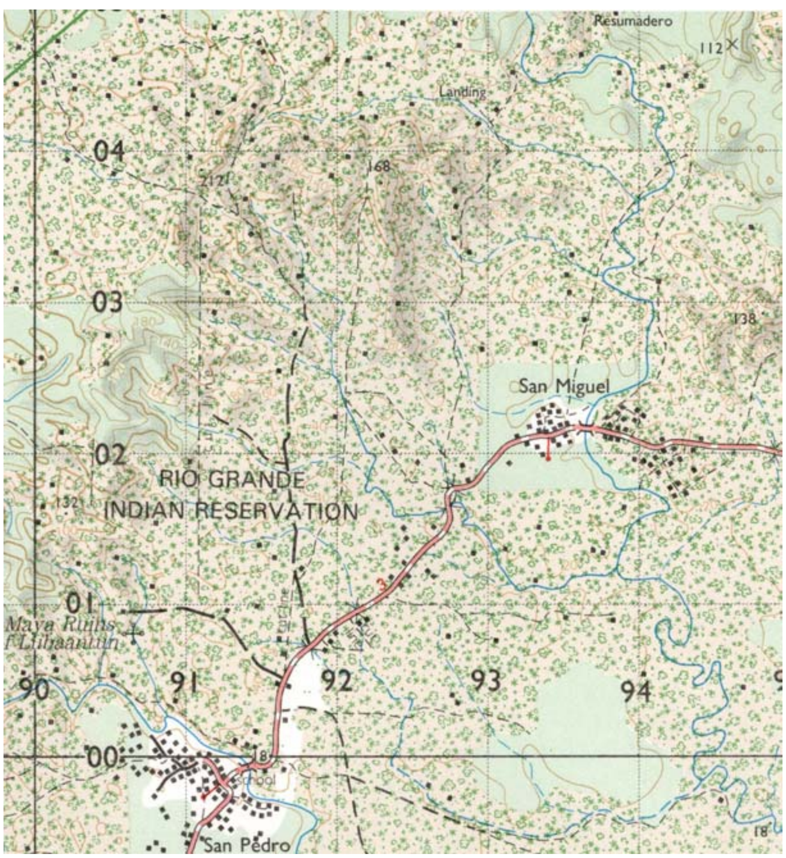

Figure 3.11 A topographic map of San Miguel, illustrating the settlement pattern of the village, with buildings represented by small black squares.

Figure 3.11 includes the “Rio Grande Indian Reservation”, which is the primary land used for farming by San Miguel families. (This area is more clearly shown in Figure 2.3, but that map does not include elevation). Farming lands were obtained from San Pedro Columbia, a village shown as “San Pedro” in the left corner of this map, when San Miguel was originally founded. The all-weather concrete bridge that joins the two halves of San Miguel is visible on this map. The bridge was constructed in the 1980s, extending the road that was pushed through to San Miguel from San Pedro Columbia in the late 1960s (McCaffrey 1966; Owen-Lewis, pers. comm.). Figure 3.11 provides some indication of the layout of the community as far as density of settlement patterns and proximity to farm and forest lands.

San Miguel was originally located only on the left side of the river, and farms were on the other aside, across a wooden bridge for foot and mule traffic only (McCaffrey 1966; Berté 1983). Previous ethnographies indicate that many villages had a similar geography, with houses on one side of the river and crops on the other, to protect farms from roaming pigs (Osborne 1982). I found during informal interviews on the history of ecological changes in the area that even within the village itself, families changed locations quite a bit. Most people remember where different family’s households were located at different times in the past. There are still many groves of cacao, annatto, or **pens** (allspice or *Pimenta dioica*) trees located near old house sites, which have now returned to tall secondary growth (**wamil** or **pim**) over the past three decades. Children know the history of these previously settled areas of the village as well as who “owns” certain fruit trees in question. Schackt observed the same thing in Crique Sarco (1986).

The community was always surrounded by secondary growth forest, so that families would pass through the forest on their way to their fields.

Although wage labor has been a common fixture in Q'eqchi' lifeways for centuries, as noted previously, Gregory (1980) states that the construction of the Punta Gorda-San Antonio road in the 1930s greatly increased opportunities. Gregory conducted ethnographic research in San Antonio in 1969-1970, and describes the process of "modernization" in that Mopan village. He describes a pattern that fits squarely into research conducted on modernization during the 1960s and 1970s in anthropology[12].

> As the road system is extended…people step up their rice and bean production for cash sale, people travel to Punta Gorda more frequently, more hogs are sold to outside markets,…shops appear, here and there a family builds a western style house, …shopkeepers begin plans to acquire a truck (1980:7).

This process is still happening in many ways, as families continue to move north to the Southern Highway, or establish new villages. But, pigs are no longer a big cash supply for most communities. Rice production is no longer increasing exponentially as it once was. The contexts for participation in the cash economy are also significantly broader and more varied than the ones described above.

Families have moved elsewhere in Belize, to communities where various business opportunities are more readily available than in Toledo, such as the predominantly Maya communities sprouting up around Belmopan. Many young people between the ages of 14 and 22 do not live in the village of San Miguel on a daily basis. Young men and women attend high school or University College Belize, Toledo Branch (a post-secondary school institution), which may mean a commute each day to Punta Gorda by bus, or returning

[12] This process is now viewed to be multi-directional (as opposed to a unidirectional, processual view of acculturation and incorporation into a nation-state economy) and much more complex (Wilk 1997).

the village only on weekends. During the time I spent in San Miguel, several young people who graduated from high school left the village semi-permanently, and sought employment in Belmopan, Placencia, or Belize City, in construction, tourism, shrimp farming, or business offices. They might visit their families once every few months. A similar pattern holds true for many men between the ages of 20 and 30 who now have families of their own[13]. They work outside the village during the week, or for several weeks at a time, returning home on the weekends. Some men travel extremely long hours on these weekly commutes, walking or riding on buses for eight or nine hours on Friday afternoon, and then returning to work on Sunday afternoon.

Non-government organizations, missionaries, and international development organizations have also had (and continue to have) a significant impact on Maya villages. "Co-management" plans are the most recent strategy for socioeconomic development that also seeks to promote conservation of natural resources. The establishment of the 41,898 acre Sarstoon Temash National Park in 1994 and the subsequent formation of the Sarstoon-Temash Institute of Indigenous Management is one well-developed example of these recent efforts. In a report on the co-management project, Caddy et al. relate the economic and ecological challenges that Maya in Toledo now face:

> The Maya, like all small farmers in Toledo's depressed economy, are facing a severe livelihood crisis that their traditional slash-and-burn agricultural system, known as *milpa*, is not seemingly equipped to resolve. The Maya have grown increasingly dependent on the cash economy, but their income sources, which are limited to the sale of subsistence crops such as corn, beans, and rice, can no longer cover their basic needs. Nevertheless, population increases, economic depression, land invasions and a lack of marketing support are all placing great strains on their traditional land tenure and subsistence systems (Caddy et al. 2000).

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[13] Men tend to marry around the age of 18-22, while women tend to marry between the ages of 15 and 20. This has changed slightly in the past decade, perhaps suggesting a trend to marry later in life.

These are all challenges that the residents of San Miguel village share. Now the recent hurricane has made an already difficult situation much worse. But judging by their history, they will be able to face this challenge as they have the many that have come before, adapting to new environments from one generation to another.

CHAPTER 4

SITUATED LEARNING IN THE LANDSCAPES OF CHILDHOOD: ACQUISITION OF SUBSISTENCE KNOWLEDGE AND SKILLS

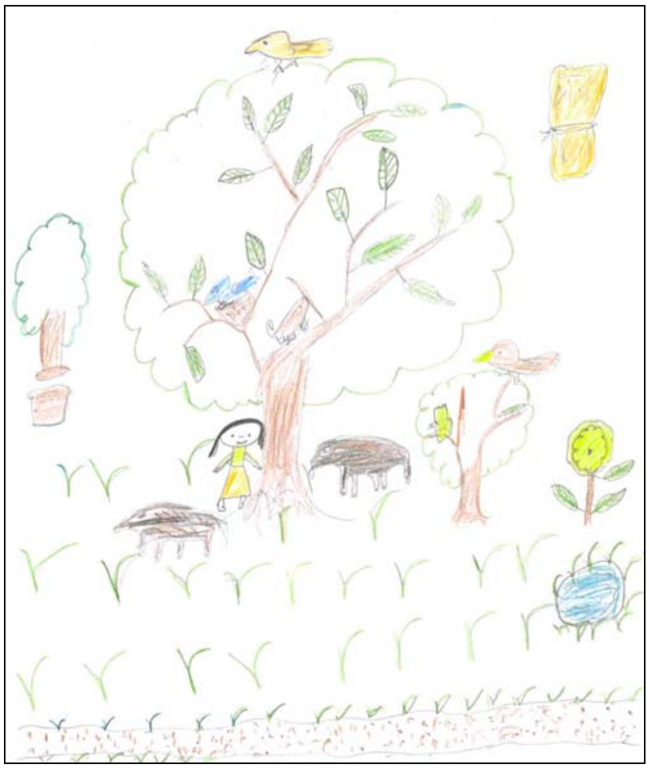

Figure 4.1 A drawing by Christine Acal, depicting her family's plantation (or farm), her favorite place in the community of San Miguel.

The interactive *process* of learning subsistence knowledge and skills during childhood is the focus of this chapter. Learning ethnoecological knowledge can be conceptualized as several overlapping spheres of interaction which move through a number of transitions during development: the individual child, cultural routines of daily life, parental and cultural beliefs and expectations, socioeconomic and subsistence strategies, and the local biophysical environment itself.

The underlying foundation for this conceptualization is a view of human cognition as the interplay between internal and external phenomena. Our minds are not merely composed of internal representations of the "outside" world as mainstream psychology has espoused for decades. Researchers have begun to view the human mind as distributed between internal (universal) cognitive processes and external, social interactions (Zhang and Norman 1994; Hutchins 1995). Therefore, cognition and learning are intimately linked to the mental and physical landscapes we inhabit: in tools and architecture, social institutions, and even in the words we use to describe these things--such as the kinds of metaphors we use (Johnson 1987; Gumperz and Levinson 1991; Hutchins 1995).

Several researchers in cross-cultural child development and developmental psychology have developed a view of cognition that is complementary to this framework of "externalized" or "distributed cognition", based on such theorists as Vygotsky and Bronfenbruner (Valsiner 1987; Göncü 1999). They argue that information is transmitted in the practice of tasks and skills and engagement in daily activities. "Situated learning", proposed by Lave and Wenger (1992) also emphasizes the contextual and social aspects of learning specific tasks or skills, in apprenticeship modes. Bronfenbruner (1977) in particular emphasized that learning takes place in different spheres or layers of interaction, borrowing from ecosystems theory. "Ecological" models for human development build on Bronfenbruner's work, exemplified by Super and Harkness (1992) "developmental niche". Previous research on the importance of children's play and work activities in traditional societies (cf. Lancy 1996; 1999; Maynard 1999) has particular relevance to the acquisition of subsistence knowledge. All of these studies inform the present research, and contribute to the development of a model of human development specific to environmental knowledge.

The chapter is divided into three sections. Section I is an introduction to studies of socialization, child rearing practices, and cultural transmission in several disciplines and research traditions. Special attention is given to studies carried out in contexts similar to that of the study communities, such as other Maya groups or horticultural societies. Those studies that treat subsistence or environmental knowledge acquisition are also highlighted.

Section II provides insight into children's daily subsistence activities in San Miguel. Ethnographic details of specific learning situations are described, based on my observations of children's play and work activities. This approach to describing learning episodes is grounded in an activity-based or co-constructionist theory of learning. Learning contexts for children are linked to the biophysical environment and cultural routines and expectations for children's behavior. Acquisition of subsistence skills is "situated" in the landscapes in which these skills are carried out daily, and the ethnographic description builds on previous research on socialization and child development by Rogoff (1990; 1981), Gaskins (1999; 2000), and Maynard (1999).

Finally, Section III contrasts the informal (or indigenous) education system and the formal education system in Belize. Discussion of the informal system focuses on parental expectations for learning and development, and an overview of schooling, past and present, in southern Belize provides an introduction to the formal education system.

Section I: Socialization, Child Development, and Cultural Transmission

Contributions from anthropology: socialization in comparative perspective

In anthropology, interest in enculturation–how children become adult members of their societies–goes back to Boas, who in turn greatly influenced Margaret Mead's interest in what childhood was like in places other than North America. Before that time, research on socialization was usually relegated to one chapter in a traditional ethnographic monograph. Seminal early works on socialization in traditional societies were Mead's *Growing Up in New Guinea* (1930), and John Whitings's *Becoming a Kwoma* (1941). Interest in socialization shaped decades of research in the "culture and personality" tradition. This approach was grounded in psychoanalytic theory and focused on broad cultural patterns of socialization, development of affect, and acquisition of cultural beliefs and values by individuals. Child rearing practices and early childhood experiences were seen as critical to uncovering the significance of adult life and characteristic personality traits for a given culture (Harkness 1992).

The 1950s marks a transition towards systematic and comparative research in the field. The "Six Cultures Study" a massive undertaking in ethnographic data collection carried out by John and Beatrice Whiting and their students, focused on documenting parental expectations for child development, and observing children in their daily activities (Whiting 1975; Whiting 1988; Whiting 1963). The studies also documented cross-cultural patterns for the acquisition of a wide range of particular skills or techniques such as cultivation, hunting practices, child care, fishing skills, dancing, and cooking (Jahoda and Lewis 1988; Hewlett and Cavalli-Sforza 1988; Lancy 1996; Harkness 1992).

However, the ultimate goal was to determine how social structure and adult beliefs and values shaped child development.

The most significant contribution of the Whitings' legacy is a systematic demonstration of the way sociocultural environments influence children's social behavior (Harkness 1992). This led to several comparative studies based on the Human Relations Area Files such as Barry, Child, and Bacon's "Relation of Child Training to Subsistence Economy" (1959). Here authors argued that patterns of socialization and personality are determined by the type of subsistence strategy that a group of people are engaged in and compared pastoralists and hunter-gatherer child rearing strategies. Much later, Rogoff et al. (1975) investigated the ages at which children take on work responsibilities cross-culturally. One of the criticisms of this approach is that it does not prove causal pathways between child behavior, social environment, and human universals (Jahoda and Lewis 1988). There was also a tendency to focus on the teacher and not on the learner, captured in the widely used terminology "child rearing", and to represent culture as a monolithic whole, to be absorbed by children in a given cultural context (paying little attention to individual variation) (Wolcott 1997; Spindler 1997; Valsiner 1995; Pelisser 1991).

The legacy of the Whitings' studies continues to be played out in current research (LeVine 1999). In recent years awareness has grown of the lack of anthropological studies that include children's perspectives. This realization is perhaps akin to a shift in the 1980s to begin to include "the other half" of the human population in ethnographic studies: women (Bluebond-Langner 2002). A recognition of the need to conduct more research with children is illustrated by the demarkation of new subfields such as "ethnography of childhood" and "childhood studies" and in the establishment of centers for childhood studies at several universities.

Cultural transmission

The 1970s witnessed a diversification in theoretical approaches to socialization and learning, and the term "cultural transmission" came into use (Tindall 1976; Hansen 1979). Researchers began to view knowledge as distributed among individuals in a society, subject to both conservative forces that ensure continuity and innovation that brings change (both adaptive and non-adaptive) (Hansen 1979). Cultural transmission as a concept has been widely applied in ethnographies of education and schooling and socialization in non-western contexts. Transmission of cultural information is also featured in theories in evolutionary biology, rooted in analogies to transmission of genetic information from one generation to the next (Hansen 1979; Cavalli-Sforza 1988; Boyd and Richerson 1989; Tindall 1976; Hewlett and Cavalli-Sforza 1986). Exactly *how* this occurs is often not a part of bioevolutionary models. Analogies of knowledge transmission employed range from "osmosis"(Erchak 1992) to "spread like an infectious disease" (Cavalli-Sforza 1988), to the individual choosing different "linkages" or pathways in the social system (Tindall 1976; Super and Harkness 1997). These approaches place greater emphasis on the interaction between individual cognition and the values and beliefs of the larger society, but the conflict was hardly resolved. In an Annual Review article Tindall (1976) argued that no theory of cultural transmission existed up to that point, that the frameworks had not been developed enough to warrant the term "theory."

Contributions from cross-cultural child development: situated learning

Recent studies in situated and social cognition, learning through apprenticeship, and guided participation illustrate how the learning process is shaped by sociocultural and ecological contexts (Lave 1990; Rogoff 1990; Graf et al. 1996): learning *in* activities and situations. Proponents of this approach are influenced by Vygotsky, Marx, and Bourdieu, and focus on how knowledge and skills are developed through participating in series of events that are characterized by interactive relationships between "teachers" and "learners". Lave documented apprenticeships among tailors in Liberia, which later led to the development of her theory of situated learning, based on Vygotsky's "zone of proximal development" (Greenfield and Lave 1982; Lave 1997). Fortunately for the present study, much of this research has been done among Maya populations. Rogoff and Greenfield studied (Greenfield et al. 2000; Rogoff 1990) the acquisition of traditional weaving skills among Maya women and girls in Guatemala and in Chiapas, Mexico. More recently, Maynard (1999) conducted dissertation research on sibling teaching in Zinacantan, Chiapas. She found that older siblings guide children's play toward the work roles they will be performing as adults, such as washing and caring for babies (ibid). Finally, Gaskins has conducted research on socialization in one Yucatec Maya village for the past 30 years and has described principals of engagement for children. These include "the primacy of adult work activities; the importance of parental cultural beliefs in structuring the children's activities; and independence of Mayan children's motivation" (Gaskins 1999:56). These studies conducted in Maya communities are discussed further in subsequent sections.

A focus on learning in non-school settings has broadened the field of child development, to include informal learning. A strict dichotomy between informal and formal learning is debated (Henze 1992; Greenfield and Lave 1982; Hansen 1979). For lack of better terminology, informal is used in this study to refer to learning that is involves observational learning, verbal and bodily instruction, imitation, and guided participation. More research is needed to better understand the formal structure involved in informal cultural transmission, and the informal aspects of formal schooling (Greenfield and Lave 1982; Ruddle and Chesterfield 1977).

Studies of child language acquisition have significantly contributed to a better understanding of individualized learning processes (Harkness 1992; Tindall 1976; Ochs and Schiefflin 1984). Insights from language acquisition research have been applied in studies of child development that emphasize social context.

Social reproduction

A growing awareness of the influences of political, ideological, and economic forces on learning and education systems has led scholars to incorporate these factors into their research (Weiler 1988). Work on topics such as identity formation (Stephens 1995) and cultural constructions of gender (Morton 1996) reframes knowledge transmission as social or cultural reproduction. Influenced by the theories of Bourdieu, scholars began unravel how schooling is structured by society through class, gender, cultural knowledge, and power relationships. Recent approaches to social reproduction include an emphasis on “production”, which gives learners more autonomy and ability to resist cultural information and structure (Levinson and Holland 1996). These perspectives informed the current research by emphasizing the importance of socioeconomic and political factors in subsistence knowledge acquisition and transmission.

Holistic "ecological" approaches

"Ecological" approaches to child development build on theories of child development pioneered by Bronfenbrenner (1979). Among these are the "developmental niche" of Super and Harkness (1986) and the "developmental contextual view of human development" proposed by Lerner and his colleagues (1995). The developmental niche takes into account the physical and social settings of everyday life, culturally-preferred customs of child-care, and the psychology of the child's caretakers; Lerner's model incorporates the community, social networks, children, parents, and designed and natural environments into a theory of cultural learning (Gardiner et al. 1998; Super and Harkness 1986; Lerner et al. 1995). More data are needed to allow researchers to evaluate the strengths and weaknesses of these models. Causal pathways are rarely identified, and ethnographic techniques, particularly in the developmental niche model, focus primarily on the caretaker and parental theories of proper development, to the exclusion of the role of children in shaping their own development (Valsiner 1995).

Play, work, and sibling teaching in traditional societies

Play is another topic that has not received much attention from anthropologists (Schwartzman 1978). Children's play is, however, an important aspect of socialization, and varies cross-culturally (Rogoff 1990; Sutton-Smith 1971). Schwartzman develops a framework for research on play that builds on Bateson's (1936; 1972) notions of play, as communication involving transformations of objects, roles and actions (1978:328). The evolutionary importance of play to the human species has been well-documented (Bruner 1974).

The role that siblings play in the transmission of cultural knowledge has recently gained some scholarly attention (Lancy 1999; Maynard 1999), but is a relatively neglected aspect of the process of socialization, since most research has focused primarily on the relationship between parents and children (Harkness 1992). Maynard's research in Zincantan in Chiapas, Mexico indicates that children regularly teach each other daily tasks, skills, games, and songs during the course of their play (1999). Lancy (1999) has also argued that children's play forms the foundation of much of their socialization, particularly from peers. Lancy (1999) argues that in most subsistence-based societies, play and work activities are frequently intertwined. Play often imitates adult roles, and children volunteer for work quite often, even well before they are capable of substantial contributions (Lancy 1996, 1999). Rogoff and colleagues conducted a survey of 50 societies documented in the Human Relations Area Files to look for patterns in the ages at which children are assigned various roles, most of them related to subsistence. Cross-culturally, there is a transition that occurs between the ages of 5 and 7 as children make a shift to working more than they play (Rogoff et al. 1975).

Research in the ethnoscience tradition influenced studies of play by suggesting that play could be "expressive or generative" of cognitive skills, not just an indicator of cognitive abilities (Schwartzman 1978:301). During the early part of their lives, children are engaged in play in an environment filled with plants and animals with a myriad of different uses, names, and values. This may fundamentally affect adult cognition and expertise with processes of the biophysical world (Nabhan 1993, 1998; Chipeniuk 1995).

Section II: Situated Learning: Acquisition of Subsistence Knowledge in Daily Activities

This section describes the contexts of children's learning in southern Belize, through their daily play, work, and school activities. Transmission and acquisition of subsistence knowledge and skills is situated in different spaces or locations in the local landscape. There are six main spaces that shape children's lives in the primary research site in San Miguel: **chi rix li kab'l** , "at home or around the house"; **se nimha'** "at the river", **se pim, se q'iche',** or **se tzuul** "the bush or forest", **se k'al**, "the farm or plantation" **se escuel "**school", and **se igles** "church". These categories are defined based on my own observations and children's drawings such as those that illustrate the head of each chapter. When asked to describe their favorite landscape in the community, these places appeared the most often in the drawings and stories. In this way they represent the children's perceptions of their biophysical and sociocultural environments. I describe observations of learning contexts and situations in that I recorded at different points during field research. All of the events occurred, but some instances have been combined into one episode to illustrate variation across observations.

Chi rix li kab'l *"around the house"*

Infants and children spend much of their early lives at home or in the house compound area known as **chi rix li kab'l**. A household typically consists of a nuclear family–a mother, father, and children. At times a grandparent or aunt may also live with a family, but this is usually only if he or she is widowed. Although the nuclear family structures child development in important ways, most families live close together in patrilineal kin groups. Typically the patriarch of the family is surrounded by his sons, who each have a separate house where they live with their wife and children. Some households within San Miguel do not fit the typical pattern, as families move to new locations within the village to have more space, because they bought or took over a house from another family, or because of disputes or tensions among family members. Because of the pattern of residence, children spend the majority of their time outside school with cousins and siblings.

The group of cousins (sometimes accompanied by friends who are unrelated), go from house to house as they play, checking to see what the adults are doing in different households. Children's activities and play are structured by adult work activities. They are for the most part expected to entertain themselves, unless called upon by an adult or older sibling to run an errand or pick a particular herb or fruit. Children are also given a great deal of freedom in their play activities, and from the time they are able to walk, they may be taken along with older siblings for many hours at a time. But, some adult is always aware of their whereabouts, or is able to find out very quickly as word travels fast in a small community. Toddlers wander by themselves from house to house within the shared yard area, visiting aunts and uncles. Sometimes they might be given a treat of sugar cane or a tortilla to snack on. Gaskins notes very similar patterns in the lives of Yucatec Maya children:

> They take part in both work and social activities from their second yea r on, with their roles and level of participation changing as they become more competent. There is a strong sense that adult work must get done and that the child should not interrupt it. What children are doing (as long as it is not dangerous or disruptive) is of secondary interest (1999:33).

Although adults do not feel the need to create learning experiences for children, learning contexts include focused observation and play that imitates adult work roles.

For the first months of their lives, infants receive more attention from adults than they will throughout the rest of childhood. Babies are rarely given the opportunity to cry or express dissatisfaction because most of their needs are immediately and continually met. On-demand breastfeeding is the norm, and breast milk is given until babies are weaned around one year of age, or until the next child is born. However, some children (generally the youngest in a large family) continue to nurse until two or two and a half years if the mother allows it. Some women feed their babies formula, approximately 20% of the women in the study site.

Newborns are tightly swaddled and some mothers tie rags around the legs and torso of the infant to keep the blankets secure. Usually the grandmother of the new baby assists the mother for several weeks in her house after the baby is born. As women may marry young men from other villages, her mother may have to travel a long distances. But this is an important time for a mother to assist her daughter. She may run her son-in-law’s household until her daughter is recovered enough to do so, particularly if she does not already have older children to help her. When not eating, being held or played with, infants are placed inside the **lepup**, which is a cotton cloth knotted and tied to make a tight sling. Once inside the infants are either suspended from a rafter in the house, or carried by placing the knotted part on the forehead (like a tumpline). Babies are perceived to be safe, happy, and secure when in the **lepup**. Mothers use the **lepup** until a child is 24 to 30 months old, and toddlers may request to sleep in it when they are sleepy. Infants and toddlers may also be placed in a nearby hammock to nap if there are adults who can supervise.

In times past a ritual called **a'tuk** marked a transition period for girls six months old and boys seven months old. At this time a older person of the same sex is selected to serve as the child's **xul**. During the ceremony, which takes place in the home, the infant is presented with tools to be used later in life. Girls are given a gourd to hold warm tortillas, while boys may be given a machete. The child is then carried on the hip and placed near the four corner posts of the house, or astride a horse or mule (Howard 1973; Thompson 1930). It is hoped that by introducing the child to the items they will become proficient in their use later in life (Howard 1973:3). Although the ritual is not commonly practiced to my knowledge in San Miguel, it is still believed that infants should not be carried on the hip until a certain age. I found this out when I picked up an infant and held her on my hip. Carmelita, who is 9, admonished me quickly and told me I should not carry her that way because she was too little.

Activities that take place in and around the house include work and play, such as helping older siblings wash dishes, playing "house," constructing imaginary kitchens and cooking pretend meals, and finding snack foods such as green mangoes and oranges to eat in the home garden. Maynard documents similar play scripts, based on future work roles, for children in Zinacantan in Chiapas (1999). She found that older children tended to "guide" play scripts and scaffold activities.

During their make-believe play, children make use of whatever items may be available. One episode in San Miguel captures the essence of the inventiveness that children display when in creating toys from “found objects”. I was walking back from the river with a ten-year-old girl. As we approached her house, we saw in the middle of the path two-year-old Alicia. She did not see us for about three or four minutes. She was marching around the yard carrying a giant board inside her own **lepup** as if it were her baby, with it tied properly and balanced on her head. When she saw us, she started to laugh and then became embarrassed, ran inside and hid. But, after her older sister encouraged her by telling me, “Alicia knows how to use the **lepup.**”and addressed her with, “Alicia, come and get your baby”, Alicia returned and resumed her play. Throughout the entire episode, Alicia’s younger brother, 10 months old, was watching her intently.

Of course, it is difficult from the point of view of the observer-researcher to “watch” learning actually taking place. At times it seemed that from one day to the next I would find a child had begun to participate in a certain task, and was unable to witness any mastery of the skill. It was almost as if they had learned it overnight. For example, in the household where I ate most meals and spent part of every day, 7 year old Theresa was just beginning to take on household work responsibilities. She wanted to help “bake” tortillas. Because I was also learning, it was interesting to watch her, observing the techniques of her mother and older sister, as I was trying to imitate them too.

At first Theresa was just given a tortilla-sized ball of **q’em** “*masa* or dough” to “play” with as we sat and worked near the firehearth. She would begin to pat out the ball, mashing the dough out in a rough circle shape. This is the first step in the process. The next step is much more difficult to master and is the key to the difference between a good tortilla and a bad one. This involves getting the dough to just the right thickness and diameter, all the while smoothing and rounding the edges. This is done by pressing the fingers together around the edge in a circular pattern. Every woman or girl 12 years or older can do this blindingly fast.

For months, Theresa would stop before getting to step two, after losing interest or becoming frustrated at not being able to do it. Or her older sister would just grab the dough from her hands after a while and tell her to go play, so she could finish her baking. I went away from the village for two days to visit another study community and when I came back, Theresa's mother announced to me that she had learned to bake. I asked "How?", and her mother said, "I just showed her what to do with her hands because she asked me to". This episode illustrates the parental belief that it is up to the child to ask for assistance or "just decide that they want to" participate fully in a particular task. Children are encouraged to take on certain tasks only if adults think they are ready and able to do them properly. Until they reach that point they are not usually assisted in the sense of "scaffolding" or guided participation. Although verbal instruction does occur as children learn to perform different tasks, by the time they get to the point of actually doing a certain task so that they make a real contribution, they are able to do with little instruction because they have observed it so many times before. Gaskins describes this aspect of the Maya learning process as "independence of child motivation". She states that, "many of a young child's activities are determined by the child's own interests and motivations, as well as by her own understandings of cultural expectations and restraints" (1999:36).

Careful observation accounts for a significant amount of children's time, particularly before the age of 5, but continues in many ways until adulthood. Not much escapes the attention of community members, young or old. Children can often be found sitting in areas out of the main traffic in the house, carefully observing what the adults around them are doing or saying.

In Figure 4.2, a little girl of 25 months was upset that her mother was washing her **lepup** by the river, and so instead of sleeping, she went and played with her own doll and miniature-sized "play" **lepup** while her sister (13) began to light a fire to make tortillas. A few minutes later, in Figure 4.3, she forgot about being tired, and she keenly observed her older sister using the lid from a "pig-tail bucket" to fan the fire in the **k'ub'** "firehearth". Then, in Figure 4.4, while her older sister went to find an herb outside the house, she went over, picked up the bucket lid and began fanning the fire herself. Note that she is already learning to carry her baby with her as she participates in the activity.

Figure 4.2

Figure 4.3 (above). And **Figure 4.4** (below).

Individual exploration of the household compound begins around the age of 12 to 14 months, as babies are weaned and begin to walk. At this time, a large proportion of the caretaking responsibilities may be relegated to an older sibling or cousin who lives in a house nearby. From weaning until the age of 3, children are usually found following older children in their routines, being carried on the hip of an older child, or playing nearby on the floor inside the house while adults are working.

Patrilineal household organization structures the play groups and peers that children interact with daily in this area. These groups have also been termed "courtyard cousins" (Whiting and Whiting 1975), and account for between 30 and 40 % of the observations of who children spend most time with by researchers in the Six cultures study. "Housemates", in the Q'eqchi' case, siblings, are the group that children interact with the most cross-culturally, more so than mothers, fathers, or grandparents (Weisner and Gallimore 1977). This does appear to be the case in San Miguel, as I found that, on average, 59% of the time children were engaged in activities with siblings. The numbers for cousins are only slightly lower, at 42%.

Se K'al *"at the farm"*

Although infants are taken along to the family farm or other subsistence-related activities, generally children begin to accompany their mothers, fathers, or older siblings and cousins to the farm around the age of four or five. However, parents indicated that it was not until 9 or 10 that children are expected to really "get to work" on these trips. Be that as it may, sometimes young children are also employed as caretakers if no one older is around, because the usual caretaker may be in school. Figure 4.5 is an illustration of this. This girl of 4 and a half years was given some sugar cane to keep her occupied and told to come find her mother if the baby, hanging in the lepup, began to cry. I was along with her mother and another woman breaking corn about 150 yards away. After about 20 minutes of working at the task, I couldn't hear the baby crying, but suddenly little Maria appeared right next to us and whispered to her mother that her little sister must be hungry.

Figure 4.5

Boys are expected to perform tasks in the k'al more often than girls. Boys may accompany their father or brothers to chop, harvest beans, plant vegetables or harvest greens. Girls also spend time at the family farm, but less than boys, because they spend time learning skills closer to home. For the most part, children usually have time to go the farm on the weekends, as they are in school during the week. Girls may accompany their mothers to assist with caretaking responsibilities, carrying the infant to her mother in the fields if she is hungry, so that the mother does not have return home. Men spend significantly more time in farm areas than women, and the structuring of experiences during childhood reflects these gender roles. It seems likely that girls probably spend less time assisting with farm work than in the past. Wilk (1981) writes that women in the southern Maya villages (considered to be more traditional) spent more time engaged in farm activities than women in the northern villages (such as San Miguel). As wage labor and cash flow make it less necessary for women to assist with farm labor, their own daughters will not have the experiences that they did as children.

Se Pim *"in the bush"*

Forested areas around the village provide another rich landscape in which children spend time. Play and peer groups are often "courtyard cousins", as children are sent on errands to collect firewood or wild food resources like mushrooms. Young boys trap birds in the forest, providing a supplement to the protein intake of their families. They build traps from wood or sticks, in the shape of boxes. The box is propped up on a stick and corn seeds are placed underneath. The birds come along in search of the seeds, bump the stick and are trapped. Knowledge of bird trapping is passed on from older to younger brothers. Boys also become quite proficient with homemade slingshots used to stone birds out of high branches. The birds are cooked in caldo stew as a substitute for chicken.

Girls usually do not venture into the forest by themselves, preferring to be accompanied by a male brother or cousin. This reflects the strict social separation of young men and women that occurs later in life, after girls reach the age of menstruation. I also observed that assuming responsibilities for tasks happens sooner for girls than for boys. While girls 9 to 12 years old are learning their household responsibilities, boys the same age are still engaged in activities that are closer to play than work, such as trapping birds, swimming in the river, or fishing. This is a generalized pattern cross-culturally (Lancy 1999).

Figure 4.6 was taken on a day I was fishing with some children in one of the little creeks when this boy walked by, dragging the large leaf of the cohune palm with him. He was helping his father and older brothers **setok k'im**, or find and cut the palm leaf to use for thatching purposes.

Figure 4.6

Section III: Informal and Formal Education Systems

Indigenous or informal education system

The traditional education system is based on the perception that children learn through experience and observation of others. Siblings, cousins, parents, and grandparents are all involved in the informal education of a child. Although much environmental knowledge is acquired in the production of daily life, it is through participation in play/work activities that knowledge and skill acquisition occurs. This aspect of TEK acquisition and transmission has not been adequately considered by other researchers. Little attention has been to the process of learning environmental knowledge during childhood. Although children may be expected to tell adults they are interested in learning certain skills, or ask questions, it is also assumed that if given the chance, children would prefer to play. It common for parents in San Miguel to remark that children are "lazy" and do not like to work hard. Most of the time this is said jokingly, but if said in earnest, this is one of the most disparaging things that can be said of a person.

Children begin to learn subsistence knowledge within the context of their experiences at home, from the time they are infants, concurrent with language acquisition (Stross 1969; 1973). By age 4, many of the most common fruits and herbs can be identified, and children follow older siblings in completing routine subsistence-related tasks. The important transition that occurs between the ages of 5 and 7, when children are expected to begin taking on an increasing amount of work responsibility, also occurs for environmental knowledge (Lancy 1999; Stross 1969; Zent and Zent 2000). Chapter

Five provides more detailed discussion of this process. Knowledge gradually and steadily increases until early adolescence, when the bulk of environmental knowledge is in place, and individuals take on adult work responsibilities.

As illustrated in Section II, make-believe play by children ages 2 to 6 or 7 often involves imitation of adult activities such as cooking, building little fires or firehearths, playing “house,” “chopping,” and carrying around dolls in the **lepup**. The **lepup** is a carrier for babies used in tumpline fashion. Siblings pass along extensive information to one another about where to find certain plants and their uses, and how to harvest or cultivate them. Children usually spend a good portion of each day solely in the company of brothers, sisters, and cousins, carrying out daily activities such as household chores, looking for edible snack foods (that most adults might consider inedible), bathing, and playing. As described in the previous section, sibling caretaking is a phenomenon that occurs in societies throughout the globe, particularly in non-Western contexts (Weisner and Gallimore 1977), and Q’eqchi’ in Belize are no exception. This has important implications for studies of TEK loss or change.

Based on the primacy of sibling and cousin relationships in the study site, it is likely that transmission of environmental knowledge may depend on sibling or peer teaching, particularly during early childhood. Adults do not normally accompany children on trips to the forested areas near the village or home gardens to collect firewood, herbs, or wild foods. On these trips children begin to learn to identify useful plants. A mother may give verbal instructions to two or three of her children who are between the ages of 8 and 10. But, younger children typically follow along, and toddlers may be picked up and sat astride a hip, going along for the adventure as well. A one-year-old may begin to cry when seeing siblings leaving the house en masse, and for this reason babies are taken along so that the mother and young women may complete their work with fewer distractions. "Teachers" of particular domains of TEK appear to vary based on the type of skill in question. This topic is further discussed in Chapter Five.

Adults are primary teachers on trips to the family farm, which are further away than younger children may travel on their own (outside the village). In interviews conducted with 44 adults on this topic, almost everyone stated that they learned plants in the forest by accompanying their mothers or fathers to the farm. Typically forested areas surround the village center, and people must pass through this secondary growth to reach their farmlands. Most adults said that they learned plants along the way, by asking their father about the ones they encountered. Others said they learned different plants by chopping before planting corn, as they begin to see which trees are good to cut and which should be left alone. Knowledge of vegetation is also important in selecting a good site for the year's corn crop. Adults also fill a teacher role when the task or skill at hand is very specific and requires mastery of a series of steps, such as weaving the **koxtal** "shoulder bag" or **chakach** "basket".

Grandparents assist with the process of socialization as well. Osborne (1982) notes that grandparents are custodians of agricultural knowledge. Elders are entrusted with remembering who has rights to what land, based on the usufruct system (1982:38). Grandparents, particularly grandmothers, may look after children when their parents are absent for some reason. They have more non-work time and often this is spent engaged with their youngest grandchildren or assisting their daughters or daughters-in-law.

By emphasizing the role of siblings and cousins in transmitting TEK, I do not wish to overlook the fundamental roles of parents and grandparents. Sibling teaching is a relatively new and unknown field and more research needs to be conducted. The point that siblings play a prominent role in child development is supported by time allocation studies carried out in traditional societies over the past 50 years (Whiting and Whiting 1975; Munroe and Munroe 1994; Weisner and Gallimore 1977). If TEK is acquired through experience and daily activities, then those with whom children spend the most time ostensibly have a significant impact on the content and process.

Parental beliefs about child development and learning

To gain insight into parental beliefs about learning subsistence knowledge, I carried out both informal and structured interviews in San Miguel and Big Falls. Structured interviews were conducted with 71 adults from 89% of all households in the primary research community, San Miguel. Adults were asked questions that explored their ideas of how children typically learn subsistence knowledge and skills and what type of skills and/or knowledge children should have at certain ages to be viewed as a competent member of the community.

One of the standardized questions that parents were asked was **Kiru chik texnaw ha telom ut ixqk'al chi rix wabej?** "What should boys and girls know about food/subsistence?". The kinds of knowledge and skills most often listed by parents illustrate the sharp distinction in tasks in girls and boys' socialization. Girls learn to **xorok** "bake tortillas", **puchuk** "wash clothes and dishes", **mesubk** "sweep", and prepare food, while boys should learn to **k'alek** "chop" bush in preparation for *milpa*,

tsibk “cut firewood”, **awk/awimk** “plant”, and **karabk** “fish”. However, both boys and girls are expected to be able to look for, identify, and harvest an array of cultivated fruits and vegetables as well as a group of non-cultivated, semi-protected plants, such as **cho’ choc**, or bri bri (*Inga edulis*), **kala’**, or jippy jappa (*Cardulovica palmata*) palm shoots, mokoch, or cohune (*Orbigyna cohune*) leaves, and **ichaj** “chaya” (*Jatropha acontipholia*) boiled as greens. Parents claim that girls and boys also tend to learn tasks from parents, siblings, and grandparents of the same gender.

Subsistence knowledge and skills are intimately tied to the concept of **k’anjelak** “work” in Q’eqchi’. When asking questions about subsistence or other activities related to obtaining food, one uses the word **kanjelak**. However, work doesn’t necessarily mean “no fun”, as it is often associated with in English. On the contrary, work is often an integral part of cultural traditions and rituals such as corn planting and harvesting. A premium is usually placed on getting work done efficiently and quickly and work parties can have a competitive quality to them, but in a good-natured way. Jokes and stories are usually a part of any group labor, and a meal is usually involved for all the workers, as thanks for the labor they provide. Children learn from an early age that they should take pride in their work, get things done quickly, and have a good attitude about the work itself.

McCaffrey (1966) relates that in the men’s work groups that he participated in during his stint in San Miguel, the friendly competition and comraderie formed an important part of the work. Using rice harvesting as an example, he tells a tale of men with 90 to 120 lb sacks of unhulled rice on their backs racing each other up a steep, slippery muddy slope to get to the roadside where the thrasher was located. And most of the men were laughing on the way. I was also quite astounded at the simultaneously efficient and celebratory aspects of both men and women's work groups with which I participated.

I found it hard to "find my place" and contribute at first, because not many verbal instructions are being passed around and one is simply supposed to know what to do in a given situation. This directly relates to the fact that one learns skills from childhood, through participation and careful observation. The instructions are replaced by stories, jokes, and closely observing and responding to others in order to know when your input or assistance is needed. For women, baking tortillas and making caldo for a large celebration involves careful orchestration of many different steps and coordinating timing, sometimes for days at a time, but to the casual observer it might appear chaotic. Groups of women are seated on small stools around a low table, **li banquet**, caring for nursing infants and patting out perfectly shaped tortillas, chatting with the other women, placing them on the **k'il** "comal", and turning them before they burn. All the while I would still be there working diligently on my first ill-formed tortilla. When women began asking me to perform the usual tasks in such work groups later on in my stay, I gratefully felt that I had gained a basic competency in some of the required skills.

Figure 4.7 Three generations of women participate in baking tortillas (**xorok**) at the **banquet**.

When asked the question, **Jarub' hab'eb' naknake'tzol ha k'anjelak?** "When do children know about work (related to food)?", 41% of the 71 adults interviewed for the study stated that by age 10, both girls and boys should be able to perform most subsistence related tasks competently. Most of the other responses were spread around the years 5 to 9. Parents were also asked how they thought children learned how "to work," or gain the knowledge to perform the tasks associated with subsistence, "**Chan kiru nakatkuxla chi rixeb' akok'al naknekextzol k'anjelak?**" The responses were tabulated and are summarized in Figure 4.9.

Overwhelmingly (37%), parents responded to this question by saying, "I send them," meaning they send their children out of the house, to the garden, the farm, the forest, and around the village. Children are sent to look for whatever is needed that day, or to accompany adults engaged in daily subsistence-related work activities. The next three categories of responses serve to support the claim that the acquisition and transmission of TEK is largely observational and experiential, and that Q'eqchi' parents know and understand this fact. "They learn it" (19%), points to self-guided experiential learning, while "I show them" (14%) indicates the importance of "learning through doing." Finally, "They see it and will learn, they see it and do it" (15%) describes the fact that as children grow, they are continually observing adult roles and internalizing adult knowledge. The rest of the responses focus on the fact that adults teach children subsistence knowledge and skills, or children being told to accompany adults to work. These make up a much smaller proportion of the overall responses, indicating a greater perceived emphasis on experience, learning-through-doing, and focused observation in the acquisition process. My observations of daily activities and learning situations indicate that these are indeed the primary modes of information transmission.

Figure 4.8 A mother helps her son stand up for a picture on his first birthday.

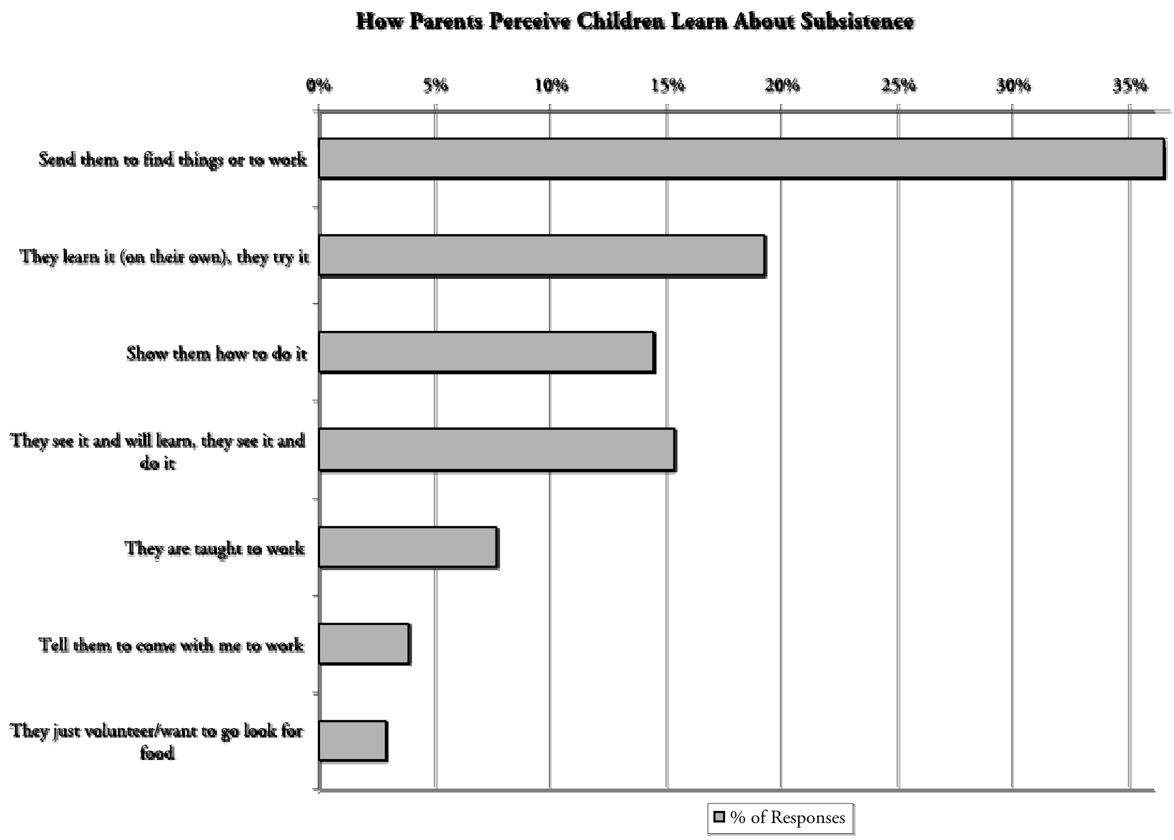

Figure 4.9 Data from Parental Belief System Interviews.

Formal Education System in Belize

Although setting up a strict dichotomy between formal and informal education systems is somewhat misleading, the contrasts between learning that takes place in school and learning that takes place outside of school are fairly sharp in Belize. Primary school education is mandatory for all children between the ages of 5 and 14. Most of the 38

Maya villages in Toledo now have a primary school for children to attend or access to a nearby school. In San Miguel, there are approximately 150 children of school age, and there are 12,000 in Toledo district. Reports for the district for the year 1998/1999 indicate that of these children, only 72% were enrolled in school (ESTAP 2000). The Jesuits were responsible for establishing many of the village schools during the beginning and middle part of the twentieth century, with the result that most schools and school-related activities are managed by the Roman Catholic church Toledo district office in P.G. Districtwide, 61% attend Catholic schools, and the rest of the school age population attends government, methodist, or private schools. However most of the non-Catholic schools are located in or near the district center, so the percentage for Maya villages is actually higher. There are 32 Catholic schools, 7 government run schools, and 5 Protestant denomination schools in the district. (ESTAP 2000:77).

Literacy rates are often quoted to be fairly high for the population of Belize, from 70 to 90 % depending on the source of the information (Belize National Human Development Report 1998; Government of Belize 2002). These rates are calculated based on the percentage of the population completing Standard V in primary school–not necessarily a guarantee of literacy–but in fact an indication of the minimum level of education that students achieve (Belize National Human Development Report 1998). Furthermore, if the statistics are broken down by district and ethnicity, 47.7 % of Mayas were considered literate (in English) in 1998, a drop from 53 % in 1991. Toledo district also ranked lowest (58 %) when compared to 91.9 % literacy in Belize district, the most populous with the greatest concentration of infrastructure and resources (ibid).

This is also indicative of the proportion of government dollars spent on education in the Toledo district as compared to rest of the country. As is true with many resources, Toledo is often receives the last of what is available, or must wait until all other areas of the country have been satisfied. There does not seem to be much overall discrepancy between males and females. Ten percent of students nationwide also repeat the grade they are in each year. The teacher to student ratio in the district is 57:1, exceeding the Ministry of Education's recommendations of 26:1 by quite a margin. In many smaller villages in the district one or two teachers are responsible for teaching all the children who attend school and/or serving as principal for 40 to 50 students, dividing their time among different classes during the day. One can imagine how difficult it might be for a child of 5, who knows very little English and has never had to sit at a desk and not speak to others all day, to be able to integrate themselves into such a learning situation.

As is true of any schooling system, the teachers and principals themselves often make the critical difference between what could be a disastrous situation and one in which students do learn some of the curriculum and encouraged to perform to the best of their ability. In San Miguel, each year for the past several years, 12 to 15 students who have scored well enough on the government standardized PSE (Primary School Exam) to move on from primary school and attend high school. In 2002, 12 students who graduated from the primary school will be attending either Julian Cho High School or Toledo Community College in the fall. But, the number of teachers to students often works against all efforts. During school year 2000-2001, almost all students who were in Standard V (the American equivalent of grade 7) failed that year. Meanwhile, several of the students who were in Standard VI the same year did pass the PSE and enroll in high school. This illustrates a situation in which the teacher focused more attention on the outgoing students, to ensure they had a better chance at passing the standardized exam, to the detriment of the younger students who would have another year before they had to sit the exam. (These students were later passed to Standard VI by a new incoming principal so as to make sure the students were more evenly distributed throughout the grades.)

Truancy laws have begun to be more strictly enforced across the country over the past several years, particularly in the Toledo District. Police roadblocks were stationed at the major intersection between the Southern Highway and the Punta Gorda-Columbia road, so that parents taking school aged children to town (P.G.) for the day to sell produce or crafts might be fined as a deterrent. In San Miguel, parents are fined 25 cents Bze (a "shilling") a day by village leaders for each day that a child is absent from school without a valid excuse such as illness. These fines are tallied several times throughout the year and viewed seriously by the community, as missed days for families with many children certainly add up. The fines typically are applied to the school itself for operating costs or supplies. As previously stated, one of the goals of the research is to determine what if any affect that increasingly higher rates of regular attendance at school has on traditional ecological knowledge. This is discussed in Chapter Five.

Nationwide, 53,118 children enrolled in primary school in Belize as of 1998, but this represents only 75% of the total school age population (Belize National Human Development Report 1998). The Human Development report suggests that increasing fees for school materials, textbooks and other costs may be a factor for some parents, in addition to their not complying with truancy laws. My research indicated that the need for children to help at home or at the farm may also result in occasional extended absences or leaving school before age 14. Leaving school before the age of 14 is particularly likely to happen if the child is not going to earn high enough PSE scores to attend secondary school, the family does not have the funds to send the child because of the new expense of tuition, travel, and uniforms, or the parents would rather their child get married than attend school. The latter example is more often the case for girls than boys but this scenario is changing in recent years.

Teacher Qualifications, Training and Certification

In the Toledo District, 24 % of teachers are "fully trained", which is to say that they have completed a government certification program and passed a series of qualifying exams. In 1998, 54 fully trained teachers were employed in the district and 164 not fully trained, or 33 % (Belize National Human Development Report 1998). Of these, 34 were female and 20 were males. This is consistent with a national trend for women to attain certification at a higher rate than men (ibid).

Many of the young teachers currently employed in the district have graduated from the local secondary school, or high school, Toledo Community College (TCC) in Punta Gorda, but have yet to pursue certification or are in the process of doing so. They have one year to begin studying for the exams after beginning their service. In addition to the certification at the Teacher's College of Belize, with its headquarters located in Belize City and Belmopan, the college offers a district program in which teachers can attain further certification, providing summer training opportunities and assignments designed by participants to stimulate new methods, techniques and information sources. Two teachers in San Miguel R. C. School were participating in the Teacher's College program, which takes years to complete if the teacher attends summer courses in Belize City each year. These two are both originally from San Miguel, and because of the nature of their training, were interested in assisting with development of community-based environmental education curricula and materials that would highlight the diversity and cultural importance of local ecological knowledge. Their curricular activities involving environmental science focused in a few instances on traditional ecological knowledge. One teacher had children collect leaves from plants they knew, press them and write essays about the uses and biology of the plant. Another had a play/work area within the classroom that highlighted rainforest animals such as the toucan (**selepan**), also the national bird of Belize. Field officers in each district coordinate training during the school year for the participants in the Teacher's College program.[1] This also provides teachers a forum to discuss problems and successes in their own schools with one another.

Historically, the majority of primary school teachers who taught in Maya village schools were Garifuna (Garinagu). Young Garifuna men and women were recruited to teach throughout the district by Jesuit priests and other officials, after they had attained a local reputation of superior performance in the role of rural educators. Teachers from other ethnic groups were perceived to be unable to flourish in the rural villages of the district due to the differences in way of life compared to what they were used to. In fact it was often viewed as punishment by the teachers who were "sent" to these schools, and single young women were almost never assigned these positions. Many Garifuna adults

[1] The current field officer for Belize Teacher's College in Punta Gorda, Mrs. Celia Mahung, was extremely helpful in relating information about this program to the researcher, and very supportive of the goals to

speak Mopan or Q'eqchi' fluently as a result of spending the early years of their lives living in Maya villages across the district while their parents served as teachers Cayetano (1984). For this reason, several Garifuna scholars wrote lengthy reports on the status of education in the communities in outlying areas, as well as descriptions of cultural traditions in the Maya villages in the 1960s and 1970s, providing a valuable resource for later research. Having largely Garifuna teachers for primary schools in the past may have contributed in part to current complexity of inter-ethnic relationships between Maya and Garifuna in Toledo. Attitudes expressed by both parties vacillate at times from solidarity as minority groups in a Creole majority society to rivalry in vying for limited resources such as land, from rural development projects and the government of Belize. A recent illustration of this is conflict over the management of the Sarstoon-Temash National Park, which is bordered 6 Maya and 1 Garifuna village (see Chapter Two for more details).

In the past decade there has been a trend for young Mopan or Q'eqchi' people to choose to become teachers and return their skills and knowledge to local communities. This is quite a lucrative option for the brightest high school graduates, although the pay is still quite low given the overall cost of living in Belize. Unmarried young men and women are both likely to be hired for such positions, one of the only steady local employment opportunities for young women at the present time. They live in the village where they teach during the week and travel to their home villages on the weekends to be with their own families. Alternatively, teachers with families may bring their entire family with them and have their own children attend school at the school where they

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create community-based environmental education curricula for use in schools were Q'eqchi' is teach. As a consequence, many of teachers' children attend school in several villages in addition to their "home" village, where they may go on weekends or as often as weather permits during the wet season when flooded rivers can prove impassible. Teachers usually live together in one or more simple teacher's houses that the government or Parent Teacher's Association has built for the purpose in each community. Or, many young men will travel 10 or 15 miles by bicycle every day or week to reach their school. Teaching positions have been a training ground for many Maya intellectuals to move on to other political or business roles in the district or nationally. Many Maya leaders, such as officers in the Toledo Maya Cultural Council and Kekchi Council of Belize, served as teachers early in their lives. Many Maya who work with non-governmental organizations and rural community development officers also served as teachers at one time.

Formal learning environments

The teaching styles and design of curriculum reflect in many ways the British colonial history of Belize. Although there are certainly differences between the districts, in general teachers were raised in the British colonial system of schooling. The curriculum, which has been revised in recent years, places a greater emphasis on more interactive, participatory teaching styles, but much remains of the old system that relies heavily on wrote memorization and lecturing. National symbols and teaching units that feature discourse about the cultural diversity of Belize are common features in school classrooms and in the activities. Figure 4.10 is a photo taken inside the Infant I (first

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predominantly spoken.

grade equivalent) classroom in San Miguel R.C. School on “Children’s Day”, a day set aside to appreciate children throughout the country, with a basis in the Unicef and United Nations emphasis on global “rights of the child”. Figure 4.11 is of the September 21 celebrations, Belize’s Independence Day, illustrating the nationwide goal of creating a joint Belizean identity from the many ethnic groups that live in the country’s boundaries.

Figure 4.10 Teacher and children in the infant I classroom in San Miguel R.C.School.

Environmental education has become a part of curriculum for many schools in Belize, but most are in the northern part of the country, located near protected areas which are managed by the Belize Audubon Society (BAS). BAS manages many of the national parks and protected areas in the country. Environmental education has reached Toledo in the form of outreach activities designed by volunteers at the Belize Zoo, located near the country's capital. These activities are well-known to school age children, and promote broad awareness of key environmental issues for the entire country of Belize. Certain aspects of the programs could be made more relevant to local ecology and the daily lives of Q'eqchi' or Mopan children. A campaign to make local peoples aware that the manatee is in danger of becoming extinct and should be protected is important, but a more relevant topic might be trash disposal in villages, or protecting riverine environments.

The structure of the classroom and teacher expectations for children's behavior in the classroom differ from the home environment. Children are expected to sit in chairs and desks, be quiet and not interact with one another. At home children in many households are typically found sitting on the floor, including meal times. Although children are expected to leave adults to their work, they also have freedom to move about and do whatever they choose until called upon to help with adult activities. Furthermore, at home children are often engaged in useful work with adults, while at school the child is treated as "an immature being" (Osborne 1982:91). Osborne's observations about Maya expectations for child behavior are remarkably similar to Gaskins' model of parental beliefs in the Yucatán. Both note the value placed on independence and ability to contribute to household work activities. Osborne observed that,

> Informal education in the home does not set out to dominate or mould a child but rather the child's will is channelled into what are considered to be productive activities and a sense of self reliance and independence is encouraged along with a sense of personal achievement (1982:89).

Osborne conducted a small educational experiment in Blue Creek as a part of the TRDP development project. She encouraged teachers to split up the school day for younger and older children. Young children attended school in the morning and older children in the afternoon, which accomodated the labor needs of households for agricultural tasks. The older children could help with agricultural work and household tasks, which left women time to tend to the home garden (1982:72). It appears that the small program was successful, but to my knowledge was not repeated. In fact, the current school hours are the opposite of the schedule implemented by Osborne and educators in the early 1980s. Children of all ages attend school from 9 am to noon, and then return at 1 pm. Children in the first two grades then leave early, at 2 pm, and the rest of the children stay until 3:30 pm. This leaves little time for older children to help at home. One outcome of this is that parents who see that their children are not performing well in school become frustrated and may feel they and their children are wasting their time. Osborne notes the same thing in her report on conflicts between the formal and informal education systems (1982). This is particularly true of adolescents between 12 and 14 who may not be excelling in the school environment.

Learning to speak, read, and write in English consumes much of the first three to four years of formal education in Maya communities. All this must be accomplished in addition to the standard curriculum. The government does not provide bilingual teacher training or resources. In school, children are strongly discouraged from speaking Q'eqchi'. In San Miguel, the policy was that children should only speak English on school grounds. Q'eqchi' language and TEK are not valued by the school system, and in fact the attitude remains that children need to learn English as quickly as possible. Children are taught to help each other at home, because group labor is an integral part of the society. In school this is considered to be incorrect, and esteem is placed on individual achievement.

Many children know only a handful of words in English when they begin school at age 5. In San Miguel there is also a trend for mothers to try to enroll their children in school before the age of 5. This is most likely due to three factors: 1) young children want to accompany their brothers and sisters as they normally do in daily activities at home; 2) parents want their children to get a "head start" on school and learning English so they can do well; and 3) mothers would welcome one less child to be responsible for during the day. Teachers discourage early enrollment, but they do make exceptions. Nationwide, preschools have become more common in the past decade, and that trend may make its way into Toledo soon, which would certainly help the language acquisition process.

As tends to be the case in classrooms of immigrant children in the U.S., teachers have little or no ability to speak the local language (Q'eqchi' or Mopan). There are very few resources for teachers interested in learning a Maya language to help their students in the classroom. A pictorial dictionary by Pedro Cucul is one of the only sources available, and this provides only very basic information. A movement has recently begun to push for bilingual education in schools in Toledo, spearheaded by the chairman of the Kekchi Council of Belize, Gregory Ch'oc,. There are successful bilingual Q'eqchi'/Spanish programs in place in neighboring Guatemala. Representatives have visited Toledo and made recommendations to the Maya organizations. In 2001, an educational consultant was hired by the Ministry of Education to document the educational challenges that children in Toledo district, particularly Maya children, face. This was prompted in part by low test performance for the district overall, as compared to the rest of the country, so there is at least some concern on the part of educational institutions.

Conclusion

Informal and formal education systems are often characterized as being in conflict, particularly when the differences between the two systems are strongly dichotomized (Greenfield and Lave 1982). Differences between parental and teacher expectations in Toledo are similar to patterns observed elsewhere in the developing world. However, there are elements of formality in the indigenous system, and informality in the formal education system. By emphasizing overlapping goals some of the tensions and difficulties that arise may be reconciled.

A glimpse into daily lives of children in San Miguel illustrates the fundamental importance of subsistence knowledge and skills to the socialization process. Learning is very much "situated" in time and space. Acquisition of skills occurs through participation with others, tied to the biophysical environment in which the skill is performed. Children contribute significantly to household subsistence from an early age. Identifying plants, learning their uses, cultivating crops, and hunting and fishing are fundamental skills that children need to become capable adults in their communities. In the next chapter, the acquisition and distribution of subsistence knowledge are further explored.

Figure 4.11 A girl waves the Belizean flag during Independence Day celebrations held in the community center, September, 2001.

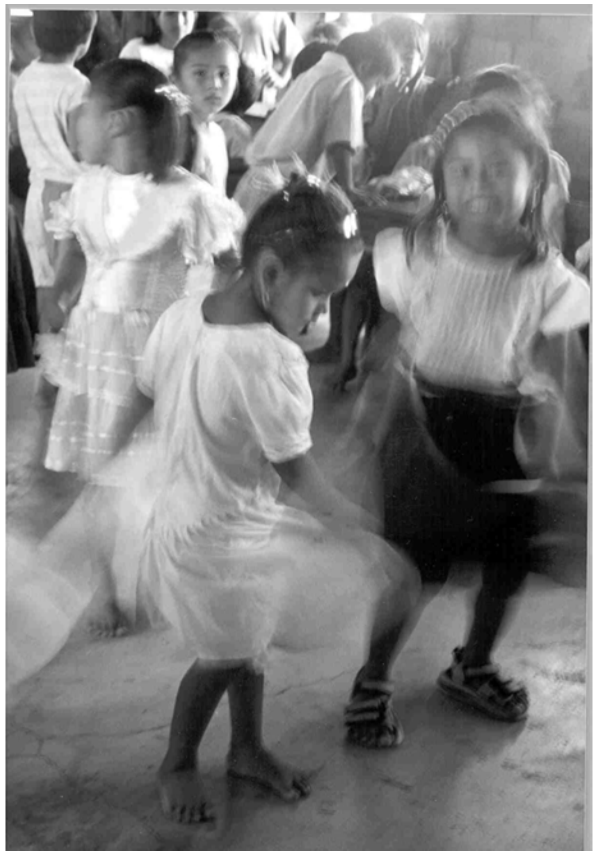

Figure 4.12 Young girls enjoy dancing their traditional dance on the last day of school.

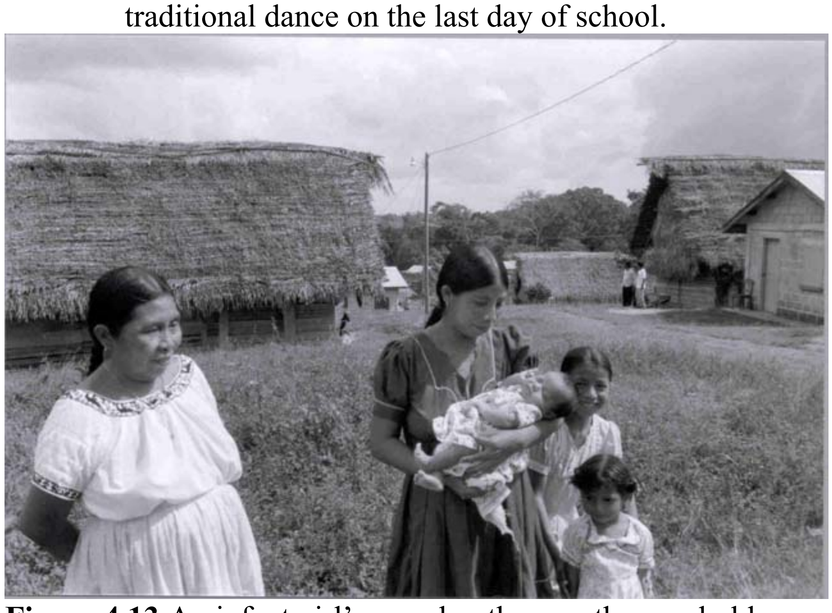

Figure 4.13 An infant girl's grandmother, mother, and older sisters share in the celebration of her baptism in the Catholic Church.

CHAPTER 5

Q'EQCHI' SUBSISTENCE STRATEGIES: DEVELOPMENT OF EXPERTISE AND INTERGENERATIONAL KNOWLEDGE

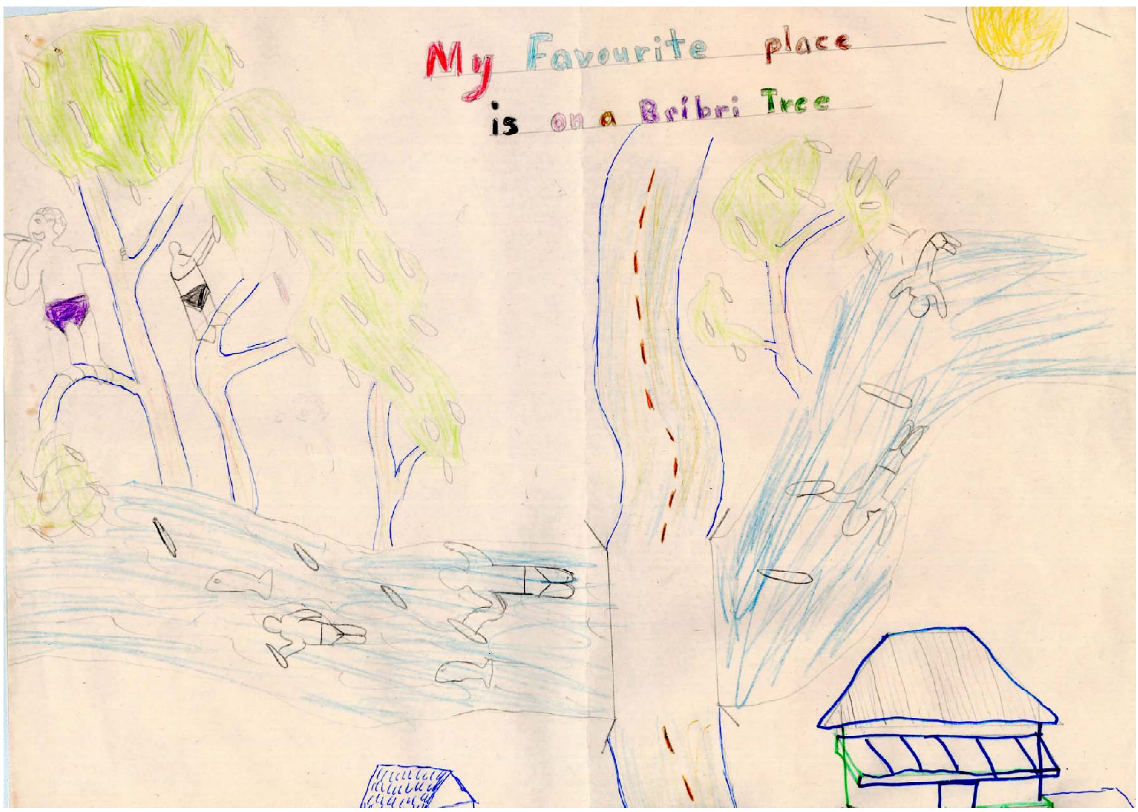

Figure 5.1 Several boys are climbing **cho' choc** (*Inga edulis*), or "bri bri" trees on the riverbank. They are harvesting the fruit of this tree, which is a long green pod, 6 to 10 inches long. The spongy white, sweet-tasting mesocarp that surrounds the seeds is eaten. Throughout the months of April and May these are a favorite non-cultivated food that people of all ages enjoy, but they are particularly loved by children. They make a sport of chasing down the pods in the river, by swimming around to catch as many as they can that have fallen into the water. Boys are swimming in the river to catch the fruit as it floats by in this figure. The trees depicted are easily recognizable, found next to the main bridge, a favorite place for jumping into the river when the water is deep enough. Several other *Inga* species "family" to the **cho' choc** are also edible, such as **saki cho'choc** (*Inga pavoniana*), **ch'elel** (*Inga fissicalyx*), and **b'its** (*Inga punctata*).

This chapter begins with a brief description of widely shared ethnoecological knowledge, such as categorization and naming conventions for plants in Q'eqchi'. This is followed by a discussion of the acquisition and distribution of knowledge among children and adults in one Maya village in Toledo District. Pile sorts, freelists, home garden interviews, and the plant trail results illustrate of the development of expertise over time. Data are also presented on adults' and children's perceptions of how knowledge is acquired. Finally, I explore differences in knowledge between and within generations and age sets in the primary study site. Data collected in the cultural transmission, or what I termed the "learning networks" interviews, provides the basis for discussion of intergenerational differences in traditional ecological knowledge. Information is also presented on who teaches certain skills and at what ages informants perceive that these skills are learned.

The chapter is divided into two sections. The first section begins after an introduction to ethnoecology and traditional ecological knowledge (TEK). Section I is entitled "Q'eqchi' Subsistence Knowledge and Skills." Section II, "Acquisition of Subsistence Knowledge and Development of Expertise," focuses on the distribution of knowledge and the acquisition process. Children and adults of different age sets are all included in the discussion. This chapter builds on the previous chapter's focus on modes and expectations for learning during childhood.

Within the broader domain of TEK, or environmental knowledge, the category "subsistence knowledge" was selected to narrow the focus of the project. This was done to ensure that research time could also be devoted to acquisition, distribution and transmission of knowledge. Subsistence knowledge and skills as used here includes food production, procurement, and preparation; the harvesting and selection of "wild"/non-cultivated foods such as herbs, fruits, and medicines; hunting and fishing activities; and the making of traditional crafts, housing, and household items (Harris and Ross 1987). Food, shelter, and household items are fundamental to all human societies and knowledge is often widely shared among people of all ages.

All members of Q'eqchi' families contribute in significant ways to subsistence work in their households, beginning around the age of 4 or 5. Families rely on a combination of subsistence-based and purchased resources for their livelihoods. Primary among these are the products of the family farm. Corn, beans, and rice are the main staples, while 10 to 20 other species are often cultivated, either intercropped with corn or in separate plots along side (Berté 1983; Wilk 1997). In addition to the farm, home gardens often provide another key source for food and household items. Children are responsible for helping maintain the home garden as well as harvesting resources when they are needed. A variety of herbs, fruit trees, tubers, chiles, coffee, cacao, and flowers are all grown in home gardens (on average, 34 different varieties). Chickens, pigs, and ducks are also a food source and income generator for approximately 80% of households in San Miguel.[1] Forested areas that surround the villages provide firewood, dozens of palms that are edible or used for household items, and many non-cultivated fruits and herbs. Wild mushrooms and **k'ib'** ("palm cabbage" or palm hearts) are often substituted for meat when it is not available. "Bush meat", or forest mammals such as **jalau** (*Agouti*

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[1] This figure is derived from a survey of non-timber forest product use for the Ministry of Natural Resources, which reported 67 animal houses in the village in 1997 (Campbell and Mitchell 1998). These figures corroborate my own estimates as well.

paca) or "gibnut" and **chakow** (*Dicotyles pecari*) or "warree" are usually hunted at night or on trips back and forth to the farm. These animals are known to "steal" corn when humans aren't present, so a trip to the **k'al** may mean a chance to find game meat without having to trek far into the bush[2]. Local fish are also an important part of the diet, and people of all ages fish in rivers and small creeks. Store-bought foods such as flour, tinned meats, frozen or fresh chicken, pork, beef, and powdered milk are also staples in the majority of households. Frequency of these items in the diet depends on cash flow and fluctuate throughout the year depending on seasonal or opportunistic wage labor opportunities.

Ethnoecology and Traditional Ecological Knowledge

Ethnoecology is an interdisciplinary field of inquiry that encompasses research in many fields concerned with human-environment relationships. At the heart of the field is an interest in how humans think about, categorize, and interact with the world around them. A growing body of scholarship enhances our understanding of indigenous or "folk" knowledge and beliefs that define relationships between humans and the biophysical environment. Perhaps the most widely used terminology at present is "traditional ecological knowledge" or TEK. Broadly defined, TEK is, "a cumulative body of knowledge and beliefs, transmitted from one generation to the next, about the relationship of living beings with one another and with their environment" (Berkes 1993:3). Scholars research TEK from the perspectives of ethnobiology, cognitive science, geography,

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[2] This type of meat is highly prized, since forest animals are becoming more difficult to find each year, due to loss of habitat and sale of bush meat in larger towns (instead of only subsistence-based use). Gibnut in particular goes for high prices in Punta Gorda, although its sale is illegal.

psychology, agroforestry, agronomy and soil sciences, natural resource management, conservation biology, and anthropology to name a few.

Ethnoecology owes its intellectual roots to the approach known as ethnoscience developed in the 1950s and 1960s, as well as interdisciplinary research in cognitive science and linguistics. Early studies documented the detailed and systematic character of human knowledge of the biophysical environment, particularly in non-state "traditional" societies (Berlin, Breedlove, and Raven 1974; Berlin 1992; Conklin 1969; Frake 1962; Hunn 1989; Boster 1986). Ethnoecology was first proposed by Harold Conklin and Charles Frake, combining theories in linguistics, systematic biology, and psychology to develop a better way to understand a particular cultural group's perceptions and classifications of the natural world (Fowler 1977).

Another intellectual tradition that contributed to the field is, "cultural ecology, the study of the role of culture as a dynamic component of any ecosystem of which man is a part" (Frake 1962). Ecosystems theory provided a framework for human ecology, exemplified by the work of Rappaport (1968). Today ecological anthropology is defined by all of these traditions. Cognitive and behavioral approaches are often perceived to be at odds with one another, however. Hunn envisioned that ethnoecology would unite cognitive anthropology with cultural and evolutionary ecology, by linking cognitive anthropology's focus on individual actors with ecology's "web of mutual influence" concept, thereby providing a way to place the individual in ecological context (Hunn 1989). These differences are hardly resolved, but scholars and practitioners in the field of ethnoecology have contributed in significant ways to current international debates about TEK (Posey 1999; Maffi 2001).

Over the past two decades, traditional ecological knowledge has become the focus of human rights and conservation projects and initiatives around the globe. Many international organizations, such as the United Nations Environmental Programme, have become increasingly aware of the linkages proposed between traditional ecological knowledge, indigenous rights, conservation of local resources, and their relevance to the global environmental crisis (Berkes 1999; Posey and Dutfield 1997; Posey 1999).

The right of indigenous or local peoples to use subsistence resources in protected areas is an issue that often divides social scientists and biological scientists. Many researchers have asserted the need to conserve both biological and cultural diversity, and argued that the two are often inextricably linked (Posey and Dutfield 1997; Maffi 2001). The assertion is based on the observation that many indigenous peoples live in tropical areas of high biological diversity, and given certain socioeconomic and ecological circumstances such as low population density, may help maintain diversity. TEK has begun to appear with increasing frequency in the project proposals of various development and conservation-oriented organizations. Recent decades have seen a proliferation of non-government organizations (NGOs) devoted to promoting indigenous rights, eco-cultural tourism, and community-based conservation or "co-management" of protected areas. Belize is no exception. For a more detailed discussion of the dynamics of indigenous peoples, protected areas, and development in Toledo district, see Chapter Two.

Ethnoecology, or ethnobiology, is being redefined in complex ways as changes occur in relationships between scholars and indigenous or local peoples. The field of ethnobiology is increasingly becoming "ethnobiology *of, by,* and *for* 'indigenous peoples, traditional societies, and local communities'"(*ISE Code of Ethics* [1998] in Hunn [2002a]). The goals are not limited to "extraction of useful knowledge", or an appreciation of how indigenous peoples "make sense of the natural world", or "a foundation for sustainable resource management", but necessarily include collaborative research and capacity building in local communities (Hunn 2002a: 4). Indigenous peoples have declared the right to determine that ethnobiological research, or any research for that matter, is collaborative and inclusive, and to choose which projects are carried out (e.g., the *Mataatua Declaration*, 1993). Researchers and indigenous peoples are increasingly concerned with the ways TEK is used and represented, whether in scholarly publications, local educational materials, or in the production of pharmaceuticals. During field research for this study, every effort was made to be clear about the goals of the project, inform communities of the outcomes of the research, and make the project a collaboration with the communities where I worked and lived. The local and regional contributions of the project are outlined in Chapter Six.

Section I: Q'eqchi' Subsistence Knowledge and Skills

The decision to limit the study to a subset of TEK facilitated a focus on acquisition and transmission during childhood. However, this also means that the information on ethnobiological classification is limited to particular aspects of local knowledge. The discussion that follows should be viewed with this in mind. A general Q'eqchi'ethnobotany does not yet exist, although Collins (2001) comes the closest, and many Q'eqchi' plants appear in Balick et al.'s *Checklist of the Vascular Plants of Belize* (2000). Although some plant specimens were collected which have no known use, and several of these species also appeared in the plant trail experiment, there was a definite bias toward collecting and recording utilized plants. I am sure there are many I missed during my 17 months of fieldwork, but I collected plants on average once a week. Over 250 specimens were collected during the research with the assistance of local collaborators, and most of these are different species within scientific nomenclature. Collections covered a wide range of widely used and culturally salient plants. Methods and permits for collecting are outlined in Chapter Two.

In addition to ethnobiological terminology and uses for plants and animals, this discussion of Q'eqchi' subsistence knowledge includes the skills that people of all ages engage in to put this knowledge into practice. Ethnoecological categories of land use are also noted, as they are useful in understanding how Q'eqchi' perceive and conceptualize the biophysical environment.

A handful of historical accounts and reports from botanists in the 1800s and early 1900s document the extensive botanical knowledge of the Belizean population during that time. Bartlett's *Botany of the Maya Area* (1935) describes methods for plant collection in the neotropics. He notes:

> It speedily became obvious that in British Honduras and Guatemala the people knew an unusually large number of plants, had names for them, which might be "creole", Spanish, or Maya, and furthermore, that they had a perfectly definite land and vegetation classification, with appropriate nomenclature in English, Spanish and Maya…Many natives have a knowledge of local history far superior to that which a scientific visitor could possibly glean with out their assistance in any reasonable length of time…Many of them have spent a large part of their lives…in the exploitation of forest products, so that they inevitably acquire a deal of astonishingly precise knowledge about plants (1935: 7).

Local knowledge of plants is not static; each generation shapes the shared information in its own way. However, local knowledge of plants continues to be quite extensive in Maya communities in southern Belize.

Q'eqchi' Ethnobiological Terminology

Q'eqchi' ethnobiological classification consists of 4 life form categories for plants: 1) **che'** or **te'**, "tree" (or "stick/post"); 2) **pachaya'**, "grass"; 3) **pim** ,"herb or bush"; and 4) **q'aham** or "vine" (or "rope"). The unique beginner "plant" is covert, but **pim** is perhaps the closest equivalent in its usage (Berlin 1992). The rest of the non-human world makes up the category **xul**, (or **xuleb'** plural) which includes mammals, birds, fish, and insects. Collins found the same life form terminology in his recent study of Q'eqchi' ethnobotany in Alta Verapaz (2001)[3].

Q'eqchi' plant classification is, like other ethnobotanical systems, reflects the primacy of the generic level (Berlin 1992), or what is also referred to as the "basic" level in other schemes of classification (Johnson and Mervis 1997) and the generic-specime according to Atran (1990). Plant names are based on several conventions of ethnobiological classification found in other systems around the world (Berlin 1992). Many cultivated species of high cultural value are labeled with a variety of secondary lexemes such as **sakitul**, (*Musa x paradisiaca*) or "white banana," **kaqitul** "red banana," **tyajtul** "sick banana". (These are called "banana" locally, in Creole, instead of "plantain.") All three are *Musa paradisiaca*, but are distinguished by color or another

[3] Collins reports a slightly different pronunciation and spelling that reflects dialectical differences. He reports **k'aam** while I found **q'aham** widely used in Belize. **Pachaya** is also written without the glottalized final letter that is common in Belize, **pachaya'**.

characteristic from the others in the same genera **tul**. These distinctions are usually confusing to younger children and the anthropologist. But, by the time children approach the adults' level of expertise, they do not often make mistakes in distinguishing between them.

Another naming convention is the tendency to mark "wild" or "forest" plants from those that are cultivated or found near the village. This is done by appending the extensions **che', te',** or **q'iche'** (literally "forest") to the primary name. This is an example of what Berlin terms "generic name extension." An illustration of this is the distinction between **chi'** (*Byrsonima bucidifolia*), "craboo", a member of the Malpighiaceae family and **chi' che'** (*Bourreria oxyphylla*) of the Boraginaceae family. **Chi'** is a highly valued tree with bright yellow fruit, with a characteristic tart and dry taste that children and adults enjoy. It is a species usually found in home gardens. **Chi che'** is found in the forest and is an edible fruit that children usually prefer more than adults, who would probably claim that it is inedible. Young boys also use the unripe fruit as sling shot ammunition for hunting birds. Collins notes a similar distinction as well. He also notes that a true-false dichotomy is also common among Q'eqchi' plant names in Guatemala: "the term **yaal** is used as a descriptive term to denote some semblance of a prototype, as in the phrase, **Li chaj aran, a'an yaal che'**, 'that pine over there, that is a true tree'" (2001:293). I did not find **yaal** to be very frequently used to denote prototypicality, but only the use of primary lexemes by themselves, such as **tul** (*Musa* sp.) or **tzi'** (ginger family). Plant names also include many animal name modifiers that reflect the morphology of the plant. An example of this is the **noq'iritimis**, (*Theuetra ahouai*) or "cat's balls," which aside from their bright red color, provides a fairly anatomically correct assessment. A widely used medicinal plant is called **kaququb'**, perhaps named for the fact that its leaves are crushed and used as a blood coagulent for small cuts or sores. **Kaq** is "red" in Q'eqchi'. Figure 5.2 is Noq'iritimis **(*Theuetra ahouai*)**. The fruit of this plant is another favorite wild food, found in disturbed areas such as trail and roadsides. The milky white sap and pulp of the fruit is eaten while walking to the farm or to collect firewood. This is a food perceived to be in the "active" domain of children.

Figure 5.2

Plant names at the species level may also include the life form modified by an adjective describing some morphological, behavioral, or cultural significance of the plant. Many names within the Q'eqchi' system include a color descriptor linked with a life form name as opposed to a more intermediary or generic category (Collins 2001). Examples of this from the present study are **keq'iche'**, "black tree" or **k'aniq'aham**, "yellow vine". Collins notes that this can make it difficult to determine if someone is relating a widely distributed "correct" name for a particular plant–which can be tested by determining if consensus exists–or merely describing the characteristics of the plant, if they are unsure of the "culturally correct" name (2001:290).

During his plant trail experiments, also based on Stross's (1973) model, Collins found this situation occurring. He conducted plant trail interviews in one Highland and one Lowland Q'eqchi' community, with the goal of describing changes in resource use in adapting to the lowland environment (2001). He distinguished between descriptive responses and "correct" names as he analyzed his data (2001).

I did not find nearly as many instances of what Collins terms "fall back" descriptive names such as these among children interviewed on the plant trail in Belize. When asked the name of a plant, most of the time children stated the name recognizable within the generic category or specific category or said, **ink'a ninnaw**, "I don't know". Perhaps children felt more comfortable admitting they did not know the name than adults in the same situation. I also may have included proportionately more widely known plants on the trail than Collins did in his study. More interviews with adults would have shed light on this issue. Another hypothetical explanation for the difference is that it is because of differences in migration history, such as a longer period of time in a particular settlement. Or variations here could be the result of different strategies of incorporating lowland species into an existing highlands-based classification system. Details on plant trail results are discussed later in this chapter.

Naming the landscape: ethnoecological stages of land use and place names

The major ethnoecological categories for land use described here are based on informal interviews with men and women and visits to family farms. Some categories are polysemous in everyday speech, such as the distinction between **q'iche'** and **pim** as Collins (2001) also found in Guatemala.

1. **Q'iche'**: high secondary or primary growth broadleaf forest; minimum 10 years old; "when no one is using it"

2. **Pim**: termed "bush" in Creole, younger than **q'iche'**; people are using it for some purpose related to cultivation, harvesting food or household resources such as firewood

3. **Nimkiru** or **wamil**: tall bush, at least 8-10 yrs old

4. **Saq'e wahil, saq'e wamil,** or **k'unil pim**: "soft" bush approximately 1 year old

5. **Kat k'al**, **chaqijal**, or **katik'al**: *milpa*; chopping the **wamil** in February, burning plot in April, and planting on burned land in May. Harvest begins in late July/August. Sown on reservation or government lands, ideally on steeper, well-drained uplands.

6. **Saq'iwa**: "matahambre" system used on levee areas or low lying hills; mulching system which eliminates burning and includes nitrogen fixing agents and use of herbicides; chop the **k'unil pim** in October and plant two or three weeks later.

Interviews and visits to high secondary growth forest indicate that areas glossed as **q'iche'** tend to be about a 45 minute to 1 hour walk of the community of San Miguel. Groups of men travel during the night to hunt by moonlight. Hunting strategies normally involve a shotgun, but younger men or men who do not own a gun may go to assist or for the adventure. Going along on these trips marks young boys beginning a transition into adulthood. Although boys may accompany their fathers from the time they are 9 or 10, most reported that they learned to hunt when they were in their mid teens. Men travel in a wooden dorry, paddling through the dark waters as quietly as possible, with the goal of sneaking up on the **jalau** (*Agouti paca*) that are feeding on fallen **tuts** "cohune nuts" (*Attalea cohune*) on the river banks. The animal makes quite a racket while it is feeding, because they have sharp teeth that are able to cut through the tough shell of the **tuts**. They are also extremely fast, so hunting success is often elusive.

Local geography has historical importance for Q'eqchi' in the traditional belief system that incorporates Catholicism and the spiritual entities **tzul taq'a** (see Chapter Three). Because of this history, I recorded local place names that were mentioned in the course of other interviews (Table 5.1). However, no one mentioned names for the hills around the village, only for caves, geological formations along rivers, and other locations that are significant due to human modification such as an abandoned logging camp.

Figure 5.3 An uplands farm, **k'atik'al** "*milpa*" is in the center. Surrounding farms belonging to other families are examples of **k'unil pim**.

TABLE 5.1 SAN MIGUEL PLACE NAMES

Name in Q'eqchi'	**Description in English**
Along Rio Grande River to Tiger Cave:	
nim li ha'	first spring that fills up in the wet season with a lot of fish
k'ix pek	long piece of limestone that juts out into river, with jagged sharp edges that will cut bare feet
se ahiin	place of the alligator, where one was spotted some time ago
b'alamax	a large b'alamax tree overhangs river
se b'enq	old logging camp, from when San Miguel was first founded in the 1950s
aqm	the water source before the first cave
Miscellaneous features around San Miguel:	
chi ru lampr	the border with San Pedro Columbia that surrounds village on three sides, in places marked by barbed wire fence
se ques	Queso creek, a small creek that feeds into the Rio Grande, **taq'a li nimha'**
li china ha'	small creek that serves as main bathing and washing place during heavy floods and the rainy season, since it carries a lower load of silt and debris at that time, and a source for sardines
chi tzuul	upriver, towards the cave, to the hills
taq'a	downriver, towards Big Falls, "the valley"
Tzuultaq'a	Literally "hills and valleys"; the ancient gods of the hills and valleys, who care for animals; give humans right to hunt and fish in certain areas; and protect them from misfortune of poor crops, snake bites, sickness.
se pim	low bush
se q'iche'	high bush

Subsistence strategies and diet

The *milpa* system of agriculture, a swidden-fallow system, is the subsistence mainstay for families in San Miguel and elsewhere in Toledo. There are generally two crops of corn per year: wet season corn, grown using the more traditional method, and dry season corn or matahambre, grown using a mulching technique. Corn plays a fundamental role in social, cultural, and economic transactions. An illustration of this point is the question that people began to ask as I told them I was going to return to the U.S. They would joke, "But there is nothing to eat that side. Where will you find the **wa** **'**corn tortilla'?" A meal is not considered a "real" meal unless corn is a part of it. Corn is planted, cleared, and harvested according to lunar cycles and/or saints' days and these processes form the foundation of ritualized labor and celebration (Berté 1983; Wilk 1997).

Although two corn crops have been the norm in Q'eqchi' villages for decades (Wilk 1997), there is a trend in recent years toward reliance on the matahambre "dry season" corn. These cornfields are planted in low-lying areas such as river levees or foothills, after the vegetation–usually young secondary growth–is chopped and left to dry for a week or two. Nitrogen fixers are often sown several weeks after the corn itself to keep down weeds and grasses. Some families now rely on this second crop of corn for their sole source of corn for the year, particularly if they use leased land. This strategy is linked to increased wage labor opportunities, which provide cash to lease land and provide for the family if there is a poor crop for a given year. If agricultural decision making is based on perception of risk, as Wilk argues (1997:103), then an increased reliance on matahambre is now possible, as cash provides supplemental food sources.

Farmers generally have plots of 20 to 30 acres of leased land. Within that allotment, they might plant 3 to 5 acres in a given year. Rotation throughout the farmer's lands continues, and **awon** is planted where last year's corn crop was sown to replenish the soil. The advantage of the mulching system is that the land can sustain cropping on the same plot for several years in a row if necessary, unlike lands sown using the swidden method (Osborne 1982). A shortcoming of the matahambre method is that the crop is not as plentiful as the wet season swidden plots, but this can be overlooked if there are other means to supplement the diet (Wilk 1997). In one interview, a farmer, 35 years old and native to San Miguel remarked,

> Most people don't burn anymore in San Miguel. This time of year [April] the air used to be thick with smoke, you couldn't see anything. But now most people just plant matahambre, which means they chop the low bush and then let it dry out and then plant. They have to use the "awon". But they don't have to use so many chemicals, because they don't grow the corn for sell, only what they will need for the year. This is different from a place like Poite or Jalacte, where the people grow corn, beans, and some rice to sell "across" in Guatemala.

Strategies may also be changing because of a growing realization that reservation lands were suffering from overproduction and walking times to farms were increasing. Many families do not want to move and establish households elsewhere as they might have done in times past in the same situation. A cement house is not something you would just pick up and leave, unlike a traditional wood and thatch house that can be rebuilt in a matter of days given access to materials. One visible symptom of overproduction on farming lands near the community is an ever worsening problem with invasive grasses from South America that choke out the young **ixim** "*maize*" plants. The only defense against them is a harsh (and expensive) chemical herbicide like dramazone. Applications must increase over time to combat this grass and other invaders and this essentially eliminates the use of traditional intercropping techniques and the growth of widely used volunteer species such as **mox** (*Calathea lutea Attale*.).

As is true in other societies, such as among the Tzeltal Maya, consumption of non-cultivated species steps up during times of scarcity or when supplies of corn or meat run low (Berlin 1985; 1999). Wild greens have an important place in the Q'eqchi' diet and are eaten throughout the year, normally prepared fried or boiled with chiles. This is true for Q'eqchi' in Guatemala as well, as Booth et al. (1992) found in a nutritional study near San Pedro Carchá, where he recorded 17 species of indigenous greens. In his study, he found that socioeconomic status was not related to the intake of wild or cultivated greens, but geographic location and proximity to growing areas was.

In her study in San Miguel, Berté (1983) conducted weekly interviews in village households to document dietary intake. She observes that store-bought items were not a major portion of the diet at that time. When no money was available or the purchased items themselves unavailable, families easily supported themselves with a subsistence-based diet. During my research in San Miguel, I found that store-bought items, including processed foods such as tinned meat and bulk items such as flour, sugar, or lard, form a much larger proportion of the diet than was true two decades ago. Berté also remarks that the same pattern occurs with household items. In 1980, the substitution of manufactured commodities such as hammocks and bowls made of plastic for local craft items made primarily from forest products had yet to reach the point where people depended on them (1983). This is no longer the case. Only a handful of people in San Miguel said they can make baskets, pottery, or hammocks, and most are above the age of 50.

Home gardens and child-guided surveys

Home gardens supply households in a variety of ways with fruits, vegetables, herbs, and materials for household items such as **mach palau (***Luffa cylindrica*). Home garden surveys were conducted with 43 children between the ages of 4 and 14, in 20 different households identified using a randomized sampling technique. The children were each asked to identify all the plants with food or any other uses growing around their house. This information was then checked against a resident adult's ability to name the same plants and their uses. The method was based on the assumption that there would not be any plants that children knew that adults in the same household did not.

As described briefly in Chapter Two, conducting home garden surveys is not a new technique, in fact there are several studies that document species diversity and crop management in Maya home gardens (see for example Alcorn 1984, Vogl et al. 2002, and Caballero 1992). To my knowledge child-guided homegarden interviews have not been done prior to this study. Previous research in a Tzeltal Maya community in the Highlands of Chiapas by Stross (1973) and a follow up to that study in 1999 (Zarger and Stepp 2000) provided the impetus investigating what plants children knew in their immediate environments. This provides a contrast to information collected about development of children's expertise in the plant trail experiment, which did not traverse through any home gardens. The trail winds through an area away from immediate household environments.

The average number of plant varieties in the household gardens surveyed was 34, ranging up to 76 different varieties. These exist in a continuum between cultivated species tended regularly by household members to infrequently managed semi-wild species that are simply protected when they sprout up. Examples of species consistently planted in home gardens are **benq** (*Ocimum campechianum*) or **ox** (*Alocasia macrorrhizos*), while **matacuy** (*Annona purpea*) or ***lotsleb'*** *(Cordia diversifolia*) are semi-cultivated, or protected, species. Such protected species are often favorite snack foods for children and adults may view these as inedible. (This topic is further explored in the pile sorts section below.)

Home gardens in San Miguel contain similar numbers of species as home gardens in other lowland Maya areas. For example, Caballero (1992) reports the occurrence of 83 species in Yucatec Maya home gardens. Collins found 75 different named plant species in a survey of 20 home gardens in a Lowland Q'eqchi' community in Alta Verapaz, with the average number of species being 18.05 (2001:174). In an identical study in a Highlands community closer to Cobán, there were 111 total species, with an average of 32.2 plants per garden (Collins 2001:161). Interestingly, Collins also found that the largest number of plants occurs in just one garden, and most other gardens surveyed have numbers much closer to the average.

This is precisely what I found in the home garden surveys in San Miguel, although there were 3 gardens of the 20 that I surveyed that had more than 50 plants. All of these are elders in the community. In San Miguel older people live further away from the village center and have larger, more diverse gardens that more closely mimic the tropical forest.

There are a few exceptions to this pattern, such as families who have houses in patrilineal clusters, in which the case the land has been in use as a home garden for several decades. This is also indicative of the tendency for communities to have become more centralized over the past three or four decades (McCaffrey 1966; Schackt 1986) and a more common reliance on buying or trading for certain food resources instead of growing them oneself.

Figure 5.4 A man points out the flower of the **kala'** (*Cardulovica palamata*) in his home garden. This is one of the most widely used non-cultivated species for food and household items, and is highly managed. Young shoots are ideally harvested during the full moon, and the palms are allowed to regenerate for a couple of months before the same plants are re-harvested.

Turning to the results of the child-guided interviews in home gardens, there is a noticeable transition that occurs in plant knowledge between the ages of 4 and 7 (see Figure 5). This is precisely the time children become more significantly incorporated into daily subsistence activities. Experiences available to them in the local ecosystem exponentially increase. By age 9, all children can easily identify at least 85% of the useful plants around the house–and many others as well. As adolescence is reached, knowledge gradually, but steadily increases, to the point at which child knowledge merges with adult knowledge (represented in Figure 5 as 100% for home gardens). The results demonstrate the extensive knowledge children share about different plants in their immediate landscapes. Children enjoyed guiding me around their gardens, as the interviews provided them the opportunity to display their expertise.

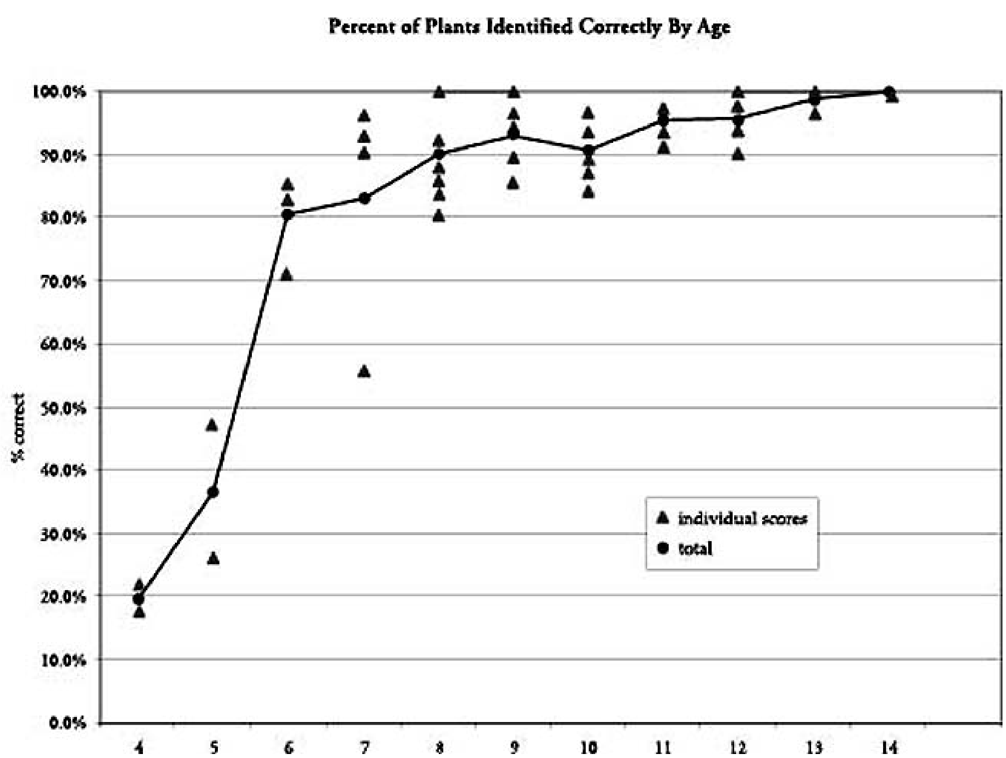

Figure 5.5 Percent of plants in home gardens identified correctly correlated with age of participants.

The results of the home garden interviews suggest that children learn plants in their immediate environment earlier in life than those found further from home. Stross (1973) describes a similar pattern among Tzeltal children, who begin to learn plants in the home.

Section II: Acquisition of Subsistence Knowledge and Development of Expertise

The second section of this chapter builds on the documentation of ethnoecological knowledge in the primary study community. The two sections reflect the two phases of data collection described in Chapter Two. The acquisition of botanical knowledge during childhood forms the focus of much of the discussion that follows on the development of expertise in the subsistence domain. Differences between children and adults' categorizations of plants are evaluated. Cultural transmission or "learning network" interviews provide insights on the distribution of subsistence-related skills among adults in different age sets

Research on cultural transmission and acquisition of TEK

I previously noted that very little research has been conducted on the acquisition of environmental knowledge by children cross-culturally (Zent 1999; Omaghari and Berkes 1997). However, there are a handful of studies that provided theoretical and methodological models that I expanded or adapted to the case at hand. Ruddle and Chesterfield's research on traditional food procurement in the Orinoco Delta, Venezuela (1977) is perhaps the closest of all previous research to the present study, as they attempt to integrate human ecology with an analysis of informal education. The authors emphasize the formalized aspects of indigenous education systems, and document a trajectory for mastery of skills during childhood. Hewlett and Cavalli-Sforza's work with the Aka in Africa (1988) and Ohmagari and Berkes's research in Northern Canada with Cree women's acquisition of bush skills (1997) provided the stimulus for the interviews conducted with adults on the acquisition of a set of culturally important skills. Research on the acquisition of botanical terminology by Tzeltal Maya children by Stross (1973) provided a model for the plant trail, which is extremely useful in obtaining data on children's ability to identify names and uses of plants at different points in their development. Previous research on tropical agroforestry practices and subsistence strategies (cf. Alcorn 1984; Etkin 1994; Posey 1984; Nations and Nigh 1980) informed the ethnoecological and home garden interviews.

The present study also contributes to a newly developing interest in acquisition and transmission by a few other researchers in the field of ethnobiology (Zent 1999; 2001, Hunn 2002; Ross 2002a, 2002b). Hunn's research in Oaxaca, Mexico, documents children's astounding depth of plant knowledge in non-western contexts (Hunn 2002). Research by Ross (2002a; 2002b) documents Lacandon men's mental models, examining changes in knowledge of forest interactions over time in a cross-sectional study. Zent conducted research on the loss of ethnobotanical knowledge among Piaroa in Venezuela and developed quantitative methods for addressing this and related research questions (Zent 1999;2001). Heckler (2002) also worked in three Piaroa communities and documented changes in TEK as an Amazonian population undergoes the transition to becoming more sedentary. She found that the use of wild plant resources was decreasing dramatically in response to social change as women's roles also changed.

Many of these studies utilize systematic research methodologies such as consensus analysis (Romney, Weller, and Batchelder 1986), forest plot interviews (Zent 1999), and sorting and freelisting flora or fauna as I have also done. The discussion section at the end of this chapter provides a synopsis of contributions of the present work to the growing body of literature on the acquisition, transmission, loss and change of TEK.

Contributions from ethnobiology and developmental psychology

Ethnobiologists have begun to note that almost no ethnobiological research has been conducted with children (Waxman 1999; Medin and Atran 1999). Medin and Atran state that this is one of the major shortcomings of ethnobiological studies to date (ibid). Stross (1973) is the oft-cited exception within ethnobiology. Dougherty's (1979) work is one of the only other ethnobiological studies of children's categorization in industrialized societies. What little research has been done is primarily in the field of developmental psychology on the transition that occurs when individuals move from "novice" to "expert" within a given domain (Johnson and Mervis 1997; Carey 1985). The majority of studies were carried out in North America (Waxman 1999:251). Waxman provides a synopsis of major findings from developmental psychology and linguistics on childhood acquisition of ethnobiological terminology. She argues that, "there are precise and powerful relations linking linguistic and conceptual development and these support the establishment of hierarchical systems of knowledge" (Waxman 1999:274). The notion that ethnobiological systems of classification are learned from infancy is also supported by Stross (1973).

Research in cognitive and developmental psychology on the transition that occurs when individuals go from novice to expert in a particular domain of knowledge, has focused in particular on the classification of natural kinds (Johnson and Mervis 1994, 1997, 1998; Medin et al. 1997; Boster 1987). Relevant to a discussion of classification of natural kinds is the notion of "rank," which is inherently different than classification of non-living objects, such as "objects to remove from a burning house" or "things to take camping." Rank refers to inclusive hierarchies, with distinct taxonomies, while some other domains are not increasingly inclusive at successive levels (Atran 1996, 1990; Berlin 1992). The purpose of such studies are varied, but have provided insight into how cognitive abilities may develop over time as children grow and gain more experience with the world, as perceptual knowledge and conceptual knowledge begin to overlap (Johnson and Mervis 1997; Carey 1985). The research is also concerned with the ways knowledge about item behavior, utility, and other background information contributes to categorization priorities, in relation to perceptual and morphological features (Boster 1987; Berlin 1992; Johnson and Mervis 1998; Medin et al. 1997). This is illustrated in the intellectualist/utilitarian debate in ethnobiology (cf. Berlin 1992; Ellen 1996), and is also treated in a series of articles in the 1980s and 1990s in cognitive psychology, as researchers sought to determine if utility or goal-directed theories affected classification in certain domains of knowledge (Medin et al 1997).

Does categorical knowledge change as a function of domain expertise?
This question is addressed in the presentation of pile sort data in Section II. In a series of cross-sectional studies by Johnson and Mervis (1994, 1997, 1998) experiments were conducted with expert birders, intermediate birders, and fish experts. The experiments

included triads tests, pile sorts, and auditory stimulation (birdsongs), to test how quickly novices and experts grouped different species, and how morphology and perceptual features were reflected in similarity judgements. Results indicate that perceptual and morphological features are privileged in the reasoning process. That is, novices usually group different items on the basis of perceptual features, such as wing shape, fin size, markings, and number and placement of toes. Experts could also perform better than novices on the task that involved recognizing a bird based only on the silhouette or shape and even faster when the birdsong could be heard. This may be due to the fact that those stimuli best represent the actual conditions that birders experience in the field as they attempt to identify birds at great distances, who are moving about, etc. (Johnson and Mervis 1997).[4] Boster (1986) conducted research on distribution and variation of cultural knowledge among Aguaruna manioc cultivators (among other things), which led him to assert that categorization is based on perceptual characteristics, but deeper knowledge and experience in a given domain may enable experts to distinguish finer, more subtle features that a novice may miss.

Another concern of the literature on development of expertise is with what constitutes a universal or "basic" level category for biological kinds. Several studies have been designed to investigate a shift in the basic level as a result of expertise or experience with a given domain. The question arises out of recognition that US populations categorize the "life-form" level as the basic level, while for those in non-western contexts the generic level is the basic level. Ultimately, many research findings

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[4] This provides corroborating evidence that environmental knowledge and skills are inextricably linked to daily experience and the situations in which expertise or skills are acquired (Rogoff 1990; Kirschner 1997; Hutchins 1991).

in cognitive psychology on the topic are largely in keeping with ethnographic, ethnobiological studies on the primacy of the generic category (Berlin 1992).

Pile Sort Interviews with Children and Adults

It is often helpful for researchers to find out how participants categorize and think about the relationships among different plants. This includes how humans use plants, what plants may look, feel, smell, or taste like, and cultural significance attached to plantlife. Pile sorts are one way to better understand these cognitive and behavioral dynamics. The method allows the researcher to document which plants or animals are more similar to one another in ethnobiological systems of classification (Weller and Romney 1988). Pile sort data can also be used to determine the amount of agreement informants have about a particular domain of knowledge and to determine subgroups within populations (Nolan 2002; Boster and Johnson 1986). As mentioned in Chapter Two, pile sorts have infrequently been carried out with children (Roos 1997).

Three different types of pile sorts were carried out with a randomly selected group of children and adults: one unconstrained sort and two constrained sorts. Each participant was asked to perform the three sorts with the same 60 cards. Unconstrained pile sorts require the participant to decide which piles or categories he or she will make and how many are necessary. Constrained sorts involve categories that are pre-described by the researcher, to further elucidate some cultural pattern of interest that appears to fall within a salient domain. In this case, the constrained sort categories were based on prior interviews on management and cultivation of food resources.

Unconstrained pile sorts

Thirty-two children and six adults participated in the unconstrained pile sort interviews. I asked participants to place those cards together that "seemed to go together" or were similar in some way ("**K'iru wankeb' juntaket**?"). This was done until all cards were sorted into piles or left to form their "own" piles of one because they were not similar to any other plant. Rationales for creating different piles were recorded and these were analyzed for common themes across participants.

A tabulation of the different rationales that children used to sort plants indicates that most children ascribed both morphological and utility-based reasons for relationships between plants. Out of the 29 children who completed unconstrained sorts, 4 sorted solely on utility and 11 sorted only by morphology. The remaining children sorted based on both types of characteristics (14). Children tended to agree more consistently on those plants that were placed in the same piles because of morphological similarities than those plants that were grouped based on utility. This is evident in Table 5.2. Plants grouped by utility were comprised of a broader set of determining characteristics, with many rationales mentioned only by one child. For the most part, morphological rationales accounted for over half the explanations unless the child sorted entirely based on utility. A fundamental tendency for children to sort plants on perceptual characteristics is consistent with Berlin's assertion that,

> The categorization of plant and animal taxa into a general system of ethnobiological classification is based primarily on observed morphological and behavioral affinities and differences among the recognized taxa (1992:21).

A child's age is not definitively linked to certain types of rationales, but a few differences exist between older and younger children that provide interesting insights into how children think about plants in their local environment. One hypothesis I was interested in exploring with the unconstrained pile sorts was the possibility that younger children might sort primarily on the basis of utility, while the older children would focus on morphology. This hypothesis arose from a previous plant trail study that I carried out in Chiapas in 1999 (Zarger and Stepp 2000). In that study, younger children appeared to learn cultivated plants first, that is, common cultivars were correctly identified by almost all children, including the youngest participants (4- 5 years old). I was interested in finding out why this might be the case, if morphology precedes utility in overall salience. I wondered if a similar situation would be found among Q'eqchi' children. I also hypothesized that older children would also have to become more proficient at differentiating between plants that look very similar as their expertise grew, therefore they might consider perceptual qualities more often.

This hypothesis was not borne out in the results for the pile sorts. In fact, younger children sorted primarily on morphological characteristics, not based on utility. Older children tended to sort by a combination of morphology and utility. Children of all ages sorted based on morphological (perceptual) characteristics more often than they sorted based on uses for those plants. I found during the plant trail interviews that young Q'eqchi' children were also much better at correctly identifying the cultivars on the trail than the other classes of plants. Based on data from the two plant trails in Chiapas and in Belize, and the pile sort interviews, it is likely that children acquire the ability to name cultivated plants first because those are the first plants they encounter on a regular basis as infants. During infancy, it may be the case that morphological characteristics form the basis for primary acquisition of a particular plant, and they are gradually associated

Table 5.2 Rationales for sorting in the children's unconstrained pilesorts. Numbers indicate the number of children using each rationale at least once in their sorts.

MORPHOLOGY	UTILITY
Leaves look similar (20)	Things that are used to prepare caldo (12)
Similar fruit (12)	Good to eat (11)
Size of trunks, similar trunks (**che'**)(8)	Plant around the house (2)
Grows like a vine (**q'aham**) (6)	Eat the fruit (7)
Flowers similar (5)	Good to drink (7)
Color of fruit when ripe (5)	Inedible (6)
Leaves have prickles (**k'ix**) (3)	Eat the fruits when they turn yellow or red (5)
Same roots (3)	Used for wrapping food (**mox**) (4)
Large trees (**te'**) (3)	Use plants to make household items (3)
Just grow by themselves (wild) (1)	Ground foods (roots or tubers) that can be eaten (2)
Same taste (1)	Firewood (2)
Looks like grass (**pachaya'**) (1)	For bathing or washing (2)
	Trees that grow tall because people don't chop them (1)
	Trees people chop for *milpa* (1)
	Trees that bear fruits twice a year (1)
	We eat these in the forest (1)
	Can cut your hand or has bugs on it (1)
	Makes skin itchy (1)

with uses within the household. Stross (1973) also notes that babies first learn to name plants that are often used in the home.

Boster and Johnson (1989), in a similarly designed pile sort study with adults, also found that novices tended to sort marine fish by morphological features, while experts sorted based on a combination of utility and morphology. Boster and Johnson used photos and drawings for their sorts. The results with Q'eqchi' children suggest that a similar pattern may be a possible indicator of developmental changes in reasoning. Out of the 14 children who sorted on a combination of uses and morphology, the younger respondents tended to cite only a few (5-10%) utility-based rationales, and the rest were morphological (often based on similar looking leaves, trunks, or fruit). For children above the age of 10, at least 50% of their rationales were utility-based, and the number was often higher. It appears that as children mature (both cognitively and socially), they begin to overlay foundational knowledge based on perceptual characteristics with experiences of using those plants of daily life. Longitudinal research with a larger sample of children would provide more detailed information about when and how children move from novices to experts. This transition is also discussed in more detail in the Plant Trail section found in this chapter. The plant trail provides more rigorous results on the relationship between ethnobotanical knowledge and age.

Although an observable pattern was found *within* the group of children who sorted on a combination of use and morphology, what about the children who sorted based only on one or the other? The split suggests that more research is necessary before conclusions can be made. Of the children who sorted only by morphology, it may be that their ethnobotanical knowledge is less developed than children the same age who participated in the study. In the case of the four children who sorted only based on utility, it is probably the case that these were the "lumpers," those who tend to parse items in a few large groups instead of many smaller ones. This is a situation that often arises in pile sort studies (Weller and Romney 1986). Another factor may be the stimulus used in the study. A comparison between this study that used photos of plants and one with plant names only written on cards would assist in determining whether children tended to sort more often based on morphology because they had "images" to work with instead of cultural schemas generated just by hearing the name of the plant, as Borgatti suggests may be the case (1994). Based on previous studies and what is known about plant classification I would be surprised if the results were significantly different.

Constrained pile sorts

In addition to the unconstrained sort that I asked children and adults to do, there were two sets of constrained sorts with the same 60 plants. The interviews tended to stretch to two or two and a half hours when participants did the unconstrained and both constrained sorts, which is asking a bit much of the attention span of most seven year olds. So, I randomly alternated between the two types of constrained sorts with all the children. With constrained pile sorts, the "piles" into which participants are asked to sort the cards are determined by the researcher, not by participants. I was interested in exploring two main topics with these sorts: the continuum of cultivated and non-cultivated plants in the local environment and the categorization of certain plants as far as edibility and whether or not they are considered the primary or "active" domain of children. I'll discuss the results of the plant management sorts first, followed by a discussion of the edibility categorizations.

Cultivated/management continuum sorts

The first constrained set was based on conceptualizations of cultivated (**tintoo ta'wow, awimk**), semi-cultivated (**joq'ejak ta'wow**), and wild (**muku ta'awow**, **namok**) within the primary study community. This sort was done with all adults and half of the children. The "piles" in which children placed cards were recorded and the answers for each participant placed in an item by item proximity matrix, based on which cards

Table 5.3 Plants used in Pile Sort Interviews

No.	Q'eqchi' Name	English Name	Scientific Name	Family	Description
1	**mach palau**	luffa, sponge	*Luffa cylindrica (L.) M. roem.*	Cucurbitaceae	semi-cultivated, used for scrubbing when bathing
2	**mox**	Waha leaf	*Calathea lutea Attale.*	Marantaceae	leaf preferred one used for wrapping poch, tamales
3	**k'an te'**	madre cacao	*Gliricidia sepium (Jacq.) Stead.*	Fabiaceae-Papilionoideae	wood used for door frame, living fence post
4	**lotsleb'**	glue tree	*Cordia diversifolia Pavon ex DC.*	Boraginaceae	juice from fruit used as glue for paper
5	**masapan**	breadfruit	*Artocarpus altilis (Parkinson) Fosberg*	Moraceae	cultivar, edible fruit
6	**noq'iritimis**	cat's balls	*Theuetra ahouai (L.) A. DC.*	Apocynaceae	eat white flesh inside bright red fruit
7	**pata' che'**	wild guava	*undetermined*		edible fruit, used for ammunition in sling shots
8	**sajab'**	pot scrubber	*Curatella americana L.*	Dilleniaceae	use leaves to scrub pots
9	**nimka ik**	big chile	*Capsicum var.*	Solanaceae	edible cultivar
10	**chi kai**		*Calathea lutea (Aubl.) G. Mey*	Marantaceae	edible inflorescence, used in caldo
11	**karabans**	string bean	*Phaseolus spp.*	Fabiaceae-Papilionoideae	edible cultivar
12	**kaqitul**	red plantain	*Musa x paradisiaca L.*	Musaceae	cultivar, edible fruit
13	**ch'op**	pineapple	*Ananas comosus (L.) Merr.*	Bromeliaceae	cultivar, edible fruit
14	**ox**	cocoyam	*Alocasia macrorrhizos (L.) G. Don*	Araceae	cultivated tuber
15	**xaq ceboyx**	green onion	*Allium cepa L.*	Alliaceae	edible cultivar
16	**ik**	chile	*Capsicum var.*	Solanaceae	edible cultivar
17	**okr**	okra	*Abelmoschus esculentus (L.) Moench*	Malvaceae	edible cultivar
18	**atz'um**	hibiscus	*Hibiscus spp.*	Malvaceae	Aesthetic value

19 **xiyow**	annato, achiote	*Bixa orellana L.*	Bixaceae	cultivar widely used herb for cooking
20 **matacuy**	cowsop	*Annona purpea Moc. & Sesse. Ex Dunal*	Annonaceae	cultivar, edible fruit
21 **cacao**	cocoa	*Theobroma cacao L.*	Sterculraceae	cultivar, roast seeds for traditional beverage, edible mesocarp
22 **chi'**	craboo	*Byrsonima crassifolia (L) H.B.K.*	Malpighiaceae	cultivar, edible fruit
23 **kape**	coffee	*Coffea arabica L.*	Rubiaceae	cultivar, seeds roasted for beverage
24 **cooc**	coconut	*Cocos nucifera L.*	Arecaceae	cultivar, edible fruit
25 **samat**	kulantro	*Eryngium foetidum L.*	Apiaceae	semi-cultivated, used as spice
26 **map**	suppa palm	*Acrocomia aculeata (Jacq.) Lodd. Ex Mart.*	Arecaceae	edible cultivar
27 **okox**	mushroom	*Squamulose lichen, Cladonia sp.?*		wild edible found on downed wood
28 **kulant**	cilantro	*cf. Eryngium foetidum*	Apiaceae	cultivar, herb used in cooking
29 **kaqkaq**	gumbo limbo tree	*Bursera simaruba L. Sarg.*	Burseraceae	used for firewood, lumber
30 **mokoch**	cohune palm	*Attalea cohune Mart.*	Arecaceae	leaf used for thatch, edible heart ("cabbage"), & etc.
31 **inup**	cotton tree, ceiba	*Ceiba petandra (L.) Gaertn.*	Bombacaceae	protected tree, cotton used for pillows
32 **papay**	papaya	*Carica papaya*	Caricaceae	cultivar, edible fruit
33 **callaloo**	callaloo	*Ameranthus dubius Thell.*	Amaranthaceae	edible greens
34 **kala'**	jippy jappa	*Cardulovica palamata Ruiz & Pav.*	Cyclanthaceae	used for baskets, edible shoots
35 **badoo/baloo**		*Alocasia macrorrhizos*	Araceae	cultivated tuber
36 **benq**	basil	*Ocimum campechianum Mill.*	Lamiaceae	cultivated herb used in cooking

37 **arroz**	rice			cultivated grain
38 **ch'on te'**	wild papaya	*Carica papaya L.*	Caricaceae	edible fruit
39 **kayamit**	star apple	*Chrysophyllum cainito L.*	Sapotaceae	cultivar, edible fruit
40 **tul**	plantain	*Musa x paradisiaca L.*	Musaceae	cultivar, edible fruit
41 **sakitzin**	white cassava	*Manihot esculenta*	Euphorbiaceae	cultivated root crop
42 **b'il**	basket tie-tie	*Desmoncus orthacanthos Mart.*	Arecaceae	used to make baskets
43 **ch'ima**	chocho, chayote	*Sechium edule (Jacq.) Ws.*	Cucurbitaceae	cultivar, edible fruit
44 **xan**	bay leaf, sabal	*Sabal mauritiiformis (H. Karst) Griseb. & H. Wendl. Ex griseb.*	Arecaceae	used for thatch, edible heart
45 **marallon**	cashew	*Anacardium occidentale L.*	Anacardiaceae	cultivar, edible fruit
46 **jolob'ulb'**	monkey apple	*Licania platypus (Hemsl.) Fritsch*	Chrysubalanaceae	edible fruit
47 **kis k'im**	lemon grass	*Simbapogon citratus (D.C.) Stapf.*		cultivated herb used as medicine and beverage
48 **pata'**	guava	*Psidium guajava*	Myrtaceae	cultivar, edible fruit
49 **jom**	calabash	*Cresentia cujete L.*	Bignoniaceae	cultivated, fruits used as containers
50 **xanxivre**	ginger	*Zingiber officinale Roscoe*	Zingiberaceae	cultivated spice
51 **ixim/jal**	maize	*Zea mays L. subsp. Mays.*	Poaceae	cultivar, staple food
52 **sakik'ib'**	long leaf, pacaya	*Chamaedorea tepejilote Liebm.*	Arecaceae	wild edible
53 **pekayuch**	water vine	*undetermined*		liana cut for drinking water in jungle
54 **utz'aj**	sugar cane	*Saccharum officinarum*	Poaceae	cultivar
55 **teb'**	English thyme, oregano	*Plectranthus amboinicus*	Lamiaceae	cultivated herb
56 **che' kape**	big coffee	*Casearia corymbosa*	Rubiaceae	cultivated local coffee
57 **merican likape**	coffee variety	*Coffea arabica L.*	Rubiaceae	cultivated local coffee
58 **chi k'il mox**	waha leaf	*Calathea sp.*	Marantaceae	protected species, used to wrap food for cooking or transport
59 **rum pook**	golden plum, hog plum	*cf. Spondias radlkoferi Donn. Sm., or Spondias mombin*	Anacardiaceae	cultivated, edible fruit
60 **lamux**	Lime	*Citrus limonia Osbeck*	Rutaceae	cultivated, edible fruit

were sorted together. An average aggregrate proximity matrix based on all participants' responses was then created in ANTHROPAC (Borgatti 1994). With the aggregate matrix I was able to produce non-metric multi-dimensional scalings (MDS) of the adults and children's sorts, which provide a rough guide to the manner in which they categorized the 60 plants in the experiment. In this case, there are three possible categories. An MDS analysis is considered to be relatively accurate if the stress in two dimensions is equal or less than "0.1". The graph itself is merely a representation of distances between items based on the similarity matrix (Borgatti 1994). Distances between points on an MDS are related to degree of similarity between different participants' sorts.

Figures 5.6 and 5.7 are the MDS graphs for the cultivar sorting task. For both MDS graphs the stress loadings fall within the acceptable range, which indicates that the aggregate responses are approximated in graphic form. In figure 5.6, the adult sorts, non-cultivated plants are clearly grouped together on the left side of the diagram, while cultivated foods are clustered together on the right. In the center are those foods that fall into the semi-cultivated, "in between" category. **K'is kim** (*Cymbapogon citrata*), **kayamit** (*Chrysophyllum cainito*), and **mox** (*Calathea lutea*) are plants located in the "in between" category I asked people to consider, species that are sometimes cultivated and other times volunteer or regenerate.

Figure 5.7, the MDS of children's sorts, differs from the adults in several important ways. First, children have more variation in their sorts than adults, even though there were four times as many of them included in the sample. Non-cultivars are grouped on the left, while cultivars are on the right, and a scattering of plants in the middle of the diagram is the "in between" category. This indicates that younger children are less sure about what is actually cultivated and what is a non-cultivar. As they mature, children approach the adult mode of categorization. Children often placed the plants they were unsure about in the semi-cultivated pile. However, many of the plants children placed in the middle pile can be considered “volunteer” plants that are often found in abandoned household sites or in the forest. So in a technical sense, adults know these plants are human managed, even if they continue to regenerate without reseeding in secondary growth areas. Younger children are not immediately aware of this fact, and so place plants such as **xanxivre** “ginger” and **jom** “calabash” in the semi-cultivated category.

Edibility sorts

One of the interests I had in the study was to determine if there are certain types of foods that are considered primarily children’s “active domain” (or others that may be considered adults’ active domain). Wilk (1997) previously noted that there were certain wild foods that are primarily children’s foods. For the edibility sorts, 15 children and 4 adult participants sorted the same 60 cards into piles based on edibility and who might eat fruits, flowers or other plant parts. The four categories were: inedible (**muku tatkuxta**), “everyone eats them” (**re li kristian**) “adults eat them” (**re li yuwaeb’, re li yawaeb’**), and “children eat them” (**reheb’ li kok’al**).

For the edibility sorts, non-metric multidimensional scaling was performed on two separate aggregate matrices, one for children and the other for adults’ responses. Consensus analysis was also done on the individual proximity matrices for all participants. The MDS results are presented first. Figures 5.8 and 5.9 are MDS plots of adults’ and children’s sorts. The ovals on each graph indicate the strongest clustering around three groups: inedible plants, grouped on the left; plants children eat on the far upper right; plants everyone eats on the lower right; and plants adults eat are in areas outside the ovals. The differences between children and adults are mainly in regards to plants considered for the "adults eat" pile. Children typically placed more plants into this category, based on unfamiliarity or ones they do not prefer. An excellent example of this is **xan** (*Sabal mauritiiformis*). The heart or **k'ib'** "cabbage" of this palm is edible, usually roasted on the fire for many hours. It has a somewhat bitter taste, although the longer it is roasted, the less bitter it becomes. This is referred to as one of the foods that "the old people used eat when they lived in the jungles". It is preferred by some, but **li xan** is not necessarily a high status food item and is probably eaten less often now than in times past. Many children did not know this was edible and put it into that pile. The ones who did know the plant placed it into the "adults eat" pile, because they often complain that it's bitter if they do eat it in their own households. Some adults also stated that this falls into the "inedible" category.

Figure 5.9 contains 4 ovals, the smallest one indicating that children grouped the coffee varieties and lime (**lamux** and **kape**) together, appearing close to the indeble group in the MDS. The fact that this grouping does not show up in the adult's sorts reflects the fact that children interpreted the question, "who *eats* this plant?" in a more literal fashion, while adults considered eating and drinking to fall into the same category. It also seemed children grouped these apart from other fruits that are edible in a raw state, as they are not as tasty when eaten right off the tree. Children also seem to agree more than adults about which plants are considered part of the active domain of children.

In addition to the MDS, consensus analysis was performed based on the individual proximity matrices of children's and adults' sorts to what, if any, pattern of agreement exists among the participants (Romney et al. 1986; Borgatti 1994; Nolan 2002). Consensus analysis is a method developed to measure agreement between informants about a given domain of knowledge. The method uses factor analysis to calculate level of agreement between informants, to determine how much knowledge each informant shares with others interviewed (Romney et al 1986). Consensus analysis was performed with ANTHROPAC data analysis software (Borgatti 1994). The output of the consensus analysis module provides eigen values (divided into 1st, 2nd, and 3rd), which indicate the degree to which informants agree. A strong consensus exists among the group if the first eigen value accounts for a large proportion of the variance in the sample, generally three times larger than the second factor (Johnson 1990).

The expected results of the consensus analysis were that children would agree most with one other and adults would also have more intragroup agreement. The eigen values generated from consensus analysis itself indicate that there is a high level of cultural agreement for children and adults. Tables 5.9 and 5.10 summarize the eigen values for the edibility sorts; the values do fall within the constraints of the consensus analysis model. To ascertain patterns of intragroup variation, I turned to MDS analysis. From the agreement matrix generated by consensus analysis module in ANTHROPAC, I had hoped to create an MDS of children and adults' agreement with one another. In this case, informants are plotted against one another instead of the *items* that informants sort, to assist with identifying subgroups within the informant sample. Ideally, I should have been able to identify that the children all clustered together in one or two groups, and adults clustered together in their own group, if there were significant differences between the way adults and children categorized the plants. In fact this did not turn out to be the case. The stress loadings in the analysis were insignificant when children were plotted only with one another and together with adults. MDS did not prove to be helpful in visualizing the agreement between children of different ages, nor where adults a distinct subgroup from children.

Table 5.4 Eigen values from consensus analysis for children's edibility pile sorts.

FACTOR	VALUE	PERCENT	CUM %	RATIO
1:00	4.494	72.7	72.7	4.106
2:00	1.095	17.7	90.4	1.849
3:00	0.592	9.6	100	
	6.18	100		

Pseudo-reliability = .862

Table 5.5 Estimated "knowledge" of each child for the edibility sorts, a score generated as on output of consensus analysis in ANTHROPAC.

Estimated Knowledge of each Respondent		
AGE	GENDER	SCORE
14	F	0.45
10	F	0.46
9	M	0.47
8	M	0.50
9	F	0.51
7	F	0.51
12	F	0.52
12	M	0.53
8	F	0.53
7	M	0.54
12	F	0.58
10	F	0.58
11	F	0.61
13	F	0.64
13	F	0.72

In Table 5.5 are the "scores" that measure children's agreement in the edibility sorts. Although an MDS did not illustrate any pattern among the children, the scores presented a few interesting results. First, there does not seem to be greater agreement based on age. Note that the two most extreme scores were for girls ages 13 and 14 respectively. Part of this may be that agreement among all children was fairly high. There are two instances of higher agreement between children who are members of the same household/kin group. The two girls (ages 10 and 12) who have the score ".58" are sisters. The 7 year old girl with at score of ".51" and the 12 year old girl with the score ".52" are first cousins, live next door to each other, and are usually found in one another's company.

Although these results are preliminary, it would perhaps be worthwhile to follow up this study with a larger sample of children to determine if kinship and household social networks are related to agreement between children. As the sample is rather small and there are two such instances, I argue that the quantitative data triangulate with the data presented in Chapter Four, which indicates that such knowledge is usually acquired from older siblings and cousins or friends in nearby households.

Table 5.6 Eigen values from consensus analysis for adults' edibility pile sorts.

FACTOR	VALUE	PERCENT	CUM %	RATIO
1:00	1.269	86.6	86.6	8.533
2:00	0.149	96.7	96.7	3.086
3:00	.048	100.0	100.0	
	1.466	100.0		

Pseudo-reliability = .644

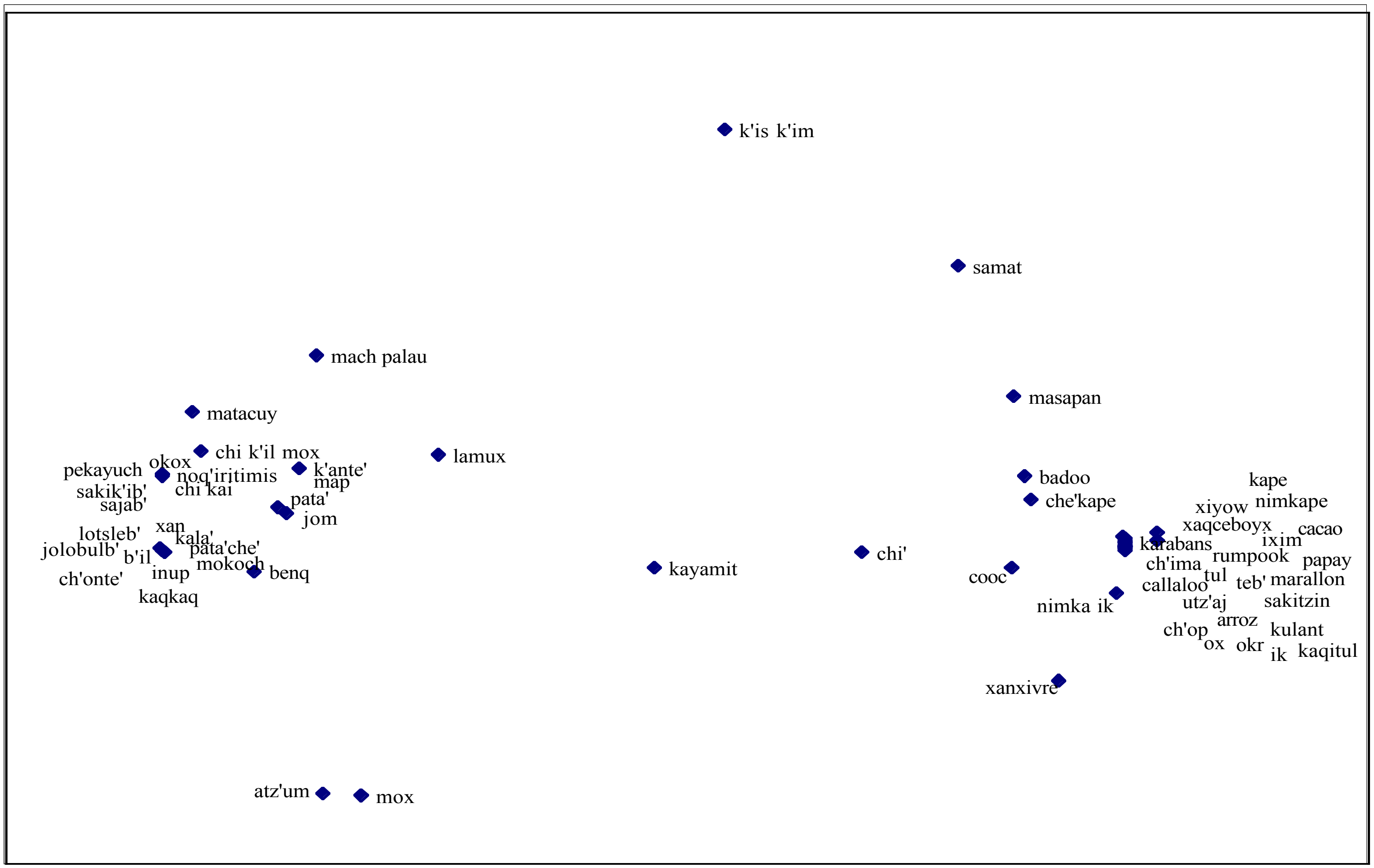

Figure 5.6 MDS of Adult's cultivar/management continuum. Noncultivated plants are grouped on the left, while cultivated are on the right. Stress in two dimensions is .046. Scientific names for all plants used in the pile sorts may be found in Table 5.3

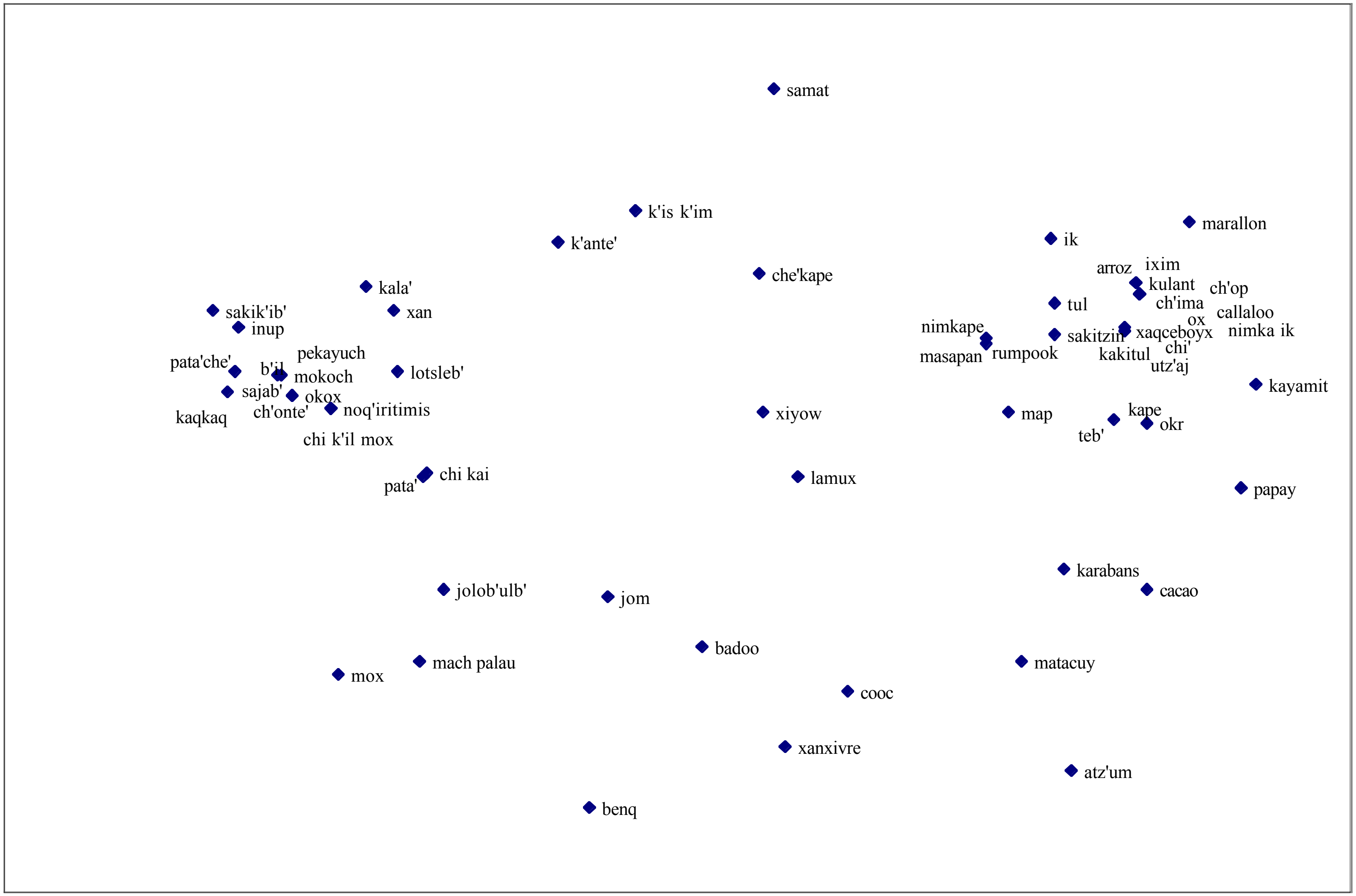

Figure 5.7 MDS plot of children's sorts for the cultivar/management continuum. Stress in two dimensions is .10.

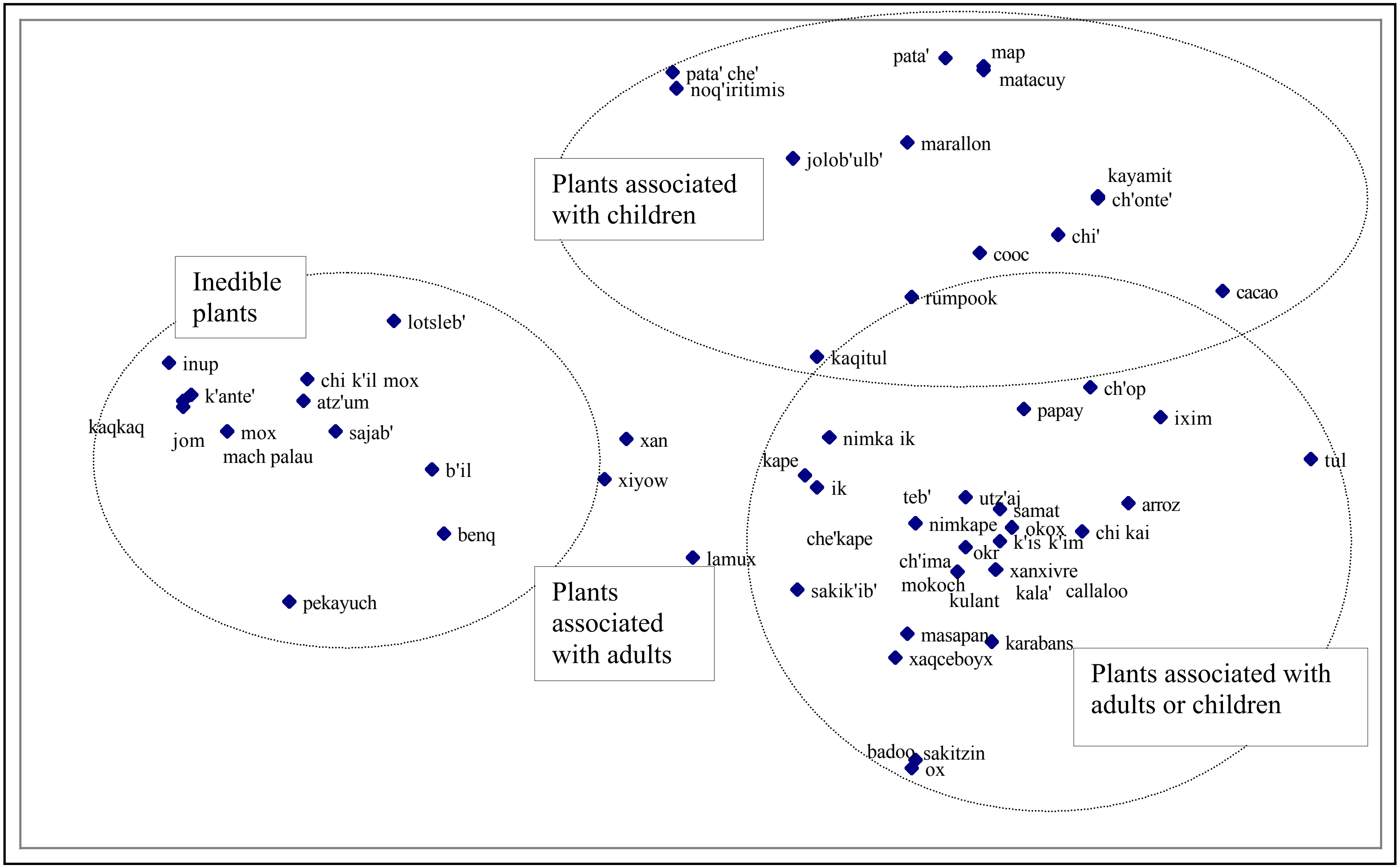

Figure 5.8 MDS of adults' sorts on the edibility scale. Stress in two dimensions is .096.

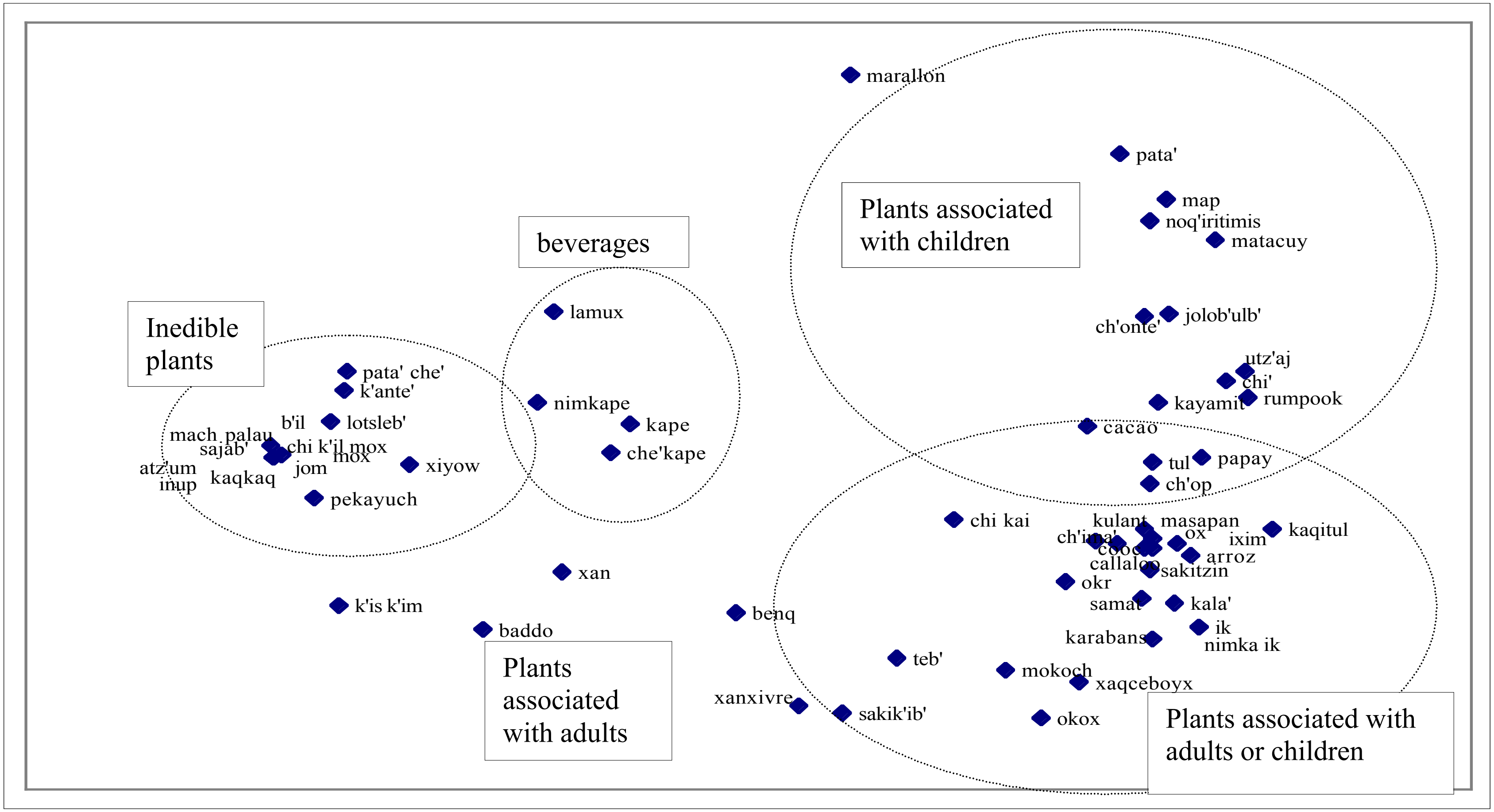

Figure 5.9 MDS of childrens' sorts on the edibility scale. Stress in two dimensions is .092.

Freelist Interviews

Freelists are useful in indicating the most salient, frequently reported items assigned to a particular domain of cultural knowledge, in this case, food resources. The methodology is deceptively simple, but typically provides very useful data about the domain in question. During the freelist interviews, adults and children were asked, **"Kiru chi wajol ha nakakux?"** "Can you tell me all the kinds of foods there are?" and the responses were recorded in Q'eqchi' in the order they responded and later translated into English and tabulated (Weller and Romney 1988). The lists were analyzed using the freelist module in ANTHROPAC software package (Borgatti 1994). This produces lists of frequencies for each food resource listed, along with a salience ranking (Smith's S), and average rank order. It is interesting that for the children, just because an item was listed most often, in this case orange, it did not mean that it was ranked first in the order they listed the foods.

The freelist interviews consisted of 32 children, the same one who participated in the pile sorts, and 32 adults, who were did not participate in pile sort interviews. The children's lists were collected at a different time than the adults'. There were actually 75 adult freelists, but the smaller sample of 32 was randomly chosen to set up an equal comparison with the children (ANTHROPAC freelist module only accepts up to 50 different freelists). Tables 5.7 and 5.8 only represent a subset of all foods listed. For children, the table includes all foods listed by at least 5 participants. For the adults, the table includes all foods listed by at least 4 participants.

Table 5.7 Children's food freelist results, foods ranked by frequency.

Food items listed in Q'eqchi'	Food items listed in English	Frequency: no. times mentioned	% Respondants who listed item	Average rank order listed	Smith's S (measure of salience)
CHIIN	Orange	23	72	10.783	0.412
COOC	Coconut	18	56	8.667	0.364
KENQ	Beans	18	56	7.5	0.416
MANK	Mango	18	56	8.778	0.382
CHILAN	Chicken	18	56	7.111	0.389
TUL	Banana	18	56	12.722	0.287
KAPE	Coffee	17	53	11.294	0.292
WA	Corn tortilla	16	50	7.313	0.361
CACAO	Cocoa	16	50	11.875	0.283
ARROZ	Rice	14	44	7.429	0.328
HARIN	Flour	13	41	9.231	0.275
KUY	Pork	13	41	10.077	0.219
RUM	Plum	12	38	12.5	0.196
O'	Avocado	12	38	13.833	0.196
PATA'	Guava	11	34	18.091	0.136
IK	Chile	10	31	18	0.122
CH'OP	Pineapple	10	31	17.3	0.113
PAPAY	Papaya	10	31	13.7	0.154
KALA'	Jippy jappa	9	28	6.333	0.211
CHI'	Craboo	9	28	12.667	0.152
KAR	Fish	9	28	12.111	0.164
KOOLAID	koolaid	9	28	10.778	0.13
LAMUX	Lime	9	28	14.889	0.112
PIAK	Yam	8	25	16.375	0.119
PATZ	Duck	8	25	13.625	0.102
SENTI	Watermelon	8	25	11.5	0.124
OX	Cocoyam	8	25	16.5	0.106
SALTUL	Mamey	7	22	17.714	0.093
IDEAL	Icepop	7	22	13.429	0.112
LIIM	Sweet lime	7	22	17.286	0.083
UTZAJ	Sugarcane	7	22	15.143	0.096
PIXP	tomato	7	22	12.286	0.131
WAKAX	Beef	7	22	13	0.078
OKR	Okra	6	19	11.667	0.122
MOKOCH	Cohune	6	19	6	0.155
COKE	Coke	6	19	10.667	0.105
MATACUY	Cowsop	5	16	18.8	0.061
ANAAB'	Soursop	5	16	17	0.071
JALAU	Gibnut	5	16	14	0.062
PAN	Bread	5	16	8.2	0.105
TZIN	Cassava	5	16	14	0.092
MAP	Suppa palm	5	16	21.6	0.049

Table 5.8 Adult's food freelist results, foods ranked by frequency.

Food items listed in Q'eqchi'	Food items listed in English	Frequency: no. times mentioned	% Respondants who listed item	Average rank order listed	Smith's S (measure of salience)
ARROZ	Rice	30	94	3.767	0.768
HARIN	Flour tortilla	27	84	4.296	0.661
CHILAN	Chicken	25	78	5.4	0.551
WA	Corn tortilla	23	72	1.739	0.694
KENQ	Beans	19	59	6.947	0.377
TUL	Banana	17	53	8.176	0.275
KAR	Fish	16	50	10.75	0.186
TZIN	Cassava	16	50	7.125	0.286
WECH	Armadillo	12	38	10.333	0.152
JALAU	Gibnut	12	38	11.583	0.157
KALA'	Jippy jappa	11	34	7.455	0.207
CALLALOO	Callaloo	10	31	11.3	0.104
MOKOCH	Cohune	10	31	10.7	0.106
KUY	Pork	9	28	8.222	0.15
CH'OP	Pineapple	9	28	9.111	0.158
AAQ	Peccary	9	28	12.778	0.079
OKR	Okra	8	25	9.25	0.123
PIXP	Tomato	8	25	6.375	0.161
PAPAY	Papaya	8	25	8.25	0.138
YAMPA	greens	8	25	10.125	0.111
MOLB'	Egg	8	25	10.25	0.1
OX	Cocoyam	7	22	9.571	0.089
MANK	Mango	7	22	10.714	0.099
PIAK	Yam	6	19	8.167	0.109
CHIIN	Orange	6	19	12.5	0.078
KULANT	Cilantro	6	19	11.5	0.081
IK	Chile	6	19	13	0.077
SAUSAGE	Sausage	5	16	8.2	0.073
TAP	Crab	5	16	9	0.076
WAKAX	Beef	5	16	9	0.089
ICHAJ	Chaya/greens	4	13	12	0.035
IS	Potato	4	13	9.25	0.058
COOC	Coconut	4	13	17.5	0.037
CHI'	Craboo	4	13	18	0.033
POCH	Corn dumpling	4	13	9.5	0.055
KEJ	Deer	4	13	11.25	0.044
PATZ	Duck	4	13	9.25	0.067

Freelists of food resources from interviews with children and adults provide some insight into differences between children's diet and that of adults as well as what community members prefer to eat. Children, on the whole, list fruits much more frequently than adults. I was quite surprised to see that **chiin** "orange" was listed most often rather than **wa** "corn tortilla" or **arroz** "rice". This probably reflects the predominance of fruit in children's diets, as children snack on different fruits throughout the day if they can be obtained. Adults on the otherhand, listed the staples of the diet such as **wa** "corn tortilla" and **harin** "flour or flour tortilla" and **kenq** "beans" first almost every time. The "top ten" foods listed by adults were mentioned by almost all participants. Adults agree much more about the first items they list than children. "Bush meat" also appears quite high on the list for adults, more so than children. If the entire lists for children and adults are considered, game meat is found throughout. According to a survey commissioned by the Forest Department, bush meat such as **aaq** "peccary" and **wech** "armadillo" is consumed an average of once a week in 11 communities in Toledo where surveys were done (Campbell and Mitchell 1998). My data, based on my own records from meals with different families match these. Socioeconomic differences often affect the consumption of bush meat, however, as wage laborers do not have time to hunt on a regular basis (but they are also able to buy the meat from others). For these reasons, their appearance on the food frequency lists can be seen as also representative of what people are consuming.

Consensus analysis provides an indication of how widely distributed knowledge of food resources is among children and adults (Tables 5.9 and 5.10). There is very high agreement within this domain, as the first two eigen values account for 98% of the variation in the sample (Romney et al. 1986).

Table 5.9 Eigen values from consensus analysis of children's food freelists.

FACTOR	VALUE	PERCENT	CUM %	RATIO
1:00	21.804	95.0	95.0	31.898
2:00	0.684	3.0	98.0	1.462
3:00	0.467	2.0		
	22.955	100.0	100.0	

Pseudo-Reliability = 0.985

Table 5.10 Eigen values from consensus analysis of adults food freelists.

FACTOR	VALUE	PERCENT	CUM %	RATIO
1:00	20.979	92.6	92.6	22.378
2:00	0.937	4.1	96.7	1.269
3:00	0.739	3.3	100	
	22.655	100.0	100.0	

Pseudo-reliability = 0.983

Plant Trail

The "plant trail" is deceptively simple natural experiment. It is an insightful way to be able to compare individuals' knowledge of plants, and determine what factors might be affecting individual variation. This design, pioneered by Stross (1973) with Tzeltal Maya children in Chiapas, Mexico, has also been revived by a few other researchers recently, most notable and relevant is Collins (2001) research with Q'eqchi' in Guatemala[1]. In this case, I was most interested in the variation of knowledge among children of different ages, to ascertain how expertise develops during childhood. Data collected during plant trail interviews provides a way to quantify (in approximate terms) different children's knowledge so as to compare competence on the plant trail among different children. The "scores" which were generated from analysis were used in regression analysis to determine how performance on the plant trail was associated with performance in formal schooling.

During the plant trail interviews, a researcher and local assistant walk with one individual along a set path and ask the participant to identify certain plants. The path in San Miguel village followed varying terrain and a wide variety of plants were used to approximate local plant distribution. A total of 119 plants were tagged along an existing trail winding through varied successional stages of vegetation in easy reach of the center of the village and the school. The plants included on the trail accounted for a range of cultivated, semi-cultivated, "wild", and insignificant plants. The trail began with easily identified plants, while more difficult plants were found on the middle section, and the plants gradually became easier as the trail ended. Children were asked to state name of each plant and its use. I also recorded how the child made the determination, based on sight, smell, taste, etc. For an overwhelming majority, children answered primarily on sight alone. Answers were recorded and later coded based on the culturally "correct" answers for each plant. The correct answers were determined by consensus among adults who were also interviewed and information from prior ethnobotanical collecting trips and interviews.

The trail took approximately an hour and half to two hours to complete. The length of the trail was gauged an optimal balance between a high number of possible

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[1] The results of my plant trail will be comparable to Collins data set. A comparative study would provide documentation of the variation in plant knowledge in three Q'eqchi' communities across the entire region.

plants and avoiding boredom and distraction among the participants to ensure accurate answers (Collins [2001] notes a similar trail length and number of plants as optimal). Twenty-three children (10 girls and 13 boys) and 6 adults (3 men and 3 women) were interviewed before the experiment was dramatically ended by hurricane Iris in October 2001.

Results

The system for scoring responses on the plant trail was developed during analysis of the results of the plant trail done in Majosik', Chiapas in 1999 (Zarger and Stepp 2000). Because it is not possible to quantify the difference between a child correctly identifying a plant at the generic level versus the species level, the responses were coded separately. In other words, if someone knows the specific name for a plant in Q'eqchi', do they know twice as much as someone who only knows the generic name? Three times as much? In order to avoid such arbitrary quantification, the results are presented for both types of responses. For each participant, their correct responses at the generic level and the specific level were summed, producing two separate scores, which were used in the other analyses presented here. Overall, the mean score for the number of plants identified correctly at the species level is 61.7 out of a possible 119, or 52%, for all respondents (children and adults). The mean score at the generic level is 68 correct, or 57%.

A linear regression analysis was done to understand the relationship between age of informants and their overall ability to correctly identify plants. As is evident from the regression line (in red) in Figure 5.10, there is a predictable sharp upward trend

Table 5.11 Plants found on Plant Trail, ranked by frequency. Frequency indicates the number of participants who correctly identified the plant.

Q'eqchi Name	English Creole	Scientific Name	Cultivated or Wild	Freq./ # correct
Pata'	Guava	***Psidium guajava***	C	26
Okr	Okra	*Abelmoschus esculentus (L.) Moench*	C	26
Noq'iritimis	Cat's balls	*Theuetra ahouai (L.) A. DC.*	W	26
Matacuy	Cowsop	*Annona purpea Moc. & Sesse. Ex Dunal*	C	26
Mank	Mango	*Mangefera indica L.*	C	26
Liim	Sweet lime	*Citrus sp.*	C	26
Kape	Coffee	*Coffea arabica*	C	26
Cooc	Coconut	*Cocos nucifera*	C	26
Ch'op	Pineapple	*Ananas comosus (L.) Merrill*	C	26
Chi'	Craboo	*Byrsonima bucidifolia Standl.*	C	26
Xiyow	Annatto	*Bixa orellana L.*	C	25
Samat	Kulant	*Eryngium foetidum L.*	W/C	25
Mokoch	Cohune	*Attalea cohune*	W	25
Masapan	Breadfruit	*Artocarpus altilis (Parkinson) Fosberg*	C	25
Wara k'ix	Sleeping prickle	*Undet.*	W	25
Tzin	Cassava	*Manihot esculenta*	C	24
Mox	Waha leaf	*Calathea lutea Attale.*	W	24
Lotsleb'	–	*Undet; cf. Cordia diversifolia Pavon ex DC*	W	24
Lamux	Lime	*Citrus limonia Osbeck*	C	24
Kala'	Jippy jappa	*Cardulovica palamata Ruiz & Pav.*	W	24
Ik	Chile	*Capsicum frutescens L.*	C	24
Pens	Allspice	*Pimenta dioica (L.) Merr.*	W/C	23
Pachaya	Grass	*Undet.*	W	23
Sub'in	Cockspur	*Acacia Collinsii Saft.*	W	22

Pata' che'	Wild guava	*Undet.*	W	22
Pachaya	Grass	*Undet.*	W	22
Hu	Fig	*Undet. cf Ficus obtusifolia H.B.K.*	W	22
Habaner	Habanero	*Capsicum chinese Jacq.*	C	22
Ch'onte'	Wild papaya	*Carica papaya L.*	W	22
Teb'	Herb	*Plectranthus amboinicus (Lour.) Spreng.*	C	21
Sakitul	White plantain	*Musa x Paradisiaca*	C	21
Raire chiin	Sour orange	*Citrus sinensis*	C	21
Ox	Cocoyam	*Alocasia macrorrhizos (L.) Schott*	C	21
Benq	Basil	*Ocimum campechianum Mill.*	C	21
Anaab'	Soursop	*Annona muricata L.*	C	21
Ub'el	Cowsfoot	*Piper auritum H.B.K.*	W/C	20
Saltul	Mamey	*Pouterra sapota (Jacq.) H.E. Moore and Stearn.*	C	20
Sajab'	–	*Curatella americana L.*	W	19
Okox	Mushroom	*Undet. squamulose lichen*	W	19
Masan arroz	Molly apple	*Undet. cf Pouteria sp.*	W/C	19
Mach palau	Luffa	*Luffa cylindrica (L.) M. roem.*	W/C	19
Kaquq'ub'	–	*Undet.*	W	19
Callaloo	Callaloo	*Ameranthus dubius Thell.*	C	19
Atz'um kaminak	–	*Undet.*	W/C	19
Alab'am	Plantain	*Musa x Paradisiaca*	C	19
Mes	Give and take palm	*Chyrosophila stauracantha (Heynh.) R. Evans*	W	18
Cho'choc	Bri bri	*Inga edulis*	W	17
Ch'alam	Fish poison, barbasco	*Undet. cf Lonchocarpus castilloi*	W	17
Uxb'	Liana	*Undet.*	W	16
Noq'	Cotton	*Gossympium hirsutum L.*	C	16
B'il	Basket tietie	*Desmoncus orthacanthos Mart.*	W	16
Cocowak	Horse balls	*Undet. cf Tabernaemontana alba*	W	15
Ch'abai	–	*Guazuma ulmifolia Lam.*	W	15
Ak'l	Trumpet tree	*Cecropia peltata L.*	W	15
Wachiil	Tambrand	*Dalium guianense (Aubl.) Steud.*	W	14
Tolo'ox	–	*Undet. cf Clusia flava Jacq.*	W	14

Q'amank	Jack ass bitters	*Neurolanena lobata (L.) R. Br. Ex.Cass*	W	14
Karetiche'	–	*Undet. cf Garcinia intermedia (Ppittier) Hammel*	W	14
Kaqkaq	Gumbo limbo	*Bursera simaruba L. Sarg.*	W	14
Jolob'ulb'	Monkey apple	*Licania platypus (Hemsl.) Fritsch*	W	13
K'is k'im	Lemongrass	*Simbapogon citratus (D.C.) Stapf.*	W/C	13
Xukubiyuk	–	*Undet.*	W	12
Xkotkaway	Chow shit	*Undet.*	W	12
Tutit	–	*Undet.*	W	12
Paraxq	plantain	*Musa x Paradisiaca*	C	12
B'alamaax	Bay cedar	*Undet. cf Luehea speciosa Willd.*	W	11
Xkotakach	Turkey shit	*Undet.*	W	10
Xan	Bay leaf, sabal	*Sabal mauritiiformis (H. Karst) Griseb. & H. Wendl. Ex griseb.*	W	10
Sank'il che'	Ant's tree	*Undet.*	W	10
Ronron	–	*Undet.*	W	10
Pooq	Wild plum	*Spondias sp*	W	10
Sa'juan	San Juan, emory	*Vochysia hondurensis Sprague*	W	9
K'ix k'ib'	Battery palm, prickle palm	*Bactris mexicana Mart.*	W	9
Aax	Breadnut	*Brosimum alicastrum Sw.*	W	9
Yuk	Antelope	*Anthurium sp.*	W	8
Xmalitzi	Chint	*Undet.*	W	8
Uuliche'	Rubber tree	*Undet. cf Castilla elastica*	W	8
Saki cho' choc	White bri bri, mountain bri bri	*Inga pavoniana G. Don*	W	8
Q'oyo'	Prickle	*Undet.*	W	8
Q'anxan	–	*Undet. cf Terminalia amazonia (J. F. Gmel.) Excell in Pulle*	W	8
Huruch ahin	Alligator's back	*Undet.*	W	8
Chaq kob'		*Undet.*	W	8
Yow	Cedar	*Cedrela odorata L.*	W	7
Xmisiha'	fern	*Undet. cf Lycopodiella cernua (L.) Pic. Serm.*	W	7
Noq' te'	Wild cotton tree	*Undet.*	W	7
Lamux che'	Wild lime	*Undet.*	W	7

Yaxab'	–	*Undet.*	W	6
Xmisiha'	fern	*Undet. cf Terminalia sp.*	W	6
Koj	–	*Undet.*	W	6
Kakati	Wild coco plum	*Undet. cf Hirtella americana L.*	W	6
Ruxbikaq'	–	*Lygoium venustum Sw.*	W	5
Pox	Wild custard apple	*Annona sp., cf Annona reticulata L.*	W	5
Ch'uun		*Undet. cf. Costus pulverulentus Presl.*	W	5
–	Medicinal vine	*Undet.*	W	4
Pomte'	Wild copal	*Protium multirimiflorum Lundell, Field, & Lab.*	W	4
Cortes	Cortez	*Tabebuia chrysantha (Jacq.)*	W	4
Baknel	Bone herb	*Undet.*	W	4
Atz'um	Flower, Hibiscus	*Hibiscus sp.*	W/C	4
Ak te'	Warree cohune	*Astrocaryum mexicanum Liebm. Ex Mart.*	W	4
Roq'hab'	–	*Undet.*	W	4
Poqxik	–	*Undet.*	W	3
Kukte'	Squirrel tree	*Castilla elastica*	W	3
I'ike	bromeliad	*Tillandsia sp.*	W	3
Yipu'u	–	*Undet.*	W	3
Tzinte'	–	*Undet.*	W	2
Sak xoq'	White scorpion	*Undet.*	W	2
Roqixa'an	Old lady's foot	*Undet.*	W	2
Pamak	picaya	*Geonoma interrupta (Ruiz & Pav.) Mart. Var. interrupta*	W	2
–	Medicinal	*Undet.*	W	2
Loba'ache'	–	*Undet.*	W	2
Kuxiche'	moss	*Undet.*	W	2
Kaqte'	–	*Undet.*	W	2
Q'anamal	–	*Undet.*	W	2
Ch'un akte'	–	*Undet.*	W	2
Choqloq te'	–	*Undet.*	W	2
Che' tzib'ik	vanilla	*Vanilla pfaviana Rchb. f.*	W/C	2
B'ilix	Mountain cow	*Undet.*	W	2
Q'an pak	–	*Undet.*	W	1

during childhood that levels off a bit into adulthood. Scores do not level off significantly during adolescence, but continue to increase with age. This somewhat different from the previous study done in Majosik', in which adolescents' knowledge was very similar to adults' knowledge in that community. Here, there is greater difference among adults and adolescents. For children and adults, males and females do not differ significantly in their performance on the plant trail.

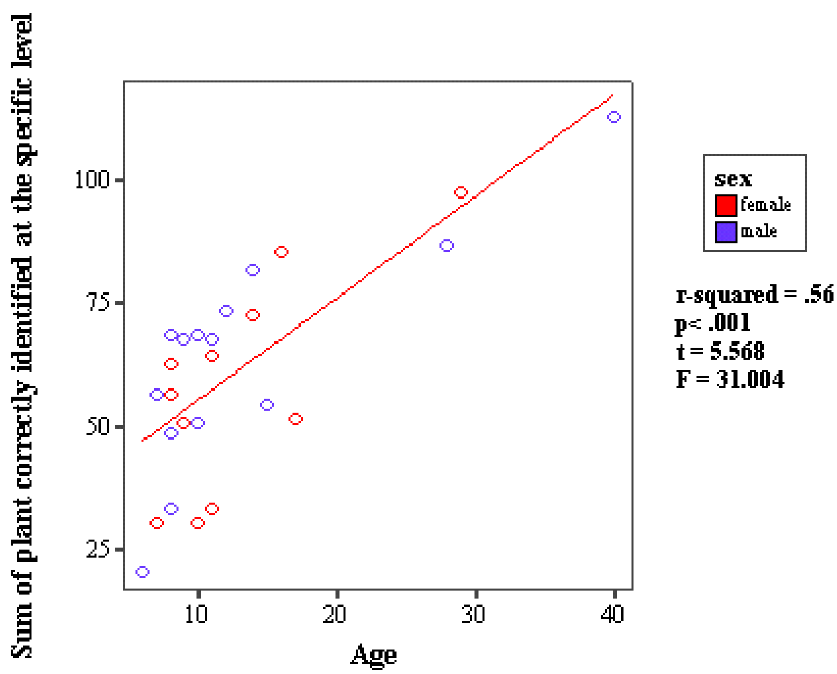

Figure 5.10 Linear regression of the relationship between age of all participants (children and adults) and score for correct identification of plants at species level.

Figure 5.11 is a linear regression of the children's scores only. Linear regression is not as appropriate for this smaller sample–the adult's scores do not have the affect of increasing the r-square value. A logistic regression was then used to see if the relationship of age and plant knowledge for the children in the study could be further understood. The statistical results of the binary logistic regression are presented in Table 5.12.

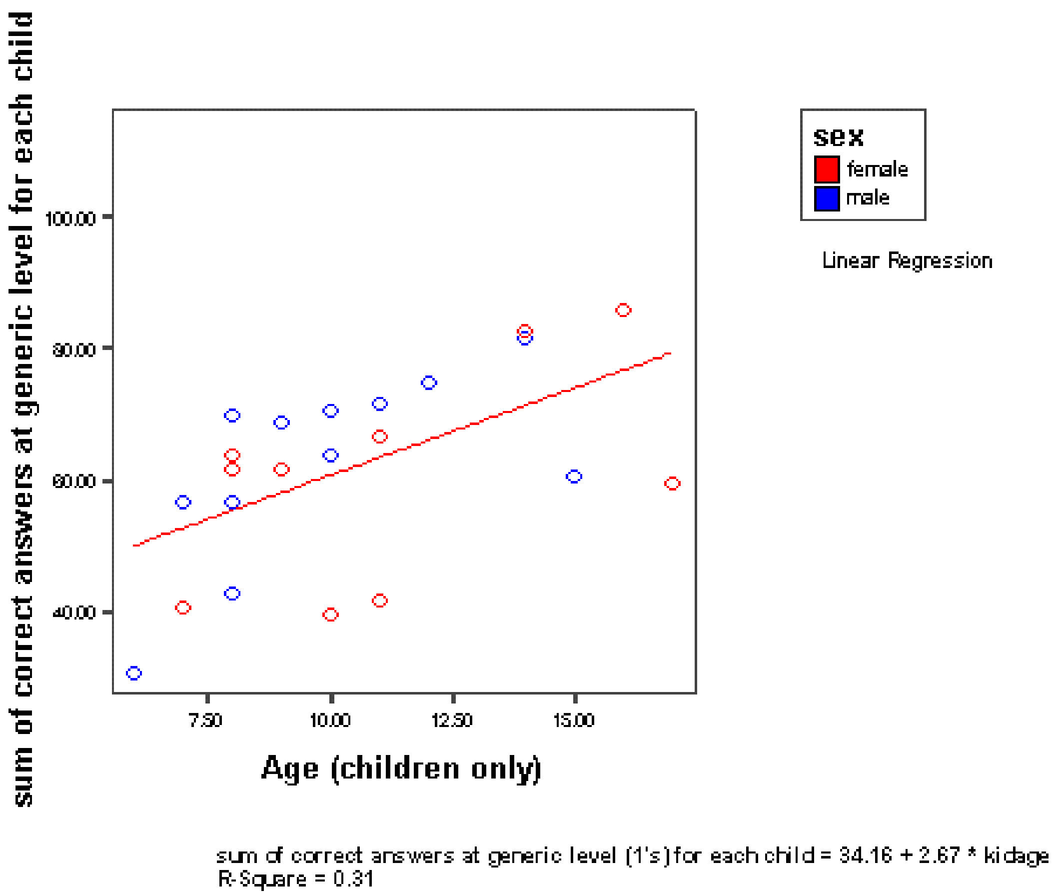

Figure 5.11 Linear regression of children's ages and their score based on correct answers at the specific level.

Table 5.12 Binary logistic regression of children's scores on the plant trail and age.

	Chi Square (Wald.)	Standard Error	Degrees of Freedom	P value
Score for generic level	47.6043	0.0133	1	<.0001
Score for specific level	54.5940	0.0976	1	<.0001

Based on the binary logistic regression, it is possible to predict the likely scores that children of different ages within the population might obtain on the plant trail [P = .02566 + .0232 *(age)]. For example, at age 5, children are likely to correctly identify 37% of plants. By the time they are 10 years old, children are predicted to know 48% of the plants on the trail. By age 15, children may know 60% of the plants.

One of the most interesting results of the plant trial study is that ability to correctly name plants and their uses undergoes a significant transition between the ages of 5 and 9. This pattern has been documented in previous studies conducted in Latin America, including Chiapas and Oaxaca, Mexico, and Venezuela (Zarger and Stepp 2000; Hunn 2002b; Zent and Zent 2000). The pattern in Figure 5.12 is not as readily recognizable as it is in the graph of home garden survey results (see Figure 5.5), but ethnographic evidence and interviews with parents indicate that the same pattern is certainly present. Although there is a trend for a gradual increase in ability between the ages of 9 and 16, the figure also illustrates that individual variability exists.

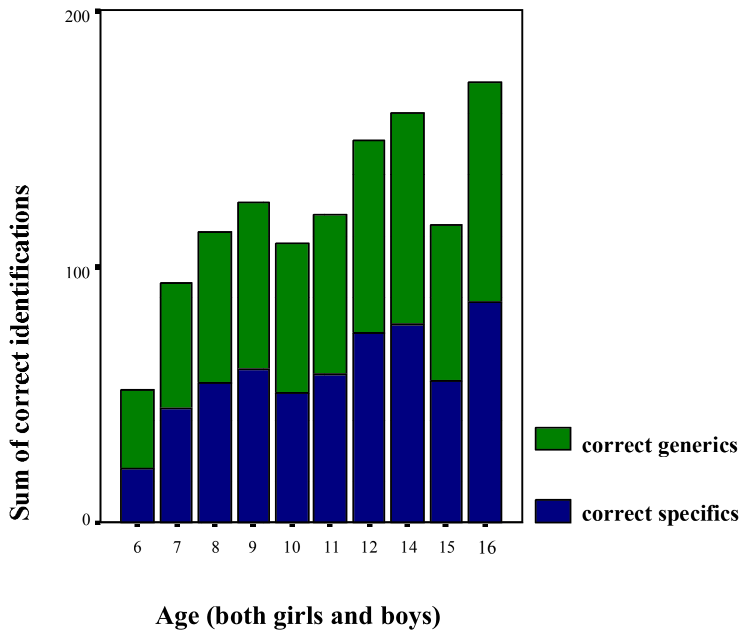

Figure 5.12 Mean scores for each age, based on the total number correctly identified by each participant to the generic and specific levels.

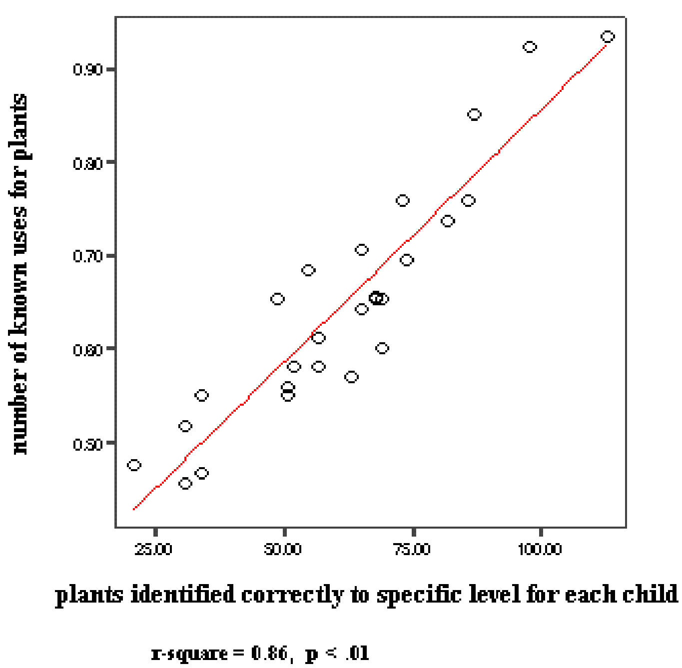

Figure 5.13 A linear regression of the relationship between plant trail use scores and identification scores for children.

To further explore patterns of agreement among children, a linear regression was performed to determine the relationship between the ability to correctly name plants and knowing their uses. Figure 5.13 represents a linear regression based on the number of plants correctly identified and the number of correct uses stated for each plant for all children interviewed. This demonstrates the fact that if a child knows a plant's name, he or she very likely knows the use of that plant as well. Zent found that plant-naming ability was also a "significant positive predictor of correct knowledge of use categories" (2001: 205). Stross also found this correlation among Tzeltal in Chiapas, Mexico.

In some instances during ethnobotanical collecting trips I observed that at times people would know the use of a particular plant, but not the name. The plant trail data demonstrates that this is a relatively uncommon occurrence. There is very little difference between the regression for generic and specific levels of identification when each score is correlated with correct uses. The scatterplot for the generics is almost identical to the specifics, with r-square = 0.87, so is not reproduced here.

Formal education and plant trail cultural competence

A comparison between performance in school and performance on the plant trail is useful to determine if any relationship exists between attendance at school and development of expertise in traditional ecological knowledge. I hypothesized that regular attendance at school would have a negative impact on competency and/or continuity of TEK. Experience in participating in daily subsistence activities is one of the main "modes" of learning TEK, and the more time children spend in school, the less time they are then spending engaged in subsistence-related activities. However, these assumptions have yet to be tested in a systematic way. Figure 5.14 is a bar graph illustrating the relationship between scores on the plant trail and mean final grade in school for each participant.

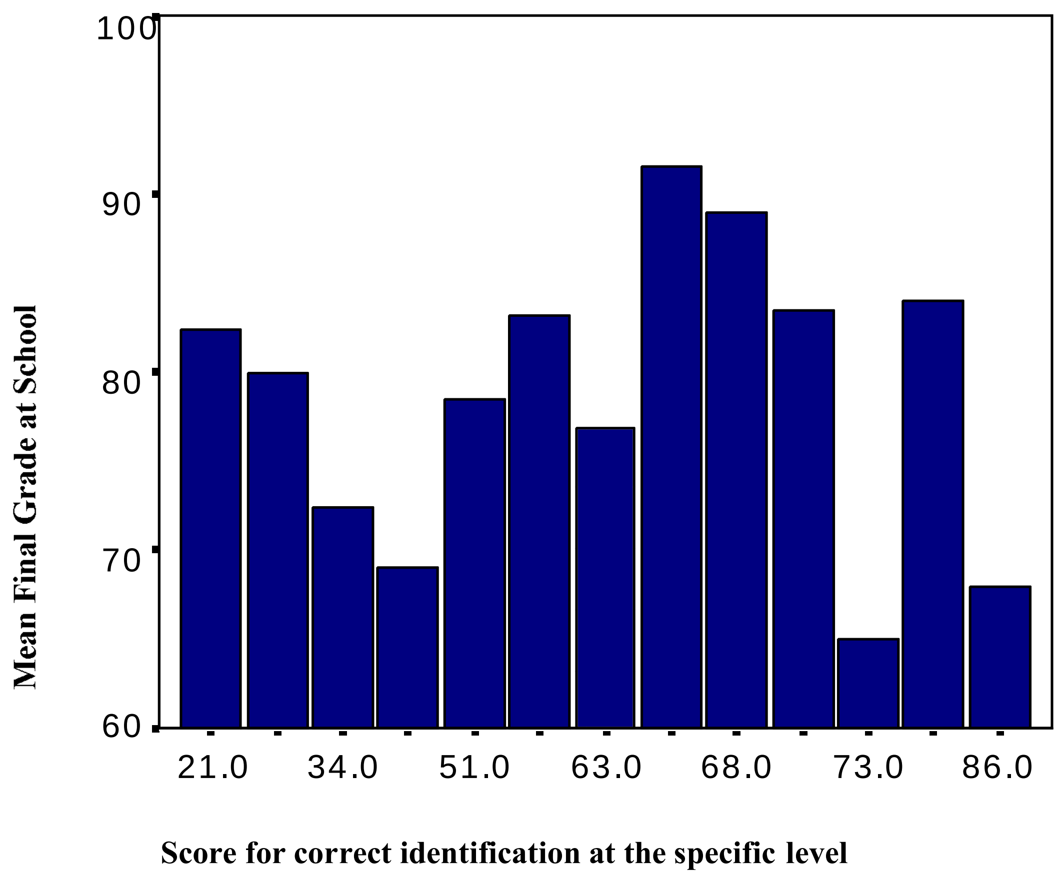

Figure 5.14

Surprisingly, there does not appear to be any relationship between performance at school when measured by final cumulative grade for the school year 2000-2001, and performance on the plant trail. A linear regression also showed no significant relationship between the two variables. However, it is interesting to note that two girls who had among the best "scores" on the plant trail dropped out of school recently due to inability to pass the last grade in primary school, or because they had turned 14 and were no longer required by law to attend school. Sometimes this decision is the parents' who would prefer their children helping out at home rather than not doing well in school. At other times leaving school before finishing primary school is initiated by the students themselves, who feel they are wasting their time in school if they know they are not going to go on to attend high school. Despite the fact that these girls may have scored higher because they spent less time in school, another high score on the plant trail was obtained by a boy who also has above average grades in school. It is possible that further research with a larger sample size might succeed in finding a significant relationship between schooling and TEK.

I also obtained attendance records from the principal of San Miguel school. I thought this might be an alternative way to see if there is a statistical relationship between amount of time spent in school and TEK. School attendance is mandatory between the ages of 5 and 14, and truancy laws are enforced for the most part, at least in San Miguel. Children must present an excuse to the principal for missing school or be fined, so most children attended school a minimum of 300 days out of the year. I was only able to record 18 of the children's attendance records because two had left primary school and two others were in attendance at high school. A bivariate correlation suggests that there is a slight negative relationship between attendance at school and performance on the plant trail, however the results are not significant (Spearman's $r = .142$). Heckler (2002) found that schooling had a negative impact on TEK among the Piaroa in Venezuela, who are undergoing the transition to sedentism. However, Zent (2001) states that education has a negative relationship to TEK only for certain use-value scores in his study. He found that education had a relatively weak negative relationship to plant naming ability (Zent 2001:202).

Although it is very difficult to judge causality based on correlation (or lack thereof in this case), one explanation for the lack of significance that formal school appears to have on TEK (in the form of plant trail scores) is the relatively small sample size. As stated earlier, the original goal was to include at least 40 children in the plant trail study, so as to give more variation at each age. Due to two tropical storms and Hurricane Iris that effectively ended the plant trail, the sample size was smaller than planned. However, the results reported for identification and known uses for the plants on the trail are in fact quite robust given the sample size.

Additionally, I think the results might be quite different in other villages, particularly those with mixed ethnic populations, such as Big Falls, or where subsistence farming is no longer practiced by a majority of the community. As was discussed in Chapter Four, children still spend a significant portion of each day engaged in subsistence activities such as gathering firewood, fishing, trapping birds, and gathering wild foods and fruits. The most likely explanation for the lack of affect of formal school is that children are still very much engaged in the biophysical environment.

On weekdays, subsistence activities are completed before or after school. School and related activities such as football or softball are not the sole focus of children's day. For the most part children seem excited to get to school (most arrive between a half hour and 20 minutes early to play with their friends) and enjoy their time there. But, since most children rise by 6 a.m., and school doesn't begin until 9, they accomplish a great deal in that time: bathing, washing clothes and dishes, playing, trips to the store etc. In addition, children go home to eat lunch and are finished with school in the afternoon in time to do various household chores in the evening as well. This leaves time for the more casual, less ritualized subsistence activities with sibling or play groups. But, school does mean elimination of longer trips away from home to the family farm or to the older secondary growth forest during the week. These activities must be left entirely to the weekend for children in primary school, and weekends for children are often filled with work that has been accumulating during the week.

A similar work pattern is becoming more common for men, since more and more people are seeking wage labor that takes them away from their farm work. Group labor parties are most often scheduled on Saturdays now, but many men indicated that this was not the case 15 years ago. It was much easier to arrange for a group of men to help thatch a house than it is now. As one man in his mid thirties told me, “Now, everyone is always busy working at the citrus or in construction to help you during the week. It was not like that from before. We were able to take the time to build much bigger houses when I was a boy, too.”

The time spent in traditional activities may still be enough for young people to achieve a basic level of cultural knowledge, but further investigation into this issue is needed for clarification. A larger stratified sample from several different types of communities might provide more insight into any link between formal education and informal education. It is my feeling that performance in school may be a weaker indicator than attendance at school, due to the participatory nature of learning TEK, so future research will focus on the effects this variable.

Cultural Transmission and "Learning Networks" Interviews

Documenting changes in TEK over time, from generation to generation, is an extremely difficult task. Research time frames are so limited when compared to the dynamics of cultural transmission. Some transformations in knowledge or cultural beliefs occur over decades, while others may persist for centuries or even melinnia. To understand intergenerational differences in subsistence knowledge, a series of interviews were conducted that focused on certain culturally significant skills or tasks.

By framing traditional ecological knowledge as information transmitted through participation in daily activities, TEK is more than knowledge, it is also the behaviors associated with this knowledge– the practical "skills" associated with expertise. Hewlett and Cavalli-Sforza's (1986) research with Aka in Africa and Ohmagari and Berkes's(1997) work with Cree women's bush skills quantified cultural transmission by recording individual competency with a specified set of skills. For example, in the case of Cree women, this involved fur preparation, making clothing, or hunting, and for the Aka, making a crossbow and finding honey or vine water. These two studies in particular provided guidance in developing a similar interview protocol for use in Belize, with an explicit focus on subsistence skills and tasks.

Structured interviews with 45 adults (20 men and 25 women over the age of 16) were conducted using a standard interview form (see Appendix E). All interviews were done with one of two collaborators from San Miguel, a man and a woman, who assisted with translation and transcription. The set of skills was derived from informal interviews and freelists with adults for "things children should know how to do" by the time they are grown. The list contains gendered tasks and gender-neutral tasks, with a degree of overlap, ranging from extremely simple to more complex. I intentionally included some tasks that very few people still know how to do, so as to document at what ages shifts in knowledge and ability occurred. Tracking competency, teacher, and age learned for the set of 52 skills allows comparison across generations and age sets for men and women. Table 5.13 presents an overview of the range of knowledge and skills among men and women and the age at which they learned each task.

The ages that informants reported are actually much older than my participant observation and child focal follows suggests. For example many cooking tasks are assigned to young girls starting at age 9 or 10. In these interviews women said they learned cooking skills between 12 and 14. I think there is a logical explanation for the discrepancy between parent's perceptions of the when work roles are assigned to children, as discussed in Chapter Four, and the later ages reported here. The age people are reporting is the age at which the skill is finally mastered. At 12 to 14, young people are held accountable to their families and communities. This is linked to a transition that occurs when individuals are expected to marry and create their own households. Many people mentioned during the interviews that they didn't really learn these skills (master) them until they had to perform them when they got married.

A transition in skill level occurs around the age of 14 as children begin to be viewed as adults, and take on adult responsibility. This coincides with the age they leave school, and subsequently look for a life partner, attend high school, or leave the village in search of wage labor. The ages reported here also mark a transition between the time when a distinction arises between "work" and "play" associated with the practice of the various skills.

I previously noted in Chapter Four that children are expected to be able to perform a wide range of work activities *when asked* beginning at age 5, and increasingly significantly at 8, 9, 10 years. Children learn the bulk of subsistence knowledge during this important developmental period. However, it is not until adulthood is reached (~14 years) that they are held accountable for their skills, as it becomes a matter of survival for their families.

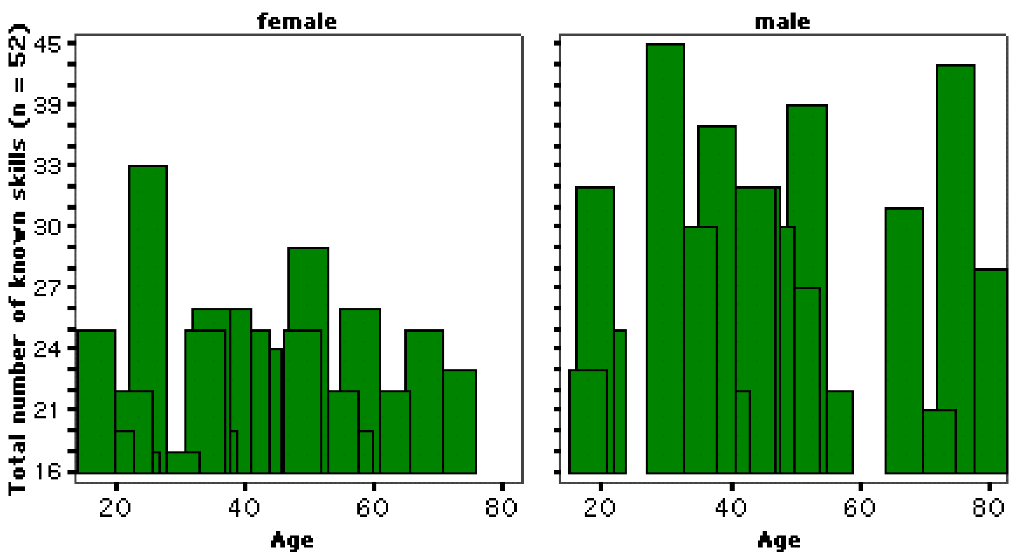

Figure 5.15 Total number of skills for women and men for different age groups.

Overall, men know more of the selected sample of subsistence skills. This is most likely the result of an emphasis on including a wide range of agricultural skills and hunting and gathering skills in the survey. I wanted to find out the role gender and age plays in who tends to carry out these subsistence tasks. Gender also shapes who taught the informants certain skills. Learning tends to occur in same-gender interactions, whether the teachers are peers, parents, or friends. Observation of others plays an important role in learning generalized skills, such as caring for domesticated animals and home gardening. However, parents or grandparents are instrumental in teaching skills that require more extensive acquisition periods to master, such as weaving the **koxtal**, or making baskets.

There are some points that should be made about the relationship between men and women's knowledge. Based on my own observations, I think women tended to underreport the agricultural or "bush" skills they know. This is true for two reasons: laboring at the family farm is not something most women do on a daily basis and such activities are not highly esteemed by most women in San Miguel as desirable activities. Although women do not perform the skills daily, I did find that most women in San Miguel visit their family's farm once or twice a month on average, to break corn, harvest greens, or find wild foods. Wilk (1997) notes a similar frequency for women's visits to the plantation, based on his research carried out in 1980 in Auguacate village. Interestingly, Wilk suggests that there is a trend for women the "northern", less traditional villages, such as San Miguel, to spend less time engaged in gathering food resources or agricultural work (1997:156). He attributes this trend to wider availability of store-bought foods and a stigma attached to such activities by other Belizeans.

> Some Kekchi, especially in the northern zone, are also becoming aware that some wild foods carry a stigma among other Belizeans, that eating such things as river minnows and palm heart brands them as "bushy" in the eyes of schoolteachers, government officials, and foreign preachers (1997:156).

These economic and cultural factors certainly impact use of wild foods in San Miguel. But, pressures may have not increased significantly since the 1980s when the majority of Wilk's data were collected, and some aspects of wild food use are transforming along with the cash economy. The frequency of wild foods in the diet of San Miguel households is still fairly high. Heads of households in San Miguel listed wild foods with regularity in freelist interviews. My observations of food resources used in a sample of 10 households indicates that families eat gathered foods such as palm hearts or wild mushrooms once every two weeks on average. There is some variation among households based on access to the cash economy, but wild foods are still present in the diet and relied on in times of scarcity. In fact high value is attached to certain wild foods, such as **saki k'ib'** "picaya" (*Chamaedorea tepejilote*), which are increasingly difficult to find due to deforestation or lack of access to protected forests. These are now purchased, by families who have available cash, from men who work with the logging company or spend more time in the forest. This marks a transition for scarce wild foods, as they, too are integrated into the cash economy.

Another factor affecting the distribution of skills in this set of interviews is that men tend to underreport their involvement in household work that is considered "women's" work, such as cooking or cleaning. Younger men are the exception here, since they "work out" of the village in wage labor, they are required to learn to how to cook, sweep, and bake tortillas because there is no one else around to do so. But older men would never want to admit that they knew these tasks because women are supposed to do them. Also, same goes for older women, they don't admit that they fish, etc, but they do. Also, it's not expected that older people still have to provide all of the subsistence for the family, they can rely on children and grandchildren to assist them when they can no longer engage in difficult agricultural tasks. For instance, older couples or widows are provided with bags of corn and rice, even if they still remain in a separate, nuclear household from their children.

In addition to exploring the role gender plays in subsistence knowledge, I wanted to track skills and knowledge in 5 age sets or cohorts within San Miguel. The goal was to identify certain age groups who had significantly less knowledge than their elders, and to use a cross-sectional sample as a proxy for knowledge change over time. The results of the analysis of age and number of skills known are presented in Figure 5.16.

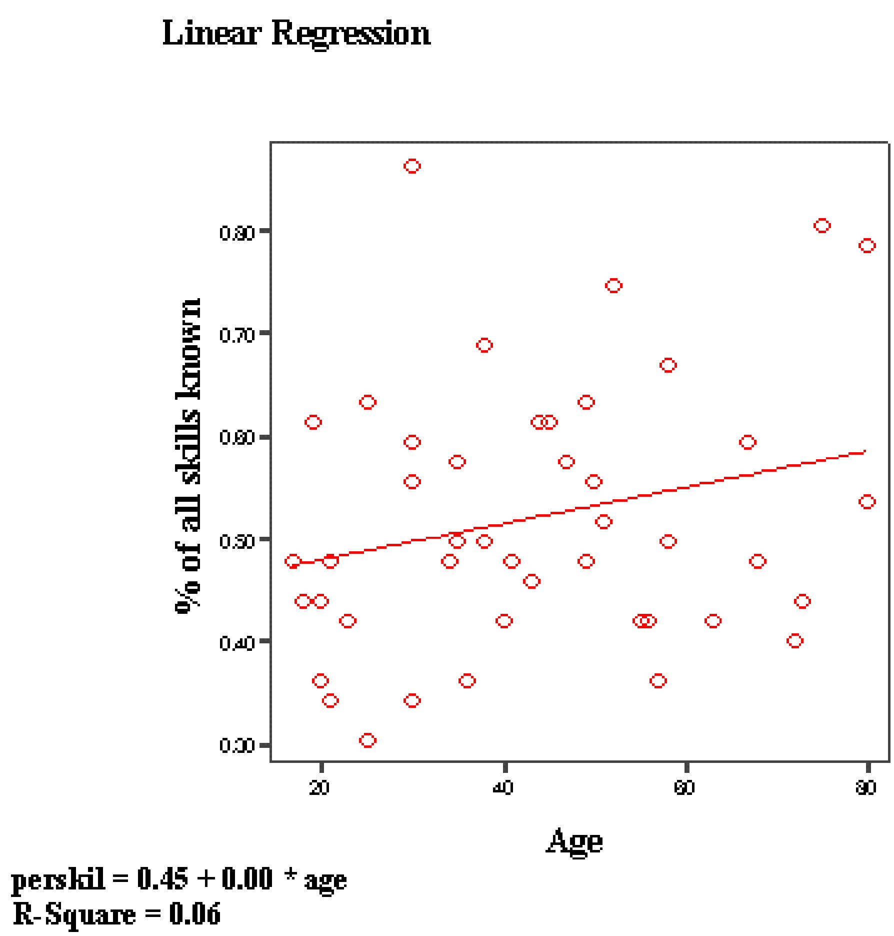

Figure 5.16 Linear regression of age and percent of skills known for all adults interviewed. P = 0.106 from ANOVA of the two variables.

As is evident from the scatterplot in Figure 5.16, there is not a significant relationship between age of participants and the number of tasks or skills known. There is a very slight upward trend for older individuals to know more skills, but this is statistically insignificant. The results are fairly surprising, particularly since middle aged individuals often remarked that they felt they did not know nearly as much of the "culture" as their elders. The expected results were that age and knowledge would be highly correlated, as found in previous studies (Ohmagari and Berkes 1997; Hewlett and Cavalli-Sforza 1986). One factor that may be affecting this pattern is that older people tended to underreport their knowledge because they no longer perform certain tasks or skills that they engaged in daily earlier in life. Clarification was made during interviews that we wanted to know if the individual had *ever* known how to do the tasks. Even so, there was still a tendency for underreporting, as when older men were asked questions about chopping bush or harvesting palm hearts. They responded that they did not do those things because they are so keenly aware that they no longer contribute to community work.

Another explanation for the lack of correlation between age and knowledge is that there is simply not much variation in knowledge between generations. This could be interpreted as favorable for continuity of TEK, as the majority of subsistence knowledge and skills have not been lost. Or, it may be that certain skills were never passed on by the elders in the community and the uniformity reflects knowledge loss. However, since the study is cross-sectional and not longitudinal, only tentative explanations can be made.

One thing is clear–that the he middle-aged individuals who were born in San Miguel shortly after it was established in the early 1950s and their children do not have substantially different knowledge and skills, despite the changes that have taken place in the community. For example, electricity was made available to San Miguel in April 2000, and a water system was installed by community members in 2001. Each year, more primary school students are moving on to attend high school or technical school in neighboring villages or towns. Villagers said the large number adolescents attending high school is a recent phenomenon, very noticeable over the past 5 to 7 years.

Conclusions

The first section of this chapter provided an overview of Q'eqchi' subsistence knowledge and skills. Local categories of land use and agricultural practices attest to extensive knowledge of the biophysical environment. Children develop expertise in the domain of knowledge at a very early age, beginning in the household. They learn in increasingly rich and varied environments as they mature. An overview of the process is presented in Figure 5.17. Over time, parents, siblings, and social networks shape the learning contexts for subsistence knowledge. By the time they are 9 or 10, children's plant-naming abilities and knowledge of plant uses is sophisticated and extensive. Consensus analysis illustrates that although children and adults categorize local plants in different ways, overall they consistently agree about cultural uses for certain plants, such as cultivar status or edibility. Children learn plants in their immediate environment more quickly than plants found in other locations. The primacy of the generic level of categorization is also evident. Children tend to group plants based on morphology in early childhood, while they incorporate more sophisticated utility-based explanations as they mature. The transformation in subsistence knowledge that occurs corresponds with their increasing incorporation into adult work roles at the ages of 9 and 10. Intergenerational differences in subsistence knowledge and skills were not clear from the cultural transmission interviews, but qualitative data indicate that differences may be present. There are not significant differences among adults' knowledge and skills in the primary study community, suggesting some continuity of TEK in one Q'eqchi' Maya community in Toledo District.

Table 5.13 Percentage of skills known by males and females and median age learned for a set of 52 subsistence activities

Task or Skill	Female N = 25	Male N = 19	Median Age Learned
(*Q'eqchi'*, English)	**% who know skill**	**% who know skill**	
Cooking Skills			
xorok, bake	100.0%	36.8%	9
tib'ank'i calt, make caldo	100.0%	52.6%	13
chiq'ok poch, boil poch	92.0%	36.8%	12
chiq'ok arroz, kenq, boil rice, beans	100.0%	57.9%	14
chiq'ok xe' awimj', cook groundfood	100.0%	68.4%	14
xchiq'b'al li muku na awmankta (kala'), cooking non-cultivated food such as *Cordulovica palmata*	96.0%	42.1%	12.5
Beverages			
tib'ank cocao uuk, making cocao drink	100.0%	57.9%	12
xk'linkil, roasting cacao on comal	88.0%	26.3%	13.5
xbukank'il; stirring cacao in traditional way	72.0%	5.3%	11.5
tib'ank kape, making coffee	100.0%	100.0%	10
risink'il irix li kape, grinding coffee	100.0%	57.9%	13
k'ilink'il li kape, roasting coffee on comal	100.0%	26.3%	13
tib'anki kaj, k'ilank'il kaj, make roast corn drink	96.0%	42.1%	14
Household Items from Plant Resources			
nakanaw iru xche'el li mes, find the "broom" tree, *Chyrosophila stauracantha*	72.0%	100.0%	12
tibank chakach rikin b'il, make baskets from *Desmoncus orthacanthos*	12.0%	52.6%	15
tibank chakach rikin uxb', make baskets from lianas	12.0%	26.3%	15

tibank chakach rikin kala', make basket from *Cordulovica palmata* (primarily for sale to tourists)	16.0%	10.5%	15
tib'ankil li ch'ixb', make mat for drying chiles	16.0%	68.4%	14
tib'anki ch'aab', make calabash strainer	76.0%	36.8%	14
tib'anki sel, make tortilla holder from gourd	44.0%	21.1%	12
tib'ankil li aab', making a hammock	–	15.8%	13
risink ruq'bi'iq' se che', take out macapal to make strap	8.0%	100.0%	12
Agricultural Skills			
k'alek, chop	56.0%	100.0%	10
awki tul, awki tsin, plant plantain, cassava	52.0%	100.0%	12
awk ixim, plant corn	24.0%	100.0%	12
awk arroz, plant rice	68.0%	100.0%	13
Craft Skills			
tib'ankil li k'ub', build firehearth	96.0%	21.1%	15
kemok koxtal, weave koxtal	12.0%		14
pakok, make pottery	32.0%	5.3%	14
tib'anki kuxb'iuq'b', make bracelet	32.0%	5.3%	17
b'ojok, sew embroidery or clothing	56.0%	57.9%	14
tib'ank rochochi ch'ich', make a scabbard	–	21.1%	22
pechok kayuk, carve dorry	–	21.1%	14
Harvesting Palm Cabbages & Other 'Wild' Foods			
sikok k'ib' finding palm cabbage	16.0%	89.5%	14
botz'ok li kala', pull **kala'** shoots	96.0%	100.0%	10
pokok mokoch, "opening up"/harvesting cohune palm (*Attalea cohune*) heart	4.0%	94.7%	15

pokok lau, harvesting wild banana (*Heliconia mariae*) heart	72.0%	78.9%	12.5
pokok xan, harvesting palm heart (*Sabal mauritiiformis*)	8.0%	78.9%	14
sikok q'ehen, find medicinal plants	20.0%	68.4%	14.5
Miscellaneous Skills			
mesubk, sweeping	100.0%	94.7%	8
tzi'ibk, cut firewood	52.0%	100.0%	9.5
k'iresink chilan/patz, caring for chickens/ducks	96.0%	73.7%	15
Hunting and Fishing			
karabk, fish	68.0%	100.0%	10
sikb'al achib' , hunting/finding meat	12.0%	57.9%	15
rikin gun, li tsi'eb', hunt with a gun or dogs	12.0%	57.9%	14
Roofing Skills			
chok'o banki kab'l, make house frame	–	94.7%	14
setok k'im, cutting chune leaf	4.0%	94.7%	14
tsuluk k'im, build thatch roof from cohune palm	–	100.0%	13
Music/Instruments			
pechok harp, violin, guitar, carve instruments	–	21.1%	14
xb'atzunlenkil, play instruments	–	47.4%	14
Trapping Birds and Animals			
ra'lik" li tzik, li baj, trap birds, moles	4.0%	57.9%	14
ch'imb'ek li jalau, trap gibnut	–	42.1%	18

CHAPTER 6

CONCLUSION

Figure 6.1 A child is carried by her mother back to their home after picking beans at the family's farm.

The major findings of the study indicate that knowledge of the biophysical environment is acquired through the experiences of daily life and immersion in a local human ecosystem. Learning and teaching processes are shaped by individual cognition, cultural belief systems, ecology, socioeconomic institutions, and gender roles.

Siblings and cousins pass along extensive information to one another about where to find certain plants, their uses, and how to harvest or cultivate them. Children usually spend a good portion of each day engaged in daily subsistence activities. Play often imitates adult roles, and children volunteer for work quite often, even well before they are capable of any real contribution. Make-believe play by children ages 2 to 6 or 7 often involves imitation of adult activities such as cooking, building little fires or firehearths, washing, cooking, playing "house," "chopping," and child caring. Parents are aware of the emphasis on experiential or informal learning in the traditional education system. Furthermore, notions about learning and development of expertise are semantically and culturally linked to **kanjelak**, "work." Children are expected to contribute to the work of running a household early in life and to approach these experiences with a sense of independence. Families rely on a combination of subsistence-based and purchased resources for their livelihoods. Parents perceive that their role in assisting their children develop into capable adults is to "send them to work" and incorporate children into subsistence-related activities. Focused observation by individual children is another primary learning mode, as is true for other Maya populations in which child development has been studied (Gaskins 1999; Maynard 1999).

Based on this study, it seems likely that experiences of early childhood do fundamentally shape adult cognition and expertise with the biophysical world as Nabhan (1993, 1998) and Chipeniuk (1995) have argued. When one considers this alongside the evidence that young children in many instances exhibit an uncanny affordance for mastery of local folkbiological terminology and usage, new directions for future research on childhood acquisition of environmental knowledge are more easily hypothesized.

Children possess extensive, systematic knowledge of their biophysical environment. The acquisition process begins in infancy and increases very rapidly until the age of 14 to 16, when adult competency is reached for the most part. Children begin to learn the plants and animals in the immediate household environment first. Knowledge increases as experiences widen in scope during childhood. These expanding spheres of influence grow to encompass trips to the family farm, the forest, school, church, and the district town center.

The home garden provides the earliest laboratory for children to begin to explore their biophysical environment. Home gardens surveyed contain up to 76 varieties, with an average of 34, so children are immersed in a diverse environment. Children assist their mothers in the care and maintenance of home gardens, often gathering herbs, fruits, or fuel for the fire in the area around their house. By the time children are 9 years of age, they know 85% of Q'eqchi' names for plants in their own home gardens. and 50% of plants elsewhere. The results of the child-guided interviews in home gardens and the plant trail experiment indicate a noticeable transition that occurs in plant knowledge between the ages of 4 and 7. The same time frame and transition has been reported in other studies of botanical knowledge acquisition (Stross 1973; Hunn 2002b; Zent and Zent 2000).

Figure 6.2 Siblings play in an orange tree in their home garden.

Data from the pile sort interviews provided some insight into differences between the ways adults and children categorize the same plants. Children are more likely to agree with adults as they become older, as they gain experience and expertise. There was also a high level of agreement among children, as evidenced by cultural consensus analysis, and no significant differences among children of different ages was found. However, children's sorts in the constrained task indicate variation occurring that reflects developmental differences. Overall there is a significant, high level of agreement among all participants about cultivated and non-cultivated plants and plants that are edible or inedible.

The plant trail experiment allows us to see the development of plant knowledge over time. The mean score for the number of plants correct at species level is 61.7 out of a possible 119, or 52%, for all respondents (children and adults). Mean score at the generic level is 68 correct, or 57%. Knowledge of plant names and plant uses are very significantly correlated with one another. Children knew more generic names than specific names, and young children rely more on generic names in their responses. This indicates that generic names are learned first and the terms become more accurate as a child ages. Based on plant trail results, children learn cultivated and culturally significant plants first. Their knowledge incorporates lesser-known plants and more-difficult-to-distinguish plants by the time they are 12 or 13. During adolescence, ethnoecological knowledge becomes similar to adults' knowledge in the same community.

A significant part of children's diet is made up of wild and cultivated fruits. When asked to list all the foods that they can think of, children list many more fruits than adults. The orange is the food item listed most frequently by children, while adults listed food staples such as corn and flour tortillas and rice. Younger children take advantage of some wild food resources that adults consider inedible or at least undesirable. These species fall into the "active domain" of children. Although most adults are aware of the "inedible" wild resources that children eat, the knowledge is not actively used by adults. Although adults may say they do not remember these plants, or know their uses, at one time in their lives they probably ate them regularly.

Categorization of plants in San Miguel follows universals for human classification of natural kinds. Younger children categorize plants based primarily on morphology. As children gain experience, utility and cultural salience are integrated. Significant and widely used species are learned first, as infants experience them in the home and home garden. Results from the plant trail experiment indicate that the generic level is the most fundamental aspect of plant categorization. Q'eqchi' ethnobiological classification consists of 4 life form categories for plants: 1) **che'** or **te'**, "tree" (or "stick/post"); 2) **pachaya'**, "grass"; 3) **pim** ,"herb or bush"; and 4) **q'aham** or "vine" (or "rope"). The unique beginner "plant" is covert, but **pim** is perhaps the closest equivalent in its usage (Berlin 1992). The rest of the non-human world makes up the category **xul** (or **xuleb'** plural), which includes mammals, birds, fish, and insects.

Changes in subsistence strategies, insecure land tenure, population growth, logging, and ecotourism also mean learning environments for Q'eqchi' children are changing. More young people are leaving communities for educational and wage labor opportunities than ever before. A high value continues to be placed on education, particularly for children to go on from primary school and attend high school. This dynamic is one that will have significant impact on the transmission and acquisition of knowledge. Fathers who are absent for weeks or months at a time are also unable to pass on their knowledge and experience to their children except during visits home.

Children begin to attend school at age 5, and a significant amount of their time will be spent in school over the next 8-9 years of their lives. For the most part, parents' values and expectations for child behavior at home differ from the expectations of formal educators. Conflict between educators and parents is not uncommon, arising from lack of cultural understanding, local and regional politics, and inconsistent rules from school to school. Most teachers and principals are devoted to their jobs and put in long hours in the classroom and commuting to and from school. Although children spend 10 months of the year in school, according the data presented in Chapter Five, regular attendance at formal school does not have a significant relationship to expertise in ethnobotanical knowledge.

Performance in school, as measured by overall average grade, also has no significant relationship to performance in the plant trail task. More research is necessary to further explore the effect that schooling has on TEK. Ethnographic interviews suggest that children spend more time in school now than ever before, and I would still hypothesize that they are learning less about the forest and subsistence skills than their parents or grandparents did as children.

Adults continue to learn from one another after they establish their own households, primarily by observing how others behave in new situations. Adults said they pay close attention to the subsistence strategies other households use. Elders in the primary study community are revered for their cultural and ecological knowledge. They serve as repositories of information about land use practices such as usufruct rights to certain plots within the communal land system, and they have extensive expertise in general ethnobiological knowledge. Middle aged and young adults often expressed sadness that the experiences, stories, and wisdom that the older people share is being lost to new generations of Q'eqchi'. Although people of these age groups engage in a variety of subsistence skills and tasks, locate and use medicinal plants, and are successful farmers, they perceive that their knowledge is different from that of their parents and grandparents.

Local Contributions of the Study: Environmental Education Initiatives

There are two major contributions that theories from child development and anthropology of education can potentially make to TEK transmission and acquisition. First, the theories aid in pinpointing the ages at which children learn different types of environmental knowledge and skills. Second, they allow for a better understanding of the mechanisms and modes for teaching and learning in traditional contexts. This also provides the chance to tease out and strengthen pedagogical modes within the traditional education system, or to replicate them in the formal education system.

Results of the study indicate that a close relationship exists between the social or individual demand for a certain subsistence skill or item, and the individual's likelihood of acquiring the relevant environmental knowledge. The desirability and value that is now placed on the "old people's" knowledge may shift very rapidly from one generation to the next. Whether the "demand" for a certain skill or type of knowledge is there depends on a multitude of socio-economic, cultural, ecological, and historical factors. The situation is likely different in various communities in Toledo. Local ecology, specifically a diverse ecosystem and sustainable land use, greatly determine the "classroom" for the informal education system. Supporting this link is critical to efforts to sustain, document, or even revitalize environmental knowledge. One way to address the potential or actual loss of TEK is to incorporate informal environmental education into the formal education system. Data presented here are being developed into materials and activities for use in schools in Toledo district, with the goal of integrating the informal and formal education systems. Previous projects with similar goals suggest that education initiatives must take place in situ, locally and collaboratively designed and implemented (Nabhan 1998; Zarger 1999).

Sustaining, documenting, and promoting TEK are the goals of an education initiative begun in collaboration with local schools, NGO's, and parents during field work. The information I have collected through collaboration with Q'eqchi' communities, such as local names plants and animals, elder's stories, pictures, and uses for forest products, are being compiled for a series of instructional and resource materials for use in area schools in concert with environmental education curricula. Interest in this aspect of the project has been high since the first time I visited Toledo. Government education officers, Maya leaders, teachers, parents, and most importantly of all, the children, have supported and participated in the initiative.

Previous ethnoecological research did not incorporate perspectives on learning and cognition from child development theory into research design or analysis. This study addresses an interdisciplinary gap and illustrates the potential contribution of educational theory and practice to a growing global interest in the conservation of cultural and biological diversity.

Figure 6.3 A view of San Miguel village from the museum building where I lived, taken in July 2000.

APPENDICES

APPENDIX A

Guide to Q'eqchi' Orthography

The orthography of the Q'eqchi' language has been restructured during the past decade. Even though the spelling "K'ekchi" is the one most commonly used in Belize, I chose to use the conventions currently accepted in Guatemala, because there seems to be a movement to standardize the spelling across the international boundaries. The language is one of the most widely spoken Maya languages today. Various other spellings in use in Belize and Guatemala include: "Ketchi", "Ke'kchi", "K'ekchi'". The conventions used in this dissertation are based on the orthography developed by the *Proyecto Linguístico "Francisco Marroquín"* (P.L.F.M.) and the *Academia de las Lenguas Mayas de Guatemala* (A.L.M.G.), published in the *Diccionario Q'eqchi'* (1997). There are thirty-three letters in the Q'eqchi' alphabet. Double vowels indicate a long vowel sound. Apostrophes represent a "glottal stop", or glottalized consonants. The English reader can note that most letters are pronounced the same in English as in Q'eqchi'. There is one exception, the "x", which corresponds to a "sh" sound, as in **xaab'** "shoe". The only diversion I have made from the A.L.M.G conventions is to replace the Spanish "j" with the English "h", for easier intuitive readability by Maya in Belize who do not speak Spanish as a second language. For plants that are mentioned throughout the dissertation, the Q'eqchi' name is given in bold, while the scientific name appears after it in italics and parentheses. Belizean English common names are stated after the Q'eqchi' name in quotation marks.

A Table with New and Old Alphabets*

New Q'eqchi' Alphabet	Example	Old K'ekchi' Alphabet
a	kala’	a
aa	xaab’	*a*
b'	b'ar	b
ch	chaam	ch
ch'	ch'alam	ch'
e	sel	e
ee	peepem	*e*
h	ha'	h
i	ixim	i
ii	ch’iich’	*i*
j	jal	j
k	kar	c
k'	k'il	c'
l	lol	l
m	molb'	m
n	na'	n
o	ilok	o
oo	hoon	o
p	paap	p
q	paq	k
q'	q'em	k'
-	-	qu
-	-	q'u
r	rax	r
s	sis	s
t	tul	t
t'	t'orto	t'
tz	tzi'	tz
tz'	tz'unun	tz'
u	xul	u
uu	uuliche’	*u*
w	wa	cu
x	xol	x
y	yuk	y
‘	toq’	‘

*Based on *Gramatica Q’eqchi* (1997, Oxlajuuj Keej Maya' Ajtz'iib' (OKMA)) and *Nuevo Diccionario de Las Lenguas K’ekchi’ Y Española*. (1997 [1955], Guillermo Sedat S. and Summer Institute of Linguistics).

Appendix B

Q'eqchi' Ethnobotany: Collections List by Q'eqchi' Name

Q'eqchi' Name	English Name	Scientific Name	Family	Use/Preparation	Cultivar Status	No.
aax	breadnut, ramon	*Brosimum alicastrum Sw.*	Moraceae	firewood/famine food	W/P	87/196
ak' te'	warree cohune	*Astrocaryum mexicanum Liebm. Ex Mart.*	Arecaceae	edible palm cabbage, "k'ib", palm nuts "monok", and young shoots "och akte'"	W	44
ak'l, puhur	trumpet tree, guarumbo	*Cecropia peltata L.*	Cecropiaceae	old people used to roll up young leaves and smoke like tobacco; protected plant	P	49
anaab'	soursop	*Annona muricata L.*	Annonaceae	Edible fruit	C	75
arroz	rice	*Oryza sativa*		Dietary staple	C	147
atz'uum kaminak	cemetery flower	*undetermined*		planted in cemetary	C	183
atzum tzin	cassava	*Manihot esculenta*	Euphorbiaceae	tuber	C	14
awon	velvet bean, acuna	*undetermined*		type of bean used to nitrate soil in corn fields, planted after corn gets waist high and during fallow in matambre fields	C	88
awon	velvet bean, acuna	*q*		type of bean used to nitrate soil in corn fields, planted after corn gets waist high and during fallow in matambre fields	C	202
b'aalam	similar to cacao, older variety	*undetermined*		Beverage, cultivated similar to cacao	P/C	89/185
b'aknel		*undetermined*		plant trail	W	168
b'alamaax		*undetermined*		lumber/firewood	W	179
b'alamax	broadleaf bay cedar	*cf. Luehea seemannii Triana & Planch.*	Tiliaceae	firewood	W	90
b'eninapim	poison plant	*Peperomia rotundifolia (L.) H.B.K.*	Piperaceae	none, "badplant", which covers up mango trees, etc, strangling them	W	57
b'il	basket tie tie	*Desmoncus orthacanthos Mart.*	Arecaceae	baskets	W	35
b'ilweb'	billyweb	*Sweetia panamensis*	Fabaceae	house	W	91/176
b'ilweb'	billyweb	*undetermined*		lumber/firewood	W	176

b'its		*Inga punctata Willd.*	Favaceae-Mimosoideae	edible fruit	W/P	71
b'olonyok	fishpoison	*Serjania*	Sapindaceae	pound vine against rock, stick in water to kill fish (wowobk)	W	36
badoo	badoo	*cf. Alocasia macrorrhizos (L.) G. Don*	Araceae	Tuber	C	4
benq, tem k'ana	basil, wild basil	*Ocimum campechianum Mill.*	Lamiaceae	Herb	C	3
bukut	Stinking toe	*cf. Cassia grandis L.*	Fabaceeae-Caesalpinoideae	Edible pods, strong odor	P/C	92
bukut	Stinking toe	*cf. Cassia grandis L.*	Fabaceeae-Caesalpinoideae	Edible pods, strong odor	P/C	199
cacao	cacao	*Theobroma cacao L.*	Sterculraceae	Beverage, red pods	C	19
cacao che'	wild cacao	*Theobroma cacao L.*	Stenculraceae	edible seeds used for beverage	W/P	25
callaloo	callaloo	*Ameranthus dubius Thell.*	Amaranthaceae	Boiled greens	C	11
ch'abai		*Guazuma ulmifolia Lam.*	Sterculicaceae	house construction--crossbeam	W	148
ch'alaam	barbasco	*Lonchocarpus castilloi*		fish poison, crushed leaves put in streams in dry season to stun fish, so you can catch them when they float to surface, turns water bright green	W	33
ch'elel		*Inga fissicalyx Pittier*		family to cho choc, eat spongy material inside seed pod	P/C	93
ch'on te'	wild papaya	*Carica papaya L.*	Caricaceae	Edible fruit, family to papaya	W/P	7
ch'un			Zingiberaceae	edible inflorescence, can also feed to chickens	W	152
ch'un		*cf. Costus pulverulentus Presl.*	Costaceae	edible inflorescence, can also feed to chickens	W	153
ch'un ak te'		*undetermined*			W	161
cha'jib'	macapal	*Trichospermum greiifolium (A. Rich) Kosterm.*	Tiliaceae	strip young trees of bark,make straps to carry loads, tie thatch, etc.	W	55
chak' qop	sa'uuk in Mopan	*undetermined*		house	W	97
chaq kop		*undetermined*		house	W	163
che' kape, nim kape	coffee, large bean, taller	*cf. Faramea sp.*	Rubiaceae	Beverage	C	69
che' tzi' b'ik	vanilla	*Vanilla pfaviana*		fruit ground in cacao drink	W/P	143/98
chem chem	palm	*Chamaedorea pinnatifrons (Jacq.) Oerst.*	Arecaceae	can eat cabbage	wild	27
chi che'	wild craboo	*Bourreria oxyphylla Standl.*	Boraginaceae	edible fruit, children use fruits as ammunition for slingshots to kill birds,house, corner post	W	67/166
chi'	craboo	*Byrsonima bucidifolia Standl.*	Malpighiaceae	Edible fruit	C	6

chi' kai		*Calathea lutea (Aubl.) G. Mey*	Marantaceae	Edible flowerbud, after emerging, before blooming, for caldo	W/P	15
chib' iyal	pimienta vine	*Tynanthus guatemalensis Donn. Sm.*	Bignoniaceae	bark used to make tea	W	29
chiin	orange	*Citrus sinensis*		Edible fruit	C	99
chima'	cho cho, chayote	*cf. Sechium edule*		Edible squash	C	100
cho' choc	bri bri	*Inga edulis*	Mimosaceae	Edible fruit: eat white mesocarp around seeds inside pod	W/P	150
choqloq te', kaqi te		*undetermined*		firewoood	W	102/194
cortes	cortez	*Tabebuia chrysantha (Jacq.)*	Bignoniaceae	strong lumber, used for house posts	W	42
esem	mushroom	*undetermined*		edible mushroom, blood red in color, spongy circular with no stem	W	54
guanacast	guanacaste	*Enterolobium cyclocarpum*		large jungle tree, has earshaped reddish fruit, seeds inside were used for necklaces	W	135
habaner	habanero	*Capsicum cf. chinese Jacq.*	Solanaceae	Chile	C	9
hob'ub'			Moraceae		W	155
hu	fig	*Ficus spp. Undet. cf Ficus obtusifolia H.B.K.*	Moraceae	fig with round green fruits with pink flesh	W	103/164
huch'um mox	strong waha leaf	*undetermined*	Maronthaceae	similar to mox, but "the thick one", very disirable for wrapping food items	W/P	62
ichaj', ch'iloj'	chaya	*Jatropha acontipholia*		Greens	W/P	95
iis	potato	*undetermined*		Tuber	C	104
inup	ceiba, cotton tree	*Ceiba petandra (L.) Gaertn.*	Bombacaceae	protected species, brown "cotton" used to stuff pillows	W/P	48
ixim	corn, maize	*Zea mays L. subsp. Mays.*	Poaceae	dietary staple	C	79
jolob'ulb'	Monkey apple, Monkey Cap	*Licania platypus (Hemsl.) Fritsch*	Chrysubalanaceae	edible fruit, construction	W	37
jolom a' tz'o		*undetermined*	Rubiaceae - Cephaelin	medicinal plant, used for snake bite or respiratory illness	W	141
jom	calabash	*Cresentia cujete L.*	Bignoniaceae	hollowed out fruit used for strainers, cups, bowls	C	81
k'an inoq	yellow ginger, turmeric	*Curcuma longa L.*	Zingiberaceae	root dried, gound used as spice	C	105/188
k'an paraway		*Vismia camparaguey Sprague & Riley*	Clusiaceae	house construction, medicinal, vertical center beam that holds roof	W	140/162
k'an paraway		*Vismia campararguey*		house, vertical center beam that holds roof	W	106

k'an q'ahan, k'aniq'ehen		*undetermined*		vine, se ru che', yellow fruits, suck black seeds (jungle)	W	47
k'an te'	madre cacao	*Gliricidia sepium (Jacq.) Stead.*	Fabiaceae-Papilionoideae	strong wood used for door frame, living fence post, bark can be ground and used as rat poison	living fence/W	50
k'is k'im	fever grass, lemon grass	*Simbapogon citratus (D.C.) Stapf.*		make tea with leaves by boiling, add sugar	P/C	201/108
k'ix hu	Prickly fig	*Poulsenia armata (Mig.) Standl.*	Moraceae	edible fruits	W	24
k'ix k'ib	battery palm	*Bactris mexicana Mart.*	Arecaceae	inedible, used to tie thatch/house frame	W	198
k'um	pumpkin	*undetermined*		squash	C	109/144
k'un batz	passion flower	*cf. Passiflora*		vine w/ fruits, suck seeds, or eat fruit	W	101
kakikenq	red kidney bean	*Phaseolus vulgaris L.*	Fabaceae-Papilionoideae	Dietary staple	C	30
kala'	jippy jappa	*Cardulovica palamata Ruiz & Pav.*	Cyclanthaceae	edible shoots (k'un), older k'un used for jippy jappa baskets, edible young flower--boil white strands inside	W/P	2
kape	coffee	*Coffea arabica*		Beverage	C	110/200
kaqkaq	gumbo limbo tree	*Bursera simaruba L. Sarg.*	Burseraceae	firewood	W	193/111
kaquq'ub'		*undetermined*		leaf put on cut to stop bleeding	W	77
kaketiche'		*Garcinia intermedia (Ppittier) Hammel*	Clusiaceae	edible fruit	W	112/197
kayamit, kaimito	star apple	*Chrysophyllum cainito L.*	Sapotaceae	edible fruit	C	13
kej		*undetermined*			W	173
keqiche', k'eq che'	black stick		Celastraceae	posts for houses	W	132
kis aaq'am		*undetermined*			W	113
kok ik	small pepper	*Capsicum frutescens L.*	Solanaceae	Chile	C	8
lamb'a pom		*Chamaedorea cf. ernesti-augustii H. Wendl.*	Arecaceae	used to wrap the pom (copal)	W	63
lamux	lime	*Citrus limonia Osbeck*	Rutaceae	edible fruit	C	114
lamux che'	W lime	*undetermined*		leaves used for tea	W	167
lau	wild banana	*Heliconia mariae Hook f.*	Heliconiaceae	edible heart	W/P	22
leech	santa maria	*Odontonema callistachyum (Schltdl. and Cham.) Kuntze*	Acanthaceae	house, smaller lengthwise crossbeam	W	60
loba'a che'		*undetermined*		plant trail	W	172/182

lotsleb'	glue tree	*cf. Cordia diversifolia Pavon ex DC.*	Boraginaceae	juice from berries used for glue, children eat fruits	P	76
lotspim		*undetermined*			W	186
mach palau	luffa, sponge	*cf. Luffa cylindrica (L.) M. roem.*	Cucurbitaceae	use inside of fruit for scrubbing when bathing, remove black seeds and dry in sun	P/C	83
mank	mango	*Mangefera indica L.*	Anacardiaceae	edible fruit	C	1
map	Suppa palm	*Acrocomia aculeata (Jacq.) Lodd. Ex Mart. (syn Acrocoia mexicana Karw. Ex Mart)*	Arecaceae	edible fruit, suck peanut butter-like substance from around nut	C/P	82
marajk		*undetermined*	Araceae	none	W	137
marallon	cashew	*Anacardium occidentale L.*	Anacardiaceae	edible fruit/nut	C	85
masan arroz	molly apple	*undetermined*		edible fruit with red skin, white flesh	P/C	160
masan arroz		*cf. Cugenia sp.*	Myrtaceae	edible fruit, w/ yellow fruit	P/C	72
masapan	breadfruit	*Artocarpus altilis (Parkinson) Fosberg*	Moraceae	edible fruit	C	21
matacuy	cowsop	*Annona purpea Moc. & Sesse. Ex Dunal*	Annonaceae	edible fruit	C/P	66
mes	give and take palm, broom tree	*Chyrosophila stauracantha (Heynh.) R. Evans*	Arecaceae	brooms, palm cabbage edible but bitter	W	46
mokoch	Cohune Palm	*Orbigyna cohune,syn Attalea cohune*	Palmae	edible shoots, "cabbage", nuts: "tuts"	W/P	107
mox	Waha leaf	*Calathea lutea Attale.*		leaf preferred one used for wrapping poch, tamales	W/P/C	138
mutch'uch	chipoliin	*undetermined*	Fabaceae	Eat young leaves, fry them	C	17
muxtas	mustard greens	*Brassica juncea (L.) Czern.*	Brassicaceae	edible greens with peppery flavor, boiled or fried	C	31
muy	chicle, sapodilla	*Manilkara zapota*		chicle, house, fruits	W	116
muy	chicle, sapodilla	*Manilkara zapota*		chicle, house, fruits	W	165
noq'	cotton	*Gossympium hirsutum L.*	Malavaceae	use cotton for applying medicine to sores, clothing, koxtal	C	59/94/195
noq' te'	cotton tree	*undetermined*		firewood	W	181
noqiritimis	cat's balls	*Theuetra ahouai (L.) A. DC.*	Apocynaceae	eat white flesh inside bright red fruit	W	40
o'	Avacado, Pear	*Persea americana*	Lauraceae	edible fruit	C	117

okox	mushroom/lichen	*Squamulose lichen, Cladonia sp.*		edible mushroom/lichen: white, lettuce leaf-like, grows in k'al, on dead wood	W	53
okr	okra	*Abelmoschus esculentus (L.) Moench*	Malvaceae	boiled in caldo, fried	C	12
ox	coco, coco yam	*cf. Alocasia macrorrhizos (L.) Schott*	Araceae	tuber	C	18
paap		*Dioscorea conolvulacea Uline*	Dioscoreae	eaten like potato	C	145
pak	custard apple	*Annona reticulata*	Anacardiaceae	eat fruits when ripe, brownish shell, stinky	W	118
pamaq, pamak		*Geonoma interrupta (Ruiz & Pav.) Mart. Var. interrupta*	Arecaceae	edible wild resource, roast cabbage on fire	W	51
paq	sugar locos	*undetermined*		edible fruit	W	174
paraxq, parax	blogo banana, apple banana	*Musa x Paradisiaca*		edible fruit	C	142
pata'	guava	*Psidium guajava*	Myrtaceae	edible fruit	C	119/146
pata' che'	wild guava	*undetermined*		semi-edible fruit, children use them as ammunition for slingshots	W	78
pens	allspice, pimienta gorda	*Pimenta dioica (L.) Merr.*	Myrtaceae	herb used in caldo, tea	W/C	70
piak'	yam	*cf. Dioscorea*		tuber	C	159
pom te'	wild copal	*Protium multirimiflorum Lundell, Field, & Lab.*	Burseraceae	no use	W	39/178
pux, pox	wild custard apple	*Annona sp.*		Edible fruit, high jungle, family to kayamit	W	43
q'amank, k'aniq'ehen	Jackass bitters	*Neurolanena lobata (L.) R. Br. Ex.Cass*	Asteraceae	medicinal/bitters, widely used thruout belize	W	28
q'iche' cacao	wild cacao	*cf. Theobroma cacao*		Beverage	W	175
q'oyo'	prickle	*undetermined*		none, sticks on clothes	W	139
ron ron		*undetermined*		lumber/firewood	W	177
roq' hab'		*undetermined*		none--makes skin itchy	W	169
roq'ixa'an		*undetermined*		whistle by kids	W	133
roqixa'an	old lady's foot	*Psychotria grandis Sw.*	Rubiaceae	stem used by children to make whistle	W	34
rum	plum	*cf. Spondias mombin L.*	Anacardiaceae	edible fruit	P/C	74
rum pook	golden plum, Hog plum	*cf. Spondias purpea L.*	Anacardiaceae	edible fruit	C	123/189
ruxb'ikaq'		*Lygoium venustum Sw.*	Schizaeceae	vine, sometimes used to make baskets or for other tying purposes	W	64

sajab'		*Curatella americana L.*	Dilleniaceae	use leaves to scrub pots	W/P	68
sajom te', xabon te'	soap tree	*Sapindus saponaria L.*	Sapindaceae	used for soap when ripe	W	41
sak'il te'		*cf Jatropha curcas L.*	Euphorbaceae	Edible fruit: roast seeds, yellow fruit	W	136
saki cho'choc	mountain bri bri	*Inga pavoniana G. Don*	Fabiaceae-Mimosoideae	edible seeds inside large green pods, tends to grow in jungle	W/C	45
saki k'ib	long leaf, pacaya	*Chamaedorea tepejilote Liebm.*	Arecaceae	edible shoots, fried w/ egg	W	52
saki tsuk'l		*undetermined*		similar to waha leaf/mox, can be used to wrap poch if can't find mox	W	58
saltul	mamey, or "mommy apple"	*Pouterra sapota (Jacq.) H.E. Moore and Stearn.*	Sapotaceae	edible fruit	C	38
samat	kulantro	*Eryngium foetidum L.*	Apiaceae	herb/caldo, can also be used to treat black stool for children: crush root and put in cold water	wild/cultivated	26
sedi, senti	watermelon (sandia)	*Citrullus lanatas (Thunb.) Matsum.&Nakai*	Cucurbitaceae	edible fruit	C	84
senti ch'o		*undetermined*		Edible fruit/berries	W	170
si ki		*undetermined*		firewood	W	192
su chaj'	samwood	*cf. Cordra alliodora*		closer to cedar or mahogany	W	124
su chaj'	timbersweet	*undetermined*		lumber firewood	W	157
sub'in	cockspur, cuerno de vaca	*Acacia Collinsii Saft.*	Fabaceae-Mimosoideae	can use thorns for needles, medicinal plant, edible fruit	W	56
tapak'al	string beans	*undetermined*		boiled, fried	C	5
tasub' q'aham		*undetermined*		vine found in jungle you can drink water from	W	121
teb', tep, teb' pim, kolax		*Plectranthus amboinicus (Lour.) Spreng.*	Lamiaceae	herb/caldo, thick, hairy heart shaped leaves	C	80
tolo'ox	strangler fig	*Clusia flava Jacq.*	Clusiaceae	firewood	W	149
tolo'ox	strangler fig	*Souroubea guianensis Aubl*	Margraviaceae	firewood	W	126
toronj	grapefruit	*Citrus*		edible fruit	C	127
tutit		*undetermined*		none	W	171
tzi'		*undetermined*	Zingiberaceae	edible berries, use them in caldo, by squeezing juice from seed coverings, rinsing the trash, add yellowish liquid to caldo, makes it sweet and smell nice	W	128

tzi'		*undetermined*	Zingiberaceae	inedible	W	154
tzin te', tsutsu		*undetermined*		children use stems for a whistle	W	73
tzul ik, chup ik	small, hottest pepper	*Capsicum cf. annum L. var. annum*	Solanaceae	Chile	C	10
u'tzaj'	Sugar cane	*Saccharum officinarum*		edible stalk, sugar	C	129
ub'el	cowfoot	*Piper auritum H.B.K.*	Piperaceae	used to flavor fish, snails in boils or "lancha": fish roasted in mox leaf over fire	W/C	20
uk'al ch'un		*undetermined*			W	190
unnamed		*undetermined*	Polygonaceae	used for sores on the ear, crush leaf in hot water and put mixture on ear	W	65
waachil, quajil	tambran	*Dalium guianense (Aubl.) Steud.*	Caesalpiniaceae	house	W/P	130
wach'iil	ironwood, tombrand	*Dialium guianense*	Caesalpiniaceae	Eat small brown fruits, suck on spongy seed covering	W/P	151
wara' k'ix	sleepy prickle	*undetermined*		none	W	180
xan	bay leaf, sabal palm	*cf. Sabal mauritiiformis (H. Karst) Griseb. & H. Wendl. Ex griseb.*	Arecaceae	often used for thatch roofs thruout Belize, for roof ends in Kekchi traditional houses, also a famine food, the cabbage is bitter but "healthy to eat"	W/P	23
xanxivre	ginger	*Zingiber officinale Roscoe*	Zingiberaceae	leaves and flowerbuds used in caldo, root	C/P	16
xiyow	annato, achiote	*Bixa orellana L.*	Bixaceae	most widely used spice, in caldo, stew, tamales	C	120
xmisiha'	fern	*undetermined*		on trail	W	61
yamor	Cerrosee	*Momordica charantia L.*	Cucurbitaceae	leaves used as bitters, red seeds can be sucked and spit out again	W	86
yamor	cerrosee	*undetermined*		medicinal, seed coverings edible	W	191
yepu'u		*undetermined*		none	W	184/131
yow	cedar	*Cedrela odorata L.*	Meliaceae	wood used for instruments: harp, guitar, violin	W	96
yuk	antelope/brocket plant	*Anthurium sp.*	Araceae	eat fruit, boil and eat or fry with egg	W	134/32

Determinations were made at the Belize National Herbarium, Belmopan, Belize, with the kind assistance of Ramon Vargas and Hector Mai;
and with the kind assistance of Steven Darwin, Director, Tulane University Herbarium. However I am responsible for any errors in documentation.
The annotation, "cf." is used to indicate probable scientific names based on the available literature, primarily common names, descriptions and uses of plants.
Sources: *Checklist of the Vascular Plants of Belize* (Balick et al. 2000); *The Flora of Guatemala vol. 24 of Fieldiana Bot*
Undetermined specimens have been sent to specialists and will be published at a later date.

Key to Cultivar Status Column:
W = wild
P = protected
C = cultivated

Q'eqchi' Ethnobotany: Collections by Scientific Name

Scientific Name	Q'eqchi' Name	English Name	Family	Use/Preparation	Cultivar Status	No.
Bactris mexicana Mart.	**k'ix k'ib**	battery palm	Arecaceae	inedible, used to tie thatch/house frame	W	198
Abelmoschus esculentus (L.) Moench	**okr**	okra	Malvaceae	boiled in caldo, fried	C	12
Acacia Collinsii Saft.	**sub'in**	cockspur, cuerno de vaca	Fabaceae-Mimosoideae	can use thorns for needles, medicinal plant, edible fruit	W	56
Acrocomia aculeata (Jacq.) Lodd. Ex Mart. (syn Acrocoia mexicana Karw. Ex Mart)	**map**	Suppa palm	Arecaceae	edible fruit, suck peanut butter-like substance from around nut	C/P	82
Ameranthus dubius Thell.	**callaloo**	callaloo	Amaranthaceae	Boiled greens	C	11
Anacardium occidentale L.	**marallon**	cashew	Anacardiaceae	edible fruit/nut	C	85
Annona muricata L.	**anaab'**	soursop	Annonaceae	Edible fruit	C	75
Annona purpea Moc. & Sesse. Ex Dunal	**matacuy**	cowsop	Annonaceae	edible fruit	C/P	66
Annona reticulata	**pak**	custard apple	Anacardiaceae	eat fruits when ripe, brownish shell, stinky	W	118
Annona sp.	**pux, pox**	wild custard apple		Edible fruit, high jungle, family to kayamit	W	43
Anthurium sp.	**yuk**	antelope/brocket plant	Araceae	eat fruit, boil and eat or fry with egg	W	134/32
Artocarpus altilis (Parkinson) Fosberg	**masapan**	breadfruit	Moraceae	edible fruit	C	21
Astrocaryum mexicanum Liebm. Ex Mart.	**ak' te'**	warree cohune	Arecaceae	edible palm cabbage, "k'ib", palm nuts "monok", and young shoots "och akte'"	W	44
Bixa orellana L.	**xiyow**	annato, achiote	Bixaceae	most widely used spice, in caldo, stew, tamales	C	120
Bourreria oxyphylla Standl.	**chi che'**	wild craboo	Boraginaceae	edible fruit, children use fruits as ammunition for slingshots to kill birds,house, corner post	W	67/166
Brassica juncea (L.) Czern.	**muxtas**	mustard greens	Brassicaceae	edible greens with peppery flavor, boiled or fried	C	31
Brosimum alicastrum Sw.	**aax**	breadnut, ramon	Moraceae	firewood/famine food	W/P	87/196
Bursera simaruba L. Sarg.	**kaqkaq**	gumbo limbo tree	Burseraceae	firewood	W	193/111
Byrsonima bucidifolia Standl.	**chi'**	craboo	Malpighiaceae	Edible fruit	C	6
Calathea lutea (Aubl.) G. Mey	**chi' kai**		Marantaceae	Edible flowerbud, after emerging, before blooming, for caldo	W/P	15

Calathea lutea Attale.	**mox**	Waha leaf		leaf preferred one used for wrapping poch, tamales	W/P/C	138
Capsicum cf. annum L. var. annum	**tzul ik, chup ik**	small, hottest pepper	Solanaceae	Chile	C	10
Capsicum cf. chinese Jacq.	**habaner**	habanero	Solanaceae	Chile	C	9
Capsicum frutescens L.	**kok ik**	small pepper	Solanaceae	Chile	C	8
Cardulovica palamata Ruiz & Pav.	**kala'**	jippy jappa	Cyclanthaceae	edible shoots (k'un), older k'un used for jippy jappa baskets, edible young flower--boil white strands inside	W/P	2
Carica papaya L.	**ch'on te'**	wild papaya	Caricaceae	Edible fruit, family to papaya	W/P	7
Cecropia peltata L.	**ak'l, puhur**	trumpet tree, guarumbo	Cecropiaceae	old people used to roll up young leaves and smoke like tobacco; protected plant	P	49
Cedrela odorata L.	**yow**	cedar	Meliaceae	wood used for instruments: harp, guitar, violin	W	96
Ceiba petandra (L.) Gaertn.	**inup**	ceiba, cotton tree	Bombacaceae	protected species, brown "cotton" used to stuff pillows	W/P	48
cf Jatropha curcas L.	**sak'il te'**		Euphorbaceae	Edible fruit: roast seeds, yellow fruit	W	136
cf. Alocasia macrorrhizos (L.) G. Don	**badoo**	badoo	Araceae	Tuber	C	4
cf. Alocasia macrorrhizos (L.) Schott	**ox**	coco, coco yam	Araceae	tuber	C	18
cf. Cassia grandis L.	**bukut**	Stinking toe	Fabaeceae-Caesalpinoideae	Edible pods, strong odor	P/C	92
cf. Cassia grandis L.	**bukut**	Stinking toe	Fabaeceae-Caesalpinoideae	Edible pods, strong odor	P/C	199
cf. Cordia diversifolia Pavon ex DC.	**lotsleb'**	glue tree	Boraginaceae	juice from berries used for glue, children eat fruits	P	76
cf. Cordra alliodora	**su chaj'**	samwood		closer to cedar or mahogany	W	124
cf. Costus pulverulentus Presl.	**ch'un**		Costaceae	edible inflorescence, can also feed to chickens	W	153
cf. Cugenia sp.	**masan arroz**		Myrtaceae	edible fruit, w/ yellow fruit	P/C	72
cf. Dioscorea	**piak'**	yam		tuber	C	159
cf. Faramea sp.	**che' kape, nim kape**	coffee, large bean, taller	Rubiaceae	Beverage	C	69
cf. Luehea seemannii Triana & Planch.	**b'alamax**	broadleaf bay cedar	Tiliaceae	firewood	W	90
cf. Luffa cylindrica (L.) M. roem.	**mach palau**	luffa, sponge	Cucurbitaceae	use inside of fruit for scrubbing when bathing, remove black seeds and dry in sun	P/C	83
cf. Passiflora	**k'un batz**	passion flower		vine w/ fruits, suck seeds, or eat fruit	W	101

cf. Sabal mauritiiformis (H. Karst) Griseb. & H. Wendl. Ex griseb.	**xan**	bay leaf, sabal palm	Arecaceae	often used for thatch roofs thruout Belize, for roof ends in Kekchi traditional houses, also a famine food, the cabbage is bitter but "healthy to eat"	W/P	23
cf. Sechium edule	**chima'**	cho cho, chayote		Edible squash	C	100
cf. Spondias mombin L.	**rum**	plum	Anacardiaceae	edible fruit	P/C	74
cf. Spondias purpea L.	**rum pook**	golden plum, Hog plum	Anacardiaceae	edible fruit	C	123/189
cf. Theobroma cacao	**q'iche' cacao**	wild cacao		Beverage	W	175
Chamaedorea cf. ernesti-augustii H. Wendl.	**lamb'a pom**		Arecaceae	used to wrap the pom (copal)	W	63
Chamaedorea pinnatifrons (Jacq.) Oerst.	**chem chem**	palm	Arecaceae	can eat cabbage	wild	27
Chamaedorea tepejilote Liebm.	**saki k'ib**	long leaf, pacaya	Arecaceae	edible shoots, fried w/ egg	W	52
Chrysophyllum cainito L.	**kayamit, kaimito**	star apple	Sapotaceae	edible fruit	C	13
Chyrosophila stauracantha (Heynh.) R. Evans	**mes**	give and take palm, broom tree	Arecaceae	brooms, palm cabbage edible but bitter	W	46
Citrullus lanatas (Thunb.) Matsum.&Nakai	**sedi, senti**	watermelon (sandia)	Cucurbitaceae	edible fruit	C	84
Citrus	**toronj**	grapefruit		edible fruit	C	127
Citrus limonia Osbeck	**lamux**	lime	Rutaceae	edible fruit	C	114
Citrus sinensis	**chiin**	orange		Edible fruit	C	99
Clusia flava Jacq.	**tolo'ox**	strangler fig	Clusiaceae	firewood	W	149
Coffea arabica	**kape**	coffee		Beverage	C	110/200
Cresentia cujete L.	**jom**	calabash	Bignoniaceae	hollowed out fruit used for strainers, cups, bowls	C	81
Curatella americana L.	**sajab'**		Dilleniaceae	use leaves to scrub pots	W/P	68
Curcuma longa L.	**k'an inoq**	yellow ginger, turmeric	Zingiberaceae	root dried, gound used as spice	C	105/188
Dalium guianense (Aubl.) Steud.	**waachil, quajil**	tambran	Caesalpiniaceae	house	W/P	130
Desmoncus orthacanthos Mart.	**b'il**	basket tie tie	Arecaceae	baskets	W	35
Dialium guianense	**wach'iil**	ironwood, tombrand	Caesalpiniaceae	Eat small brown fruits, suck on spongy seed covering	W/P	151
Dioscorea conolvulacea Uline	**paap**		Dioscoreae	eaten like potato	C	145
Enterolobium cyclocarpum	**guanacast**	guanacaste		large jungle tree, has earshaped reddish fruit, seeds inside were used for necklaces	W	135
Eryngium foetidum L.	**samat**	kulantro	Apiaceae	herb/caldo, can also be used to treat black stool for children: crush root and put in cold water	wild/cultivated	26
Ficus spp. Undet. cf Ficus obtusifolia H.B.K.	**hu**	fig	Moraceae	fig with round green fruits with pink flesh	W	103/164
Garcinia intermedia (Ppittier) Hammel	**karetiche'**		Clusiaceae	edible fruit	W	112/197

Geonoma interrupta (Ruiz & Pav.) Mart. Var. interrupta	**pamaq, pamak**		Arecaceae	edible wild resource, roast cabbage on fire	W	51
Gliricidia sepium (Jacq.) Stead.	**k'an te'**	madre cacao	Fabiaceae-Papilionoideae	strong wood used for door frame, living fence post, bark can be ground and used as rat poison	living fence/W	50
Gossympium hirsutum L.	**noq'**	cotton	Malavaceae	use cotton for applying medicine to sores, clothing, koxtal	C	59/94/195
Guazuma ulmifolia Lam.	**ch'abai**		Sterculicaceae	house construction--crossbeam	W	148
Heliconia mariae Hook f.	**lau**	wild banana	Heliconiaceae	edible heart	W/P	22
Inga punctata Willd.	**b'its**		Favaceae-Mimosoideae	edible fruit	W/P	71
Inga edulis	**cho' choc**	bri bri	Mimosaceae	Edible fruit: eat white mesocarp around seeds inside pod	W/P	150
Inga fissicalyx Pittier	**ch'elel**			family to cho choc, eat spongy material inside seed pod	P/C	93
Inga pavoniana G. Don	**saki cho'choc**	mountain bri bri	Fabiaceae-Mimosoideae	edible seeds inside large green pods, tends to grow in jungle	W/C	45
Jatropha acontipholia	**ichaj', ch'iloj'**	chaya		Greens	W/P	95
Licania platypus (Hemsl.) Fritsch	**jolob'ulb'**	Monkey apple, Monkey Cap	Chrysubalanaceae	edible fruit, construction	W	37
Lonchocarpus castilloi	**ch'alaam**	barbasco		fish poison, crushed leaves put in streams in dry season to stun fish, so you can catch them when they float to surface, turns water bright green	W	33
Lygoium venustum Sw.	**ruxb'ikaq'**		Schizaeceae	vine, sometimes used to make baskets or for other tying purposes	W	64
Mangefera indica L.	**mank**	mango	Anacardiaceae	edible fruit	C	1
Manihot esculenta	**atzum tzin**	cassava	Euphorbiaceae	tuber	C	14
Manilkara zapota	**muy**	chicle, sapodilla		chicle, house, fruits	W	116
Manilkara zapota	**muy**	chicle, sapodilla		chicle, house, fruits	W	165
Momordica charantia L.	**yamor**	Cerrosee	Cucurbitaceae	leaves used as bitters, red seeds can be sucked and spit out again	W	86
Musa x Paradisiaca	**paraxq, parax**	blogo banana, apple banana		edible fruit	C	142
Neurolanena lobata (L.) R. Br. Ex.Cass	**q'amank, k'aniq'ehen**	Jackass bitters	Asteraceae	medicinal/bitters, widely used thruout belize	W	28
Ocimum campechianum Mill.	**benq, tem k'ana**	basil, wild basil	Lamiaceae	Herb	C	3
Odontonema callistachyum (Schltdl. and Cham.) Kuntze	**leech**	santa maria	Acanthaceae	house, smaller lengthwise crossbeam	W	60
Orbigyna cohune,syn Attalea cohune	**mokoch**	Cohune Palm	Palmae	edible shoots, "cabbage", nuts: "tuts"	W/P	107
Oryza sativa	**arroz**	rice		Dietary staple	C	147

Peperomia rotundifolia (L.) H.B.K.	**b'eninapim**	poison plant	Piperaceae	none, "badplant", which covers up mango trees, etc, strangling them	W	57
Persea americana	**o'**	Avacado, Pear	Lauraceae	edible fruit	C	117
Phaseolus vulgaris L.	**kakikenq**	red kidney bean	Fabaceae-Papilionoideae	Dietary staple	C	30
Pimenta dioica (L.) Merr.	**pens**	allspice, pimienta gorda	Myrtaceae	herb used in caldo, tea	W/C	70
Piper auritum H.B.K.	**ub'el**	cowfoot	Piperaceae	used to flavor fish, snails in boils or "lancha": fish roasted in mox leaf over fire	W/C	20
Plectranthus amboinicus (Lour.) Spreng.	**teb', tep, teb' pim, kolax**		Lamiaceae	herb/caldo, thick, hairy heart shaped leaves	C	80
Poulsenia armata (Mig.) Standl.	**k'ix hu**	Prickly fig	Moraceae	edible fruits	W	24
Pouterra sapota (Jacq.) H.E. Moore and Stearn.	**saltul**	mamey, or "mommy apple"	Sapotaceae	edible fruit	C	38
Protium multirimiflorum Lundell, Field, & Lab.	**pom te'**	wild copal	Burseraceae	no use	W	39/178
Psidium guajava	**pata'**	guava	Myrtaceae	edible fruit	C	119/146
Psychotria grandis Sw.	**roqixa'an**	old lady's foot	Rubiaceae	stem used by children to make whistle	W	34
Saccharum officinarum	**u'tzaj'**	Sugar cane		edible stalk, sugar	C	129
Sapindus saponaria L.	**sajom te', xabon te'**	soap tree	Sapindaceae	used for soap when ripe	W	41
Serjania	**b'olonyok**	fishpoison	Sapindaceae	pound vine against rock, stick in water to kill fish (wowobk)	W	36
Simbapogon citratus (D.C.) Stapf.	**k'is k'im**	fever grass, lemon grass		make tea with leaves by boiling, add sugar	P/C	201/108
Souroubea guianensis Aubl	**tolo'ox**	strangler fig	Margraviaceae	firewood	W	126
Squamulose lichen, Cladonia sp.	**okox**	mushroom/lichen		edible mushroom/lichen: white, lettuce leaf-like, grows in k'al, on dead wood	W	53
Sweetia panamensis	**b'ilweb'**	billyweb	Fabaceae	house	W	91/176
Tabebuia chrysantha (Jacq.)	**cortes**	cortez	Bignoniaceae	strong lumber, used for house posts	W	42
Theobroma cacao L.	**cacao**	cacao	Sterculraceae	Beverage, red pods	C	19
Theobroma cacao L.	**cacao che'**	wild cacao	Stenculraceae	edible seeds used for beverage	W/P	25
Theuetra ahouai (L.) A. DC.	**noqiritimis**	cat's balls	Apocynaceae	eat white flesh inside bright red fruit	W	40
Trichospermum greiifolium (A. Rich) Kosterm.	**cha'jib'**	macapal	Tiliaceae	strip young trees of bark,make straps to carry loads, tie thatch, etc.	W	55
Tynanthus guatemalensis Donn. Sm.	**chib' iyal**	pimienta vine	Bignoniaceae	bark used to make tea	W	29
undetermined	**atz'uum kaminak**	cemetery flower		planted in cemetary	C	183

undetermined	**awon**	velvet bean, acuna		type of bean used to nitrate soil in corn fields, planted after corn gets waist high and during fallow in matambre fields	C	88
undetermined	**awon**	velvet bean, acuna		type of bean used to nitrate soil in corn fields, planted after corn gets waist high and during fallow in matambre fields	C	202
undetermined	**b'aalam**	similar to cacao, older variety		Beverage, cultivated similar to cacao	P/C	89/185
undetermined	**b'aknel**			plant trail	W	168
undetermined	**b'alamaax**			lumber/firewood	W	179
undetermined	**b'ilweb'**	billyweb		lumber/firewood	W	176
undetermined	**ch'un ak te'**				W	161
undetermined	**chak' qop**	sa'uuk in Mopan		house	W	97
undetermined	**chaq kop**			house	W	163
undetermined	**choqloq te', kaqi te**			firewoood	W	102/194
undetermined	**huch'um mox**	strong waha leaf	Maronthaceae	similar to mox, but "the thick one", very disirable for wrapping food items	W/P	62
undetermined	**iis**	potato		Tuber	C	104
undetermined	**jolom a' tz'o**		Rubiaceae - Cephaelin	medicinal plant, used for snake bite or respiratory illness	W	141
undetermined	**k'an q'ahan, k'aniq'ehen**			vine, se ru che', yellow fruits, suck black seeds (jungle)	W	47
undetermined	**k'um**	pumpkin		squash	C	109/144
undetermined	**kaquq'ub'**			leaf put on cut to stop bleeding	W	77
undetermined	**kej**				W	173
undetermined	**kis aaq'am**				W	113
undetermined	**lamux che'**	W lime		leaves used for tea	W	167
undetermined	**loba'a che'**			plant trail	W	172/182
undetermined	**lotspim**				W	186
undetermined	**marajk**		Araceae	none	W	137
undetermined	**masan arroz**	molly apple		edible fruit with red skin, white flesh	P/C	160
undetermined	**mutch'uch**	chipoliin	Fabaceae	Eat young leaves, fry them	C	17
undetermined	**noq' te'**	cotton tree		firewood	W	181
undetermined	**esem**	mushroom		edible mushroom, blood red in color, spongy circular with no stem	W	54
undetermined	**paq**	sugar locos		edible fruit	W	174
undetermined	**pata' che'**	wild guava		semi-edible fruit, children use them as ammunition for slingshots	W	78
undetermined	**q'oyo'**	prickle		none, sticks on clothes	W	139

undetermined	**ron ron**			lumber/firewood	W	177
undetermined	**roq' hab'**			none--makes skin itchy	W	169
undetermined	**roq'ixa'an**			whistle by kids	W	133
undetermined	**saki tsuk'l**			similar to waha leaf/mox, can be used to wrap poch if can't find mox	W	58
undetermined	**senti ch'o**			Edible fruit/berries	W	170
undetermined	**si ki**			firewood	W	192
undetermined	**su chaj'**	timbersweet		lumber firewood	W	157
undetermined	**tapak'al**	string beans		boiled, fried	C	5
undetermined	**tasub' q'aham**			vine found in jungle you can drink water from	W	121
undetermined	**tutit**			none	W	171
undetermined	**tzi'**		Zingiberaceae	edible berries, use them in caldo, by squeezing juice from seed coverings, rinsing the trash, add yellowish liquid to caldo, makes it sweet and smell nice	W	128
undetermined	**tzi'**		Zingiberaceae	inedible	W	154
undetermined	**tzin te', tsutsu**			children use stems for a whistle	W	73
undetermined	**uk'al ch'un**				W	190
undetermined	**unnamed**		Polygonaceae	used for sores on the ear, crush leaf in hot water and put mixture on ear	W	65
undetermined	**wara' k'ix**	sleepy prickle		none	W	180
undetermined	**xmisiha'**	fern		on trail	W	61
undetermined	**yamor**	cerrosee		medicinal, seed coverings edible	W	191
undetermined	**yepu'u**			none	W	184/131
Vanilla pfaviana	**che' tzi' b'ik**	vanilla		fruit ground in cacao drink	W/P	143/98
Vismia camparaguey Sprague & Riley	**k'an paraway**		Clusiaceae	house construction, medicinal, vertical center beam that holds roof	W	140/162
Vismia campararguey	**k'an paraway**			house, vertical center beam that holds roof	W	106
Zea mays L. subsp. Mays.	**ixim**	corn, maize	Poaceae	dietary staple	C	79
Zingiber officinale Roscoe	**xanxivre**	ginger	Zingiberaceae	leaves and flowerbuds used in caldo, root	C/P	16
undetermined	**ch'un**		Zingiberaceae	edible inflorescence, can also feed to chickens	W	152
undetermined	**hob'ub'**		Moraceae		W	155
undetermined	**keqiche', k'eq che'**	black stick	Celastraceae	posts for houses	W	132

APPENDIX C

Eb’ li Xul: Q’eqchi’ Fauna and Insects

Q'eqchi’	**English/Creole**	**Scientific Name***
K'anchi	**snake**	
ajow ch'an	“wowla” or boa constrictor, not poisonous to bite, big snake but will "blow" on you and if this lands on you will kill you. Also said to have made the rainbow	*Boa constrictor*
baknel	another tommy goff--poisonous	
chok b'oli	jumping tommy goff, jumping viper	*Atropoides nummifer*
jom teq'en	snake with nests in ground, ik b'oli goes to eat its' eggs	
k'anchi' ha'	red snake in the water that can bite	
k'anixij'	Rat snake, swallows mouse	*Spilotes pullatus*
kaxkawel	tropical rattlesnake	*Crotalus durissus*
kolas k'anchi, kolars	coral snake, red, black and white	*Micrurus diastema*
nuq'ul pel pel	bright green, eat frogs	
raxkaj	green snake	*Leptophis ahaetulla*
usixul , iik b'oli	yellow jaw tommygoff, Fer-de-lance	*Bothrops asper*
Tzik	**bird**	
akach	ocelated turkey, wild turkey	*Agriocharis ocellata*
chacmut	great currasow	
chakmut	great currasow	*Crax rubra*
chej chem	kingfishers, ringed kingfisher	*Ceryle torquata*

cho'cho'	yellow-headed parrot/yellow-lored parrot	*Amazona xantholora*
hut hut	mot mot	*Motmotus momota*
keq'itzo'	chachalaca, cockrico	*Ortalis vetula*
k'ilkej	kiskadee	*Pitangus sulphuratus*
k'ob'ul, k'anitje	yellow tail	
kolol	Great tinamou	*Tinamous major*
konkolich	by water at cave, looks like grouse, walking on ground	
korechech	small woodpecker, golden fronted woodpecker	*Melanerpes aurifons*
leetseb'	Woodcreeper, smoky-brown woodpecker	*Venilionornis fumigatus*
letzletz	woodcreepers	*Dendrocincla anabatina*
lik lik	chicken hawk, laughing falcon	*Herpetotheres cachinnans*
lox	King vulture	*Sarcoramphus papa*
mo'	scarlet macaw	*Ara macao*
mukuy	morning dove	*Columbina passerina*
paap	pyem pyem, brown jay	*Cyanocorax yncas*
palom	pigeon	*Columba cayennensis*
pasakuk	family to pigeon but for jungle	*Columba flavirostris*
patziha'	wild duck, moscovy duck	*Cairina moschata*
pichik	(similar to toucan), collared aracari	*Pteroglossus torquatus*
pukuyuk	lesser nighthawk	*Chordeliles acutipennis*
pu'u	crested guan	*Penelope purpurascens*
puyuch	parrot, white-crowned parrot	*Pionus senilis*
q'an kok	blackhead trogon	*Trogon melanocephalus*
q'ubul	montezuma's oropendola	*Psarocolius montezuma*
q'uch	hawk, "white tailed hawk", goes after snakes	*Leucopternis albicollis*
selepan	Keel billed toucan, "bill bird"	*Ramphastos sulfuratus*
tserej, kakxjolom	red headed woodpecker, father red-cap	*Campephilus guatemalaensis*
tsilun	Aztec parakeet, olive-throated parakeet	*Aratinga nana*
tsoltsol	john crow, black vulture	*Coragyps atratus*

tut	ground dove	*Columbina talpacoti*
tyiw	eagle, Harpy eagle	Accipitridae
tzu'nun	hummingbird, rufous-tailed hummingbird	*Amazilia tzacatl*
warom	owl, "mottled owl"	*Ciccaba virgata*
Kar	**fish**	
k'an tsajom	yellow forehead, similar to tuba	
k'anchi kar	snake fish, freshwater eel	
k'ob'ej	catfish	
machaca	machaca	*Brycon guatemalensis*
masan	freshwater shrimp	
perechenq	has stripes	
pur	river snail	
sak kar, sakikar	white fish	
tap	crab	
tub'a	fish with red forehead	*Cichlasoma spp.*
Eb' li xul	**forest mammals**	
hix	ocelot	*Leopardus pardalis*
aaq	collared peccary	*Tayassu tajacu*
aaq'am	agouti	*Dasyprocta punctata*
b'a	ground mole, pocket gopher	*Orthogeomys sp.*
batz	spider monkey	*Ateles geoffroyi*
chakow	white-lipped peccary, warree	*Dicotyles pecari*
ch'ixl, tix	tapir	*Tapirus bairdii*
cho'	rat	*Rattus norvegicus*
cho' h'ix	jaguarundi	*Herpailurus yaguarondi*
conej	forest rabbit	*Sylvilagus brasiliensis*
h'ix	jaguar	*Panthera onca*

igwan	green iguana	*Iguana iguana*
jalau	paca, gibnut	*Agouti paca*
kaqib'a	red mole	*Orthogeomys sp.*
kaqimax	kinkajou, night walker	*Potos flavus*
kaqk'o	puma	*Puma concolor*
kej	white tailed deer	*Odocoilieus virginianus*
k'ix uch'	porcupine, Mexican porcupine	*Coenduou mexicanus*
kok	turtle, river turtle	*Dermatemys mawii*
k'op'op'o	toad	*Bufo valliceps*
kuk	squirrel (Deppe's squirrel)	*Sciurus deppei*
max	black howler monkey	*Alouatta pigra*
oow	racoon	*Procyon lotor*
pakmal	lizard	
par	skunk	
pel pel	tree frog	*Rana sp.*
q'em kun	lazy lizard	
sak'b'in	long tailed weasel	*Mustela frenata*
sakol	tayra, bushdog	*Eira barbara*
sis	coati, coatimundi, quash	*Nasua narica*
tsi'ha'	waterdog, neotropical river otter	*Lutra longicaudis*
tz'otz	bat	
tzuktzun	anteater, Northern Tamandua	*Tamandua mexicana*
tzakal pakmal	true lizard, Jesus lizard	*Basiliscus vittatus*
uuch	opossum	*Didelphis sp.*
wech	Nine-banded armadillo	*Dasypus novemcinctus*
woiyo'	Silky anteater	*Cyclopes didactylus*
xoqtsi'	gray fox	*Urocyon cinereoargenteus*
yuk (pronounced tyuk)	antelope, red brocket	*Mazama americana*

Eb' li xul	**domesticated animals**	
akach	turkey	
caway	horse	
chilan	chicken	
koq'ech	guinea hen	
mis	cat	
mul	mule/donkey	
patz	duck	
tsi'	dog	
wakax	cow	
Eb' li xul	**Insects**	
chikirin	cicada	
chup'il	white worm, with 2 " long hair, will sting	
chajal	green worm, will sting	
tsolol	cicada/makes noise during the day	
k'ok'kai	lightening bug	
joyoy	cicada, loudest one at night	
hirich'	cicada for rainy season (onomonopoeia)	
ch'ili'	cricket	
chen	mosquito	
saak	grasshopper	
puroch'och'	grasshopper	

*Scientific names are suggested based solely on identification of Q'eqchi' names with illustrations, habitat desriptions, description of species, and distribution. Sources were Beletsky (1999) and Reid (1997). I would like to thank Reynald Cal for his assistance and sharing information on Q'eqchi' bird names from the Birds Without Borders project, and Salvador Cus for his help.

APPENDIX D

San Miguel Household Survey

1. Ani laa k'ab'a? Informant's Name:______________________________

2. Jarub'eb' ha kristian wankeb' sa wochoch? How many people live in your house?_______

Jarub'eb' jab'eb? Ixq uraj Wenq?

List the Age and Sex of each household member, and relation to Informant (daughter, son, etc.)

3. Relaj hab'l ha escuel naxat wankoo? Ut laj ixaq'el uraj laj belom?
What was your last year of school attended? And your spouse?____________

4. B'ar tzaqal xachal? Kiru xk'ab'a laa tenamit? Where are you from originally?
____

5. Jarub' jab' ha wanrik se San Miguel? How many years have you lived in San Miguel?
____

6. Xkanjeleb' ha kristian sa na wochoch? What are the occupations of the members of your household?

*List each one who is out of school. * Find out what kind of work if they are a laborer.

7. Ma wank ha k'al? Ma wank ha sab'an? Do you have a plantation? Do you have a farm? K'al: yes _____ no ____ Sab'an: yes______ no ________

   a. Xataw ixim uraj arroz? Do you plant corn or rice?

   b. Ut kiru chik xatawok? What else do you plant?

c. Jo najtil chi rix li tenamit?
How far is it (are they) from your house? (walking time **AND** distance)

d. Ma lok'om ch'och' uraj ch'och gobier, uraj tenamit'il ch'och'? What kind of land is it?____

e. What size is your plantation or farm? (acres, mansana) ________________

Food Resources

8. Kiru chi wajol ha nakakux? What kinds of foods do you eat?
(List in the order they answer.) (Also note if food item is used for special occasions, or if only certain people eat it, such as kids or pregnant women.)

I. Name in Kekchi	II. Kiru chi pojol namok ha ni wa winj? (Season available)	III. Ma na kalok, uraj naka kwow, rukin laj famil, laj wechkab'l? Where do you get it from?	IV. Chan ki'ru na naka listari? How is it prepared?
a.			
b.			
c.			
d.			
e.			
f.			
g.			
h.			
i.			
j.			

k.			
l.			
m.			
n.			
o.			
p.			
q.			
r.			
s.			
t.			
u.			
v.			
w.			
x.			
y.			
z.			

9. Kiru chik nakakux ha ink'a nakakow? What kinds of things do you eat that grow, but you don't plant on purpose? Example: jippy jappa shoots (kalaj')

10. Kiru chik texnaw ha telom ut ixqk'al chi rix wabej?
What should boys /girls know about planting, cooking or other things related to food?
Telom/Boys:____
Ixqk'al/Girls:____

11. Jarub' hab'eb' nak naknake'tzol ha k'anjelak?
When should they be able to do these things? (at what age?)

Boys: ____

Girls: ____

12. Chan kiru nakatkuxla chi rixeb’ akok’al naknekextzol k’anjelak?
How do you think children learn to plant things, find fruits/herbs, prepare food, hunt, fish?

13. Kiru chi k’a’at keru che’ul nakausare’ chix kibankil k’ajeb j’awe? What plants do you use to make things with (houses, baskets, bags, instruments, etc)? (List names of plants and what they’re used to make)

Hunting and Fishing

14. Ma wan ani napub’ak sa’ wochoch?
Do you or anyone in your house hunt? YES ______ NO __________

a. Ani nabanunkre? Who does it? ___________________________________

b. Joq’e? When? _______________________________________

c. B’ar nikexik? Where do they go?______________________________

d. Ka’at kiru nakapub bachak?
What kinds of things do you (they) hunt?___________________________

15. Ma wan ani hakarab sa wochoch?
Do you or anyone in your house fish? YES ______ NO __________

a. Ani nabanunkre? Who does it? ____________________________________

b. Joq’e? When? ____

c. B’ar nikexik? Where do you (they) go?___________________________

d. Ka’at kiru chikaril nakachap? What kinds of fish do you (they) catch?

APPENDIX E

San Miguel Village Learning Networks Survey

General Questions

1. Who taught you what plants are good to eat a) in the bush?
b) in the plantation? c) around the house?
--Ani xtzolok awe chi xnawb'al k'a iru chi pimil li us chi k'uxek li wank se q'iche'?
--Ut se k'al?, -- Ut chirix li kab'l?

2. Who do you ask when you have questions about planting, harvesting, etc.?
--Ani aje nakat patzok chirix li awk ut li k'olok?

3. Who do you ask when you have questions about the bush, or trees in the forest?
--Ani put aje nakapatz a tenq'ank'il naq'inka nakanaw ru li pim?

4. Where do you go ask for help when someone in your family is sick?
--B'ar nakatxik xpatzb'al ha tenqa'ink'il na wank ani hire tyaj?

5. How many years old are children when they start to go to plantation?
--Jarub hab wankreheb' ha kok'al naknekextyolb' i xik se k'al?

6. How did you learn to know all the trees in the forest?
--Chan k'iru nak'xattzol xnowb'aleb' iru li che' sa li q'iche'?

7. How do you know what is good to plant around the house, and what you will plant at the farm?
--Chan k'iru nak'nakanaw k'iru chi awimjil li us rawb'al chirix li kab'le ut lie us rawb'al se k'al?

Who taught you this?
--Ani xtzolok awe a'in?
8. a) Who taught you about what kinds of soil there are? b) Which soil is the best to grow certain things?
--a) Ani xtzolok awe chi xnawb'al li jalank piy chi ch'och' wank? b) chan k'iru chi ch'och'il li us re li awimj junjunk?

9. How did you learn to find meat to eat and where to find it?
--Chan k'iru nak'xat-tzolok chi xsikb'al achib ut b'ar jon nakataweb' li xulileb'?

10. Who taught you to fish? What kinds, where to find them? Do you use any plants to put in the water to kill the fish?
--a) Ani xtzolok awe chi karab'k?

--b)Ma nanak' wo'wob'k?

11.Do you know where to find q'ehen/ban (medicinal plants)? Where do you go? Who taught you about q'ahen/ban ? How often do you go look for them?

--a) Ma nakanaw b'ar tataw li q'ehen?

--b) B'ar nakatxik (chi xsikb'al)?

-- c) Ani xtzolok awe chi xnawb'al iru li q'ehen. Coma jo najt'il tyamb' nak'nakatxik chi xsikb'al?

12. Who helped you plant corn the last time?
--Ani xtenqank q'awe nakxatawk li joq'e awale'?

13. Who helped you harvest rice the last time?
--Ani xtenqank q'awe chi setok arroz li joq'e awale'?

Learning Tasks

1=yes, 0=no

TASK/SKILL	XNAWB’AL ? KNOWS HOW?	ANI XTZOLOK? WHO TAUGHT?	JARUB’ JAB’? AGE?
1. xorok *bake*			
2. tib’ank’i calt *make caldo*			
3. chiq’ok poch *boil poch*			
4. chiq’ok arroz, kenq *boil rice, beans*			
5. chiq’ok xe’ awimj’: tsin, *cook groundfood*			
6. xchiq’b’al li muku na awmankta: lau, mokoch, okox, kalaj’ *cooking non-cult. food*			
7. tib’ank cacao uuk; a) xk’ilinkil b) xbukank’il *making cacao drink,* *roasting, stirring*			
8. tib’ank kape a) risink’il irix li kape b) k’ilink’il li kape *making coffee, 1st* *grinding, roasting*			
9. tib’anki kaj a) k’ilank’il kaj *make roast corn drink*			
10. karabk *fish*			
11. mesubk *sweep*			
12. nakanaw iru xche’el li mes *know the broom tree*			
13. k’alek *chop*			
14. awki tul, awki tsin			

TASK/SKILL	**XNAWB'AL ? KNOWS HOW?**	**ANI XTZOLOK? WHO TAUGHT?**	**JARUB' JAB'? AGE?**
15. tibank chakach rikin : a) b'il b) uxb' c) kalaj' *make baskets*			
16. awk ixim *plant corn*			
17. awk arroz *plant rice*			
18. tib'ankil li k'ub' *build firehearth*			
19. kemok koxtal *weave koxtal*			
20. tib'ankil li ch'ixb' *make mat for drying chiles*			
21. nakat ru botz'ok li kalaj'? *pulling kalaj'*			
22. nakat ru pokok mockoch *opening up cohune palm heart*			
23. nakat ru pokok lau *opening up wild banana shoots*			
24. nakat ru pokok xan *opening up palm heart*			
25. tsi'ibk *cut firewood*			
26. tib'ankil li aab' *making a hammock*			
27. k'iresink chilan, patz *raising chickens/ducks*			
28. sikb'al awib' a) rikin gun, li tsi'eb' *finding meat* *a) with gun or dogs*			
29. tib'anki ch'aab' *make calabash strainer*			

TASK/SKILL	**XNAWB'AL ? KNOWS HOW?**	**ANI XTZOLOK? WHO TAUGHT?**	**JARUB' JAB'? AGE?**
30. tib'anki sel *make tortilla holder from gourd*			
31. tib'anki kuxb'iuq'b' *make bracelet*			
32. b'ojok *sew embroidery or clothing*			
33. a) chok'o banki kab'l b) tsuluk k'im *make house frame; build thatch roof*			
34. pechok harp, violin, guitar *carve instruments*			
35. xb'atzunlenkil *play instrument(s)*			
36. tib'ank rochochi ch'ich'? *make a scabbard*			
37. risink ruq'bi'iq' se che' *take out soft,strong part of macapal to make strap*			
38. setok k'im *cutting cohune leaf*			
39. sikok q'ehen *find medicinal plants*			
40. sikok k'ib *finding palm cabbage*			
41. pechok kayuk *carve dorry*			
42. ra'lik: li tzik, li baj *trap birds, moles*			
43. ch'imb'ek: li jalau *trap gibnut*			
44. pakok *make pottery*			

I. Ma nakat ru _____________? Or Ma nakex ru tib'ank _____________?

II. Who did you learn __________ from?
--Ani tzolokawe re ___________?

III. How old were you when you learned it?
--Jarub jab wankawe nakxat-tzol li___________?

APPENDIX F

A History of San Miguel Village
By Leonardo Cal

In the late 1940s and early 1950s, the people of Santa Teresa migrated from their village because it was very difficult for them to reach Punta Gorda Town to sell their products. Rearing pigs was the only means of income for the family. The return trip to Punta Gorda would take them between five to six days and the only means of transportation was by dorry on the Moho River, which was very dangerous during the rainy season. The decision was made to move further east to a place where it would not be too difficult to reach Punta Gorda Town. Leading hunters of the village knew of an area beside a river in the territory of San Pedro Columbia, where the soil was as fertile as in Santa Teresa. They decided to settle on that land, but first requested permission from the people of San Pedro Columbia to give them access to some of their land. After several consultations among the Columbia villagers, they were given about 200 acres of land to settle on. During the migration, they brought along with them the school's admission register from the Santa Teresa R. C. School. The admission register is still in use up to this day in the San Miguel R. C. School. The people also brought along with them the statue of St. Michael, from which the village name is derived. The elders, in consultation with a Catholic Jesuit, decided to name the new settlement San Miguel. Today, the statue can still be seen standing in the Catholic Church, St. Michael's Church.

The new settlement sat on the banks of the Rio Grande River, fenced with barbed wire so as to prevent pigs from interfering with the farms of the neighboring village. Under the leadership of an alcalde, the villagers made it a rule that the fence should be checked and rechecked every fajina day. Fajina is held at least four times a year, and is a communal workday for all the men in the village. The Village Alcaldes enforced the fence law until the mid-1980s when the checking of the fence was abandoned. During the 1950s people began to develop and cultivate the land. They started raising animals such as pigs, chickens and turkeys. They built their houses, then they built the Catholic Church with sticks and cohune leaves from the forest. Slowly the settlement developed into a small village as more and more people kept coming in. The San Miguel R. C. School was the first concrete building to be built by the people under the supervision of a Catholic Priest. It was completed on the 15th May 1953.

About fifteen or twenty years later, there was a reduction in population of the young and developing community. A few families decided to move a little further eastward and settled about four miles from the village of San Miguel. This small village is known today as Silver Creek. Still others left for places like Aguacate, Laguna, Machaca and San Jose while others returned to Santa Teresa.

In the 1960s the public road between San Pedro Columbia and San Miguel was opened and in the late 1970s the public road was opened between San Miguel and Silver Creek Villages. After the opening of the public road to Silver Creek, residents of San Miguel started building their houses on the eastern bank of the Rio Grande River. The same year the road to Silver Creek was constructed, a steel bridge was built over the Rio Grande River. The permanent bridge was built, because in the rainy season, it was once used as a diversion when the Big Falls bridge was impassable due to flooded waters.

Around 1975, a few families broke away from the Catholic Church and introduced the first protestant church and it remains to this day. Today, there are numerous denominations. The Catholic Church represents 75% of the community.

In 1990, the new Catholic Church was built from concrete and was named Church of St. Michael. The inauguration, the feast day of the Patron Saint of the village, St. Michael, 29th, September 1990, attracted other villages who came out in large numbers and joined in the ceremony. Some villages generously contributed financially towards the event. Labor was contributed by Catholic members of the community. During that year, the TEA Guesthouse was introduced and established. The program is being run and managed by a group of villagers, who show an interest in developing Belize's eco - tourism.

The main tourist attractions in the village are the cave (Tiger's Cave), the river, the guesthouse program, the corn mill project and a few grocery stores. In 1993, the High Hills Women's Group was formed. It became a reality when the corn mill project was funded by Canada Fund later that year. The women's run corn mill is operational up to this day. A community telephone system was installed by the Belize Telecommunications Limited on January 7th, 1998 and the number to dial is 501 - 709 - 2002. Many of the buildings in San Miguel Village are concrete.

Over the past decades, village leaders lobbied with former government area representatives for development projects such as electricity and water systems. However, everything was a failure as politicians have their own way.

In the New Millennium, the year 2000, the village finally accomplished its main objectives: electricity and water systems. On April 18th, 2000, the people saw the light of electricity in the community for the very first time. The installation of a water project also has been completed. With these two projects, villagers benefited economically. These and some other projects came through the efforts of Hon. Marcial Mes, a Government Minister responsible for Rural Development and Culture in the Said Musa government of the People's United Party (PUP) administration from 1998 to 2003.

It was Palm Sunday, April 16th, 2000, Mr. Pedro Cus no. 2, the community's most famous bush doctor passed away after a time of illness. He is sadly missed by the community. Although Mr. Pedro Cus no. 1 (San Miguel's Grandfather) passed away on October 26th, 2000, at the age of 98, some of the stories he told continue to be remembered by those he left behind. It is a fact that he is the oldest man to have lived in this Maya community.

Generally, mostly Kekchi Maya are found in this community and majority of them do farming. Today most people from San Miguel Village live on reservations. A few people have leased land. The village produces teachers, students, farmers, drivers, laborers, artists, carpenters, tour guides, soldiers, policemen, public officers, musicians, health workers and bush doctors. The friendly and hospitable people in this community are open to visitors especially to internationals.

Maya musicians from this beautiful, hilly community have represented Belize and the Maya culture through the playing of traditional harp music at national, international and Caribbean festivals. Over the years, the musicians participated and performed in Belize City for national events and in the Caribbean Islands for the Caribbean Festival of Arts and Culture held in places such as Cuba 1979 (CARIFESTA 111), Barbados 1981 (CARIFESTA IV), Trinidad 1992 (CARIFESTA V) and Tobago 1995 (CARIFESTA VI), and the Federation of St. Kitts and Nevis 2000 (CARIFESTA VII, the last of the century). Other events San Miguel musicians have attended are: the commemoration of the 500 year anniversary of the arrival of Christopher Columbus to the Americas held in Mexico City in April of 1992 and the 7th International Congress of Ethnobiology held in Athens, Georgia USA in October 2000.

In February of 2001, the Toledo Maya Cultural Council, an organization based in Toledo, took the initiative to train at least 7 youths (males) with the playing of the traditional Maya harp. The program went for about three months and was a success.

International visitors come to this community and stay in the TEA Maya Guesthouse, very surprising and interesting to note, that they return back for visits to this community. Some have made it a commitment to return every year. There are also international researchers who have come, lived and spent a year with the people. At the end of their studies, they return to their respective countries, without fear or troubles. From the 1960s to around early 1990s a Canadian researcher has visited this community annually. During this period, he drove from British Columbia, Canada to San Miguel, Belize, Central America.

Today, the Maya community of San Miguel Village has a scenic view. The village sits on top of two hills with a full view of a part of the Maya Mountains in the east and the Columbia River Forest Reserve in the North. On a bright sunny day, if one is standing on top of the tallest hill just outside the community, one can see the Caribbean Sea and at night, the power of electricity lights in Puerto Barrios and Livingston, Izabal in Guatemala. The famous and refreshing Rio Grande River source is located approximately 2 miles north of the village near Tiger's Cave and the Columbia Forest Reserve, running in the direction of the village and, thus dividing the peaceful community into two halves.

San Miguel is governed by the executive body of the Village Council, seven individuals elected to serve a three year term by a majority of the community members to represent them at national meetings. They cannot make decisions on their own. Democracy is practiced in this community. The Village Council Chairman's role is to chair meetings at the executive level with the presence of the village alcalde. Each member of the Village Council has an area of responsibility within the village affairs. After a series of consultations with the people, decisions are applied. The sole duty of the Alcalde is to hold court for minor offences and petty crimes committed by members of the community and to serve justice where it is due. The Village Council along with the Alcalde reports to the community on the latest happenings and developments that are about to take place or currently in progress in the community. Entrance fee for new coming residents, people who wants to make this village their home, is $ 300.00.

On October 8, 2001, Hurricane Iris made landfall on the coast of Belize at 8 :00 p.m. The duration of the hurricane lasted for 2 1/2 hours. San Miguel Village was among the many villages destroyed by this natural disaster. Approximately 95% of the thatched houses were destroyed, including the San Miguel Community Library and proposed computer lab.

APPENDIX G

RESEARCH TIMELINE

Date	Research Component
July-August 1998	Preliminary research & selection of research site, research at SPEAR library, Belize Audubon Society, and interviews at Ministry of Education and with environmental educators
August 1999	Received preliminary permission to work in San Miguel village, Toledo district
March-April 2000	Language training in Q'eqchi', Coban, Alta Verpaz, Guatemala
April 2000	Electricity available in San Miguel
May 2000	Arrived in Belize for dissertation field research
June 3, 2000	Obtained permission to conduct research from community of San Miguel at village fajina
June-July 2000	Household demographic survey, participant observation, visits to farms and forested areas surrounding San Miguel
July-August 2000	Participant observation, child-guided home garden interviews, ethnobotanical collections (ongoing), freelist interviews with adults
September 2000-October 2000	School interviews and observations, farm inventories and agricultural interviews
October 2000	Visit to 7th International Congress of Ethnobiology in Athens, GA with Xe' Ton il Son Kekchi Maya Cultural Group
November-December 2000	Cultural transmission and learning networks interviews with adults ages 18-85, began community map of San Miguel, presentation with Forest Department to Methodist school in Punta Gorda on protected areas
January-February 2001	Ethnobotanical collections resume (dry season), visits to Maya villages inToledo, geographical place names recorded, fauna and insect freelist interviews
February-March 2001	Structured interviews with children, including freelists of food resources and fauna/insects, pile sorts, informal interviews with children, child focal follows
March-April 2001	Cortes Dance in Santa Teresa Village, interviews with alcalde and village chairman, informal interviews in Santa Teresa
March-October 2001	Design and set-up of plant trail, coordination with PTA, conducted plant trail interviews with children and adults, collections for plants on trail
April-August 2001	Interviews with adults about parent's beliefs on child development
June 2001, September 2001	Research in Belize national archives collection and SPEAR library
September 21, 2001	Independence Day celebration in San Miguel
September 28, 2001	Conducted workshop for Golden Stream Corridor Preserve for community trainees on local ecology and environmental issues
October 8, 2001	Hurricane Iris strikes Toledo, destroying 90% of houses in San Miguel and throughout Western Toledo district

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