

MOPAN MAYA SCIENCE: TRADITIONAL ECOLOGICAL KNOWLEDGE AND ITS
TRANSMISSION AMONG MOPAN MAYA MILPA COMMUNITIES OF BELIZE

By

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To my son Keith James Saqui Garcia and my parents Pedro Saqui and Juana Saqui, as well as all the Mopan Maya Children of Belize

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Abstract of Dissertation Presented to the Graduate School
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This study explores the various elements of Mopan Maya traditional ecological knowledge that ensures its persistence. The unit of evaluation is the 'milpa agricultural system', and the practice and traditional ecological knowledge that are explicitly associated with it. The Mopan Maya of Belize have been under threat of losing their traditional ecological knowledge and they struggle to forage a living within the ever changing society of Belize. *Milpa* farming has been a key survival mechanism for the Mopan Maya. This study shows that *milpa* agriculture is far more important than a simple source of food production. It is one of the most important means by which both Traditional Ecological Knowledge and the understanding of community social structure is transmitted through the generations.

Within the Mopan Maya community, people are closed linked by the concepts of *Kol* and *Tzik*. *Kol* is defined as the traditional *milpa* system that is practiced with use of the unique cultural elements of the Mopan Maya. *Tzik* is defined as the sociopolitical structure of the Mopan Maya community that is activated in the *Kol* practice. These two concepts connect to all the functions of the community culture and social structure. In fact these two concepts form the framework for the Mopan worldview. This study shows

that the making of *milpa* (kol) is dependent upon and ensures the persistence of both *tzik*, which embodies and supports community social networks, and Traditional Ecological Knowledge, which embodies and supports the network of human culture and ecology.

The data gathered in this ethnographic study of *milpa* agriculture and community in Toledo, Belize have shown that Mopan Maya traditional ecological knowledge has four distinguishable elements: a) a holistic ecological knowledge of the ecosystem as it currently sustains the Maya livelihood; b) a socio-political structure that is enforced and activated by the practice of making *milpa*; c) an aesthetic that highlights the traditional spiritual respect and appreciation of the natural environment as expressed in Mopan Maya oral history ; and d) a philosophy that highlights elements of the ancient Maya cosmology. This study focuses on the ecological knowledge and socio-political structure, leaving studies of aesthetics and philosophy for later research.

This study concludes that being indigenous Mopan Maya requires close contact with, and traditional knowledge of, the ecosystem and the ways in which it interacts through *milpa* farming with daily life, community and kinship. It is this close connection with *milpa* farming or kol and *tzik* that ensures the transmission of TEK through the generations. The transmission of traditional ecological knowledge requires: a) the knowledge of the Mopan Maya Elders, b) the activation of *tzik*, c) the making of kol, and d) the knowledge and use of the native language. These elements ensure that the whole complex of the Mopan Maya traditional ecological knowledge is transmitted. The indigenous person that abandons their indigenous environments squanders a true self of indigenous identity.

CHAPTER 1 PROBLEM STATEMENT

Introduction

This study focuses on the transmission of traditional ecological knowledge primarily between generations, but also through other community networks, among four Mopan Maya communities in Belize that are engaged in *milpa* farming. *Milpa* farming is a traditional farming system used by the Mopan Maya in Belize as their primary mode of subsistence as it is today by Maya across Central America. Traditional Ecological Knowledge is that body of knowledge built by groups of people through generations in close contact with nature, which encompass cultural as well as substantive and procedural ecological knowledge (Balee 2006; Berkes, et al. 2000; Brosius, et al. 1986). In this study I used *milpa* system as a proxy to evaluate the Mopan Maya traditional ecological knowledge system and its persistence through time within each of the four communities. This study further examines why traditional ecological knowledge is preserved within Mopan Maya communities and how that knowledge system is being transmitted between generations among the Mopan Maya. The vertical and horizontal transmission of traditional ecological knowledge will also be explored as they occur within groups.

The objective of this study is to contribute to the understanding of the practice of *milpa* agriculture as it is associated with community integration and traditional ecological knowledge transmission. Ecologically, *milpa* is a highly diverse agriculture system that uses crops that are carefully integrated with local ecology (Bernstein and Herdt 1977). *Milpa* also requires many traditional practices that rely on community culture which seems to enable ecological sustainability (Atran, et al. 1999a). Additionally, this study

also aims to analyze how important traditional ecological knowledge is for the Mopan Maya culture in Belize, which is under threat within the current national socioeconomic conditions. These objectives will be accessed through observations of the *milpa* farming methods and the cultural enactments associated with the annual farming cycles of the Mopan Maya in the Toledo, Belize.

Studies of the Maya traditional ecological knowledge have focused on the use of local plants for healing (Balick and Mendelsohn 1992; Bourbonnas-Spear, et al. 2005), as food source (Bernstein and Herdt 1977; Steinberg 1998a; Zarger and Stepp 2004), and for sale or barter in local markets (Caddy 2002; Levasseur and Olivier 2000; Wilk 1997). These studies clearly demonstrate that there is an immense wealth of traditional ecological knowledge about plants among Mayans. Most plant use prevalent among the Maya is associated with their farming techniques indicating a strong connection between *milpa* farming and traditional ecological knowledge. There is also a strong connection between *milpa* farming and cultural activities among the Maya people in Belize. The study presented here analyzes the linked role of cultural and ecological competency in allowing the younger generation to keep actively perpetuating the Mopan Maya culture.

The Mopan Maya communities' social interactions revolve around a *milpa* and those activities that are required for food production. However, the Mopan Maya engagements are guided by a well-defined sociopolitical system that is marked by the concept of *tzik*. Literally translated from Mopan Maya language into English, the word *tzik* mean 'respect'. *Milpa* also intersects with the cultural value of *tzik* that is the

organizing principle of Mopan Maya communities. In later chapters the intersection of these two concepts are decried and analyzed in detail.

When *milpa* traditional practices are examined within the four Mopan communities, it seems that there is an increased presence of traditional ecological knowledge and cultural enactments associated with *milpa* farming where the number of *milpa* plots seems higher. This observation shows that *milpa* farming practices exist in tandem with the use of traditional ecological knowledge and the practice of rituals that are associated with *milpa* making. What remains to be understood is the significance of this association and how does the making of *milpa* directly contribute to the transmission and persistence of traditional ecological knowledge of the Mopan Maya?

Finally, this study has important implications for the future stability of the Mopan Maya population of Belize. Belize has seen tremendous population growth over the last two decades, including intensified commerce and improved infrastructure (Barry and Vernon 1995; de Frece and Poole 2008). As these economic and infrastructural changes take hold in rural areas, the Maya population is forced to adopt new livelihood strategies, including a change from subsistence-based agriculture to market-based agriculture (Chibnik 1980; Chomitz and Gray 1996). For some Mopan Maya, especially the younger generation, this change is indicative of an entry into main stream commerce, including tourism wage labor, or employment in the public sector (Janvry and Sadoulet 2001; Wilk 1997). These social changes demand new kinds of knowledge that is replacing traditional ecological knowledge. This study explores the implications for the loss of Belizean Mopan Maya traditional ecological knowledge through the abandonment of community and ecological connectedness in the future.

Research Guiding Questions

Milpa is typically defined as the yearly cyclical production of maize by indigenous communities (Amiguet, et al. 2005; Gomez-Pompa, et al. 1990; Gregory 1984) and as a traditional form of agriculture and economic activity that involves the plantations of maize on small parcels of land at sites near residential areas among Maya communities (Cruz 2003; de Frece and Poole 2008). However, this traditional definition does not do justice to the complexity of the *milpa* system. For the purpose of this study a more appropriate definition of *milpa* will include these considerations: first, *milpa* is a system of scientific knowledge embedded within traditional ecological knowledge; second it is an interaction within the ecosystem that directly impacts the cultural structure of the community; and third, it is a multi-crop resource that includes maize but also involves a host of different nutritional and medicinal crops including non-cultivated plants within a system that ensures ecosystem balance.

This study shows that the concept of *milpa* is a not seasonal activity but a continuous process throughout the year that requires the social engagement of all members of the community. *Milpa* is a communal activity rather than an individual venture. The farming process itself starts with the establishment of a *milpa* corn plot which it proceeds to convert into a diverse garden through many cultivation stages (Atran, et al. 1993; Cruz 2003; Hostettler 1996). The effectiveness of the year-long use and process of *milpa* is evidenced by the harvest of a diversity of plants and crops within kitchen gardens, along *milpa* foot paths, within the multi-year fallow *milpa* plots, and within the year's current *milpa* (Amiguet, et al. 2005; Atran, et al. 1993; Brosius, et al. 1986). But, as this study will show, its effectiveness is also shown through the

stability of the community structure that is woven through the process of making *milpa* throughout the year.

This assessment is guided by one overarching question: Is *milpa* a cultural strategy utilized by the Mopan Maya to ensure the transmission and persistence of their traditional ecological knowledge? This very broad question cannot be answered in a single research project, but several of its parts are approached in this study and are used as the guiding questions for this study. The evaluation and responses to these questions garner insights to the *milpa* process as a cultural strategy that effectively supports the transmission of traditional ecological knowledge. They also provide insight to changes within the cultural framework of the Mopan Maya that currently threaten use and transmission of traditional ecological knowledge associated with *milpa* farming. The guiding questions are.

Question 1:

Can the understanding of the traditional practices associated with *milpa* farming provide insight to the transmission of traditional ecological knowledge of the Mopan Maya people between generations?

Question 2:

Can the analysis of *milpa* crop diversity demonstrate understanding of the local ecology and the community's cultural sustainability?

Question 3:

Does the shift from *milpa* agricultural to intensive agriculture strategies reduce the number of *milpa* crop varieties and lead to the loss of traditional ecological knowledge?

Question 4:

Does the Mopan Maya engage in cultural activities to maintain their culture and as a way to transmit traditional ecological knowledge?

These five questions were derived to guide the original research. The first three are those questions for which data will be presented and evaluated in this dissertation. Nonetheless discussion with this dissertation will touch on the remaining question that will use to guide future studies. The complexity of the traditional ecological knowledge will require other studies that are beyond the scope of this study.

Study Location

The data for this study was collected in four Mopan Maya communities in Belize. Each community was selected based on Mopan Maya ethnic composition and the active practicing *milpa* agriculture of those Mopan Maya individuals. Each community was visited to determine the number of households who were practicing *milpa*. A simple tally of the number of existing *milpa* plots was done for each community. The four communities of Blue Creek, San Jose, Santa Cruz and Pueblo Viejo, were determined to be most active communities practicing *milpa* making.

The village of Blue Creek was established somewhere between 1925 and 1930. It was initially called Rio Blanco, the name honors the crystal clear river that emerged from a nearby cave which ran through the village. According to the recollection of elders in this village, the name of the village was changed to Blue Creek in 1950. The village currently has a population of 250, with that number fluctuating at certain times of the year.

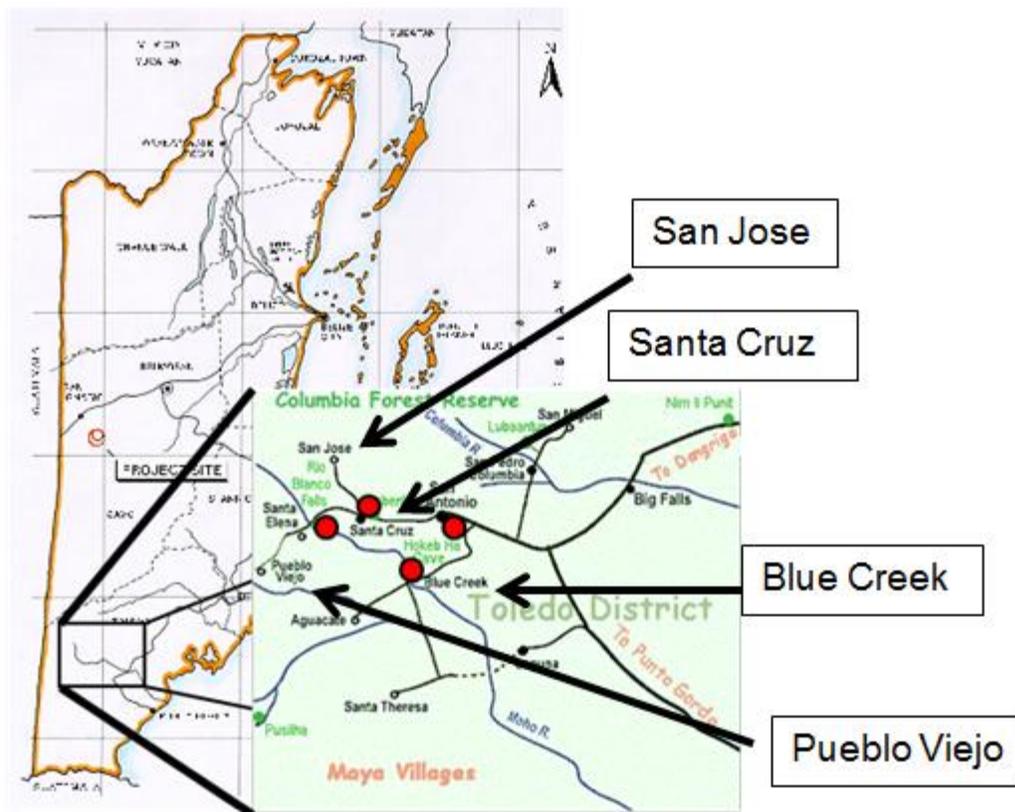


Figure 1-1. Study area within the Toledo District of Belize.

Pueblo Viejo, is the Spanish name that is given to this community much later after it was established. Several Mopan Maya communities that have splintered and spread throughout the country of Belize will find some historical origin in this community. For that reason the name aptly fits. According to a few members of the community, the earliest date that they can remember that this community is settled is around 1911. Today the population for this community is approximately 550, with that number fluctuating a various times of the year. In this community, the predominant language is Mopan Maya.

San Jose village is the largest of the four communities in this study. The official year for the establishment of this community is recognized as 1954. Prior to that time

the area was only frequented by hunters. The community has grown since then and currently has a population of approximately 700. These numbers are changing rapidly and fluctuate during the year. This is a predominantly Mopan Maya Speaking community.

Santa Cruz village was a splinter of the Pueblo Viejo community. According to an elder No'och Winik Susano Caanti, the first settlers moved into the area around 1950. The area was selected because of the water source and good land for agriculture. The community currently has a population of approximately 400. The community still practices milpa as the primary sources of livelihood. In 1999, tourism was introduced to the village.

History of the Mopan Maya

The presence of the Mopan Maya in Toledo district in Belize clearly predates the Spanish 16th century arrival (Leventhal, 1997) evident by many archeological sites that are replete throughout entire country of Belize. However since the dawn of British colonial era, the Mopan Maya have remained isolated in the jungles of the Toledo districts for the most part. As a result of that long-standing isolation from central government in the Toledo District, the Maya culture and identity persisted depending solely on their traditional knowledge (Medina 1998). However, with the ensuing national developmental strategies, their cultural demise has become more imminent; and their relationship with the natural environment is quickly changing. What remains is the strong will to continue making *milpa*.

Although the Mopan Maya are phenotypically similar to the Ke'chi Maya of the highlands Guatemala, they speak a uniquely different language that is incomprehensible to the Mopan Maya. Their agriculture practices have some strong

similarities to that of the Mopan Maya. One of the glaring difference in *milpa* production, is that the Ke'chi people seem to make their *milpa* in close proximity to large water sources (Carter 1969; Popenoe 1960).

The Mopan Maya are predominantly a religious people and many are now followers of Christianity that was introduced by the Europeans. Until the 1970's a strong majority of the Mopan Mayas were committed to the Roman Catholic faith. Since the 1970's there has been a continuous departure from Catholicism to the more aggressive Protestant religions (Steinberg 2002b).

Culturally the Mopan Maya have been able to maintain small villages in the Toledo district that are almost entirely Mopan. Invariably the traditional practices are still deeply rooted among the elders of the communities. There is a strong persistence of traditional healing, in which the traditional healers use medicinal plants as well as invoke spiritual powers of the supernatural world. The Mopan Maya are very animistic in their worldview (Gregory 1984). They are very conscious of the fact that their presence within the ecosystem is determined by spiritual powers for which they have no control.

The strength of the Mopan Maya is the re-enactment of their traditions. Many of these traditions, such as costumed dances, are historically practiced during the major holidays related to the Catholic Church. However, there is still a strong significance to those traditional practices that is directly connected to the various cycles of the annual *milpa* practices. These traditions also underlie the primary political structures of the community. Festivals are often hosted by families under the 'cargo' system through which status is gained by expending wealth in the hosting of the festival (Dewalt 1975; Hayden and Gargett 1990). These very huge responsibilities were accepted and

revered with pride to establish a position of honor and respect within the community. The festivals are passed around annually to different families.

At the start of 1970s to present, many Mopan Maya families dispersed from the mother villages of Pueblo Viejo, San Antonio and San Jose. Some of these families formed new Mopan Maya communities and others sought refuge in urban areas such as Punta Gorda and Belmopan. The largest migrations of the Mopan Maya settled in the Stann Creek district, just north of the Toledo district, establishing the villages of Maya Mopan, Santa Rosa, San Roman, and Maya Center.

The education system of the Belize is predominantly the “Church State System” that is highly influenced by the Catholic Church(Crooks 1997). Almost all elementary schools within the entire Toledo and Stann Creek District were taught by Garifuna (an Amerindian African group) teachers. These teachers were often the only contact the Mopan Mayas had with the world external to their own societies. Nonetheless, as we move into the last decades, many Mopan Mayas are receiving education that is higher than the elementary grade. In fact there are a significant number of young people that have gone on beyond the secondary level of education to higher education.

However it must be noted here that as the mandate for formal education takes a firm hold within these communities, the traditional ecological knowledge takes a significant toll. Children spend more time in the classroom and very little time with remaining keepers of the traditional ecological knowledge. Although the promise of a better livelihood from good education is welcomed, very often the young educated Mayas leave the communities only to return with little respect to cultural norms of their

society. Therefore it is important to understand what cultural strategies that the Mopan Maya uses as they transmit the traditional ecological knowledge.

Significance of the Study

In studies of Maya culture, the Mesoamerican region has been characterized by the growing concerns of cultural loss and the loss of traditional ecological knowledge. There is a legitimate concern over the loss of traditional ecological knowledge of indigenous people worldwide as they come in contact with new information and technologies. Traditional ecological knowledge is lost along with the loss of languages, followed by the loss of cultural identity. In the case of the Mopan Maya, there is a real threat of the loss of traditional ecological knowledge, as the younger generation actively seeks alternative lifestyles that deviate from the more traditional Mayan ways. Those traditions are important and have served as the bedrock of the knowledge utilized thus far for their subsistence and sustainable environmental maintenance (Montagnini 2006; Steinberg 1998a).

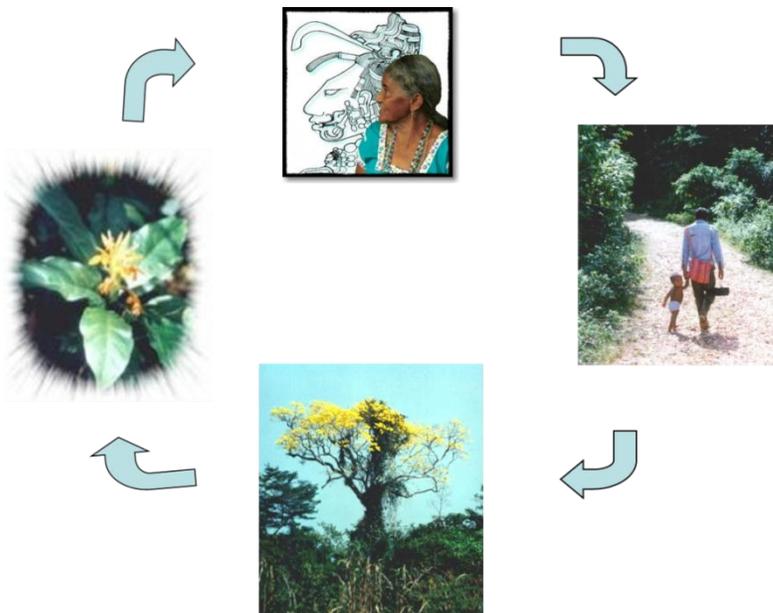


Figure 1-2. Traditional Ecological Knowledge model of the Mopan Maya.

Figure 1-2 illustrates the nature of the traditional ecological knowledge of Mopan Maya. This knowledge is holistic, and very complex. The Mopan Maya people, as a society keep practicing their way of living and therefore have maintained their close contact with the natural environment. Religion and ceremony also play an important role in validating those elements that are beyond the human control. The Mopan Maya often refer to Earth as *na' luum*, which is translated into English as 'Mother Earth'. Such types of references speak to the belief of a supernatural or spiritual world. The notion that traditional ecological knowledge is embedded in the cultures of the Mopan Maya can be seen in the paradigm.

An optimistic paradigm is emerging that values traditional ecological knowledge. The concept that traditional ecological knowledge is permeating the norm of western science is creating a wider discourse for new ways of knowing (Barrera-Bassols and Toledo 2005; Brosius, et al. 1986; Kottak 1999). Some social scientists are insisting that the 'time tested' knowledge of the indigenous people, particularly traditional ecological knowledge, is laden with important information that is paramount and timely for human existence today (Berkes 1999; Meilleur 2002; Orlove 1980). Studies have indicated that ecosystems cannot function in perpetuity to support human livelihood without the careful ecological management by those relevant indigenous and local societies that understand those particular ecologies (Balee 2006; Berkes 2004; David 2004; Lambert and Arnason 1986; Steinberg 1998a). A second school of thought insists on a new ecology that clearly recognizes the functions of humans as another important species within the ecological processes, thereby considering those functions to be more biological rather than cultural (Kottak 2004; Orlove 1980; Posey, et al. 1984).

This study is critical for the documentation of the traditional practices of Mopan Maya communities. It provides an opportunity to highlight the effective use of traditional practices in *milpa* making that coincide with cultural competence of the Mopan Maya in their use of traditional ecological knowledge. The study provides evidence that the making of *milpa* is a strong mechanism within the Mopan Maya culture that contributes to the transmission of traditional ecological knowledge. In that process, the stability of each community's social network is ensured through the activation of *tzik*. *Milpa* is more than the simple method of planting and harvesting crops, but rather it is a knowledge system that is a conduit to the knowledge transmission. The study is particularly valuable because it has been done by an indigenous Mopan Maya and therefore it documents aspects of the Mopan Maya cultural practices that are associated with *milpa* agriculture and traditional ecological knowledge that have been overlooked by other studies because they appear trivial to the external observer.

There are significant cultural concepts that are used by the Mopan Maya *milpa* system which may prove useful in other agricultural communities of Belize. Traditional ecological knowledge can then be used to effectively transform the agricultural techniques that are both used and appropriate for the Mopan Maya as they integrate into the formal economy of Belize. By extension, this study adds credibility and validation to the traditional ecological knowledge of the Mopan Maya that is associated with *milpa* making. Therefore it provides incremental opportunities for that knowledge to be transmitted to the future generations of the Mopan Maya as they negotiate the increasing cultural changes that are both natural and exogenous to their community.

The country of Belize is currently challenged with many changes in land tenure and 'Indigenous land right' issues. Decisions are being made by various agencies based on strong opinions regarding the socioeconomic status of the Mopan Maya, relegating them to the lower brackets of poverty. Associated governmental policies are being adopted that seek to force the Mopan Maya into the "National Economic Developments Strategy" of Belize without regard for the already existing survival strategies of the Mopan Maya. Very little attention is paid to the traditional ecological knowledge of the Mopan Maya and the permanent negative impact such laws can have on their long-term basic livelihood survival. This study can inform the various government agencies that will be required to make legislations for the management of the Belizean people and their lands. As the Mopan Maya migrate into non-traditional geographic locations, various agencies will need to comprehend the survival system of the Mopan Maya in order to be able to provide the necessary support.

Additionally, traditional ecological knowledge is a pedagogical strategy for the Mopan Maya that is not discussed or recognized in the formal education system of Belize(Crooks 1997). Traditional ecological knowledge is absent at all levels of the education system(Hervik and Kahn 2006), which is true in Belize. This study can be used to inform a new mode of learning methods to academia that may allow the inclusion of traditional ecological knowledge in Belize's education curriculum. As it stands, Belize's formal education system is deeply embedded in the western knowledge system with a very formidable Christian foundation. This study is part of a long-term goal to inform those pedagogical strategies within the western education method that have ignored traditional ecological knowledge thus far.

There are many forms of learning within the Mopan Maya knowledge system that are adapted to their natural environments, and which may be replicable in other parts of Belize or larger landscapes. The Mopan Maya *milpa* farmers have conducted natural experiments over hundreds of generations to refine their traditional ecological knowledge and thus can contribute to scientific and applied research on local environments and agriculture. Without a doubt the Mopan Maya worldview is physically constructed around the geographical location that they frequent in their daily lives, but they are most definitively aware that various ecological elements of their environment hold significant purpose. The Maya, furthermore embrace a more holistic paradigm of their natural environment, where several elements of the biodiversity have a direct connection to one another. An excellent example that can illustrate this holistic paradigm is the trapping of a ground mole (*Neurotrichini spp*) which requires an in-depth understanding of the physical natural environment as well as a detailed knowledge of the natural history of this animal as discussed later in the dissertation.

Milpa: Shifting Cultivation

Milpa farming is often termed “shifting cultivation” or “swidden agriculture”. According to Harold Conklin (1954), ‘swithen or swiven’ is an old dialect word from northern England, meaning ‘burned clearing’, which effectively describes the objective of the practice in shifting cultivation. Shifting cultivation or “swidden” agriculture is an extensive, multi-phase agriculture system that is dependent on shifting cultivation plots across the landscape, the use of fire as a primary way to clear debris from agricultural plots, and the production of multiple crops in a carefully managed cycle.

Shifting agriculture is a traditional system of farming employed by indigenous cultures all over the world, depending on vast knowledge of soil, climatic cycles and

local biodiversity (Barrette 1972). Several studies have revealed that indigenous people are well aware that certain crops species prefer certain soil types (Johnson 1974). More importantly they are aware that the timing for clearing (slashing and burning) must be synchronized with the arrival of the rainy periods to properly take advantage of soil nutrients, made available through burning (Alegre, et al. 2005; Atran, et al. 1999b; Horwich and Lyon 1993a). These principles apply entirely to the procedural processes of making *milpa* among the Mopan Maya.

The use of fire has substantial positive effects on the soil's structure, fertility, and pH (Giardina, et al. 2000). The use of fire in shifting cultivation favors positive soil conditions. Perhaps the evolution of fire use as corollary to *milpa* agricultural clearing is not accidental among the Mopan Maya, given the array of positive benefits burning facilitates. Fire use in shifting cultivation is often denigrated as a limited technology of indigenous people and those of past civilization, rather than being considered an innovative soil management method. Fire has been used for at least 3000 years within tropical regions of the Maya world, where it seems to have been closely linked to local climatic and geographical conditions which can vary from wetland humid (often lowland) to arid (often coastal or upland) forest (Diemont, et al. 2006). The humid forests are often very dense and can produce substantial amounts of above ground biomass (Lambert and Arnason 1989), which make land clearing very difficult without the use of fire. After the initial phases of shifting cultivation, which includes slashing the forest cover from a desired plot site, the farmers will wait between two to four weeks before a burn is initiated (Altieri, et al. 1987; Carter 1969; Conklin 1954; Gliessman, et al. 1982; Horwich and Lyon 1993b; Reina 1967). Burning may cause the most drastic changes

within site nutrient status in the entire shifting cultivation cycle. For this reason, shifting cultivation and burning practices have been extensively scrutinized for their immediate effects particularly on soil nutrients and micro fauna. The role that such events as burning play in the transmission of traditional ecological knowledge is also important to protecting sustainable forest ecology.

Traditional knowledge is the study of how people interact with all aspects of the natural environment (Berkes 2004; Gonzales 2001). Traditional ecological knowledge is the only door into cultural realities of many indigenous people around the world. It provides a direct access to a way of understanding the past and informing the future of human relationships with the natural environment. However traditional ecological knowledge cannot be easily repackaged wholesale and deployed in other agricultural contexts, even those with areas of similar geographical or social conditions. For such knowledge to function it requires the cultural involvement of each cultural group.

Traditional Ecological Knowledge is a valuable resource and is being lost faster than we can gain knowledge of it (Balick and Mendelsohn 1992; Berkes 2004). In many situations, traditional ecological knowledge has proven to be essential for the development of appropriate resource conservation management strategies among local or indigenous communities (Agrawal 1999). Traditional ecological knowledge is perhaps the most comprehensive knowledge base that truly represents the unique ways people conceptualize and choose to use the plants in their local environments (Martin, 2004; Gonzales 2001). Understanding the way in which the Mopan Maya uses traditional ecological knowledge holistically provides and more concrete understanding of the direct connection of a society and natural environment, beyond the ecology.

Mopan Maya and Shifting Cultivation

The Mopan Maya people of Belize are regarded as the poorest or most underprivileged members of the Belizean society (Carter 1969; Primack, et al. 1998; Steinberg 1998a; Van Ausdal 2001; Wilk 1997). Studies of Maya socio-economic activities suggest that their limited engagement in the national economy or ability to sustainably generate income can be correlated to *milpa* farming activities (Lambert and Arnason 1986; Levasseur and Olivier 2000; Medina 1998; Steinberg 2002a). *Milpa* farming strategies do not produce significant commercial quantities of crop yields, thereby limiting any significant engagement by *milpa* farmers with the market economy. Some Mopan Maya can and do leave the traditional communities and *milpa* farming in favor of commercial activities that provide financial gain. A testament to this fact is the migration of the many Mopan Maya out of the Toledo district and resettlement in area of Stann Creek and Cayo district in the 1980's (Barry and Vernon 1995). In search of better financial opportunities many Mopan Maya became successful Citrus farmers, only to return to *Milpa* farming soon after. This fact suggests that traditional Mopan Maya communities practice *milpa* farming for reasons other than direct financial returns that would better support their subsistence needs.

Some Mopan Maya never leave their communities and dependent on traditional *milpa* agriculture suggests a much deeper cultural significance of the relationship between the people and their agricultural system that goes beyond food production or economic success to the value of retention of the Mopan Maya cultural traditions themselves. Those culturally significant elements are sustained through practice and enactment of the traditions associated with *milpa* farming. There are some traditional

practices within the Maya value system that are kept alive and enacted only during the making and maintaining of *milpa* farms.

According to Wilk's (1997) study of the Belizean Kekchi, Gregory's (1984) early study of the Mopan, and confirmed in this more recent study, societal interactions within Maya communities are enhanced during the preparation, planting and harvesting of *milpa*. Additionally during the cycle of the *milpa*, food exchanges and food preparation associated with festivals, bolster community ties. Many relationships are revitalized in the form of 'formal gift giving' which becomes more complex when major tasks associated with *milpa* have to be carried out (Wilk 1997). It is also expected that each member of the community is required to assume some responsibility for the festivals that are associated with *milpa* making. Wilk (1997) indicates that for the most part, all community functions can be directly connected to the corn production and the diverse *milpa* cropping systems, but the details of those connections are not yet understood.

Milpa is a diverse cropping system that provides food security for the Mopan Maya. Such cropping system holds a large traditional ecological knowledge that base also invoked for diverse crop varieties during the making of *milpa*. The purpose of using many crop species within *milpa* plot is not linked to increases production, but more as a response to unpredictable conditions that may arise. The Government of Belize's agriculture policy favors modern agricultural strategies and insists on the principles of entrepreneurship and profit gain by encouraging mono-cropping systems. Such methods disenfranchises the traditional agriculture value systems of the Mopan Maya, making their food security more fragile (Van Ausdal 2001). Many Maya seem to respond to such pressures of economic and social change by varying their *milpa* crop diversity,

leading to intensified mono-cropping or adopting new crop varieties (Chomitz and Gray 1996; Keys and McConnell 2005; Wyman, et al. 2007). This study evaluates the extent to which traditional Mopan Maya communities do the same. It is not clear how diversity of *milpa* crops contributes to community traditional ecological knowledge. It is not clear how important other crop varieties are, other than the corn varieties, for each planting cycle. This study explores these aspects as well.

The Mopan Maya are not immune to the growing pressure of development. Every step towards development by the national government seems produce various exogenous forces (Medina 1997). Those exogenous forces include the economic pressures of modernization that force the Mopan Maya to engage in a more profitable form of agriculture. Intensified agriculture for high yielding crop is strongly promoted among the Mopan Maya (Caddy 2002; Chomitz and Gray 1996). The Mopan Maya through the generations have collected several varieties of corn that is planted every year. In any one plot a farmer may plant up to five varieties (Steinberg 1999), however as recent effort by the government of Belize to increase corn production, many Mopan Maya farmers are planting hybrid corn seed. Beyond the fact that this variety may be high yielding, the hybrid corn is susceptible to tropical pests without the extensive use of pesticides. Moreover the Mopan Maya do not understand that the seeds collected from hybridized corn will not produce in consequent planting.

There are fewer people who are practicing multi-cropping *milpa* systems. This loss of crop diversity parallels the loss of traditional ecological knowledge of plants that are essential for the food security of Mopan Maya. There are fewer people acquiring traditional ecological knowledge today and those who have maintained traditional

ecological knowledge appear to use it less. Still, there are also many people who continue to return to traditional ecological knowledge use in their daily lives and even make conscious efforts to pass that knowledge on to their children. This study will consider both loss and retention of traditional *milpa* systems and environmental knowledge.

CHAPTER 2 THE TRADITIONAL ECOLOGICAL KNOWLEDGE OF MAYA MOPAN IN BELIZE

Ancient History of Maya Ecological Knowledge

The region of southern Mexico and the Central American countries of Belize, Guatemala and the north of Honduras and El Salvador was populated by the Maya civilization and their ancestors from at least 12,000 years ago until the 1498 arrival of the Europeans (Awe, et al. 2007; Bronson 1966; Lovell and Lutz 1994). Archaeological research in the area has shown that during that time the Maya developed a dynamic array of languages, farming practices, medicine, astronomy, engineering skills, marine navigation and long trade routes. The cultural florescence of the southern lowland area that includes modern Belize is traditionally dated to the Classic period between 250-800AD. A period of political and economic disruption sometimes called the Maya collapse was followed by a shift of cultural center to the northern region of the Yucatan peninsula and the coastlines. It is important to note that the archaeological evidence does not indicate significant health stress, depopulation or mortality during this time. The “collapse” period is better defined as a time of social restructuring, perhaps in response to the changing relationship of climate, human population, and agricultural systems. The Classic Maya civilization of the inland southern lowlands of Belize was already fading when the Europeans made contact and the cultural centers had moved to the northern Yucatan and the coastlines. However, at contact the Belize region was still active with large populations of Maya in both dense cities settlements (at sites such as Lamanai, Tipu, and the coastal centers) and scattered farmsteads across the landscape. At the point of European contact, the tropical forest dominated the landscape as an integral part of the tropical agroforestry/agricultural system of the Maya residents (Faust 2001;

Gomez-Pompa, et al. 1990). It is noteworthy that the Yucatan remained populated until the Spanish contact with significant forest regrowth starting after about 700 BP and tropical forest returning to dominate the Peten after 950 to 400 BP (Dunning, et al. 1998; Toledo and Ctor 2005).

Most of this region is tropical and enjoys lush vegetation that teems with a large biodiversity of animals and plants that must be respected in their right. Over time, the Maya people have developed a very profound understanding of their relationship with their natural environment and species as is evidenced by their ability to survive from their first presence through to modern day despite sometimes harsh conditions (Gregory 1984). This relationship developed over millennia underlies the modern traditional ecological knowledge of the many modern Maya groups living throughout the region including the Mopan Maya of Belize. It is this ancient history of over 10,000 years of traditional knowledge, passed through generations of Maya, that forms the foundation of the stable and sustainable Mopan Maya agricultural system.

Human societies have managed various ecosystems worldwide for thousands of years. Remnants of those ancient civilizations have mesmerized biologist and social scientists alike, as they try to understand the social factors that made those societies thrive. Various methodologies have been developed to understand the interactions of traditional cultures with natural and man-made ecosystems (Heider 1972). In-depth analysis of human activities employed in food production, medicine, and management of natural resources and landscapes have provided new insights to traditional knowledge (Berkes 2004; Gonzales 2001). A common subject of study has been the use 'shifting agriculture systems' (Carter 1969; Conklin 1954; Johnson 1974)

reminiscent of modern *milpa* systems. This interest comes from the fact that this so-called “simple” agricultural system maintained urban cities with human populations often in excess of modern population in many areas today, through thousands of years of changing climates, landscapes, and politics.

We know from paleoenvironmental and environmental archaeology research that the Maya practiced intensive agriculture, which included shifting cultivation, orchard agroforestry and polycropping, raised terraces and wetland land channeled agriculture among other management techniques (Gomez-Pompa, et al. 1990; Gómez-Pompa and Kaus 1999; Pyburn 1998). These methods of agriculture would have been effective means to produce food that would accommodate the high densities of populations that are recorded archaeologically for the region. Archaeobotanical (Lentz 1991; Pohl, et al. 1996) and ethnobotanical research together have shown that the ancient Maya grew a wide diversity of crops although the main staples were, as they are today, the triad of corn, beans and squash (Gómez-Pompa and Kaus 1999). The Maya were able to create surplus food even in the face of increasing demands for food and materials through a continuous process of agricultural innovations that enabled them to change from extensive shifting cultivation agriculture to intensive agriculture over time (Dunning, et al. 1998; Faust 2001). These agricultural methods are discussed in more detail below.

There is still great interest in determining the cause of one period of political and social upheaval termed the Maya collapse. The interest remains despite the archaeological evidence that this was not a “collapse” but rather a dramatic social upheaval. As such, it is an interesting example of the sustainability of the Maya agricultural systems to withstand and survive even the most traumatic of political and

social transitions without significant environmental or biodiversity destruction or loss of human life through starvation. The most well-known, but now discredited, hypothesis that has been proposed is that an ecological collapse brought about by overexploitation of the environment. This hypothesis suggested that the methods of agriculture caused the destruction of the tropical forest. Tropical forest soils are generally not very fertile and often very thin, thus can be led into nutrient depletion by intensive agriculture. The forest material itself is the main source of nutrient recycling, by deposition of organic material. If agriculture got out of control and caused severe deforestation, then it is may also cause faunal extinction as a result of habitat depletion. Once the forest was destroyed and the landscape denuded, immense amounts of organic material would have entered the water ways, which would have led to pollution. Additionally there would have been the ever present erosion and siltation of water bodies leading to major diseases affecting whatever human crops they may have been growing (Rice and Rice 1984).

However, there is mounting evidence that the Maya Collapse of the ninth century cannot be attributed simplistically to environmental degradation, soil erosion, deforestation, and resulting famine. As early as 3500 BCE ancestors of the Maya were supplementing their diet with a diversity of agricultural produce including corn (Pohl et al., 1996). Recent paleolimnological research has shown that it was during this period, not the period of urban population growth that most deforestation occurred and primary siltation resulted (Anselmetti, et al. 2007). After that period, Maya agricultural techniques became more intensive but appear not to have dramatically affected the sustainability of plants or animals (Butzer 1996; Emery 2007; Ford and Emery 2008). Archaeological

evidence show that the most human induced changes occurred in the Yucatan by about 3600 BP and continued to peak at Coba in the Maya late classic (Dunning, 1998). Evaluations of ancient forest and environmental managements' success or failure must take into account the complexity, stability, and *resilience* of the local environment. If given the appropriate length of time, coupled with the ability to reseed, a tropical forest will recover to stable state in a relatively short period of time. It is likely that the forest that was selected for human use would have been those with the most fertile soils and high species *resilience*. In fact, a sediment core sampled and tested, adjacent to one field system showed both maize and native species pollen dating to the Late Classic Period(Brenner, et al. 2002; Leyden 1987; Pohl, et al. 1996). This would suggest that there was a healthy forest present alongside intensive agriculture. What have been more likely to lead to the Maya collapse would be the relatively permanent elements within the lowland environmental change. Brenner (1995) proposed that there were changes in ground water hydrology or climate change that may have significantly constrained Maya agriculture as well as influenced the course of Maya civilization. This thought has led to major research efforts on the topic of climate change and Maya prehistory (Emery 2007; Haug, et al. 2003; Hodell, et al. 1995) .

The lowland Maya region, particularly the Northern Yucatan is limited in readily available water resources. Great seasonal variation in rainfall leads to long drought periods within the year. Prior to industrialized water management and irrigation, very detailed knowledge of weather patterns would have been necessary to be able to harness the sparse available moisture(Dunning and Beach 1994). Shallow soils were frequently leached during periods of heavy rains, which are associated with

hurricanes(Vernon 1998). Water retention in the soil was further complicated by the geomorphic processes, with porous limestone as the bedrock, most water that was collected soon found its way into the underground hydrologic system. Water resources only became accessible at various points in the landscape at the water table surface or through large collapsed sinkholes, known as cenotes. The ancient Maya actively controlled water accessibility in various ways. One method was by constructing underground cistern known as “chultuns” (Beach, et al. 2008; Vernon, et al. 1995)[Another method was by geomorphic landscaping of city profiles to act as drainage basins collecting water in aguadas and other natural and modified water retention features(Dahlin and Litzinger 1986; Vernon, et al. 1995).

For agriculture the slope gradient and drainage caused by geologic structures were chief environmental factors that required the understanding of a mosaic of habitat. Uneven rainfall from year to year, especially further North in the Yucatan, had major consequences of increased risk of crop losses. Today as in the past, famers are aware of the weather pattern and the risk it presents to crops, therefore every farming cycle has to be planned with risk strategies that are an important component of agriculture (Levi 1996). The North Yucatan is dominated by swamp estuaries and seasonally-inundated savanna. During the dry seasons, these regions are desiccated beyond the ability of supporting any form of agriculture. Therefore, prior to industrial agriculture, savannas had very little agriculture potential because of salinity, inundation, severe drought and soil which was generally thin or completely absent (Beach 1998), without the active supplementing of soil nutrients. Portions of savannas and isolated freshwater spring areas (petenes) may also have been mined for highly organic soils and

periphytons that would have been transported to enriched gardens and fields farther inland (Beach 1998). Periphytons are a form of algae that is common in seasonally inundated savanna and that is rich in phosphorus and nitrogen. Both of these nutrients are often in short supply in most soils of the Maya Lowland.

Again, these examples emphasize that ancient Maya agriculture was highly varied in nature, adapting to a changeable mosaic of environments and responding to shifting cultural pressures (Pyburn 1996). The ability of the Maya agricultural system to adapt even to drought conditions is evidence of its strength and *resilience*.

Maya Farming Resilience

In spite of its long history of human-environment interactions there is no evidence of any major biological collapse produced by ancient Maya activities (Gomez-Pompa and Kaus 1999), instead there are signs that they were able to sustain their biological diversity. Some believe that the nature we see around us today is a remnant of ecosystems shaped and created by humans in the past (Gomez-Pompa, 1987). Ford has suggested in fact that the entire Maya lowlands are a managed ecosystem that she has called the “Maya forest”. It seems that ancient agriculture throughout the Maya world centered on intensive garden, infield and outfield, and orchard cultivation within and near nucleated settlements (Killion et al. 1989). All of these methods are, however, fundamentally based on the shifting cultivation methods now called *milpa* since they required slash and burn field preparation, multi-cropping, and shifting fallow fields. Shifting cultivation still stands out as the basic mode of food production throughout the millennia of Maya history.

During Precolumbian times, extensive slash-and-burn agriculture was practiced in many areas, although intensive terraces and raised (or drained) fields in wetlands were

also used. Shifting cultivation is a much longer cycle of agriculture that can produce crop yields in as little as three months. Soils developed under long fallow cycles provide perfect growing conditions for food crops in the short term, and then other crops that may be harvested in the second or third years (Atran, et al. 1999a). This form of agriculture is also probably the most sensitive to the timing of rains and dry periods (Bautista-Zuniga, et al. 2005). Today the Maya generally start clearing their agricultural plots in the cooler dry months of the year, expecting to burn just before the start of the rainy season (Bernstein and Herdt 1977). The rainy season is essential after a *milpa* burn, in order to incorporate loose nutrient rich ash into the soil. If indeed there was a dramatic change in climatic conditions, shifting cultivation would be most vulnerable to such changes (Folan et al., 2000). But it is clear from the prior discussion that the system is also highly adaptive to such changes in climate, and is able to survive even multi-year droughts. This is likely the result of the generational exchange of traditional ecological knowledge about the cultivation method and its application under various conditions in the local ecology.

Gomez-Pompa and Kaus (1999) are convinced that the shifting cultivation method of agriculture is more beneficial to the Lowland Maya than any other forms of agriculture. They base their argument on their ethnographic observations of high biodiversity in disturbed habitat or fallow areas. After clearing and planting of basic grains, other crop varieties are typically introduced (Carr 2005). Squash is a shade adapted plant that can serve as ground cover (Gillespie, et al. 1993). That service was greatly appreciated in the *milpa* fields where the soil would be temporarily exposed to direct sunlight. The squash would provide shade to keep the soil temperature cooler

and at the same time preventing the success of noxious weeds. Beans are also a very common secondary crop (Steinberg 1998b). The soil within the lowland region is low in nitrogen as stated earlier therefore the introduction of nitrogen fixing crop variety like beans would serve to alleviate that problem (Atran, et al. 1999a). Additionally, when the grain crops are harvested, the legumes will dominate the entire field, resulting in a more nutrient rich soil. This process will continue for about two to four years before the consistent use of the plot is minimized or abandoned altogether. At that point the plot is left in long fallow, which can also mean that it includes continual harvesting of long-lived plant species. Some selected species introduced in the first years of production are purposefully planted to attract wildlife, some that can be hunted for game. Therefore the fallow period is often combined with hunting of game animals that are attracted by their preferred forage, generally at the early stages of succession (Faust, 1988). Much research on the “garden hunted” spectrum of animal species has shown that this practice was also very common in the archaeological past (Emery 2007)

A very critical aspect of the fallow period is its ability to regenerate and be reseeded by nearby forests. Traditionally agricultural plots seldom exceed a hectare in size. Among the Tzimane people of Bolivia, Huenca (1998) documents that such sizes are determined based on the desire to keep regeneration plant species diversity to original levels. A very critical phase of the land preparation is the management of fire itself (Gliessman, et al. 1982). For the sake of maintaining diversity protection, minimizing the fire intensity will ensure that stumps and roots are not totally destroyed and can emerge with pioneering species. Firebreaks are routinely constructed around the border of the field to be burned (Carter 1969; Lima 2002; Reina 1967). The trees

and brush are cut, so that the bulk of the biomass is away from the standing forest and heaped while creating a firebreak. Even when more than one plot is established within close proximity, stands of high forest are preserved between agricultural plots. A plot maybe re-cut the in the second and third year for grain productions, although this shows reduced yields. The Maya, as many other indigenous peoples of the tropics and semi-tropics, prefer to re-cut areas of secondary growth, because it is requires less physical labor(Lambert and Arnason 1986).

After the fourth year of continuous use of the same area, a *milpa* plot will most likely be overrun with plant species that more adapted to infertile soils, further reducing agriculture productions. The Maya will traditionally return to a plot within 10–30 years with 20 years being the most common period of fallow, when overcrowding is not a problem (Lambert and Arnason 1980). This is the time required in this region for substantial re-growth of trees, accumulation of organic material from leaf litter, and reduction of weeds due to tree shade within an area under fallow. The process of getting to ecological climax level can be further accelerated by ‘stump re-shoots’(Szott, et al. 1999). Those tree roots functions hydraulically to bring up minerals from the subsoil, enriching the soil for later crops. In this process, the biodiversity of the local environment is ensured.

‘Pet Kot’

The ancient Maya may have deliberately tried to replicate natural forest ecosystems, and constructed managed forests using native species. Gomez-Pompa (1987) proposed that the Maya maintained specialized gardens, with species of trees that are known to grow in other regions of the Maya lowland. A very telling example is the discovery of a cacao orchard at the bottom of a sink hole. Cacao was very important

to the Maya as a symbol of wealth and later a system of currency and this find indicates that the natural ecology of this plant was understood and replicated. Cacao is better suited for climate conditions that are moist and generally cooler. Finding these conditions would seem like the logical reasons for establishing a cacao orchard within a sinkhole (Gomez-Pompa, et al. 1990). Research by Anabel Ford has continued to emphasize the managed nature of the 'Maya forest' as an example of the very specialized traditional ecological knowledge of the ancient and modern Maya (Ford and Nigh 2009).

The Maya may have had other reasons to maintain specialized gardens. Today, kitchen gardens, and doorway gardens play a vital role within the diet of rural people. Gomez-Pompa et al (1987) surveyed one such type of garden. These gardens are called 'Pet Kot'. To the untrained eye one may see such places as nothing more than standing forest. It is quite intriguing to note that within one enclosed wall structure a botanical survey yielded 29 plants species that are all useful to the Maya people even today (de Frece and Poole 2008). Today this practice is still alive with Maya communities in Mexico and Central America. Anderson (2005) reported that in Chunchuhub, a door way garden indicated in excess of 243 species of plants that are kept for several reasons. Some served as vegetable that supplemented the diet, while others were used for medicinal purposes and still some species were used as food for livestock or wildlife.

One explanation for the "Pet Kot" is that it may have served as an enclosure for local game. The tree species that were present within this one enclosure are primarily fruit producing species. These fruits are not only used by humans, but they are also a

staple of deer and peccary diet. The ramon trees were also used as a source of food for famine for Maya people, but both deer and peccary also seek the fruits after they have fallen to the ground (Lambert and Arnason 1982). Secondly the Maya also accumulated knowledge of foods for famine times, some of which are wild, some planted, and some are protected volunteers in house yards and fields (Thompson, 1970). Maya forest is itself an anthropogenic community of plants, formed by 3000 years of Maya slash-and-burn agriculture, as well as selection and protection of useful plant species.

History of Intensive Agriculture

The Maya inhabited virtually all regions of the Lowland, this included regions that were not ideal for agriculture. Agricultural plants had to be farmed even in the poor soil conditions of the wetland regions. Jacob (1995) has presented evidence that the huge bajos around Nakbe may have once been perennial wetlands which could have been used for intensive agricultural production (Pohl, et al. 1996). The wetland region surrounding the Lamanai archaeological site in Belize provides similar evidence (Leyden 1987). Pyburn (1999) reported extensive use of intensive agriculture around Chau Hix in the Northern lagoons system of Belize. Levi (1996) has noted that the ideal settlements were located adjacent to both productive wetlands. Scarborough (1993) has reported evidence of ditching of channels and construction throughout the Lowlands.

Archaeologists have suggested that in the Maya Lowland the water system defines the community. The use of terracing appeared later and has been documented most extensively by Turner (1983). The most elaborate, extensive, and integrated system of agricultural terracing known in the Maya Lowlands was centered on the city of Caracol (Chase and Chase 1987), known as the Vaca Plateau areas in the Maya

Mountains. The use of this form of agriculture is related to the increase in population density, which would suggest that available fertile land may have been scant.

Maya Agriculture Today

What is considered as traditional Maya agriculture now, demonstrates a long history of development of local environmental knowledge. Environmental knowledge itself is not readily traced in the archaeological record, but the prior discussions show clearly that the agricultural and forest management systems of the ancient Maya were successful, adaptable, and sustainable, and thus were the foundation of the development of Mopan Maya traditional ecological knowledge.

It is also clear that this ancient success continues today since in most places where traditional practices of Maya agriculture are allowed, the diversity is extensive and agriculture production is healthy (Atran, et al. 1999a; Bernstein and Herdt 1977; Brubacher, et al. 1989). One of the successes of the Maya people has been the continuation of the traditional *milpa* system in many areas. Wilk (1997) asserts that it reduces the risks to family food security when long-distance markets for other products fluctuate. The home gardens and orchards also contribute to family nutrition and provide additional food security (Anderson, et al. 2005). The problem for the Maya today is not in their method of agriculture, but rather in their limitation of access to land and water resources. The shifting agricultural methods require extensive land and that is not always available in high population density areas.

Overpopulation is a problem in many Lowland Maya regions and changes in land tenure farther complicate agricultural practices. *Milpa* system seems to function best in regions where agricultural land is available and communal lands are still part of the land tenure system (Steinberg 1999). The Maya culture continues to depend on forest and

milpa farming and thus the future of the Maya will be closely linked to the future of their *milpas*. Unfortunately much of the traditional ecological knowledge is still only minimally understood, and very little of it effectively transmitted to future generations. Oral traditions preserve historical ecological lessons in encryptions of language, legends and religious practices. Many of the agricultural practices documented or explored in the archaeological record will be difficult to revive within today's Mayan societies. The people themselves are seeking change, culturally, economically and politically. The notions of a modernized world are more appealing and the rewards are readily visible. Community members struggle with and are sold on the idea of making a better future for their children, often at the expense of passing on traditional knowledge about *milpa* farming.

The global economy is looming forever over Maya societies of Mexico and Central America. It would seem that the best way for the Maya to survive political and economic changes is to ensure that their food production is kept local. If so, the Maya will have to ensure access to land and continue to use traditional systems of agriculture. Fallow periods have to be maintained at the right length, and forest must be kept at climax level long enough to be able to reseed new forest. Ensuring that a forest is kept at climax also ensures that it will benefit the local fauna that provide a vital source of protein for local communities.

Five hundred years after European contact caused depopulation, abandonment of traditional political and economic structures, and introduced new land and forest management techniques; the Maya relationships with their lands have been redrawn and disconnected. At the time of European contact there were an estimated two million

Mayas that inhabited the region that is known today as Guatemala, Southern Yucatan, and Belize which was only 40% of the total population of Central America. Even at that time, it was evident that the environment that the Maya inhabited was highly manipulated and already in intensive agricultural use (Bronson 1966; Turner 1974). Well managed forest were highly productive and supplied food for the local wildlife as well as the Mayas themselves (Faust 2001; Gomez-Pompa, et al. 1990). As the era of colonization continued the Maya met with many ills, causing further reduction in population. In recent times, as late as the 1900s, many Maya were relocated by the Colonial powers. The lowland Mopan Maya were not immune to such disasters (Wilk 1997).

The Mopan Maya migrated to strange lands and environments as they sought safety and opportunities to live free (Loucky and Moors 2000). Their culture and their relationship with the land is no longer as evident to them or their children as it was before European contact. What they have left of their past is only told in stories, fables, legends, and the language itself. Re-creation of their past life has been hard, but is nonetheless carried out with amazing accuracy (Zarger and Stepp 2004). Evidence of this past is seen in the farming system. For many years biologists and western scientists focused on the 'slash and burn,' and perhaps only that aspect of the farming system (Atran, et al. 1993). Until recently, this method was dubbed the primary reason for destruction of the tropical forest within the region. As a result, extensive conservation and development efforts were crafted and implemented within the Maya world to help improve this system of farming (Steinberg 1998a). That effort still remains to be proven to be a sustainable method of development.

Maya people believe and know that they are part of the ecosystem. They know that they are caretakers of the natural environment. The practice of farming epitomizes and reaffirms this belief every year. One poignant example of the traditional knowledge of Maya people is the annual practice of *milpa* (slash and burn). *Milpa* farming acts as a “glue” for each community and all the cultural values it holds. A farmer who wishes to start a *milpa* must be a member of his community and have proven ties to other members of the community. There are obvious reasons for this, but also unspoken, unwritten reasons that are clearly understood.

Traditional knowledge

Traditional knowledge is the only door to understanding cultural realities of many cultures around the world. It provides a way to understand the future of human relationships with the natural environment. Traditional knowledge is the study of how people interact with all aspects of the natural environment (Berkes 2004; Gonzales 2001). It is the result of generations of knowledge changing and evolving among a group of people. It is often neglected and sometimes abused. Valuing traditional knowledge is an essential step in recognizing and building upon the livelihood strategies of these indigenous populations. But indigenous knowledge, like other great ideas, cannot always be repackaged and deployed in other contexts, even those with similar ecological or social characteristics.

Belize’s southern Toledo District contains approximately 14,000 Maya, mainly Ke’kchi and Mopan Maya ethnic groups (Barry and Vernon 1995). Maya presence in the Toledo District clearly predates the 16th century Spanish arrival (Leventhal, 1997). As a result of long-standing isolation from central state powers in the Toledo District, the Maya culture and identity persisted, depending solely on their traditional knowledge

(Caddy 2002). Their cultural demise, however, has accelerated and their relationship with the natural environment is quickly changing. The challenges that persist have impacts, varying from traditional development strategies by the central government to local community participation in tourism and conservation strategies (Lindberg, Furze, Staff, and Black, 1997). Development is an inherently flawed mechanism for intervening in the lives of populations in an attempt to improve their lives. (Comment: This is a bold statement and requires some justification).

Traditional ecological knowledge is a valuable resource that is being lost faster than we can gain knowledge of it (Balick, 1990). In many situations, traditional ecological knowledge has proven to be essential for the development of appropriate resource conservation management strategies among local or indigenous communities (Berkes, 1991). Traditional ecological knowledge is perhaps the most comprehensive knowledge base that truly represents the unique ways people conceptualize and use resources in their local environments (Martin, 2004; Gonzales 2001). Traditional ecological knowledge is still utilized today among the Maya communities in Belize (Caddy 2002). This knowledge is constantly threatened by the ever increasing pressures of tourism and other dominant economic structures (Balick, 1996).

Belize has seen tremendous growth over the last two decades, including rapid population increase, intensified commerce and improved infrastructure (Barry and Vernon, 1995). As these structural and infrastructural changes extend into rural areas, the Maya population, like indigenous people in many parts of the world, are forced to adopt new livelihood strategies (Case, Pauli and Soejarto, 2005), including a change from subsistence-based to market-based agriculture for some, and entry into commerce

(including tourism), wage labor, or employment in the public sector for others (Godoy et al, 2005). These changes demand new kinds of knowledge that replace traditional knowledge, particularly traditional ecological knowledge (Steinberg, 1998). In commercial agriculture, citrus, banana and rice production are favored over the traditional food crops, again replacing traditional with new forms of knowledge. Therefore, traditional ecological knowledge is never constant, it is not stagnant and it does not die with the people because they themselves (local people) are ensuring that it survives from one generation to another (Altieri, et al. 1987; Berkes 2004; Heider 1972).

Participation by indigenous people in markets, wage labor, and the public sector demands a homogenous formal education and strong skills in the national language (Newport, 2003). In Belize, the national language, and the language of instruction in school, is English. Immersion in this system erodes skills in native languages (2001). Mayan languages are no exception. This makes acquisition of traditional knowledge difficult because it is encoded in and imparted via the Mayan language.

The effect of all these changes is that fewer people are acquiring traditional ecological knowledge today and that those who have maintained traditional ecological knowledge appear to use it less. Still, there are many people who continue to use traditional knowledge in their daily activities and continue to pass that knowledge on to their children. The mechanism by which this knowledge is passed on depends on how much, or at what intervals traditional practices occur.

The use of traditional ecological knowledge within Maya communities continues to exist, but to actively pass on the knowledge for preservation is not easy. Without immediate study and documentation of the remaining traditional knowledge, the risk of

total loss is imminent (Balick, 1990). Coupled with that is the ever-increasing pressure to homogenize culture as it modernizes and tries to adapt to an increasingly technological age (Attran, 1983). Research should include analysis of the sophisticated understanding of ecosystems that indigenous management practices sustain.

The Culture of *Milpa* and Traditional Knowledge

Shifting cultivation or “swidden” agriculture is a multi-phase cycle of agriculture that is dependent on the use of fire to remove debris from agricultural plots and enrich them with nutrients. Substantial effects of fire on soil structure, fertility, and pH changes are associated with shifting cultivation. The use of fire for agricultural clearing is not accidental, given the positive benefits. Fire use in shifting cultivation is often attributed to the limited technology of modern indigenous people and those of past civilizations, rather than an innovative and effective way of soil management. According to Harold Conklin (1954), ‘swithen or swiven’ is an old dialect word from northern England, meaning ‘burned clearing,’ which effectively describes the objective of this practice in shifting cultivation. Recent studies show that fire has a bigger impact on soils and can be the determining factor of a good crop yield.

Fire has been used for at least 3000 years within the tropical regions of the Maya world, where it seems to have been closely synchronized with local climate and geographic conditions, which can vary from wetlands to dry forests (Diemont, et al. 2006). The more humid forests are often dense and produce substantial amounts of above-ground biomass (Lambert and Arnason 1989), which make clearing very difficult without the use of fire. After the initial phase of shifting cultivation, which includes slashing of the forest from a desired plot site, the farmer waits two to four weeks before a burn is initiated (Altieri, et al. 1987; Carter 1969; Conklin 1954; Gliessman, et al. 1982;

Horwich and Lyon 1993; Reina 1967). It has been said that the burning phase may cause the most detrimental changes in the entire shifting cultivation cycle with respect to site nutrient status. For this reason, shifting cultivation burning has been extensively scrutinized for the immediate effects particularly to soil nutrients and microfauna.

Burning in the practice of shifting cultivation is necessary to create short-term nutrient-rich soil conditions for crops and for control of pests, including weeds and insects. There are many dynamics at work from the point of slashing to the point of burning, which may include the release of volatile gases including nitrogen (Giardina, et al. 2000; Styger, et al. 2006 ; Toky and Ramakrishnan 1983). Effective management of fire is very important during a burn. Detailed studies of post-burn fields indicate that the burn can have varying effects on soil nutrient concentrations (Juo and Manu 1996), soil structure (Styger, et al. 2006) and soil microbial activity (Gliessman, et al. 1982). There seems to be awareness of soil nutrient changes as a result of burning *milpa* among the Lowland Maya of Guatemala and Belize (Carter 1969; Diemont, et al. 2006; Lambert and Arnason 1980; Reina 1967). It is clear that land converted from forest to burned plots for sustained production relies on detailed knowledge of the fluxes and losses of nutrients incurred during and after the burning of slashed biomass. The Lowland Maya appear to have understood the soil changes that occurred during a burn and were able to harness the nutrients released after *milpa* burns (Dunning and Beach 1994).

Effects of Burning

The immediate effect of burning is the conversion of slashed vegetation into nutrient-rich ash from the fire-consumed biomass. Carter (1969) and Reina (1967) reported that slashed biomass can be 1 to 3 feet thick before a burn. Although there is no record of deliberate spreading of slashed biomass to make even layer, farmers

occasionally will lop off branches and place them in areas with thinner slash, to ensure a more consistent burn and distribution of ash, though this is rarely done (Wilken 1987). Trees with larger trunk diameters are felled after slashing is finished, and at that time more branches may be lopped off and spread to ensure a good burn. The trunks of large trees are typically left untouched and are not expected to burn entirely (Atran, et al. 1993). During the slash process, much of the combustible wood is retained for future use as firewood in the home.

According to Buschbacher et al. (1988) and Kauffman (1995), there is more nutrient concentrated in fine plant material, such as leaves and twigs, than in large portions of the tree. Such leaves and twigs are readily converted to plant-available nutrients during a *milpa* burn. In most cases, however, the fine plant materials are only a small portion of the total above-ground biomass. This component is also the portion of the plants that dry quickest and forms a layer that is vulnerable to intense heat. If a slashed area is left to dry too long, the fine plant material is at risk of being totally lost to intense fire during a burn. That is, large quantities of ash can be lost, therefore the timing of a burn must be perfect. When the intensity of the burn is too high it is likely that there will be strong turbulence, and there may be both loss of fine ash material and loss of nutrients to volatilization (Brady, 1996). Such loss is beyond the farmers control and could only have been managed by the timing of the burn. Excessive heat can cause great soil nutrient disturbance and may result in a sterile farming plot.

Although one might expect the goal of burning in shifting cultivation to be creation of ash for short-term soil nutrient availability, the shifting cultivator often takes great precautions to prevent all biomass from being converted to ash (Dunning and Beach

1994; Giardina, et al. 2000). Ash may also vary in nutrient content and quantity. The ash deposited on the soil after burning may not always contain the right kind of nutrients required for cropping. Additionally, ash is structurally unstable material and will not stick to the soil, especially soon after a burn, which exposes it to erosion by water run-off and wind. Ash must be incorporated into the soil immediately to harness the full nutrient potential (Raison et al., 1985). In order to achieve this, *milperos* time the burn to maximize the chances that a light rain will occur after the burn. Many Maya ethnographies report that burns are conducted on days with specific weather conditions, i.e. in late afternoon when wind is low (Re Cruz 1996; Redfield and Rojas 1962; Wilk 1997). The phases of the moon are also monitored to better predict onset of the first rains (Carter, 1969).

To get full use of the ash, it is important to ensure that it is integrated into the soil immediately. A farmer must first choose the right soil type to fully harness the nutrients in the ash (Reina 1967). Among the Maya of Guatemala, Mexico and Belize, site selection is critical and requires an understanding of soil types (Wilk 1997). Most soils are known to the Maya and are classified by color and in some cases by structure. Color, however, is the criterion most widely used to identify soils (Gonzales 2001; Redfield and Rojas 1962). The Yucatec Maya of northern Yucatan distinguish between 'ek-luum' and 'kan luum', recognizing the fertility differences (Dunning and Beach 1994; Re Cruz 1996; Redfield and Rojas 1962). They are aware that the darker soils (ek luum) are more fertile than soils of redder or lighter color (Kan Luum). Also, they know that soil with redder color has more clay content and becomes very hard after a burn, making it harder for ash material to be incorporated into the soil.

Tropical soils are notoriously low in nitrogen and most loss of nitrogen occurs because of volatilization and convective losses during a burn. A good burn causes the loss of 90% of the nitrogen within the above-ground biomass, as well as up to 30% of the carbon (Raison et al., 1985). Such values represent great N and C losses derived from aboveground biomass that could be potentially accessible for plant use. Cations such as calcium (Ca), magnesium (Mg) and potassium (K) remain high in ash, which can be attributed to them having a lower level of volatilization at high temperatures than N and C.

Soil Changes from Burn

Soils in tropical regions are typically shallow, with rich clay content. The top layer of the soils throughout the Central America and Yucatan region, holds most of the soil nutrients. The greatest amount of P is generally found in the organic matter layer of the soil. During a burn, this layer of soil can be lost. Typically, farmers grow concerned if too much 'white ash' or 'bright orange soil' is present. These are two indicators that the fire intensity was too high and excessive nutrients may have been lost. When most of the field surface area shows such signs, farmers may opt to forfeit the crop cycle and seek other means of survival (Anderson, et al. 2005; Carr 2005).

Considering the implications of abandoning a badly burned field, we can appreciate that such action is dependent on a clear understanding of soil characteristics and functions, and that soil must be protected. Soil heating is controlled by a variety of factors, which include fuel quantity, fuel quality (type of original biomass cover), moisture and distribution of biomass on the soil surface (Martin, 1990; Walker et al., 1986). Most shifting cultivation cycles are initiated in drier months of the year. In drier regions, biomass may not require prolonged periods to reach optimal dryness preceding

a burn. Slashed biomass also tends to be thinner in drier regions and at higher elevations. Therefore a burn can be done much sooner after slashing, compared to moister regions.

In moister regions of the lowlands of Mexico, Guatemala and Belize, vegetation tends to be denser and will yield a much larger amount of biomass after slashing. The drying period of the slashed area must be timed carefully to ensure that burn is not too intense and risks sterilizing the soil (Reina 1967; Wilken 1987). Carter (1969) and Reina (1974) describe the vigilance Kek'chi communities of Peten, Guatemala take in determining the right day to start burning slash. In some cases, the first light rain is used as a sign that a burn should take place. There may be more to this practice than just fear that the biomass may never burn if heavy rains begin. According to Khanna (1994), moisture that is present in the soil at the time of burning can cause dramatic increase in temperatures. Heating the soil for longer than 10 minutes at 70 °C can effectively sterilize topsoil of fungi, protozoa and bacteria, with the effect amplified if there is a 15% moisture soil content (Garcia-Oliva et al 1999). As Paul and Clark (1996) highlight, soil microbial communities are essential for organic matter decomposition and mineralization of nutrients for plant uptake. Intense and prolonged burning can have severe impacts on microbial biomass and soil microbes, interfering with their ability to carry out their functions (Serrasolas and Khanna, 1995).

Topography and microclimate conditions can also play significant roles at various stages of a burn. Generally, if *milpa* plots are on the windward side of a slope, there will be more direct effects on fire intensity and speed of a burn. Carter documents that the Kek'chi people whistle to call the wind as they ignite fires in their fields. The speed and

spread of the fire will determine the duration of the entire burn (Martin, 1990), and shorter and less intense burns yield the right quality of ash, and prevent the soil conditions from being altered excessively. Some volatile soil nutrients like sulfur (S), N and C may be lost, but will likely be replaced in the form of newly formed ash.

Wilken (1987) suggest that a benefit for slash and burn agriculture is that it aids in changing soil pH to a more neutral state, allowing plant growth. Some studies also argue that heating effects on soil pH change are not very consistent. Giardina et al. (2000) point out that elevated soil pH can be attributed to consumption of organic acids during a burn. Again, it is important that the intensity of a burn not be too high. One of the farmer's objectives when using fire is to disturb the soil sufficiently with heat, to make planting with a dibble stick less strenuous, but not to "bake" the surface.

Like many indigenous communities worldwide, the Mopan Maya are a close-knit, endogamous community. *Milpa* is still used today among the Maya people not only as a means to secure food for everyday survival, but as a mechanism to cement community interaction.

Community is a concept that has evaded definition. Tonnies (1975) defines a community a group of people or society who come together, stay together and engage in joint action. One can envision a society in which members think collectively and seek reciprocity to maintain social cohesion. The premise is that a community is seen as small and homogenous, without internal conflicts, and is assumed to act as a democratic and consensual unit (Leach et al. 1997), which is clearly misleading. The Mopan Maya community is no different from any other western society that experiences internal conflict.

In a study with Nepalese and Indian women, Agrawal and Gibson (1999) show that communities are very heterogeneous in their ways of managing natural resources. The construction of a mythic community, such as that suggested by Tonnies (1975), fails to recognize important differences among community members, often resulting in the effective disenfranchisement of the weaker members. According to Wilkinson (1998) community has several components, which include a shared territory, common life, collective actions, mutual identity and social interactions.

The Notion of Tzik

The structure of the community comes from the interaction or relationship among the Mopan Maya that can be encapsulated in the notion of 'Tzik' (Danziger 1996). A community has a range of different actors who have influence over and manage natural resources. The various actors will undoubtedly be socially differentiated in a number of ways, including gender, religion, social status, and in economic and political terms. The true picture of community emerges in the local society when a bond of common interest exists within the community itself and draws people together so they are enabled to express common sentiments through joint action. The embodiment of this concept is represented in the notion of "Tzik," which can be loosely translated as 'respect,' which has a prominent place in the establishment of *milpa*. Although food production is the primary reason for the making of *milpa*, the more subtle objective of establishing and demonstrating 'Tzik' is equally important (Danziger 1996). Tzik is a fundamental part of Maya engagement with other Maya and with the natural environment. Although the Maya people may be faced with tremendous exogenous forces of change, the notion of Tzik is unchanged and persistent.

CHAPTER 3 RESEARCH METHODOLOGY

Introduction

The aim of this study is to contribute to the analysis of the transmission of traditional ecological knowledge of the Mopan Maya from one generation to the next. The Mopan Maya of the Toledo district are one of the last remaining cultural groups that still actively practice the *milpa* system. There is a strong association between the Mopan Maya cultural traditions and those practices associated with the production of *milpa* (Gregory 1984; Wilk 1997). There have been various documentations of the constant threats of exogenous forces to the traditional ecological knowledge base system of the Mopan Maya, including political and religious threats (Steinberg 1998a; Van Ausdal 2001; Wilk 1999), economic threats (Chibnik 1980; Cruz 2003) and ecological threats due to new farming methods (De Clerck and Negreros-Castillo 2000; Ekeleme, et al. 2004). The focus of this study is to explore those strategies that are actively pursued and enacted by the Mopan Maya *milpa* practitioners as they negotiate the transmission of their knowledge to the younger generation.

In order to arrive at an understanding of the various aspects of traditional ecological knowledge transmission, an assumption is made that there are multiple modes by which traditional ecological knowledge transmitted. Within the groups of this study, various individuals process traditional knowledge that is used as the need arises. These kinds of need-based knowledge will be regarded as 'unique knowledge'. Elders in the communities are often the keepers of this unique knowledge that can take the form of traditional healing, spiritual healing, livestock husbandry, plant propagation, or hunting and fishing techniques. There is also 'shared knowledge' which entails the more

frequently engaged activities. These types of knowledge are the more mechanical and pertain to the operations of daily living, such as the preparation of common food, planting of the primary crops and building homes and other basic structures. These types of knowledge are readily passed on among friends and family members, with less care about who may have access to and use of it.

The primary assumption made is that for these multi-layers of knowledge to be transmitted the keepers of that knowledge must use that knowledge in the appropriate situations. The activation and use of traditional ecological knowledge can be transmitted vertically or horizontally. In such cases the use of such knowledge at any given time is considered 'observable behavior' which provides the opportunity for the observer to receive that knowledge (Thomas-Hunt, et al. 2003). Figure 3-1 illustrates how such a knowledge flow may occur between generations. This model presumes that there is a direct path of transmission of knowledge from one generation to another through enactment of traditional behaviors as well as the indirect observable behaviors between generations.

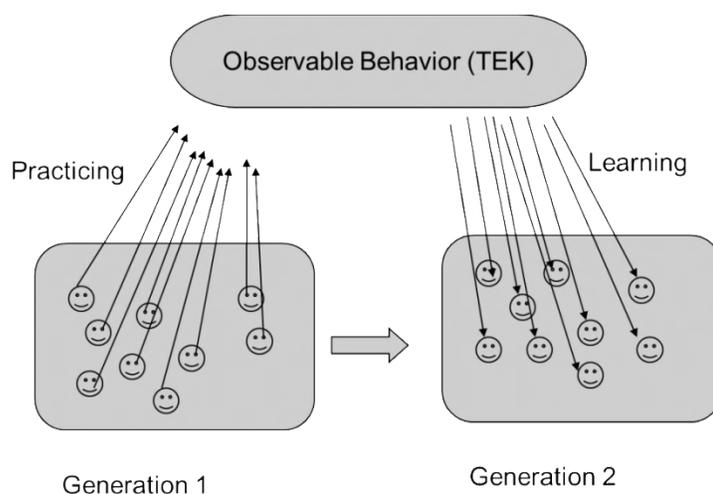


Figure 3-1. Traditional Ecological Knowledge transmission model

Indigenous Researcher

For all intents and purposes, I am by definition a native Mopan Maya. Although genetically and culturally to some extent I fit the profile of Mopan Maya, I have not lived my entire life only within this cultural group. In fact I have lived away from the Mopan Maya communities for more than 80% of my entire life. I was born in San Antonio Village of the Toledo, district, (a community not a part of this study), and grew up in the Garifuna community of Dangriga Town. I have sporadically participated in some activities that are related to *milpa* making, only as a helper. I have never made *milpa* the traditional way independently, nor have I participated in the making of *milpa* intimately in the time of this study.

My family migrated from the village of San Antonio Toledo, in 1974, to live in the village of Maya Center, Stann Creek district. Although the families that migrated to this Maya Center village, including my family, practiced *milpa* production, they were lured into citrus farming with the promise that it would be more profitable venture. At the time of this study, a majority of the farmers in Maya Center village dually practice Citrus farming and *milpa* farming.

The Mopan Maya are those people that predominantly inhabited the lowland regions of the Eastern Peten in Guatemala and Southern Belize (Awe, et al. 2007). The Mopan Maya speak a distinct Mopan language that is mutually intelligible with the Yucatec, Itza and Lacandon Maya (England 2003). The Mopan language is my native language and I did not speak any other language until I was nine years old, when were introduced to English and English Creole. The gift of being able to speak the Mopan Maya language allowed me to appreciate most of the cultural constructs of the Mopan Maya people and accepted their behavior as proper with very limited prejudice.

The fact that I am Mopan Maya steer my interest in this study that is entirely focused on the Mopan Maya. As long as I can remember, my family has been committed members of the local Roman Catholic Church. As such a large portion of my own values were formed as I was being raised as a Roman Catholic. Historically the Roman Catholic Church in Belize is the only Christian religion within the region that seems to have managed to co-exist with the ancient Maya religions and practices. Many of the traditional ceremonial events that I have witnessed as a child are often closely associated with religious celebrations of the Roman Catholic Church.

Being a native Mopan Maya doing research among the Mopani Maya has its challenges. One of the major challenges that I faced was the risk of overlooking very significantly relevant aspects of the Mopan Maya cultural practices that appear irrelevant or mundane to me as an insider. Being aware of this issue, I consciously made extra efforts throughout the study to allow myself the necessary cultural distance from my subject of study. This was accomplished by marshaling the assistance of students from the University of Belize as observers of my data collecting processes. In a few instances, the students were allowed to gather data and to conduct interviews to ensure objectivity.

However, the benefits of studying my own people outweigh the challenges. There were many conversations that only could have happened because of my intimate knowledge of the culture. There were fewer tendencies for the respondents to feel inferior or threatened, and felt comfortable in describing the concepts they wanted to convey. In some cases where I repeated what I understood, they readily corrected me without hesitation. The idea that a native Mayan can study the culture immediately

validates the significance of the various aspects of the culture. In fact special care is taken on the part of the participants to ensure that whatever was shared with me as researcher was authentic and genuine. Additionally, there were many very important and sensitive data that was shared with me, that will not be included in this dissertation, upon the request to the participants.

I was welcomed in villages and extended immeasurable hospitality. In the summer of 2008 in particular, foreigners were not welcomed into the Mopan Maya communities of the western Toledo district, because the threat of Oil Exploration to the Maya homelands. Fortunately as a Mopan Maya, I was welcomed and allowed to continue conducting my fieldwork uninterrupted. Albeit during this time of data gathering, stronger emotions were expressed by the participants regarding their defense of the local forests.

Description of the Research Participants

Recognizing that the research participants will be interviewed, a protocol from the University of Florida Internal Review Board (UFIRB) was attained. The IRB approval number is UFIRB # 2005-U-0404. The protocol was read to each participant before the initial interview, and translated into the appropriate language when necessary. Each participant was given the opportunity to decline participation, and we informed that they can stop at any time during the interviews. A signed informed was secured in cases where the participants were able to do. In situations where the participant was not able to sign, especially in the case of elders, another member of the family were asked to sign on behalf of the participant.

Four communities were selected based on their location, size and proximity to other non-Mayan communities. In this case the villages of Blue Creek, Pueblo Viejo,

Santa Cruz and San Jose were selected as the most remote villages that are predominantly dominated by the Mopan Maya. The Mopan Maya are traditional farmers that use the *milpa* system of agriculture. Due to the remoteness of these communities there is presumable less disruption in the farming practices.

Initially each community was approached using a ‘rapid community appraisal strategy’ (Murray, et al. 1994) to confirm the level of engagement for each community in *milpa* farming. Considering that *milpa* farming is a male dominated cultural activity, the study focused predominantly on the male members of the communities. It was also determined that according to the cultural structures of the community, the male served as the head of the household. In that case, the research conducted in all four communities was done at the household level. Thus, the smallest unit of analysis was the head of the family household. By that fact, the study is dominated by the perspective of men, even though a few women were interview as heads of household. In total 118 participants took part in this study, with 88 males and 30 females.

Table 3-1. Gender of interviewee * Name of the Village Crosstabulation

		Pueblo Viejo	Santa Cruz	Blue Creek	San Jose	
Gender of interviewee	Male	28	15	21	24	88
	Female	5	15	4	6	30
Total		33	30	25	30	118

Those participants were the primary target for surveys and in-depth interviews. Additionally, the community members were screened to include only those actively engaged in *milpa* production. In this case, the elders or the oldest member of the family was first approached. Then the immediate male children of the elders were interviewed, in most cases soliciting the advice of the elders. The younger participants or the third

generation of the family was selected for interview only if they were above 18 years of age and were practicing *milpa* farmers. The ideal condition for each case was a household unit that had at least three generations living together. This allowed for comparison of responses between multiple generations.

Each family was visited first to complete the surveys and a longer amount of time was spent interacting with the family in order to conduct any in-depth interview. In some cases, the family allowed for longer stays that boded well for conducting the participant observations strategies. The observant participation often had many parts, those included following the elders to the *milpa* site to make further observations of similarities and differences between the elders and the younger *milpa* farmers.

Research Design

This is a case study that describes the various strategies that account for the persistence of traditional ecological knowledge associated with the *milpa* system of agriculture. This study used the ethnographic method primarily to engage the farmers (Gold 1997; Savage 2006). The methodological approach that was required to pursue the research was diverse. As part of the ethnography method participant observation was used primarily to explore the nature of those social and cultural phenomena that are associated with *milpa* making. In this case many of the interviews were unstructured. As the data was coded and analyzed, the emergent salient themes were then converted into a questionnaire based survey instrument. The questionnaire based surveys were used in assessments of traditional knowledge held by different generations in association with *milpas*, *milpa*-making activities, and cultural activities surrounding *milpa*-making activities. The participants determined the length and content

of the interviews based on their direct interaction with *milpa* making. These strategies are summarized in Table 3-2

Table 3-2. Research Methodological approach

#	Methodological Approaches	Method Description
1	Participant Observation	This strategy was used for direct observation by the primary researcher in the field. The purpose was to determine the actual practice of activities associated with <i>milpa</i> production.
2	In-depth interviews	The in-depth interview was directed towards participants who were willing to provide more information of on salient themes that arouse during the observations.
3	Questionnaire based survey	All four communities were engaged with formal surveys. The survey was only directed to head of households, or the oldest adult that was present at that time. This was directed toward cultural knowledge competence and demographic information

Milpa plots were used as a proxy for testing traditional ecological knowledge associated with *milpa* making among the participants. Individual *milpa* plots owned by the participants were used as a source for plant knowledge. An inventory of 16 plots was created of all plant species that were cultivated or uncultivated by the participant. Each person was asked to indicate plants that they recognized, providing the name or

their uses if there was any. They were specifically asked to provide as much information of the plants that was being grown. This was also done in various phases of the *milpa* fallow to understand the retention and growth of both cultivated and uncultivated plants over time.

A shorter list of crops was used to conduct in-depth interviews to determine why those plants were more important for that particular period. The product of this exercise determined how each of the more significant plants are actually chosen and used within household. The category of Significant Plant includes those plants that a) have names, b) are cultivated, c) have names but occur naturally and d) have no names but occur naturally. Only those plants that were harvested for household use or other particular use were included in the study.

Persons who owned *milpa* were determined by visiting that year's plot and those plots that exist from previous years. Typically the male head of household claims ownership of the *milpa* plots, but it is not uncommon for sons to have their own plots. Each person who had a *milpa* was also interviewed about their participation in their communities' traditional activities. Additionally they were interviewed regarding their *milpa* crop diversity to explore the sources of those plants. This component determined various themes that indicate strategies that ensured the persistence of traditional ecological knowledge transmission. In this instance a digital voice recorder was used to document the interviews. If the need arose the recording was played back to the participant at a later date.

Data Analysis

The Data that was gathered during the ethnographic study were arranged by dates according to the community. The interviews were recording using a digital voice

recorder. The tapes were transcribed to text. Each interview text was then evaluated for the incidents of references to unique concepts related to *milpa* farming. Each incidents was recorded and tallied to arrive at the salient themes the are regarded as important to the *milpa* process.

Similarly, whenever possible video footage was collected. These video clips were also evaluated for unusual references to the concepts related to *milpa*. In most cases these concepts were then pursued in a follow up interview. The product of both the text and video analysis was used to develop the structured questionnaire.

The structured questionnaire was extended to a bigger population within each community. The purpose of the questionnaire is two folds' 1) to validate that the concepts are related to *milpa* and 2) to collect any other related concepts that may have been ignored during the first phase.

The population for the entire study was very small. Data was described using Statistical Package for Social Scientist version 18. Most of the survey data was analyzed using a 2 X 2 cross tabulation. This was adequate to illustrate the differences in number counts between each question items. No other statistical test of significance was conducted, since 'N' was small.

The in-depth interviews were analyzed for significant or unusual concepts that related to *milpa* making or plant species. Recordings made from those interviews that had elders as primary participants were evaluated and coded so that they could be placed in a questionnaire for validation. The responses from both interviews and questionnaire validation were collected to determine the more important concepts that

are related to *milpa* making. The results of these findings are described in chapter 4 of this study.

CHAPTER 4 “KOL” AND “TZIK” AND THE TRANSMISSION OF TRADITIONAL ECOLOGICAL KNOWLEDGE

Introduction

This chapter focuses on the ways that the Mopan Maya people interviewed in this study enact, transmit, and adapt traditional ecological knowledge in their everyday lives. That knowledge is under siege in ‘formal’ schooling, which does not recognize such knowledge as legitimate. It is also under siege from the increasing impact of wages and market economies that erode traditional systems of shared labor and shared survival strategies. It is also under siege from migration pressures that reduce communities in size and strength of the Mayan communities.

Traditional Ecological knowledge is learned through vertical transmission from one generation to another and it is also learned and reinforced through horizontal transmission among people of the same age group. In this chapter ethnographic and survey data are used to show how vertical and horizontal transmission of traditional ecological knowledge functions in Mopan Maya villages. Key to understanding transmission is the concepts of “Kol” or *milpa* agriculture and *tzik* or respect. These two concepts work in tandem to mold the social structures of the Mopan Maya culture and survival systems.

Traditional Ecological knowledge is more than names for things found in the Mopan environment. Within the worldview of the Mopan Maya, it is important to think of Traditional Ecological Knowledge as a system of philosophy, ecology, emotion, and aesthetics. Understanding Mopan traditional ecological knowledge requires the understanding of the various behaviors associated with this knowledge system, including the practical skills associated with that expertise. Together, this system has

been especially adaptive throughout the history of the Mopan Maya communities in Belize. In this chapter traditional ecological knowledge is shown to be the solution that Mopan people are using to mitigate the risks and dangers that are confronting their villages today.

Basic Results

Table 4-1. Basic results of the number of participants in the study

Activity	Number of participants	Total actual participants
Participant observation	10 in each community	29
In-depth interview	10 in each community	25
Structured Survey	35 in each community	118
Plots inventor	5 in each community	16

TZIK

The concept of *tzik* or respect is a central feature of the transmission of knowledge, values, and strategies that are all part of Traditional Ecological Knowledge in Mopan communities. The loss of traditional ecological knowledge is exacerbated because the younger generation of Mopan Maya is becoming disinterested in learning and maintaining their cultural tradition as they confront the overwhelming exogenous force of globalization that continues to etch its way into these remote societies. It seems that there are a few Mopan Maya young people who are competently aware of the importance of *milpa* farming, and the importance of the associated activities that establishes the socio-political elements of the society. During interviews with in all four villages very often elders lamented about the lack of ‘respect’ that suffuses the younger

generation in their community. Respect is more complex than just the one word may suggest, for the Mopan Maya this is *tzik*.

Research has long shown that the meanings of a group of words will have different interpretations to any number of individuals within a community. Placed into a cultural context, a “word” can have overwhelmingly different social meaning to an entire cultural structure. Finegan (2004), talks about ‘semantics’ as the study of the systematic ways in which languages structure meanings. Communication can be an arrangement of words or just one word (Finegan 2004). The linguistic meanings of these words are often dosed with other meanings that can be generalized, such as “social meaning” and “affective” meaning. We rely on those aspects of language and meaning in daily conversations to establish precise communications. However in some cultures, there are other roles or rules that are represented by the use of just one word that makes or breaks that culture. For example the embeddedness of the word *tzik* in the Mopan Maya culture goes beyond literary meaning and has a diverse ‘semantic’ understanding.

In her book ‘Relatively Speaking’, Eve Danziger (1996) discussed the Mopan Maya word *tzik*. I will use my research briefly discuss the importance of the concept as it is understood among my study group and attempt to connect its vital use within Maya society. As it is stated *tzik* will only have meaning if the people who use it are able to keep its linguistic meaning. Perhaps for that reason, it is not uncommon for a grown-up to feel compelled to remind another person of *tzik*, almost always as a parting advice if nothing else. I have come to understand this word to mean more than just the generic translation of “respect”, which is the literal translation, but as well as to mean ‘knowing one’s place within a kinship and social structure’.

The word *tzik* is introduced to children at a very young age. Although *tzik* is used most commonly to mean “respect” it becomes more important as one establishes status within the community (Danziger 2001). From my observation of interpersonal interactions during my research, it is clear that when a young person is introduced to an adult relative (or sometimes just a good family friend) who is older, that person is ordered to give respect (*tzik*). This may seem trivial, but in the act of paying respect, the adult explains the kinship relationship to the younger person. The younger person will say *Ca in tzik ehct*, literally meaning, “I give you respect.” However, there is more to the literal meaning, and social meaning that is invoked here. By saying “I give you respect” the speaker is acknowledging that he/she understands the relationship, and will henceforth remain within that network. This *tzik* is important for that person later in life.

Tzik also establishes social status. Once a person knows his/her place within the *tzik* of that society, then that person has obligations that come with each social status of *tzik*. For example, in the Mopan Maya communities of this study, a *Suku'un* is responsible for an *itz'in*. *Suku'un* translates to big brother and *itz'in* translates to little brother. Although that relationship is typical of consanguine relations, the same ‘responsibility understanding’ holds true for relations that are fictitious kinships. Cousins in this case are not distinguished from immediate siblings of ego. So *Suku'un* can mean older brother, cousin, nephew, or other males who are relatively older than the speaker or another person being referred to. The same principle applies to *Tataa*, which literally translates to ‘other father’ and it can be a ‘little father or grandfather’ depending on the age of the ego. Therefore *Tataa* can be used to refer to an uncle or to a grandfather.

This system allows the Mopan Maya to take *tzik* to a higher level that includes supernatural powers. The Mopan Maya are somewhat animistic in their religious belief system (Gregory 1984a). The Maya believe that all natural phenomena were under the control of, or inhabited by, one or another supernatural being or force (Dewalt 1975). During an interview with a participant from Blue Creek, he told that supernatural beings or forces exist in forests and are often thought to be species-specific, representing the species as such. Losing *tzik* or not having *tzik* to these beings or forces which present themselves in various forms, can result in harmful ramifications for the individual or community. In a similar manner, a problem animal is very often referred to as *ma' yan u tzik ba'al che* (animal without respect). This means that killing this animal would be justified. It is also known that a person who has fallen out of *tzik* can be described as equivalent of an animal or stray dog which has been clearly cursed.

Finally, the number of people networked within the society gets bigger or reduced depending on who has *tzik* or who does not. My research shows that many times when conflict within the community arises, the person who has been bestowed with the highest level of *tzik* that is usually acknowledged by everyone, is asked to be a mediator. Furthermore that person is also the one who negotiates important arrangements such as marriages. This makes sense to the society, since the entire marriage arrangement of any two people is centered on *tzik*. If a person is in formal *tzik* or has formal *tzik* arrangement to another, such as kinship relation or fictive kinship, they cannot engage in marriage. Two people who have not exchanged and maintained *Tzik* can get married. When *Tzik* has never been established with a person, that person is considered a stranger or not related and may get married into a family. This notion highlights the

significance of *tzik*; being a stranger or not kinship related does not mean one is disrespected.

At the wedding day (Traditional Wedding) the male person getting married into the family is obligated to gather all living relatives at the home of the bride-to-be. Each family member, at that time, will exchange *tzik*, establishing all possible combinations of relationships or *tzik*. The ceremony I refer to here, which I have minimized to a wedding, is traditionally called *Tzah Tzik* or “Pay/Give/Exchange Respect.” This elaborate ceremony is presided over by the most senior elder of the groom’s family.

The native language of the Mopan Maya is a vital medium for the transmission of traditional ecological knowledge and for the activation of *tzik*. During the study, it was noted that it is becoming more common for younger folks to adopt English or Spanish kinship terms to establish relations within a community or to make reference to kin. What is different about the new terms and the semantic of *tzik* is that the new terms do not have the same cultural meaning of the kinship labels being used into the old cultural system. This means that a generic kinship label such as brother, does not command the respect and responsibility cultural ties as someone who may be referred to more specifically as *suku’un*. Additionally the social interactions among community members are less formal and appear more volatile. As reflected in Table 4 – 2 there is strong agreement among the participants that young people are inclined to follow the more traditional model of *tzik* (respect). The village of Pueblo Viejo seems to be a bit more vulnerable at this time, with 24 in agreement to this item.

Table 4-2. Name of the Village * Young people are willing to give more respect if they speak Mopan Maya Cross tabulation

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Name of the Village	Pueblo Viejo	1	3	5	21	3	33
	Santa Cruz	0	2	8	17	3	30
	Blue Creek	2	0	1	16	6	25
	San Jose	0	4	4	12	10	30
	Total	3	9	18	66	22	118

The concept of *tzik* also lays the foundation for the relation a Maya person has with his or her environment. This notion is clearly manifested in my study of their farming practices. In my research the participant reported that at the preparation of *milpa* a farmer must pay respect, or give *tzik*, to the guardians of the forest and all the other living things that it holds. Among the Mopan Maya of this study, ceremonies are held for the land clearing, burning, planting and harvest of the fields (Carter 1969), and particularly for the planting of corn, the primary crop. The giving of *tzik* can be done in many ways, which includes the solicitation of help or services from a religious specialist. Today, among the Mopan Maya communities I studied, the traditional religious specialists are called *ilmah*, meaning an enlightened one who can be a healer, medicine man or the keeper of some special knowledge. Within the Mopan belief system, the *ilmah* is one who is enlightened and has special abilities that enable them to communicate with supernatural beings. In any case, they are people who clearly hold the rights and privileges to the knowledge of special prayers and rituals.

The rituals themselves may seem as nothing more than another Christian ritual, with the use of candles, effigies and symbols of Christian origins that are adorned with incense and other artifacts that represent the daily life of the Maya people (Gregory

1984). However, the ceremony of giving *tzik* is done so that a farmer is reminded that he himself is temporary in the entire scope of the world in which he will engage. The knowledge of *tzik* is also expected among the farmer's community.

An individual's understanding of *tzik* establishes his or her understanding of the network of support and help they can muster in the preparation of *milpa* at all stages. Close relatives and fictive kin are the primary members of the *tzik* network that can be called upon, given that *tzik* is recognized by both parties. The reenactment of *tzik* is also the mode by which the knowledge is passed on to the younger generation. The younger members of the society are often engaged in designated responsibilities during this process, as prescribed by the elders. Often this is the time at which young men transition into manhood and may earn the respect and honor of carrying out their own ceremonies for their own *milpa*.

In participant observation, I found out that during the the ceremonies, several other aspects of traditional knowledge are reenacted beyond those specific to the *milpa* activity being celebrated. These reenactments entail storytelling, food preparation, craft building and traditional games. Story telling is often imbued with recounts of the hunter out-witting a certain animal or the encounter of dangerous wildlife, such as snakes and large mammals. Incorporated in these stories are detailed information of the natural history of animals and plants that are not directly related to *milpa*. In the same token, lots of discussions happen regarding recent events in the community that are regarded as unusual. However, the under tone of each story or enactment is replete with the invocation of *tzik*. All the knowledge that is passed on during these long hours of

orations is indeed vital information and knowledge that will become useful during the management and care of the entire *milpa* cycle.

The vertical transmission of Traditional Ecological Knowledge

Currently in the Mopan Maya villages of this study, there is a clear transmission of knowledge that passes from one generation to the next. This can be described as “vertical” transmission of cultural knowledge and strategies (Bernstein 1999). This follows a pattern of transmission that goes from ‘elder to younger’, within the same household or kinship related community members. As I have observed within my study, traditional knowledge of daily living engagements are freely passed on actively, some of specialized types of knowledge, such as that knowledge base related to healing, medicinal plant and spiritual healing knowledge are reserved for a few chosen members of the family or fictive kin. For the Mopan Maya to be able to transmit traditional ecological knowledge, it appears that it is important to practice the *milpa* farming system.

Ground mole trapping

At very young age, children are taught to be observant of many subtle but significant details of the natural processes within the environment. In this example a child about nine years old skillfully gathers the materials that are required for the construction of a trap that is intended to catch the ground mole. The material required included a dense wood pole about one inch and half in diameter that served as the spring for the trap. The tree species that was chosen was a small barba jolote (*Pithecellobium arboretum*) that has a very dense wood with good flexibility. Next, a few strips of bark were collected from another tree, known as ‘hol’ (*Trichospermum grewiifolium*). The strip was strategically peeled off as it was being collected so that it

would be soft. The tree itself was left standing with only a small strip removed that is four feet by 3 inches in dimension. The bark was further split into four strips which were roughly twisted to make small ropes. Next, the stem from a small heliconia plant (*Heliconia spissa*) was collected. This is a succulent plant that the Mopan Maya know to be a food source for the ground mole.



Figure 4-1. A trapped ground mole (*Neurotrichini spp.*)

The nature of the ground mole is to make small mounds along the path of its burrow. These mounds were analyzed in detail to test for freshness of the soil which would indicate where the mole is. By observing the freshness of the leaves and twigs that were mixed in with the churned up soil the child quickly determined where the mole was. The child then proceeded to clear away some of the foliage that was on the burrow.

Then a hole was punctured in the burrow. Once the burrow is punctured, the climate condition changes inside alarms the mole which then returns to repair the damage in the burrow. Before that happened, the child placed a snare inside the burrow wall. A stalk was anchored into the floor of the burrow with one end of the newly made

rope attached to it. The rope was then passed through the length of the heliconia stem to mimic a fake root. This portion of the trap served as the trigger. The distance between the snare and the trigger was measured to be '4 fingers wide', or the distance between the thumb and the little finger, when a fist is made. Then the pole was anchored into the ground about one foot and a half or more deep. The depth for the pole depends on the soil structure and condition. On rainy days, like that day, the pole was anchored almost two feet deep. The pole was then bent all the way down to attach the snare and trigger to it. The snare was carefully covered with soil inside the walls of the burrow.

The principle at work here is that the mole will sense the atmospheric changes inside the burrow and will return to repair it. On the way, the mole will shred any root or twig that obstructs its path. Therefore it is important to hide the snare carefully inside the walls. The mole is also an opportunistic feeder and it will feed on any food that it happens upon. Therefore, finding the heliconia stem inside the burrow is a chance for it to feed. As the mole sees and eats the food that is in the way, it cuts the rope that was placed inside, causing the trigger to snap, snaring the ground mole just below the neck.

The point being highlighted by this event is that a child of nine years old must have an understanding of the various ecological principles that are related to the life of the ground mole. Based on the fact that the ground mole is common within *milpa* plots, it is likely that all this knowledge was learned while the child was engaged in activities related to *milpa*. None of that learning would have been possible if the child did not have the opportunity to be with elders in the natural environment. This observation highlights the extent of the details that is passed on in traditional ecological knowledge.

Milpa or *kol* farming system is a concept that acts as a social structuring mechanism for the community. In the Mopan Maya language, the word *kol* is used to farming or farming practice. *Kol* as described by participants that are currently engage in *milpa* making, can also be appropriately regarded as a social marker that conveys cultural identity and social placement for an individual within the community. It is in the making and maintaining of *kol* that a member of the community finds their place socially. Each household must have a *kol* and must have made one while following the traditions that have been passed on from one generation to the other. However, it must be noted that *kol* does not only mean the clearing of forest and the simple planting of corn, but rather, it speaks to the knowledge of the farmers, both ecological and cultural. That farmer must have access to the relevant knowledge base about *kol* that is often held by the elders within the community. In other words, if a Mopan farmer wishes to make a *kol* alone and refuses the help of other members of the community, that farmer loses access to traditional ecological knowledge. If the occasion arises where that person wishes to get help, they will likely be ignored by the elders. Furthermore the majority of the knowledge that is shared during the making of *kol* is dependent on the willingness of the holders of that knowledge to pass it on. Elders insist on using *tzik* and are adamant about keeping that social construct active.

Table 4-3. Age of interviewee * I must get help from my elders with *milpa* Cross tabulation

		Strongly Disagree	Disagree	Nuetral	Agree	Strongly Agree		
Age of interviewee	18-28	1	0	4	18	12	35	
	29-39	0	1	3	20	12	36	
	40-50	1	3	2	10	7	23	
	>51	0	1	3	15	5	24	
Total		2	5	12	63	36	118	

As reflected in Table 4-1, only one person of the entire age group that is between 18 and 28 years thought that he did not need the help of elders in the making of *kol*. Even as the age group increases, Table 4-1 still reflects a strong sense of need to involve the elders in the making of *kol*. Young people may feel that they have the physical strength to make *kol*, but often the need for the knowledge that is associated with that activity will make them return to seek the aid of the elders.

That an individual has *kol* speaks to the fact that such an individual has a clear understanding and appreciation of the cultural values that are prevalent within the community. In the interviews conducted, all participants at some point indicated that a Mopan Maya has to make *kol*. Young Mopan men do start to practice making *kol* alongside their father or an older close relative at a very young age. By the time the young male reaches an acceptable age to get married, normally about the age of 17, he must have demonstrated a strong competence for making *kol*. A survey question specifically asks this question, and all responses were positive.

Table 4-4. Name of the Village * All Mopan Maya must make *milpa*. Cross tabulation

		Neutral	Agree	Strongly Agree	
Name of the Village	Pueblo Viejo	0	18	15	33
	Santa Cruz	4	22	4	30
	Blue Creek	0	2	23	25
	San Jose	1	13	16	30
Total	5	55	58	118	

As reflected in Table 4 – 2, in all 4 communities, the participants acknowledged that making *kol* is very important to them. The village of Pueblo Viejo is the most remote of the four communities that were studied. All 33 respondents agreed that *kol* is

important. In the village of Santa Cruz, there seems to be a consistent commitment to making *kol*, which is similarly reflected in San Jose village.

It must be noted here that the community of Blue Creek, which produces upland rice (*oriza sativa*) as their primary crop using the *milpa* farming strategy, has a different recent history with *kol* than that of the other villages. Much of the traditional practice of shared labor following the community network is kept, similar to when *kol* is made. In 2009, the community members were not able to sell their crop production the “Belize Marketing Board”, an agriculture produce purchasing arm of the Government of Belize. This caused major economic loss to the local farmers and many had to leave to find wage labor to subsidize the household economy. In response, the farmers insisted on making *kol* as insurance. Some farmers in Blue Creek who could afford it, traded ‘labor-days’ for portions of already established *kol*.

With such strong demonstration of the commitment to the making of *kol* it is obvious that there is a deeply rooted cultural value among the Mopan Maya associated designated to such activities. Although the end product of *kol* is to produce food, the systems that are at play in that process is equally important. *Kol* is an activity that entirely occupies the daily lives of the Mopan Maya and influences their philosophy. Therefore it is important to consider all the traditional activities that are associated directly with the process of making of *kol*. The activities within this process are important, for they allow the Mopan Maya men and women to establish and assure their place within the society, and how they will be perceived by their community (see Table 4-3). In this way it is similar to the next most significant notion, *tzik* which is held in high

regard, invoked to determine the ‘shared labor’ network that the farmer will use, and marks the cultural place where an individual is engaged.

Table 4-5. Name of the Village * Each Man must have *milpa* in order to gain respect in the community Cross tabulation

		Disagree	Neutral	Agree	Strongly Agree	
Name of the Village	Pueblo Viejo	4	1	16	12	33
	Santa Cruz	0	0	22	8	30
	Blue Creek	2	0	14	9	25
	San Jose	4	3	13	10	30
Total		10	4	65	39	118

During personal interviews, t participants of this study lamented that ‘*tzik*’ is fading along with *kol* making. Within each community social balance is harnessed by having *Tzik* and *kol*. A person, who does not have *kol*, will likely be someone within the community who will not have *Tzik*. This can be simplified to mean a ‘disrespectful’ person or a person that have been socially ostracized. Within all the communities as it is reflected in Table 4-3, there is still that strong belief that *kol*, makes a cultural statement about being Mopan Maya and gaining *Tzik*.

Kol Making-The Early Stages

The process of *kol* making typically starts with the *Kanan Kin* (Guarding of the Sun) ceremony. This ceremony is a multi-day event, which requires the participation of the entire community. The planning of the ceremony is initiated by the person who is recognized as leader of the community. In most cases this person is recognized as the *Alcade*. The designation of *Alcade* is traditionally recognized as the local judge within the community. The *Alcade* seeks the help of other members of his council and other religious leaders. Those leaders are then further delegated to seek the help of elders

and ordinary members of the community for the ceremony. If a community member is asked to participate by any members of the council to participate in the ceremony, they are not expected to refuse.

It is important to worship the sun, recognize its power, and render it the reverence it deserves as the giver of all of life. The ability to recognize that power is entrusted within the knowledge and duty of the elders and their ability will be used during these ceremonial days. The person, who is hosting the ceremony, is required to plea the services of the elders using the highest level of formality as it is known in *tzik*. The enactment of asking for the help of the elders is very ceremonial that can last for several days leading up to the actual Ceremony days. A simple cultural mis-step can jeopardize the entire '*tzik*' network and may hinder the performance of the ceremony. Elders are especially engaged with great care and are given the recognition within *tzik* that they deserve. According to a participant in Blue Creek, those people with the designation on *ilmah* are engaged with the highest respect, for their presence in any ceremony would show higher honor.

The Mopan Maya farmers know that the intensity of the dry season and the wet seasons alike will determine the outcome of their yearly crops. The 'Guarding of the Sun' ceremony is used as an occasion to make predictions for the upcoming seasonal changes by the elders. There is an unspoken commitment to and respect for such predictions. More importantly, the ceremony is dedicated to make special offerings to the Sun God and the Rain God. The prayers of the community reflect their desire for the Sun God to allow the sun to shine during the preparation periods and the Rain God to provide the rains during the planting period. The elders take this responsibility very

seriously, and try to make the best predictions possible. There are past accounts of times when elders made bad predictions that ended up causing starvations within the community. Each community depends solely on the predictions of their own community elders. Predictions made from other communities may be shared between communities, but they are just for information and conversation, and are rarely followed.

After the ceremony and celebrations are complete the next step in the processes of *kol* making is the site selection. This is also done with prayer ceremonies that can occur before the farmer goes out to scout the forest for a site or at the point when he has selected a suitable spot. According to my informants, the ceremony, known as *Mayehak* is held upon identifying a suitable site, primarily for the eviction of all unwanted spirits. After some time of selecting the site and after the site is blessed, the actual preparation of the *kol* plot will be done. The preparation includes felling the trees of the forest which are then left to dry for several weeks if not months. After the clearing is complete the weather is monitored closely for the appropriate time burn the field.

Throughout this process, there is a wealth of social engagements that are reenacted that epitomize the true Mopan Maya Culture. The power of the concept of *tzik* is invoked during this ceremonial process, and each *milpa* farmer is forced to take stock of who is within his or her circle of *tzik* and of those that they can rely on to make their *kol*. Since the village farmers are dependent on shared labor strategies it is important that each farmer himself is regarded with *tzik*.

The man must be fully cognizant of those community and family member who can be regarded to have *tzik*. In some case a man's network of shared-labor may be limited by his wife's inter-communal relationship with another woman. He must be aware of

whom his wife or the recognized female head of household, will accept as a help for during the time that the share labor are ongoing. The recognized female head of household can be the mother of the farmer, or the oldest female relative in that family. It is traditionally required that if any member of the community is called upon to help another farmer, he is also expected to have his spouse join the household of the host farmer's wife, to prepare food that will be served to all the workers on that workday. The cycle can continue for several days during that month. Although the moods during such days are festive with the host's household, not all the women are always pleased or welcomed. The host women are very selective of which member of the community they will accept to help in during these important days. In the instance where a man agrees to help another, his wife is also expected to be available to help the host women. In cases where the women have fallen out of *tzik* the cause of such misunderstandings must be resolved before the work days arrive. Where those issues remain unresolved, a woman may send the oldest daughter to take her stead, which would make the situation less confrontational. However, such gestures are unusual, and if they do occur it is regarded as a curse and may have negative impacts on the *kol* itself.

During the food preparation processes the elder women are often consulted for specific knowledge pertaining to the culinary skills. Younger women and newly wedded wives are often taken as apprentice during these days, and taught formal social engagement skills. The elder women in the community spend a large portion of time sharing their knowledge to the younger women of proper conduct within the community that maintains their integrity and that of their husbands. The discussion that occurs during those conversations is centered on socially acceptable norms of local conduct

that delineates the concept of *tzik*. Elders are given more latitude during these social engagements to speak more openly on need for *tzik*.

Table 4-6. Name of the Village * It is important for us to get help from our elders Cross tabulation

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Name of the Village	Pueblo Viejo	0	2	1	17	13	33
	Santa Cruz	0	0	0	17	13	30
	Blue Creek	0	2	1	6	16	25
	San Jose	1	2	3	20	4	30
Total		1	6	5	60	46	118

Mopan Maya men and women alike agreed that consulting with elders is important during the process of making *kol*. During in-depth interviews, a strong majority of the respondents declared that they are ‘without knowledge without the elders’; “*Ma’ yan ti tukul, wa ma’ yan a chijaano*”, (Documented February, 2009). This statement is the basis for the information reflected in Table 4-4, which indicates that most respondents depend on the aid of the elders during the making of *kol*. How one may carry themselves during the various ceremonial engagements is judged severely. By that nature, *Tzik* is a fundamental element in all engagements.

The Making of Kol

In the process of making *kol* itself, the farmer has to ensure that the proper procedures of the traditional ceremonies are done accurately. In the communities of San Jose and Pueblo Viejo, the participants in this study consistently reported that they must wait for elders to conduct the ceremonies (Documented on October 2009). Thus, the elders are constantly consulted for the proper procedures. All the knowledge of the cultural elements of making *milpa* and the associated traditions are at this time invoked

by the elders. The ability of a farmer to access that information depends significantly on the status of himself and his family within the circle of *tzik*. A farmer may be able to acquire enough people to make *kol*, but if he has fallen out of *tzik* or is perceived to be undeserving of *tzik*, then he will be unlikely to receive help from the elders. Therefore *kol* goes beyond the mechanical processes of making *milpa*, and extends to the cultural functionality of an individual member of the community. *Kol* is the icon through which a Mopan Maya is validated within their community.

During interviews in Santa Cruz, (Documented May 2009), work parties that were preparing for planting said that detailed and extensive plant knowledge is required in *kol* making. All eleven men in the work party, of ages ranging from 21 years old to 69 years old agreed that plant knowledge was necessary. That knowledge includes information of cultivated and uncultivated plants. They claimed that Mopan Maya farmers will often plant their crops with the knowledge that the yields will be shared with the local fauna. In that sense the plants are purposefully planted to attract certain species of fauna that can be beneficial to the farmer. That knowledge is specific to the ecosystem in which the Mopan Maya will make *milpa* that period. That can be surmised from this fact is, that the plant knowledge base is immense and not all of that knowledge will be used at any one period.

The understanding and knowledge of uncultivated but useful plants that are included within the *milpa* is also typically transmitted vertically through the generation by close contact of practitioners within the specific ecosystem. In Santa Cruz village, where 8 second generation farmer household were interviewed, each participant indicated that they learned about plants in their *Milpa* from their fathers (May 2009). The farmer

himself will individually have a direct preference for which uncultivated edible plants are for food, which activate the transmission of knowledge about those plants. For example the *Cha'yuc (solanum nigrum)* plant, which is commonly, collected in the newly established *kol* plots. This is a small perennial plant that is an early emergent plant in plots that have just been burnt. This plant is an important seasonal addition to the diet, which is collected intensely. However, most of the youth within the study communities claim that they do not eat this plant (Field Notes, August 2010). However they know the plant and they know that it is edible. In many cases, they collect the plant to themselves, either for home use or for barter in the community. The youth also commonly keep stock of where plants are growing as a hunting spot. The plant itself serves as a food source for bigger bird species that are often trapped for meat. This is an example of the need for the young Mopan Maya person to be engaged in *milpa* making alongside elders who are also still engaged in *milpa* making in order to allow the transmission of *kol* knowledge. If the '*Cha'yuc*' is not a preferred crop for the younger farmers, they will selectively exclude it from their *milpa* and it cannot then be used for attracting birds.

In a traditional *kol* being managed by elders, there can be a significant number of uncultivated trees left standing during the preparation phase.

Table 4-7. List of plants that are commonly found within one elder's *milpa* plots in Pueblo Viejo Village

Plant Varieties	Primary Forest <i>kol</i> Plot	Fallow <i>kol</i> Plot
Rice (<i>Oryza sativa</i>)	X	X
Beans (<i>Phaseolus vulgaris</i>)	X	X
Corn (<i>Zea maize</i>)	X	X

Table 4-7. Continued

Plant Varieties	Primary Forest kol Plot	Fallow kol Plot
Coco Yams (<i>Colocasia esculentum</i>)	-	X
Cassava (<i>Manihot esculentum</i>)	-	X
Plantains (<i>Musa paradisiaca</i> var.)	-	X
Bananas (<i>Musa paradisiaca</i>)	-	X
Sugar cane (<i>Sacharum officinarum</i>)	-	X
Mammee (<i>Pouteria sapota</i>)	X	-
Chico Sapote (<i>Manilkara sapota</i>)	X	X
Habanero peppers (<i>Capsicum</i> <i>Chinensis</i>)	X	X
Ginger (<i>Zingiber officinale</i>)	-	X
Papaya (<i>Carica papaya</i>)	-	X
Ceder (<i>Cedrella odorata</i>)	X	X
Red Wood (<i>Colubrina arborescens</i>)	X	-
Zericote (<i>Cordia dodecandra</i>)	X	X
Cabbage Bark (<i>Lonchocarpus</i> <i>castilloi</i>)	X	-
Black Pioson Wood (<i>Metopium</i> <i>brownie</i>)	X	-
Jabin (<i>Piscidia piscipula</i>)	X	X
Granadillo (<i>Platymiscium</i> <i>dimorphandrum</i>)	X	-

Table 4-7. Continued

Plant Varieties	Primary Forest kol Plot	Fallow kol Plot
Mohogany (<i>Swietenia macrophylla</i>)	X	
Cohone Palm (<i>Orbigyna cohune</i>)	X	X
Bayleaf (<i>Sabal mauritiiformis</i>)	X	X
Jippy jappa (<i>Carludovica palmate</i>)	X	X
Chacah (<i>Bursera simaruba</i>)	X	X
Sweet Potato (<i>Ipomoea batatas</i>)	-	X
Winged Yams (<i>Dioscora alata</i>)	-	X
Cocoa (<i>Theobroma cacao</i>)	-	X
Guarumo (<i>Cecropia obtusifolia</i>)	-	X
Hog Plum (<i>Spondias sp.</i>)	X	-
Warree Cohune (<i>Astrocaryum mexicanum</i>)	X	-

Table 4-7 is a short list of plants that exist in a plot that is managed by an elder. The hardwoods are selectively left behind during the clearing phase of the *milpa*. Many of these trees are left for the purposes of construction or for later harvest for other timber purposes. Trees that provide fruits that both the human and wildlife eat are left untouched. The fruiting trees are especially protected if they are near the edge of the *milpa*. It is believed that the wildlife that may also feed on the crops will be more readily attracted to the fruits of the uncultivated plants, thus preventing excessive destruction to the crops. It is also very common for the farmers to selectively trap favored meat animals near these trees. As it was noted during this study, plots that were newly

established had bigger diversity of uncultivated trees and shrubs. As the plots remain longer in use, it appears that the diversity of tree species reduces, as several trees are collected for firewood or construction use. Most of the hardwood will have been cut from within the plots and rapid growing trees like the Guarumo (*cecropia obtusifolia*) will take over. Plots that were in the second year of the *milpa* cycle showed that the Guarumo is often left undisturbed, and are the dominant species. This tree has no significant timber value, but it is a good source of food for birds and monkeys among many other animals. In an interview with a village healer of Blue Creek village, he pointed out that the leaves of the Guarumo tree have many uses (Documented in June 2008). The leaves are often smoked as a cigar or are sometimes steeped into a tea to reduce fatigue or other forms of stress. He also uses the leaves from the Guarumo tree as a remedy for people who are suffering from diabetes. In addition to that, he also indicated, that most 'bush huts' are built using the wood from this tree as walls. The wood from this tree is very soft and very light in weight, and would last for about two years as a wall.

Elders are particularly aware that the species decrease will also mean a decrease in "ba'al che" or wildlife. The word 'ba'al che' is used to refer to harvestable types of wildlife from the forest. The animals that fall within the 'ba'al che' category can range from small burrowing mammals to large ones like the tapir (*Tapirus bairdii*). The harvest of a 'ba'al che' brings lots of joy and happiness, especially if it is a large one. Referring to those animals as 'ba'al che' is considered accepting them within the circle of *tzik*, and honors the notion that an animal is equally important as human. In that sense a snake would not be referred to as 'ba'al che', since it is not harvestable and it must be regarded with another degree of *tzik*. Elders within these communities seem to be

aware that the plant diversity within *kol* has a connection to the presence of wildlife. Elders refer to a *kol* that has very few crop or uncultivated plant species as *otzil kol* (poor *milpa*) (Documented July 2010). In other words the plants that are present within the *kol* of elders are carefully arranged in an attempt to mimic the original ecosystem.

Changing attitudes towards kol

Although *milpa* farming is fundamental for the vertical transmission of the Mopan Maya culture, young farmers are veering from the traditional *milpa* system. According to one farmer in Santa Cruz village; ‘young farmer don’t understand what it mean to have farm so they don’t show the work to the young children’ (Documented February 2009). Young *milpa* farmers who practice *milpa* agricultural system appear to be less cognizant of the values of *kol* as a medium to transmit traditional ecological knowledge. Young farmers, especially those in Blue Creek village do not feel that they should teach their children how to make *kol*. Instead, they have a tendency to plant crops that are considered ‘cash crops’, in which case Blue Creek farmers plant upland paddy rice, sale to the market. The use of a diverse cropping system becomes less favored, and hence the knowledge associated with each plant and its relevance in the entire system can be lost. In a few instances members of the younger generation farmer may continue to use the *milpa* strategy as a mode of production. They still find it important to engage in the practice of customs associated with *milpa* making, minimally. In other words, as the Mopan communities are shifting from subsistence farming to market agricultural strategies some younger community members make efforts to keep essential traditional elements of the *milpa* making for one crop only and abandon the system after the first harvest. However there is a strong move by others of the younger generation to move away from the idea of *milpa* farming. As shown in Table 4-6, the notion of abandoning

kol is evident among young people that have moved out of the Mopan Maya communities and are living in Belmopan and Punta Gorda. In fact much of the young Mayas that live in Belmopan do not feel that there is a need to make *milpa* anymore.

Table 4-8. Do you think the Mopan should have *milpa*? * Which town are you from
Cross tabulation

		Which town are you from			Total
		Punta Gorda	Belmopan		
Do you think the Mopan should have <i>milpa</i> ?	Strongly Agree	3	3		6
	Agree	6	3		9
	Neutral	5	13		18
	Disagree	5	10		15
	Strongly Disagree	2	5		7
Total		21	34		55

What Table 4-8 illustrates is the fact that when the Mopan Maya migrates from the indigenous communities, they almost immediately abandon the Mopan Maya tradition of *milpa*-making. *Kol* and *Tzik* were rarely referred to by the urban Maya of this study. Only 15 participants of the 55 that were interviewed agreed that they should make *milpa*. In many cases, the Mopan Maya people living in the urban areas of Punta Gorda and Belmopan who claim to have *milpa*, also claimed that they hire labor to make the *milpa* as shown in Table 4-9. Most participant from the urban areas claimed that they engage in *milpa* activity only as a secondary activity and not as a primary source of living.

Therefore, it is more feasible to hire other men to make *milpa* for those families

Table 4-9. Which town are you from*Do you hire other men to make your *milpa*? Cross tabulation

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
Which town are you from	Punta Gorda	10	7	2	2	0	21
	Belmopan	7	16	7	3	1	34

Total	17	23	9	5	1	55
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The way in which each traditional Mopan Maya community has been culturally arranged through many generations makes it evident that ‘vertical transmission’ of traditional ecological knowledge has been an effective transmission mode in the past (Bernstein 1999; Tehrani and Collard 2009). However, the fact that the young Mopan Maya farmers of this study are making *milpa* for reasons other than cultural commitment, suggests that the vertical transmission of traditional ecological knowledge is being disrupted. What *milpa* represents culturally is still valid to the Mopan Maya and the younger generation still find it important at least mimic this practice within their communities. The elders within all four communities insist on following traditional processes associated with *milpa* production, and believe in the value of ensuring that the practice of conducting traditional ceremonies is maintained by the younger generation. In reality, *kol* or *milpa* farming is the only opportunity that young Mopan Maya people will have to learn of their Traditional Ecological Knowledge; that learning is only achieved through contact with the older Mopan Maya generation.

Table 4-10. *Milpa* is important to me? * Village Cross tabulation

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Name of the Village	Pueblo Viejo	1	6	7	8	11	33
	Santa Cruz	0	1	4	21	4	30
	Blue Creek	0	0	0	8	17	25
	San Jose	0	0	7	11	12	30
Total		1	7	18	48	44	118

During interviews among with all four communities in this study, the word *kol* was used in various ways to represent different concepts. Although the word *kol* literally means the physical location of a *milpa* it also refers to the concept of farming and all the parts associated with it, including elements that are social and spiritual. *Kol* is often

used to make reference to the social stature of a community member (Documented June 2007). For instance, if a person is being discussed and is referred to as a 'Met *kol'lil winik*' (a maker of *milpa*), his stature is raised to a more honorable one. Such regard bestowed upon him, places him in a position among his community that grants him all the community courtesies. Similarly the value of being a *kol'lil winik* is further asserted during the arrangement of marriages; the suitor is brought before the parents of his bride to be, he will be asked if he has a *kol*. According to a participant in from Santa Cruz village, in times past, this can be the most critical of all points in arranging a marriage between the young couple (Field Notes, December 2008).

According to the *Alcalde* from Santa Cruz village a young male Mopan Maya person must demonstrate a competent level of knowledge of making *kol* or *milpa* for him to be fully accepted as a legitimate member the community (Interview, October 2009). This is the first and most important act he will have to do within the society. Especially for men, this is a rite of passage into manhood that usually signifies his readiness to start a family (Interview, October 2009). The fact that a young man has fully demonstrated the he is capable of correctly making *kol* would mean that he has demonstrated the awareness of his place within the society and has honored those that are regarded as his elders and others who will remain within his circle of *tzik*. He will have paid his respects appropriately, as dictated by the culture, to all his elders and accepted his place within the social structure of the community. Those actions would have ensured the security of the assistance from members of the community, especially those of the elders.

In cases where the young man feels limited or insecure about establishing his place within *tzik* of his society, his father or an elder that is biologically closely related to him, will establish that network for him. According to a participant in Pueblo Viejo, fathers or family elders will commit a younger man for events such as 'work days' exchanges without consultation of the young man (Interview, February 2009) . All arrangements that are made by the elder on behalf of the young farmer must be honored. In the event that the apprentice farmer is not able to fulfill those commitments, then the father or the elder who made the commitment will be obligated to fulfill them. The apprentice farmer is bonded by the commitment of the father or elder and cannot renegotiate the arrangements. It would be an insult to both the elder and the third party within the agreement.

Shared Labor Strategies

The Maya people believe and know that they are a part of the ecosystem. Based on that wisdom, the work involved in making *kol* is done involving all member of the community as a system. A participant from Blue Creek, refer to the principles of *shared labor* to have been adopted from observation of the *Ants* over the many years (Interview January 2009). As such the Mopan Maya in this study seem to understand that their role as farmers is nothing more than caretakers of the natural environment, and there appears to be a cohesive understanding among the collective. The practice of *milpa* farming epitomizes and reaffirms this belief through the yearly re-enactment of festivals and shared labor during the making of *kol*. If there can be one poignant example of how traditional ecological knowledge of the Maya people activated, it is the reenactment of *milpa* (slash and burn) production and all its affiliated activities. The engagement in *shared labor* of *Milpa* farming acts as a catalyst for each community and all cultural

values to hinge on the activities of *milpa* farming. A farmer who wishes to start a *milpa* must first be a part of his community and have proven his ties to other members of the community through *tzik*. There are obvious reasons for this virtue, but also there are other unspoken reasons that are not written but are clearly understood.

The making of *kol* is dependent on the exchange of 'work-days'. Farmers from in this study agreed that they need to help each other in making *kol* as shown in Table 4-8. To start *kol* there is a need for intense labor to clear the forests. This is done with the use of simple metal tools and human muscle labor. The number of men farmer can summon to help him at the first stage will determine the size of his *kol*.

Table 4-11. Name of the Village * I must help other farmers to make *milpa* Cross tabulation

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Name of the Village	Pueblo Viejo	0	1	1	27	4	33
	Santa Cruz	0	0	0	26	4	30
	Blue Creek	1	2	0	7	15	25
	San Jose	0	3	1	22	4	30
Total		1	6	2	82	27	118

However it must be noted, that a farmer cannot just openly invite as many men as possible. The number of men that commit to exchange work-days is calculated so that the farmer will have enough calendar days to return those work-days to every member of his work party, at the right time. An interesting point of observation during planting work days is the demography of the member of the work-day team. It was observed that younger host farmers more often sought the help of elder members of the community or close family members (Field Notes, June 2009). The reason for seeking out elders is understood to be that elders are often closely related to the farmer and they can be more lenient and patient in returning the work days. Additionally, elders are essential as

they provide on-site guidance about how a young farmer may conduct himself in actions related to *kol* making.

The seeking of elder as members of the work-day team is very complex. According to a participant in Pueblo Viejo, the term *elders* in this instance does not necessarily refer to someone old, but also anyone with a valued repertoire of traditional knowledge and community *tzik* (Documented August 2008). Within the community an old person is regarded with honor and is important (Interview, August 2008). They are given certain rights and privileges because they are considered the guides for the community way of life. In fact, a man with children that have grown up and have their own households is referred to as 'noo'ch winik' or 'the respected one' (Documented August 2008). The recognition of a man as 'the respected one' is more than just a name since it also place that individual at a higher social status. Other than the fact that such a person now must be given all due respect, this person may also be a powerful source of knowledge that can determine the success of a *kol* yield. Having such individuals as members of the work-day team also ensures that this young person will most likely get assistance in doing all the proper traditional procedures. Clearly, to have more 'Noo'ch Winik' members of the work-day teams will provide a vast knowledge base.

Additionally, having elders as members of the work-day team allow the young person to show generosity and compassion which can be regarded as a way for an individual to show *tzik*. In some cases, the young farmer will return his work-day commitment to an elder by providing an appropriate portion of his *milpa* yield as payment or physically demarcate a portion of the *kol* as well (Observation August 2008). This sort of payment seems to be preferred in a situation where the elder is aging and

may be incapable of making his own *kol*. The benefit of such an act for the young farmer ensures the commitment of that elder for his *kol* to do well. The young farmer can seek the help of the elder to perform the appropriate ceremony at the right time when there is a need for such services. In that process the young farmer learns those rituals as well and thus that knowledge is passed on.

The making of *kol* also represents the start of a life-long tradition for the Mopan young man. Here he will put into practice all the knowledge that is associated with *kol* and hone the necessary skills associated with that knowledge. In interviews with a younger farmer of Pueblo Viejo (Documented December 2010), in the instances where he reaches the limits of his knowledge regarding the husbandry of his *kol*, he can call upon the elder to advise him of the necessary actions, particularly in cases where wild animals are a problem.

The Mopan Maya are somewhat animistic and strongly believe in the supernatural spirits that are charged with protection of all things natural, including human life. Those spirits are honored in ceremonies, and are revered with great respect (Carter 1969; Danziger 1996; Gregory 1984). In Interviews (Field Notes, February 2009) the Mopan Maya of this study claim that these spirits must be appeased with the right rituals at the start of the creation of *kol*. Failure of any farmer to enact such rituals can provoke bad luck to befall the *kol*. Pests that destroy the crops are regarded as a manifestation of curses from the 'keepers' of the crops.

According to the *Alcalde* of Pueblo Viejo Village, during the 2005 corn harvest season in April that year there was plague of mice that attacked the corn. He claims that the mice were so many that using any poison was futile. In that case, an *ilmah* was

asked to perform a *Mayehac*. His recount of the event revealed that a few mice were caught alive and taken in the ceremony that lasted all night. Before sunrise the mice were taken to a nearby cave, where they were released alive. In his words, everyone was asked to stay away from the *kol* for three days. He claims that when the farmer returned to the *kol* all the mice were gone and the field was intact (Field Notes, February, 2009).

Such outbreak is an example of events that can only happen if the spirits that protect the forest were not honored. A young, inexperienced farmer may react by using poison or some method of aggressive control of the pests. However, it is believed that such acts only make the problem worse and may affect all the farmers within that area (Interview, February 2009). In such cases the knowledge of elders is often sought. There is a strong conviction that the spiritual protectors of the natural world must be appeased. Therefore, prayer and rituals are often invoked. An elder in Blue Creek claims that if a farmer did not perform a ceremony to appease the spirits at the proper moment, then he is obligated to seek the services of an *ilmah* to perform the ceremonies at a later point (Field Notes, March 2009). What this illustrates is that 'shared labor' involves the sharing of knowledge as well as the burden of challenges that come along with making *kol* which depends on the knowledge of elders.

Sharing and exchanges as cultural markers in *kol*

Kol is the basis of many material exchanges within the Mopan Maya community. As observed in Santa Cruz (Field Notes, May 2009), very important example of such exchange can be clearly seen in the 'Guarding of the Sun' ceremony. In this ceremony, the members of the community who will make *kol* will gather with their wives and families in a communal sacred place to worship the sun. In recent times, Christian

church buildings or ancient Maya temples are used alike as a common place for this ceremony. Although the church buildings are used, the Christian church leaders are often not involved, especially if they are foreigners to the culture.



Figure 4-2. Guarding of the Sun festival featuring the Deer Dance at Lubaantun Maya Site

The “Guarding of the Sun” ceremony takes three days. These days usually coincide with the three days before the first full moon in the month of February. The first two days are considered purifying days, with the last day being a celebration day. During the purifying days, the elders preside over the rituals. They will burn incense and chant ancient prayers to call upon the guardians of the natural world, and particularly Lord ‘Yum Kax’ or the Corn God. The prayers are recited in very low raspy tones, which many times sound like the wailing of pain. The words that are used in the prayers are kept secret by the elders. Those prayers will be bestowed upon deserving younger members of the community when the elders deem them to be ready. Each year one or a

few younger member of the community may be added to list of those who will perform the ceremony.

Before the sun sets on the second day of the purification days, every family will bring samples of crops and seeds or plants, and also live animals to the ceremony. These offerings are chosen as a representation of all forms of seeds and small livestock (mainly chicken and pigs) that will be used the creation of *kol*. The mood of the ceremony is often very somber and quiet for the first two days. These are regarded as sacred days and therefore an ambience of meditation and reflection is required. The musicians, including traditional marimba players and the players of locally made harps will play a specific piece of music that is only used during these days. Any form of celebration, such as drinking alcohol or excess eating or sleeping is prohibited. Men and women are prohibited from any sexual contact. The elders are often expected to hold all-night vigils, without any sleep for those two nights. All men are expected to hold vigil as well. Women with young children are allowed to rest along with their young children. By sunset on the second day all the offering are received and the vigil will continue until the morning of the third day. Very early in the morning of the third day all the live animals, mainly chicken and pigs are slaughtered and prepared to be cooked for the festival.

At day break on the third day, the local musicians will be summoned to prepare to play their instruments as the sunrise is awaited. In Pueblo Viejo, the traditional Deer Dance is prepared and performed which can continue up to seven days later. There may also be other kinds of traditional dance that are organized for performance on that day, depending on what is available in the specific community.

The final ritual of incense burning and prayer is performed just moments before the sun rises. The elders will ceremoniously walk outside and look towards the sunrise. These moments are kept as quiet as possible. As soon as the sun rises, the elders will start talking among themselves in a quiet tone, making predictions on the intensity of the dry season that will start soon. The predictions are mumbled among the elders and then passed on to the rest of the interested individuals. Although the younger farmers do not fully trust the predictions, they would not openly question them. This prediction is done so that the farmers may choose wisely on the location of their *kol*.

If the gift made by the community pleases the spirits, the sunrise will be bright red denoting that the dry season will be gentle and long with the rains arriving after the burning of the *kol* site. If the spirits are not pleased then the sunrise will be pale denoting a short and intense dry season. It is at this critical point that the farmers will decide what type of forest will be cleared for that year's *kol*. Young farmers and those who will attempt to make their own *kol* are appropriately advised on what would be the best location.

The third day of the ceremony becomes a celebration: music is played, and lots of alcoholic drink is provided to all the men. This is a time when new and exotic plants or livestock are exchanged among friends and relatives. In cases where the commodity is too precious to exchange, they may be sold for cash. All other crops and food items that were offered are prepared for the mid-day meal and all members of the community are welcomed to feast.

The men will use the rest of the time before the mid-day meal to engage in making arrangements for work-day exchanges. It is at time that an account of the previous

year's work-day exchanges is tallied to determine what is owed to each other. This can be a very delicate period of negotiations for the men and may sometimes end in disagreements. All the tallies of the work days are done from memory recollection. All men who are present presume that they have returned all work-days, but more often than not, it is revealed that some work-days were overlooked or are unaccounted for. Such discoveries become difficult, for it is considered inappropriate to challenge such claims.

After all the arrangements are made and the work-day exchanges have been agreed, everyone is left to celebrate. Some will get intoxicated from drinking the locally made alcoholic drink called *Ba'al che* or *Chi'cha*, a kind of beer made from corn. During the time of celebration, children interact more freely with the elders. In these exchanges many stories are recited for the entertainment and education of the children. A story can be prompted by the physical attribute of a plant or fruit that may be present. Within those stories valuable information is passed on. For example during a relaxed period of the ceremony I observed, a rooster walked in and made a sound that made all the hens and young chickens come running to him. At that point an Elder "Noo'ch Winik C'aanti" suddenly got animated, and said, "Did you see that? He is the man," referring to the rooster. He continued, "He is a true 'Kolil Winik' (*milpa* famer)." "Now I will tell you a story about this man", he said as he began his story about the rooster. The story "Rooster as Man" was shared by an elder in Santa Cruz village

A long time ago, with many red moons passed, when the earth was still new, a young man took a young wife. They loved each other at the beginning. The man, he made very big *kol*. The young wife made large 'waj' or tortillas. "Yum Kax" (Protector of the corn) blessed them with a gift of two chickens, a rooster and a hen. They were blessed that their chickens became abundant. The wife fed them well. But then the wife became

unhappy, and very mean and dictating. She scolded him with every little mistake. Then the peace in the house was gone. The man began to worry, and he would come home and sit by his door and gaze into empty space. The chicken and the two roosters watched, and know that the love in the family was gone. The roosters wished to tell him what to do. But how could they, they were not able to talk his language. Then one morning as the roosters awoken, 'Yum Kax' appeared to them and made a miracle, by giving them the ability to talk. The roosters waited anxiously, crowing more than usual, for their father (the man) to bring their corn. And so he did. As their father (the man) fed them, the roosters knew it was time to tell. "Tat, Tat (father, father)" said the roosters, 'we know our mother (the wife), does not love you anymore like before the first moon" The man was shocked and asked "who are you". "We are your children," said the roosters, 'you have been kind to make *kol* for our corn, we know the path you take every day is long and muddy, we know that your load of corn is heavy, and we love you our father, and we must help you correct the ways of our mother." The man was confused, but asked what he must do anyway. "Show her the way to your *kol*, let her sweat fall where your sweat have fallen and exchange with her your tumpline, remember old ways." "Let me show you" said the old rooster, and he made a low "toc, toc, toc" sound and all the hens and chicks came running and flying to him and lead them to off scratch for their own worms. "You see" said the rooster, crowing loudly, "there is beauty in the *kol*. And so did the man won the love of his wife again. And there was peace. The end. By Noo'ch Winik C'aanti (Documented February 11, 2008)

In this story *kol* is used as a metaphor to reinforce the Mopan Maya way of life. It instills within the young the understanding that everyone must have purpose and the making of *kol* is an important purpose, both individually and communally. It does not only provide the food that is eaten every day, but it also provides the calm inside each member of the household. This also speaks to the idea that a community becomes divided when a shared belief of *kol* as means of community survival ceases to exist.

Site Sections for the *Milpa*

Of all the farmers who attended the 'guarding of the sun' ceremony in Santa Cruz village 14 farmers claimed that soon after the celebrations are completed, each farmer will go into the forest for the purpose of selecting a *kol* site (Documented February, 2009) . Based on the predictions that have been garnered from the elders, the best

possible site is determined. During an interview a participant in this study claimed that elders who join the younger men to select a *kol* site will use various techniques in determining a suitable spot. He claims that elders will taste the soil to make sure that it is suitable for planting corn (Field Notes, February, 2009). This is especially important when the farmer is planning on clearing old growth forest. In one situation it was observed that this process was indeed lengthy and tedious. The soil sample is collected and examined by the elders. The elder during his examination will squeeze the soil in their hands to determine how well it may retain moisture. If the soil that is being squeezed extends from the hand, then it is determined that that soil would be adequate to withstand the dry season. That test simply indicates that the soil will have more *luc* or clay within, and thus have a better structure to retain moisture (Documented February, 2009).

Once a site is determined a 'marker' is made on that site. According to both the *Alcalde* from Santa Cruz and San Jose, this marker system is a very old traditional way of claiming farm lands. The Mopan Maya uses a communal land system of ownership (Barry and Vernon 1995; Gregory 1984; Wilk 1999). No one person has entire proprietorship of land. The marker, known as *Ja'tz'alal*, is the only way a farmer can show claims of ownership. The *Ja'tz'alal* is a pole that is fashioned with one side shaved flat, with the top of the pole split slightly and a green succulent plant, usually a *Haliconia sp* stuck inside the split end. This may be the most authoritative symbol that a Mopan Maya can use to claim ownership to an area of land. If a marker is placed then no one else can claim that particular site.

Generally, a path is cleared around the entire site that is marked. That determines that size of the *kol* that year. Clearing a path around the desired site also allows another farmer the opportunity to use any additional suitable area that may be available for claim. Another farmer can place his marker adjacent to a site that is already claimed. In instances where this is done within a primary forest setting, the markers generally mean that such a site is claimed for about five to seven years. The *Alcalde* from San Jose Villages, that *Ja'tzalal* cannot be placed there ever again, even by the owner of that *kol*. He explains that if the owner were to place a marker, it means that no one is welcomed on his *kol*, which is also a sign of aggression (Documented February, 2009).

Furthermore the *Ja'tzalal* can only be used as a marker in high forests or primary forest. Any use of this marker outside of such situation is regarded as offensive and can instill violent reactions. If a marker is placed in an occupied location, especially on site occupied by another community member, an aggressive confrontation will most likely occur. In such cases, the village appointed legal authority, in the person of the *Alcalde* is summoned to mediate the confrontation. Even after the matter is settled, the perpetrator who placed the *Ja'tzalal* has to publicly remove the marker in order to show goodwill and regain *tzik*.

The forest clearing

It was observed among the participants of Pueblote Viejo village, that the initial activities for the preparation of *kol* are very religious. On the first day of the forest clearing, a small ceremony is performed by the farmer or an elder at the site itself (Field Notes, February, 2009). A farmer further revealed that the purpose of the ceremony is to ask for permission to occupy that space and to ask forgiveness for the pain that will befall the living things in that area and to seek the blessing of the guardian spirits of *kol*.

The ceremony is to ensure safety and protection from all the bad things that can happen during this period. The farmers are aware that they are destroying the homes of many other life forms, therefore a part of the ceremony is dedicated to asking permission to clear forest and to beg for forgiveness for the pain that the making of *kol* will cause. A promise is made to the guardians of the forest that enough food will be planted in that *kol* so that the wild animals may feed as well. This promise is made as repayment for the harm caused to the natural world which may have caused hardship for the wildlife. If the ceremony is done right, and the guardians of the forest, as well as the guardians for the animals and plants are appeased then the clearing can begin. The cleared forest will be left to dry for several weeks before it is burned in late April. The planting will generally start after the first rain in the month of May.

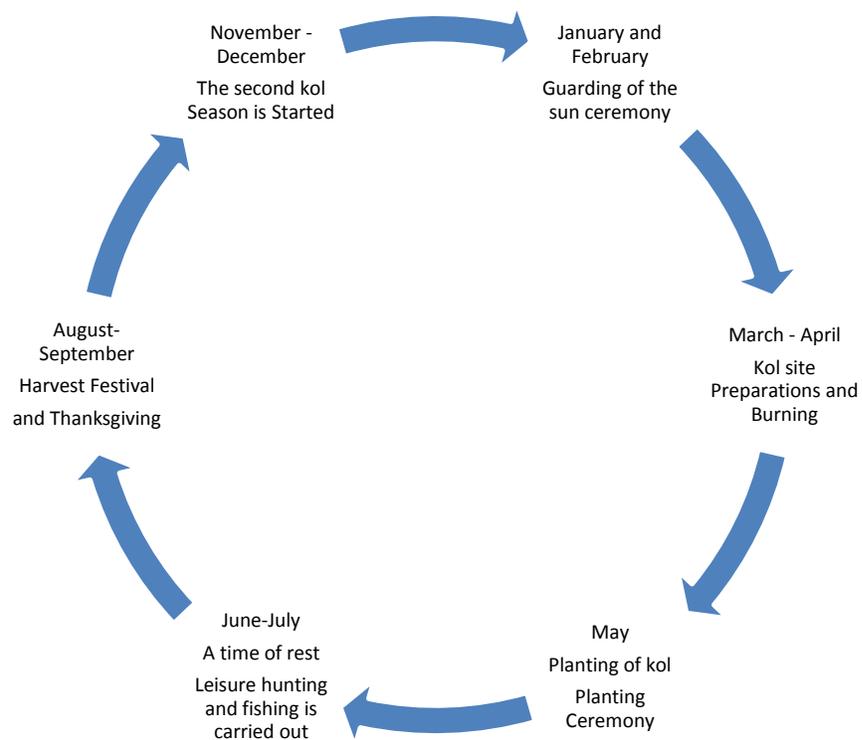


Figure 4-3 The Maya *milpa* year calendar

After the corn has been planted in the first phase of *kol*, farmers claim there is lots of time for relaxation. In Pueblo Viejo the men claim to take time out to engage in communal hunting or fishing (Field Notes, July 2009). Generally this time of year is considered the wettest period. There are inevitably many floods that will bring new fish life to the rivers that are harvested readily. Women are often engaged in making baskets or other crafts making as a past time. In some cases the young men or even the male heads of household may leave the community entirely for a couple of months in search of wage labor. However, shortly before the harvest time arrives they will return to their *kol* duties.

A Sense of time

The Mopan Maya of the 4 communities in this study seem to arrange the calendar as the time period may be relevant to the making of *kol*. According to the *Alcalde* from Pueblo Viejo the “Guarding of sun” ceremony typically held in the month of February of the calendar year, however, explained that it is not uncommon for it to happen as early as December and January of the calendar year (Interview, July 2009). The time for ceremony is set by the elders in the community in consultation with the village *Alcalde*. Although there is no scientific explanation thus far, one farmer in Pueblo Viejo claimed that the emergence of certain types of insects is used as a good indicator for the correct time to conduct this ceremony (Field Notes, July 2009). This suggests that the Mopan Maya *kol* tradition invokes the use of another method of keeping time, that of the natural life cycles of insect and other wildlife which are used as markers for the change of seasons and guide human activity within the community.

The burning of the fields must be done at the most appropriate time, under the right weather conditions. It was observed that the farmers generally never visit the *kol*

site after the forest is cleared until the day it will be burned (Field Notes, May 2009). However there is a consistent monitoring of subtle changes in the atmosphere, such as the increase in cloud cover, increase of fog in the morning or the occurrence of lightening that does not bring rain. Although none of the atmospheric changes are recorded, it was noted that such changes are openly discussed among the farmers. In an interview with a participant from Blue Creek, he claimed that the moon cycle is also closely followed (Field Notes, May 2009). Generally, the few days after the 'last quarter' of the moon are considered to be the best days to burn the fields. But a farmer may choose to burn his field earlier than normal.

The most obvious purpose of burning is to clear the *kol* site, but there are other considerations that are made. Burning the field earlier than normal is a decision driven by several factors. Some of these factors include longer-term planning and good sense of how intensive and/or how long the dry season may be. The decisions to burn are informed by the predictions of a long wet season that was made at the ceremony. A long wet season means that seasonal monsoon rains will start early, perhaps as soon as the middle of the month of May, but more typically in the middle of June and may last until September. There will sporadic short periods when the rains subside but not enough to dry any biomass material that may contain woody material. In cases where a short wet season is predicted, wood for construction and firewood can be collected from the standing forest and dried in a relatively short period of time.

Firewood is a major source of fuel for the Mopan Maya, see Table 4-7. Although many families have gas stoves, they are rarely used. If the field is burned earlier there will be a good abundance of firewood that can be collected for a long time. A young

farmer in Santa Cruz suggested that the smaller and softer wood that dries faster will be collected first while the larger and hardwoods will be left for much later collection for fuel (Documented, May 2009).

Table 4-12. Name of the Village * We need firewood for cooking Cross tabulation

		Neutral	Agree	Strongly Agree	
Name of the Village	Pueblo Viejo	0	12	21	33
	Santa Cruz	0	0	30	30
	Blue Creek	1	7	17	25
	San Jose	0	14	16	30
Total		1	33	84	118

The Mopan Maya live in traditionally built homes. All the material that is used to build home structures are collected from the nearby forests, but some wood is purposefully collected from *Kol* Sites. A participant in this study reported that a field may be burned earlier, so that the intensity of the heat is just adequate to cure the hardwoods which will be collected for building construction (Field Notes, May 2009). Extra care is taken in making decisions about when to burn if the farmer has intentions to collect building materials from his *kol*. If the burn is made too late then the fire will be too intense and the quality of the wood will no longer be suitable for construction. In that same instance, the smaller size wood that is suitable for firewood will all be lost. The knowledge of soil nutrients and soil structures is also very important. Soils that have less clay are considered newer soils and are generally burned later. It is typical for the farmers to also burn earlier when the soil is determined to be very rich in clay. The clay soil structure hardens with exposure to high levels of heat. If fields that are situated on clay soils are burned too late, and the soil have been exposed to high levels of heat intensity, then at planting the 'planting teams' will complain that the soil is too hard and

that this can prolong the number of days that is required to complete the task. Exposure to heat of high intensity will typically bake the soil, making it very dry and hard. In years when the prediction for the dry season is to be short, farmers tend to burn earlier, so that planting can be done before the rains start. If the soil has less clay then the farmer can wait longer, to ensure a good burn. The replenishment of the soil moisture will most likely occur at the first rain.



Figure 4-4. A burn that produced the desired quality of ash

The Mopan Maya farmers appear to be aware that the nutrients from the ash are also very important to make the corn field grow healthy. During interviews in Santa Cruz, farmers remarked that the ‘ash helps the corn grow’ (Field Notes, May 2009). In addition other farmers also commented that ash as gift from the guardians of the *kol*. Therefore, each burn is done with the hope that the field will get the optimal amount of ash. Not all ash is considered good. The farmers are often careful to burn at a point when the cleared material is not excessively dry, so that ‘grey’ ash will be produced. In

instances where the fire from the burn is too intense, only white ash will be produced and the farmer gets concerned as he knows that the soil will be deprived of essential nutrients. The farmer is also conscious of the fact that portions of the ash will be lost to surface runoff during the rains. Having only 'white ash' after a burn will mean that more, if not all, of the ash will be lost. In some cases, when the corn crops are affected, farmers may transport ash to their *milpas*.

It was observed that the preparation for field burning is also planned very carefully, so as to prevent wild fires. No field burning is carried out without taking the necessary precautions. Special consideration is made so that the fire does not burn the standing forests (Field Notes, May 2009). More importantly, wide fire paths are made around the cleared site to prevent the fire from spreading into the neighboring cleared forests that are waiting to be burned as well. A participant from Blue Creek village stated that while it may seem like a kind gesture to burn another farmer's field without their knowledge, but in most cases this is considered disrespectful (Field Notes, May 2009). To prevent such unwanted events, a large 'burn-party' is gathered to help control the fire.

Kol and community ties

'*Kol* or *milpa* farming is clearly very important for the Mopan Maya, beyond just the mode of food production. As it is clearly stated previously, the *kol* or *milpa* agriculture serves as the catalyst which binds the community members its entire social structure. The Mopan Maya communities that were studied are very remote, and are dependent on the basic economic system that is associated with *kol*. A participant, who works part-time as tour guide, stated that monetary exchanges for access to commodities, especially for those produced in the community, are not common (Documented August 2009). It is more likely that some items will be bartered for other

items of like value, but the offer of work-day exchanges is regarded as a significant compensation. Most, if not all, the daily needs that sustain the livelihood of the Mopan Maya are garnered locally. A few essential items that are impossible to produce locally are purchased. It is therefore significantly important for every community member to engage in the system of *kol* at some level with other members of the community. In this way, the *kol* making effort is shared and the community support and participation is harnessed. Although hiring labor to make *kol* is done, it is not regarded as the “proper” way to make *kol*. Even though *kol* is not profitable and most of the produce is for the subsistence of the Mopan Maya, there is still a strong desire to continue to make *milpa*.

In an interview with an elder in San Jose village revealed a growing concern that there are fewer young men who are willing to make *kol* and by extension unwilling to start their families (Field Notes, June 2009). Demographically, most of the young people who do not engage in *milpa* generally leave the village. Participants of this study in all 4 communities disagreed, when asked if they think that young people who had *milpa* will leave the villages as shown in Table 4-9. In other words, *milpa* also show a strong community tie to the villages.

Table 4-13. Name of the Village * Young people who make *milpa* leave the village Cross tabulation

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Name of the Village	Pueblo Viejo	8	20	5	0	0	33
	Santa Cruz	1	14	10	5	0	30
	Blue Creek	7	16	2	0	0	25
	San Jose	2	14	10	3	1	30
Total		18	64	27	8	1	118

In additional interviews with 5 young farmers, they agreed that although the way of *milpa* is difficult and labor intensive, it is the only way that they know of to be respected within their communities (Documented June 2009). Have such respect with the community they claim that they can seek marriage arrangement from within the village or nearby villages. Therefore it is essential to partake in the social arrangements of *milpa*. In the context of traditional ecological knowledge transmission, the making of *milpa* is still an acceptable mechanism for the young people to engage the elder population for the benefit of their knowledge systems. This importance that is placed on the making of *milpa* is linked to many other activities that a young person will be allowed to engage in, or will be prohibited from engaging in within the community activities.

Mode of Knowledge Transmission

Although the Mopan Maya household is basically a nuclear family, it was observed that the primary household is commonly populated with extended family members. Elder members of the family often live with the older child and their families. In these cases indigenous communities tend to create favorable environments for the 'vertical' transmission of traditional ecological knowledge. Most likely the natural engagements within the household will be culturally directed along the established path of authority by age. It must be noted that such vertical transmission of traditional knowledge may be true for exchanges within the household, but that mode of knowledge transmission will be changed dramatically and become multi-directional whenever there are interactions that occur with other members of the community outside of the household. There are many exchanges that occur between farmers who are engaged in *kol* that also lends itself to the transmission of traditional ecological knowledge. In Table 4-10, shows

farmers agreeing to share new plants as gifts, which is a good example of how knowledge may be transmitted multi-directionally.

Table 4-14. Name of the Village * I share new plants for *milpa* as gifts Cross tabulation

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Name of the Village	Pueblo Viejo	0	2	0	5	26	33
	Santa Cruz	0	0	0	4	26	30
	Blue Creek	3	5	6	5	6	25
	San Jose	0	0	1	16	13	30
Total		3	7	7	30	71	118

Within this established multi-directional mode of knowledge transmission, it is difficult to understand why traditional ecological knowledge cannot be transmitted in a compartmentalized or sterilized environment, outside of the context of the *milpa* itself. They must be actively learned in-situ as the information becomes relevant and important at the time.



Figure 4-5. Three-generation of *Milpa* farmer

For example the transmission of traditional ecological knowledge related to plants and plant use among the Mopan Maya is important. Plants that are used as spices for special or seasonal occasions are often diligently protected by specific families. These plants are non-cultivated plants and do not belong to anyone, however as soon as those plants become productive they are claimed and cared for. These plants are discovered during the acts of making *kol*, and are often marked for later use. When a younger person is present, the occasion is used to share information about that plant. A specific example of a highly protected plant is the *Caludovica palmate*. Parts of this plant are eaten and the leaves used to make baskets. This plant also attracts birds and small mammals that can be harvested. In an interview with a farmer, he also revealed that birds and mammals eat different parts of the plant at different times of the plants life cycle (Field Notes, August 2009). Additionally, spices and edible plants are collected by community member of various ages, but younger adults or children are often the dedicated collectors, so they must be informed at a much younger age.

Horizontal Transmission of knowledge

During interviews farmers, claim acquiring a new plant is desirable for most them. However, one farmer pointed out that before a new plant is persistently cultivated, he farmer will try to seek all available to regarding that plant from other farmers (Field Notes, July 2009). This type of information exchange can take various forms. In some cases if another farmer is already growing the plant in question, then a formal visit may be arranged. Such purpose of such a visit can be declared during arrangement of the visit. However it is not uncommon for the purpose of the visit to be disguised with other important matters. Farmers who are aware that someone else may interested in that

plant will offer a sample. They will also be obligated to provide the necessary information regarding that plant.

During field visit in October 2009, a new variety of banana (*Musa sp*) was introduced in Pueblo Viejo village by a friend of the village. The seedling was presented along with a few already ripe bananas. The recipient of this gift was very grateful for the present, but was clearly cautious. The bananas were very short, about 3-4 inches long, and had a diameter of about 2 inches. The bananas were light yellow in color when they were green, and turned into a dark red color when they ripened as shown in Figure 4-5.



Figure 4-6. New variety of *Musa sp* introduced in Pueblo Viejo

From the reaction of the recipient, it was clear that this was a new plant. The person making the gift suggested that his friend tasted the ripe banana. The recipient hesitantly accepted the gift with a lackluster commitment to plant it. Just about then, a child came over, and the recipient offered a banana to the child. The child ate the ripened banana and ran off happily. At that point the recipient started to inquire about the banana, asking questions about the habits of the plant. He was most interested the husbandry of the plant, so he asked where it was most likely to do well when it was planted. He asked “Should it be in a shady area? Does it require shade? Do wild animals eat this banana where it came from? Does it have a strong smell?”

All these questions were asked because the recipient was trying to understand the plant, so he could introduce it to his field. When he was later interviewed and asked why he was asking so many questions, his response was simply “I have to protect my *milpa*.” That response suggests that great care that is taken in protecting the existing *milpa*, not only from pests or diseases that are attracted by existing crops, but those that can be attracted by new crops as well. The *kol* is basically done with very little or no use of synthetic pesticides, therefore a good knowledge of the plants and the animals and insects that may feed on them is very important. Any introduction of a new plant into the already carefully placed collection of plants may upset the ‘spiritual guardian’ of the *milpa*. While such a claim sounds simplistic, one must appreciate that the Mopan Maya exists daily with the knowledge and awareness that the spirits are forever present. The farmers are always wary of accepting new plants. It was observed in Santa Cruz, that new plants seem to always be grown next to the home to start which allows thorough assessment of its behavior while growing (Noted, July 2009).

Threats to traditional ecological knowledge

All four communities that were studied have very small populations. Pueblo Viejo has about 150 households in total. There may be a slight increase in that number during the periods of making of the *kol*. The same is true for Blue Creek Village with about 80 household and Santa Cruz with about 100 household. The one community that has seen tremendous expansion is San Jose, with approximately two hundred households.

As much as the Mopan Maya try to maintain their traditional practices, the forces of western culture are still very tantalizing. In personal interviews in Pueblo Viejo, young men stated that they feel they need to abandon the making of *kol* and seek opportunities outside of their communities. A participant from the same village who has joined the military, and his wife is a school teacher, said that he may have to give up *kol* making and leave the village entirely (Interview, July, 2009). Indeed there is not much more to do in order to forage a living with these communities other than to make *kol*. That process requires hard labor as well as it requires a lot of commitment to the *kol* itself, and the entire society which is dependent of the yields for any given year. There is not much that can be sold for cash, but the communal reward, that is not measurable in cash, is far more important for anyone living in the community. Additionally the young farmer stated that it is preferable to find labor that will have immediate cash returns (Field Notes, July 2009). Although that family may be better secured financially, the negative effect is that the gap between the elders and the next generation widens and by extension threatens the transmission of traditional ecological knowledge.

Pueblo Viejo village is the oldest Mopan Maya community in the Toledo District that was established in 1840. It remained a secluded community until the late 1900's. Until then, there was a very small school and one Roman Catholic Church as the only

icons of western culture. At present, it is visible that families are insisting on sending their children to get higher levels of education. According to the *Alcalde* in a personal interview, 'when the young people finish their school they find jobs outside of the village that is not related to *kol* making' (Field Notes, August 2009). This is reflected in Table 4-9 where the members of this community agree that they are losing more of its population compared to the other communities.

Table 4-15. Name of the Village * Mopan Mayas are leaving this community Cross tabulation

		Strongly Disagree		Neutral	Strongly Agree		
		Disagree	Disagree	Neutral	Agree	Agree	
Name of the Village	Pueblo Viejo	3	11	2	15	2	33
	Santa Cruz	1	12	6	11	0	30
	Blue Creek	15	5	3	2	0	25
	San Jose	9	10	5	6	0	30
Total		28	38	16	34	2	118

The educational trend within Pueblo Viejo follows the national standards where a child at the age of 4 or 5 is typically placed into the local formal education system (Crooks 1997). That child will spend a large portion of the day at school for the next eight years. During that time the child is forced to learn to speak English and is constantly being reminded that it is important to learn that language. Immediately after elementary school the child will spend the next four years at the high school level in the nearby town or community away from their own. During that time there will be very limited contact between those children and the elders or their parents who are actively involved in *kol* making.

An interesting point of observation is that only those children who do not qualify into the next level of schooling return home to engage the way of *kol* making. The

negative aspect of that situation is that those children who return home to engage in *kol* making will have limited knowledge of *kol* making. This compounds the already negative attitudes and further encourages them to abandon the *kol* way. All the other Mopan communities are at risk of this loss of childhood integration into *kol* making as they face the dilemma of education.

Conclusion

The traditional ecological knowledge of the Mopan Maya is embedded in all aspects of their life. Their diet and daily existence is evidence of that. However, what is also clear is that the Mopan Maya nurtures a philosophy that their life is entirely connected to the natural world physically and spiritually. This philosophy encourages the Mopan Maya to fully understand the value and respect for each member of the society. *Tzik* is the concept that ensures such a philosophy of existence is maintained within the community. In order for that philosophy to continue, it must be passed to the younger generation of Mopan Maya.

There is a clear understanding among the Maya that they are fully connected to their natural environment. Each farmer makes *kol* with the knowledge that he will disturb the natural environment. Therefore ceremonies are conducted to remind him that he is only 'one leaf on the tree of life'. These ceremonies also encourage a vast understanding of the ecological interactions among the diversity element of nature. The farmer is not distant from that particular web of life and will often go into the natural world fully aware of its complexity.

Aesthetically, the Mopan are happier if they have a *kol*. Many times the Mopan will remember the family life story by describing how beautiful the location of his *kol* was during different times. The Mopan Maya often conduct ceremonies that are intended to

heal the spirit of the body outside in the environment, and very often at the location of the *kol*.

This brings a sad thought to the forefront of all this study. It reminds me of a lesson from Nooch Winik Ack from Blue Creek Village, who parallels the migration of young Mayan away from the community with that of a jaguar cub that is taken away from the forest. “That jaguar is already dead” (Nooch Winik Ack, 2009), as he goes on to explain that such an animal will not be able to reproduce, will not know how to work (hunt) and will not ever be able to earn the *Tzik* of the wild Jaguars, even its own biological mother. Similarly the Mopan who leave the community are at greater risk of losing their place within the culture and may lose their traditional ecological knowledge all together.

CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

Facing change

The Mopan Maya have actively resisted changes brought on by the exogenous forces of colonialism in the past and modernization at present. As a nation, the government of Belize is consistently adopting development strategies that would homogenize the populations of Belize. However the traditional ecological knowledge of the Mopan Maya is persistent as they negotiate powerful social changes. It is still impressive to be able to visit a Mopan Maya community in Belize and witness their actions as they carry on with their daily lives. The celebration of ceremonies as part of the making of *kol* is testament to the *resilience* of their culture. The notions of *kol* and '*tzik*' are placed at the core of their cultural existence. *Tzik* is vigorously alive as it is juxtaposed with the making of *kol*. The creation and restoration of *tzik* is constant in all forms of societal engagement.

There are challenges that will continue to threaten the cultural ways of the Mopan Maya. The exogenous forces of media and the promise of better economic standards are attractive to the Mopan Maya as well. In some cases it is easily argued that the Mopan Maya can benefit with better economic gains. Young men and women who are willing to forego the traditional practices refuse to participate in traditional practices. In some case those young people ridicule the traditional processes by creating mischief at the festivals. As their culture struggles with these continuing changes, they too, as a people will have to find their place within the formal institutions of education, the ensuing machinery of capitalistic economy and more importantly the menacing threat of

institutional objectives that are enacted to invalidate the traditional ecological knowledge system.

The loss of the traditional ecological knowledge of the Mopan Maya would ensure the total loss of *kol* and *tzik*. With these two concepts gone, the people will fail to recognize their place within greater Belizean society and perhaps the world. So much of the language and the concepts of time are structured upon these two concepts within the society.

The Mopan Maya elders in all four communities and the families that are living within urban setting of Belmopan City and Punta Gorda Town strongly recognize that the way of the Mopan Maya can disappear with the next generation if the value of their traditional ecological knowledge systems is ignored. The Mopan Maya language is also threatened as these paradigmatic shifts occur among the young people. The willingness to speak the Mopan Maya language is reducing drastically within all Mopan Maya communities, especially among the young Maya. In some cases Mopan Maya parents are purposefully encouraging their children to speak English or any other language other than the Mopan Maya.

The ability to speak the Mopan Maya language is the only effective medium by which Mopan and especially the elders can transmit their traditional ecological knowledge to the young. Some elders refuse to speak any other language but the Mopan Maya as a way to force the younger generation to speak their native language. The adaptation and use of other languages as the primary mode of communication among the young Maya totally severs the ability of the elder to share their knowledge.

Young Mayans, especially those that have recently returned to the community find it difficult to engage in the traditional ways using their newly acquired language.

In cases where the newly educated young Maya return to the community, they seem to create a new culture of their own that does not include the traditional ways and is very often promiscuous and considered undesirable by the larger community. In severe cases, young people purposefully harass the elders so that the elders feel that their knowledge is outdated and no longer useful to them. The ability to speak another language misplaces the context in which traditional ecological knowledge is useful. In other words, the teaching of traditional ecological knowledge becomes irrelevant unless they are taught in-situ and the appropriate language is used.

There are several notable efforts that are being made by the Mopan Maya to keep some their traditional ecological knowledge vibrant. Some Mopan that are living in the urban areas have diligently transported plant varieties to their tiny 'doorway' gardens in an almost futile effort to pass on their knowledge. In many cases, the elder men are the only ones who have knowledge of the plants and their uses. They too are the only ones knowledgeable of the care that is required to grow of these plants.



Figure 5-1 A home garden with traditionally used spices

There is no doubt that education is good. However, to quote an elder from San Jose, he says “the wild animal already has all the education to live; it is when that animal seeks to know more than life itself that he feels limited and bitter” (Santiago Ash, 2009). This statement is a poignant reminder of the changes that the young Mopan Maya are facing. The education system in Belize has been dominated by Christianity and a western education system that does not always embrace the traditional ways of the Mopan Maya. These societal changes force the Mopan Maya to engage an unfamiliar economy that is far less forgiving than their own traditional economies. The formal western education system is compartmentalized and it is best employed in a sterile environment. That structure of this education methodology deprives the teachers and students of any chance of engaging traditional ecological knowledge. On the contrary, the traditional ecological knowledge is delivered in a more familiar environment. The diversity and rich natural environment of the Maya world is entirely

ignored by formal education system, a notion that collides head-on with the preservation of the traditional ecological knowledge.

We now know that *kol* is a powerful concept that harnesses all forms of significantly important cultural values. Coupled with that finding we know that *kol* ensures that 'Tzik' is always honored among community members and towards the natural environments and its various parts both biological and supernatural. With that reality the need for the members of the Mopan community to know and respect all parts of their natural environment becomes essential. This is a living practice that is carried out in the daily engagements of the Mopan Maya. A person who will make *kol* must to earn the right to do so by participating in all the aspects that are associated with that activity. He or she must demonstrate a strong command of the traditional ecological knowledge. That knowledge must be holistic and takes into consideration the dynamic changes that are happening within the interactions of community individuals at that time. All degrees of 'tzik' must be honored and each participant that will engage in the process of making *kol* must be given the right level of respect. Therefore I conclude that the Mopan Maya need the *milpa* farming system and the associated natural ecology in order for them to be able to replicate and continue to produce their traditional ecological knowledge.

Study Conclusions

In Chapter one the understanding of the role of *milpa* farming among the strategies utilized by the Mopan Maya to ensure the transmission and persistence of their traditional ecological knowledge was raised as the overarching question for this study. This question was then further separated into five guiding questions as follows:

Table 5-1. Research guiding questions

Number	Research guiding questions
Question 1:	Can the understanding of the traditional practice associated with <i>milpa</i> farming provide insight to the transmission of traditional ecological knowledge of the Mopan Maya people between generations?
Question 2:	Can exploring <i>milpa</i> crop diversity demonstrate understanding of the local ecology and the community's cultural sustainability?
Question 3:	Does the shift from <i>milpa</i> agricultural to intensive agriculture strategies reduce the number of <i>milpa</i> crops varieties that can lead to the loss of traditional ecological knowledge?
Question 4:	Does the Mopan Maya engage in cultural activities to maintain their culture and ways to transmit traditional ecological knowledge?

Question 1:

The understanding of the traditional practice that is associated with *milpa* farming among the Mopan Maya provides valuable observations about the strategies used in the transmission of cultural knowledge and competence of the Mopan Maya people between generations. This study concludes that the Mopan Maya are dependent on the *kol* system of agriculture. As it was described in the Chapter 4, *Kol* goes beyond agricultural methods to functions as a sociopolitical organizing concept with the Mopan Maya communities. In that sense *kol* is essential as an avenue for the transmission of traditional ecological knowledge within and between generations. *Kol* is not just the act

making of a garden plot or farm but rather it is an important element of the corpus of knowledge that weaves the Mopan Maya culture together socially. This study clearly illustrates that within the *kol* the male individuals of the Mopan Maya communities must conform to this system in order to gain validation as members of the community.

The practical component of *kol* is no less important; as that is require for the understanding the physical engagement of Mopan Maya individuals with the natural environment. That engagement requires detailed ecological and spiritual knowledge of that specific environment that harnesses all the natural resources provided within. Although the Mopan Maya may readily have access to all these natural resources in those ecosystems; they are bonded by cultural belief and cultural value to be prudent in their degree of use of those resources. In that light the Mopan Maya are committed to re-enacting the ceremonial elements of *kol* that validates their meaning of existence.

The notion of *kol* is the holistic replication of the cultural schema of the Mopan Maya. As this study has shown, not every person who is born into the Maya society will make *kol*. However if the individual wants to be validated culturally within the Mopan Maya community, that person must honor the system of *kol* and engage the concept of *tzik*. In reality, *tziki* is a precursor for daily individual interaction, and as well as the cultural conduit that facilitates the cultural exchange that is need for *kol*. Together the two concepts *kol* and *tzik* forms two pillars in the community cultural values. When these two concepts are fully understood, the principles of the entire complex of traditional ecological knowledge become more apparent. Similarly, that understanding can provide an opportunity to understand mechanisms within the Mopan Maya culture that will ensure traditional ecological transmission.

The concept of *tzik* is a fundamental part of the traditional ecological knowledge that provides a concrete cultural framework for social interaction that fosters information exchange between generations. This study has shown that the key to unlocking the elders' reservoir of traditional ecological knowledge is the activation of *tzik*, by all members of the community. Although a person can potentially enter the Mopan Maya culture by demonstrating an understanding of all the parts of *tziki* and the systems that are associated with *kol* making; that person must also be willing to learn the strong connection of these two concepts as it relates to the natural world and spiritual world.

There is a high cultural value that is attributed to *kol* making, by way of *tzik*. Every young person at some point or another during their lifetime will have to pay the right tribute of *tzik* to their elders. Beyond its relevance to the *kol*, *tzik* is also expected in all forms of daily interactions. This includes family engagement and those engagements external to the family. Not engaging in *tzik* would signify that such a person no longer wishes to be regarded as Mopan Maya. The essential aspect of the Mopan Maya culture that truly reveals 'Mayanness' is the demonstration of competence in *tzik* coupled with a strong command of the knowledge that is associated with *kol* making.

Kol and *tzik* function as a systematic way to organize traditional ecological knowledge of the Mopan Maya. As stated above, these two concepts function in tandem, but they also do have very specific kinds of knowledge that are corollary to their use. Each segment of that knowledge is rarely activated in isolation of the other. This emphasizes the need for young people within Mopan Maya culture to learn that systematic arrangement within the culture.

Question 2:

The exploration of the crop diversity showed that the careful integration of valuable plants into the *milpa* system honors the strong commitment of the Mopan Maya to ensure food security. The Mopan Maya, carefully protect uncultivated trees and plants species during forest clearing and protect emergent plants during the entire cycle of *kol*. Those trees and plants are used for many different kinds of uses, but it is normal for them to be evaluated for food resources first. Mopan Maya men showed that they understood the connection of the plant food sources with wild animal species. Those plants species are protected, precisely so that the Mopan Maya can hunt the animals for meat. This kind of traditional ecological knowledge provides further guarantee of a secure food source for the Mopan Maya.

The Mopan Maya demonstrate understanding of the local ecology by the timing of when food crops are planted, including those plants that are considered as secondary to the *milpa* system. Additionally they are aware of the climatic changes that can occur during each year and how those abrupt changes will affect such ecologies. Having a large diversity of crops in the *milpa* provides added *resilience* for the food source. The ceremony “Guarding of the Sun” is only one clear demonstration that there is continuous observation of how the forces of nature will affect the local ecology. The enactment of such ceremonies and the exchange of crop seeds is a testament to the versatility of traditional ecological knowledge. The traditional ecological knowledge that is invoked and shared during such a ceremony ensures the health of the local ecology and the community’s cultural sustainability.

During the ‘Guarding of the Sun’ ceremony, many crop seeds and livestock are shared between farmers. This is an effective way for the farmers to share knowledge

and learn about plants that can be used in the *milpa* system. This is the point where young people through involuntary observations are expected to learn from the elders. When *tzik* and *kol* are combine, the opportunity for traditional ecological knowledge creativity is allowed. Such opportunities lead to continual applied experimentation by the farmers of new plants in various environments. That experimentation caters for the continual changes as they arise, while the Mopan Maya seeks ways to adopt accordingly.

The discussions held among the farmers plants that are especially unique and new, are precursors to information exchange of more common crop plants. Not every plant will be used as a permanent addition to the already established *kol* plant diversity, but it will be a chance for the Mopan Maya to test their knowledge. Additionally this allows them to show kindness and friendship as they share the knowledge of their plants, further validating *tzik*. Farmers are expected to have many plant varieties within their *kol* plots. A *kol* that only has one crop planted or a few species of plants typically indicates that such a farmer will not stay within the community. Such a farmer will not care to establish or strengthen any *tzik* network. Given those factors, it can be considered that that *kol* is temporary and will soon disappear, which breaks many valuable cultural practices.

Any member of the society who refuses to engage the concept of *kol* and *tzik* and other associated cultural practices will always be challenged and socially limited within the community. Those farmers who do not follow the traditional way of making *milpa* will be limited in their knowledge for the proper care. It is likely that they will not give any consideration for the wildlife that will share their space. Those farmers are also

considered to be more likely not to protect nearby standing forest and limiting food sources for wildlife. Wild animals are opportunistic feeders, which makes the *kol* more vulnerable to their destruction if their natural food source is destroyed. The process of appeasing the guardian spirits is a reminder of the ecological functions that exists in the area and validates the commitment of the human to the supernatural beings that will ensure the balance of their existence. Such process also emphasizes that all individuals are recreated in circle of *Tzik* as legitimate members of the community and even equal to the plants and animals.

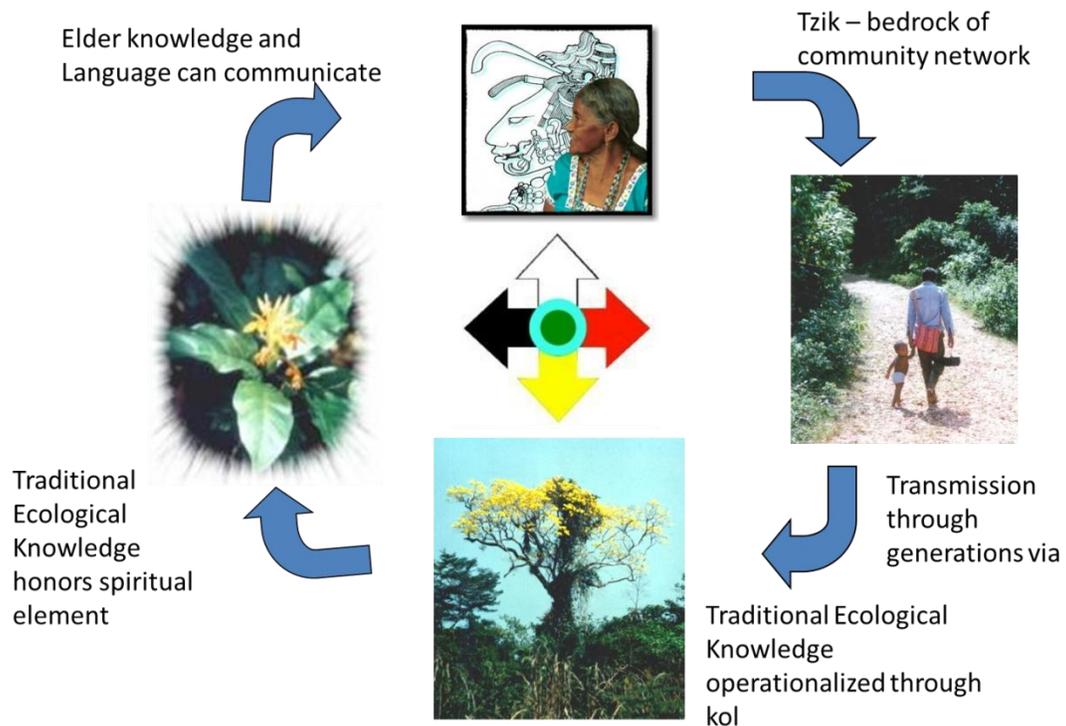


Figure 5-2 Essential complex of traditional ecological knowledge

In essence Figure 5-2 displays the complex that makes up the traditional ecological knowledge of the Mopan Maya. *Tzik* is the bedrock of all community networks, that extends from the formulation of share labor associated with *kol* to the enactment of ceremonial practices within Mopan Maya culture. The traditional

ecological corpus is transmitted by the creation and maintenance of *kol*. None of these activities can be carried out without the proper engagement of the spiritual world. The Mopan Maya are fully aware that there are things within their environment that are beyond their control and must be revered as such. The most important link to the traditional ecological knowledge of the Mopan Maya is held by the elders of each community. The elders must be valued as active members of the society, who will act as the cultural guides. Finally the knowledge of the elders are willing to share their knowledge, which can only be delivered in the Mopan Maya language by them, in the relevant learning instances.

Question 3:

This study did not analyze the crop varieties within *milpa* plots within the Mopan Maya communities. However this is a very important question for future study. With the basic exploration of crop varieties that was conducted within a few *Milpa* plots, it appears that the increase varieties of crops, placed within the *milpa* can result in an increase of traditional ecological knowledge. As described in chapter 4, each plant carries a corpus of knowledge that is particularly relevant to those particular plants that is used in the horticulture methods. However as the *milpa* system continues to interact with the market economy, the logical process seems to lead to a notable decrease in crop varieties. Farmers will need to engage in intensive mono-cropping strategies of agriculture if they want to take advantage of the market economy. Although this may be favorable to gain cash, such changes may threaten the food security of the Mopan Maya.

In all four communities, each farmer claimed that in the past they have more than five varieties of corn crops. There are 3 varieties of the 'yellow' corn alone. Currently,

the Mopan Maya have been increasing the use of hybrid varieties of corn. What is more alarming is that these corn varieties are normally planted in close proximity to more indigenous varieties. As a result the indigenous varieties are being lost through cross-hybridizations.

Farmers in these communities share many concerns about pests that are prevalent on hybridized corn which are harder to control in all stages of the corn life cycle. Pests are hard to control during the growth stages, but it is worst when the corn is producing grains. The husk on the corn ears is not thick enough, which exposes it to biting insects and birds.

As it is traditionally done farmers collect their seeds from the seasonal corn crops. A few farmers complained that the seeds they collected from hybrid corn varieties were cursed, because the corn grew but only produced small corn ears on a few plants. In one situation a farmer claimed that he had to depend heavily on the other crops that were planted within his *kol* to avoid starvation. This is result of not producing corn that one year because he collected his corn seed from a hybridized crop. Hybridized corn is designed to be planted for one generation only and do not replant well.

Question 4:

The members of the Mopan Maya community do engage in cultural activities. The cultural engagements do serve a strong purpose in transmitting traditional ecological knowledge. Beyond the practical purpose of encouraging food production using the *milpa* system the associated activities helps to maintain the Mopan Maya culture. Cultural engagements require the use of *tzik* and in so doing maintain the involvement in traditional practices as a way to transmit traditional ecological knowledge. In particular, the traditional ecological knowledge of elders is more easily accessed during

these ceremonies. Elder seems to find it easier to require those young people who are willing to commit to *tzik* by encouraging them to create their own network and participating in specific cultural activities. In all four communities, the use of the Mopan Maya language is persistent and by extension, that opens the access to traditional ecological knowledge with the whole society. During the study all the participants spoke Mopan Maya without hesitation. However, when the study was taken to the urban areas, more participants were reluctant to speak Mopan Maya language. This is a critical component of transmitting traditional ecological knowledge. As it stands currently, all the elders in the study communities preferred to speak only the Mopan Maya language.

Kol is a powerful notion that harnesses the socio-political structure of the Mopan Maya and is held in high esteem as a cultural value. Again this brings to mind the lecture of Nooch Winik Ack, from Santa Cruz village, that was presented in Chapter 4, who concludes that a Mopan Maya who leaves his village is no different than a wild animal that is taken away from the forest. As he pointed out, such an animal is dead at many levels, since it will not be able to reproduce nor find his place within the structure of his community even if it returned to the forest. This is a truth that parallels the reality of the Mopan Maya as they engage the mainstream culture of modernization. The Mopan Maya are thirsty for strategies that they can use to keep transmitting their knowledge to the next generation.

Recommendations

This study shows that traditional ecological knowledge is retained and transmitted through the biological and cultural practices of *milpa* farming. It can have significant contributions if it is amalgamated with the formal education system of Belize, especially

the curriculum that is directed at the Mopan Maya children. This step is especially important for those communities that are almost entirely Mopan Maya in ethnicity. The pedagogical strategies of traditional ecological knowledge transmission through the making of *milpa* will allow for the local education system to integrate the natural environment as a major component. For the purposes of traditional ecological persistence, using the natural environment as the platform of learning that is relevant to the Mopan is fundamental. With the traditional ecological system of Mopan Maya, there are valuable lessons that can be transmitted beyond the Mopan Maya communities. *Kol* is not just a farming practice, but if the whole complex of the knowledge is considered it teaches the world one more way of living a good and productive life. With the attitude and discipline that is required in the making of *kol* it is possible for such a lifestyle to young people whether they stay in the communities or not. The *elder's knowledge* along with *Tzik* and *kol* serve as the value pillars of the learning system for the Mopan Maya for the proper transmission of traditional ecological knowledge as illustrated in Figure 5-1.

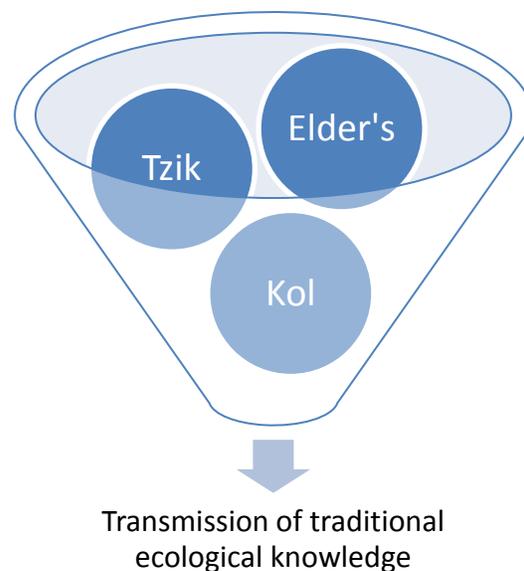


Figure 5-3. The Mopan Maya model of traditional ecological knowledge transmission

Recommendation 1

The study of traditional ecological knowledge is very complex. There is far more human behavior involved in understanding the foundations of traditional ecological knowledge. This study only addressed two concepts within the scope of the Mopan Maya knowledge system. There are several other questions that need to be answered, several pertaining to language and its use in the expression of traditional ecological knowledge. This research was challenged by the length of time that was spent for fieldwork. For any scientist to obtain the complete panorama of the *milpa*, it would be beneficial to do a longitudinal study to fully document the various stages of traditional ecological knowledge that are utilized.

Additionally it is very important to have the cooperation of the Mopan Maya themselves as a people to be fully able to capture those elements that are essential. It is essential that the community themselves get involved in documenting all other aspects of their knowledge, including the categories of names assigned to the various aspects of the natural environment.

Recommendation 2

The community themselves must insist on having their young members participate in the traditional processes that are associated with *kol*. *Kol* and *tzik* do hold important social value that can motivate the young Mayans wherever they may choose to live. There are specific powerful social values that are in the daily political engagement of the Mopan Maya that can inform other societies of new mechanisms of collaboration. Cooperation takes a whole new meaning when it is bolstered by the combined effect of *kol* with *tzik* that must be fully studied and cannot be ignored. It is common with the present day rural communities in Belize that the younger generation are determined to

deviate from the traditional practices of their cultures. However if the inherent value embedded in the Mopan Maya traditional ecological knowledge is kept alive the children will like be better served as members of the society. These values must be highlighted as the children are encouraged to engage in *kol* making. The society may need to change the intensity of their agriculture, as they face less access to arable land, but the cultural aspects of their ways of agriculture do not need to be abandoned.

Recommendation 3

The governmental agricultural agency of Belize must honor the vast knowledge that is employed the *kol* system. The farming system of the Mopan Maya can inform the agriculture strategy of Belize. Most of the Belizean settlements including the capital city of Belmopan is situated on good agricultural soils. Perhaps if the idea of *kol* and its associated part can be shared with the larger population of Belize, it is possible that the population can grow enough food to feed itself. At present Belize is an importing country; with a large portion of the imports are vegetable and wheat to feed the nation. The *Kol* system is based on a diverse cropping system that can grow food varieties that are acclimatized already to the local environments. *Kol* can be honored as an iconic national treasure; it is possible for all communities in Belize to learn how to make *kol*.

Recommendation 4

Finally, as our country continues to mold a strong formal education system, it is important to take lessons from the traditional ecological knowledge of the Mopan Maya. There are many philosophical lessons that can be adopted into the formal education system of Belize, from the elementary school level all the way to the university level of education. : Since colonial contact, Belizean societies have relied on the western philosophies and approaches to cultural integration along with ecological management.

The western approaches have proven weak in terms of successful social and environmental management thus far. Perhaps the traditional ecological knowledge of the indigenous people can be more beneficial for the establishment of a harmonious society and a sustainable ecology in Belize.

APPENDIX A
SEMI-STRUCTURED INTERVIEW QUESTION GUIDE

Question 1:

Can the understanding of the traditional practices associated with milpa farming provide insight to the transmission of traditional ecological knowledge of the Mopan Maya people between generations?

- 1.a What do members of this community do on a daily basis?
- 1.b Can you explain what are the parts that are involve in each activity?
- 1.c How many members of the community are involved in those activities?
- 1.d Who are involved in these activities within the house hold?
- 1.e What would you say are the most important elements of these activities?

Question 2:

Can the analysis of milpa crop diversity demonstrate understanding of the local ecology and the community's cultural sustainability?

- 2.a How many crop varieties do you plant each year?
- 2.b Where do you get knowledge about these plants?
- 2.c What plant you do depend on most each year and why?
- 2.d Where to obtain the different varieties of your plants?
- 2.e How do you select each plant that you include in your farm?

Question 3:

Does the shift from milpa agricultural to intensive agriculture strategies reduce the number of milpa crop varieties and lead to the loss of traditional ecological knowledge?

- 3.a Do you feel that you have to plant crops to sell?
- 3.b If you are planting plants to sell, do you use less or more plant varieties? Why?
- 3.c Do you tell your children about plants, even those that you do not plant?
- 3.d Where are the best places to plant crops that are for sale?
- 3.e How many crop varieties do you plant each year that is for sale?

Question 4:

Does the Mopan Maya engage in cultural activities to maintain their culture and as a way to transmit traditional ecological knowledge?

- 4.a Are there ceremonies that are related only to farming?
- 4.b What are the important parts of the ceremony that you participate in?
- 4.c How often do you need to participate in those ceremonies? Why?
- 4.d Do younger people in this community participate in those ceremonies?
- 4.e What do you have to do to be a part of these ceremonies?

APPENDIX B
SURVEY QUESTIONS

Transmission of traditional ecological knowledge among the Mopan Maya

Toledo District Belize Dissertation survey questions

Name of Village (Check one)	Gender of interviewee
San Jose Village: _____	Male: _____
Pueblo Viejo: _____	Female: _____
Santa Cruz: _____	
Blue Creek: _____	
What is your race?	Level of education of interviewee
Maya Mopan: _____	None: _____
Maya Kek'chi: _____	Primary level: _____
Other: _____	Secondary Level: _____
	Tertiary Level and above: _____

Weekly salary	Age of interviewee:
\$1.00 – \$100 00	18 – 28: _____
\$101.00 - \$200.00	29 – 39: _____
\$201 - \$300.00	40 – 50: _____
\$>301.00	51 : _____
Employment status:	Employed
	Self Employed: _____
	Unemployed:_____
What kind of work do you do?	Milpa Farmer: _____
	Healer: _____
	Student: _____
	Other

Notes:

Community livelihood: **For each statement, please select you level of agreement. 1- Strongly Disagree, 2- Disagree, 3- Neutral, 4- Agree and 5- Strongly Agree**

Mopan Mayas are leaving this community					
We mostly produce to feed our family					
We make milpa to so that we can sell our produce					
I only use help from people in my village					
The population in this community is growing					
Our community members are building homes deeper into forested lands					
The Maya people are forced to farm on bad soils					
We need firewood for cooking					
We consume game meat frequently					
We depend on forest wildlife for our survival					

Notes:

Attitudes towards Milpa: **For each statement, please select you level of agreement.**

1- Strongly Disagree, 2- Disagree, 3- Neutral, 4- Agree and 5- Strongly Agree

All Mopan Maya must make Milpa.						
Is Milpa important to you?						
Each person must have Milpa to be respected in the community						
We don't care if there are no more trees next year						
We need material from the forest to survive						
We consume game meat frequently						

Young People and Milpa : **For each statement, please select you level of agreement. 1- Strongly Disagree, 2- Disagree, 3- Neutral, 4- Agree and 5- Strongly Agree**

Young people who make milpa leave the village						
Young people who make milpa are respectful						
Young men don't respect Milpa						
Elders have lots of respect for Milpa						
Each Man must have milpa in order to gain respect in the community						
The government encourages us to produce more						

Notes:

Making Milpa: **For each statement, please select you level of agreement. 1- Strongly Disagree, 2- Disagree, 3- Neutral, 4- Agree and 5- Strongly Agree**

Every year we must cut high forest for milpa						
We use the same plot of land to do our farming every year						
Must attend ceremony before I start milpa						
Farm produce more if we make ceremony						
I get new plant seeds from other farmers in the village						
I share new plants for milpa as gifts						
Fires help us clear land for agriculture						

Notes:

Milpa and 'Tzik': For each statement, please select you level of agreement. 1- Strongly Disagree, 2- Disagree, 3- Neutral, 4- Agree and 5- Strongly Agree

I must get help from my elders with milpa						
We learn the old ways about milpa from our elders						
Only people with Tzik work with me						
It is important for us to get help from our elders						
I must help other farmers to make milpa						
We must take turns to help each other make milpa						
We can make milpa properly without elders						
We make milpa to so that we can sell our produce						
It is important for us to get help from our elders						

Sustainability: **For each statement, please select you level of agreement. 1- Strongly Disagree, 2- Disagree, 3- Neutral, 4- Agree and 5- Strongly Agree**

I use fire to make the soil better						
Steep slopes are not suitable for milpa						
The trees are for anyone who can cut them						
Every year more forest land is destroyed to produce food for the households						
Only broad leaf forest has fertile soils						
Agriculture on slopes are suitable for only a short period						
Fire destroys more forests than agriculture every year						
Wild forest fire occur occasionally in this area						
Most fires are started from Milpa fires						
Fire improves the soil quality						

Notes:

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BIOGRAPHICAL SKETCH

Pio Saqui was born in 1972, the village of San Antonio, within the Toledo district of Belize. He is one of thirteen children from a traditional Mopan Maya family. He did not speak any other language other than Mopan Maya until he was 9 years old. On January 2, 1974, his family relocated to the small community of what is now known as Maya Mopan village. Two years later, due to community unrest, his family relocated again to live in the village of Maya Center, where his family still resides.

He attended a small make shift school within the village of Maya Center Roman Catholic School. From there he left his village to live in Dangriga Town, among the Garifuna people as he completed his high school education. In 1992 he completed an Associated Degree in Applied Agriculture Sciences, from the Belize College of Agriculture. Two years later in 1994, he left Belize all together to pursue higher education and successfully completed a Bachelor's of Science degree, and Masters of Science degree in Natural Resources Management from Colorado State University.

He returned to Belize in 1998, to fill a position as faculty member at the University College of Belize, which became the University of Belize, in 2000. Since then he has served in various capacities at the university of while establishing the Natural Resources Management Program.

He is married to Juanita Garcia, who joined him in completing both their PhD programs at the University of Florida. Together they have one son, Keith James Saqui, age 2.