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An Anthropological Investigation of the Dynamic Human-Vervet Monkey (*Chlorocebus Aethiops Sabaeus*) Interface in St. Kitts, West Indies

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AN ANTHROPOLOGICAL INVESTIGATION OF THE DYNAMIC HUMAN-
VERVET MONKEY (*Chlorocebus aethiops sabaues*) INTERFACE IN ST. KITTS,
WEST INDIES

by

Kerry M. Dore

A Dissertation Submitted in
Partial Fulfillment of the
Requirements for the Degree of

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December 2013

ABSTRACT

AN ANTHROPOLOGICAL INVESTIGATION OF THE DYNAMIC HUMAN- VERVET MONKEY (*Chlorocebus aethiops sabaesus*) INTERFACE IN ST. KITTS, WEST INDIES

by

Kerry M. Dore

The University of Wisconsin-Milwaukee, 2013
Under the Supervision of Professor Trudy R. Turner

Over 350 years ago, the ecology of St. Kitts was dramatically altered by the advent of sugar cane production and the introduction of a highly adaptable, invasive animal species: the vervet monkey (*Chlorocebus aethiops sabaesus*). This project employed both primatological and ethnoprimate techniques to assess conflict between vervet monkeys and Kittitian farmers. Methodological tools from primatology allowed for the creation of a predictive model of monkey crop-raiding behavior. The model was highly informative about monkeys' current raiding patterns; however, viewing Kittitian farmers and vervet monkeys as interconnected through an ethnoprimate perspective revealed the significance of history with regard to this conflict. Land use patterns associated with the closure of the sugar cane industry in 2005 have significantly increased the interconnections between humans and primates. The ethnographic data showed that monkeys' increasing visibility has played a large role in Kittitians' cultural conceptualizations of vervet monkeys and the unique nature of pestilence discourse on monkeys in St. Kitts. The ethnographic data also showed that a third level of analysis was necessary for a robust understanding of the St. Kitts "monkey problem": an assessment of the complex relationship between Kittitian farmers and the land on which

they work. There is a unique human-environment relationship in St. Kitts due to the political repercussions of the island's colonial history - most farmers do not own their land. This case study serves as an example of how ethnoprimateological investigations can be informed well by the theories and methods of environmental anthropology.

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CHAPTER 1: INTRODUCTION

This dissertation is an anthropological investigation of an environmental problem: conflict between vervet monkeys (*Chlorocebus aethiops sabaesus*) and farmers in St. Kitts. St. Kitts is a small, West Indian island federation. Over three hundred and fifty years ago, the ecology of this island was dramatically altered by the advent of sugar cane production, with its African slave workforce, and the introduction of a highly intelligent and adaptable invasive animal species, the vervet monkey (*Chlorocebus aethiops sabaesus*). Ever since French peasant settlers introduced vervet monkeys to St. Kitts, they have thrived in the island's lush habitat, in part by raiding farmers' crops. In this work, the St. Kitts 'monkey problem' is examined as a case study, demonstrating ways in which ethnoprimateological investigations can be informed by the theories and methods of environmental anthropology.

The goals at the onset of this research were to create a predictive model of St. Kitts vervet monkey crop-raiding behavioral patterns and to use an ethnoprimateological framework to investigate how these raiding patterns affect Kittitian farmers' perceptions of the monkeys. Ethnoprimateology combines theories and methods from both primatology and cultural anthropology and considers humans and non-human primates as interconnected. This framework was applied through interviews and conversations with Kittitian farmers and members of the wider agricultural community.

The ethnographic data acquired through this ethnoprimateological approach reveal that the sugar industry has played a significant role in vervet monkey movements, human-vervet monkey interconnections, and the unique nature of pestilence discourse regarding monkeys in St. Kitts. As historic land use changes prove to be a key

component of human-vervet monkey interconnections in St. Kitts, this work serves as an example of how one area of environmental anthropology, historical ecology, can inform ethnoprimateological investigations. The ethnographic data also show that a third level of analysis is necessary for a robust understanding of the St. Kitts “monkey problem:” an assessment of the complex relationship between Kittitian farmers and the land on which they work. Thus, the third level of analysis in this thesis places this environmental problem in broader political-economic context, utilizing theory from a related area of environmental anthropology, political ecology, to assess Kittitian farmers’ relationship to the land. While this work utilizes theory from two interrelated areas of environmental anthropology, historical ecology and political ecology, it is primarily an example of historical ecology, a field that is concerned with the interactions through time between societies and their environments as well as political-economic systems and structures of ownership.

The three levels of analysis presented in this dissertation: primatology, ethnoprimateology and the political-economic context, are introduced below. These analytical themes and their respective results are expanded and contextualized with history and theory in Chapters Two, Three and Four. Chapter Five summarizes this work and presents suggestions that may help manage “the monkey problem” based on the results from the preceding analyses.

Primatology

The primatological component of this research shows that the likelihood and severity of St. Kitts vervet monkey crop raiding behavior can be predicted on the basis of

the environmental characteristics of farms and the behavior of farmers. This finding is based on 12 sequential months monitoring crop loss on 64 randomly selected farms around St. Kitts (this group makes up one-third of the farms registered with the St. Kitts Department of Agriculture). Within the farms, crop loss was localized to a half-acre grid cell that was part of a larger grid system created prior to data collection and that was superimposed over the entire island in a geographic information system (GIS).

Previous studies of crop-raiding primates in Africa and Asia provide the rationale for many of the predictive variables included in the models and the hypotheses generated regarding their relationship to the likelihood and severity of crop loss. These studies show that farms are more vulnerable to primate crop damage when they are closer to the forest boundary, further from roads, have fewer neighboring farms, when farmers spend less time guarding their crops, when preferred crops are grown and when there is less alternative food available in the monkey's environment (Maples et al., 1976; Strum, 1994; Naughton-Treves et al., 1998; Hill, 1997; Naughton-Treves, 1997; Naughton-Treves, 1998; Siex and Struhsaker, 1999; Hill, 2000; Gillingham and Lee, 2003; Newmark et al., 1994; Priston, 2005). By including these predictive variables, this study tests the generality of primate crop damage across continents.

The rationale for including several additional covariates in the predictive models is specific to the environment of St. Kitts. With regard to season/alternative food availability, the important factor is the mango season. During the months of May through August, thousands of mango trees fruit in St. Kitts. Mangoes are known to be a favorite food source for St. Kitts vervet monkeys (McGuire, 1974). Therefore, it was hypothesized that during the mango season, farms will have a lower risk of crop damage

by vervet monkeys because there is a significant amount of preferred, alternative food during this limited time period. McGuire (1974) has also shown that St. Kitts vervet monkeys utilize ravines (ghauts) for cover and water. Therefore, it was hypothesized that farms closer to ghauts will be more likely to experience crop damage by monkeys. Finally, as St. Kitts farmers' planting behavior is highly variable, two additional variables are included in the models: the number of months the farm contained crops in the mango season (May-August) and the number of months the farm contained crops in the non-mango season (September-April). For both variables, it was hypothesized that farms with crops planted more often would be more likely to experience crop damage from monkeys.

The relationship between crop loss (in grid cells) and independent variables (the environmental characteristics of farms and behavior of farmers) is analyzed using multilevel (hierarchical) modeling, as the grid cells monitored in this investigation are nested within farms and are not randomly selected from all over St. Kitts. In other words, grid cells from the same farm are more similar to one another, which violates the assumptions of a standard linear regression model. Multilevel modeling accounts for this nested structure of grid cells.

Most of the grid cells monitored during the course of the study did not receive damage, which necessitated a predictive model to account for a large number of zeros. A Hierarchical Generalized Linear Model (HGLM) is utilized, treating the dependent variable (crop damage or no crop damage) as a Bernoulli random variable and predicting the probability of each cell incurring damage in relation to measured predictive variables (or covariates). In order to incorporate data on the severity of damage, a second

predictive model is generated, including only the cells that experienced crop damage during the course of the study. The second predictive model (stage two) uses a Hierarchical Linear Model (HLM), treats the dependent variable as a normal random variable by using a Box-Cox transformation of the proportion of crop damage, and assesses the relationship between the percent of crop damage and the independent variables. (Box-Cox transformations are used to make non-zero data more amenable to statistics and inference.)

The HGLM shows that all of the variables except distance to the nearest road and the number of months the farmer planted crops in the mango season are necessary to make accurate predictions of a farm's likelihood of experiencing crop damage. The HLM shows that, of the farms predicted to experience crop damage, three variables predict the severity of that crop damage: whether or not it is the mango season, the monkey's preference for the crops planted, and the number of months the farmer planted crops in the non-mango season. Based on these results, two scripts, one for likelihood and one for severity, were created in the statistical program "R" (R Core Development Team, 2008) and Excel. These scripts can generate the predicted probability of experiencing crop damage or the predicted severity of crop damage (once damage is predicted to occur) from the covariates for any farm or piece of land in St. Kitts. Therefore, these predictive models can establish which farms should be slated for protection assistance and they can also determine the best places for the location of new farms. In totality, these results have significant applied value for the management of "the monkey problem" in St. Kitts.

Ethnoprimateology

The ethnographic data collected as part of the ethnoprimateological framework of this dissertation reveal the limitations of the purely primatological/quantitative approach of the first stage of this work. While the predictive models generated in stage one show that the crop raiding behavior of vervet monkeys is predictable, this approach does not take into account the historical/temporal aspect of St. Kitts' landscape, and the fact that it has undergone tremendous changes since the collapse of the sugar industry in 2005. Data from conversations with Kittitian farmers and members of the agricultural community show that the sugar industry has played a large role with regard to vervet monkey movements. From the 1600s until 2005, an organized system of sugar cane production dominated the arable land on the island, and small-scale farmers worked in ghauts and at the base of the mountain, above the cane apron, which wrapped around a high altitude forest in the center of the island. This activity created a barrier, preventing most mainland monkeys from leaving the forest (monkeys are also found on the southeast peninsula, where crops have never been grown in significant amounts). After the industry closed in 2005, thousands of acres opened up for small-scale farming. There are now more farmers than ever, but few that work at the base of the forest, where they used to maintain important food sources for monkeys. Additionally, there is no longer the kind of full-time, large-scale activity on the agricultural land that existed during sugar production, including the presence of forest rangers with guns. This situation means that monkey presence in agricultural areas is no longer restricted to the base of the forest; monkeys have come out of the mountain in search of food and now damage crops all over St. Kitts, including gardens in the villages and downtown.

The ethnographic data also highlights the effect of the sugar industry on human-vervet monkey interconnections. Ethnoprimateologists ask: how do humans affect nonhuman primate behavior and ecological patterns and how do nonhuman primates affect human cultural conceptualizations? (Fuentes, 2006). The predictive model shows how human agricultural practices currently affect monkey behaviors, and the ethnographic data on the role of the sugar industry on vervet monkey movements provides context about how humans have historically affected primate behavior. With regard to how vervet monkeys have affected Kittitians' cultural conceptualizations, the ethnographic data shows that these conceptualizations are inextricably linked to the sugar industry. Monkeys have always been vilified as crop raiders, and in order to protect their crops, farmers have always had to expend a significant amount of energy protecting crops from monkeys. However, during the sugar industry, monkeys were only pests at the forest/farm boundary, and only for the set of smallholding farmers that cultivated crops along this boundary and in the ghauts. Most Kittitians involved in agriculture worked in the well-protected cane fields, and their primary experience with monkeys was "in the pot" as food. Since the end of the sugar industry, the forest/farm boundary no longer serves as a barrier to monkey movements. Monkeys now damage crops all over the island, so many more farmers are dealing with this problem and farmers have become more conscious of vervet monkey behavioral patterns and intelligence. As a result, the similarity between humans and monkeys has become increasingly apparent, and while many Kittitians still eat monkeys, the ethnographic data shows that this number has decreased significantly.

Finally, the ethnographic data shows the role of the sugar industry on the unique nature of vervet monkey pestilence discourse in St. Kitts. The data collected for the predictive models documents tremendous damage to farmer's crops by monkeys as well as by humans, pigs and other livestock (cattle, sheep and goats), but the ethnographic data shows that this human-animal conflict is really human-state conflict. The desire for government assistance with infrastructure (access to tractors, water, seeds, marketing and fencing) came to the forefront during conversations and interviews. The desire for government assistance was also stressed with regard to preventing crop predation; however, the pestilence discourse regarding monkeys is unique (compared to humans, pigs and livestock) for three reasons. First, there is some leniency with regard to monkeys raiding crops because farmers recognize that monkeys only do this because they are hungry because of insufficient food in the mountain due to the repercussions from sugar industry closure. Second, monkeys are considered "natural" animals compared to the domestic livestock that have owners who should be taking responsibility for them. Third, monkeys' similarity to humans exacerbates conflict because farmers expect monkeys to behave with human-like manners in their crop raiding. Monkeys are "school boys, they are "educated," they have "gone to college," they are "half people," they are "just like people" they "*are* people" and they "do everything like a human," so monkeys are "willful" and are conscious of their crop-raiding behavior, they are "wasteful" or "bad minded" when they take one bite out of twenty different cucumbers instead of eating one whole cucumber, and when your crops get damaged the day after you chase monkeys off your farm, they are "spiteful."

The pestilence discourse on monkeys is also unique because while farmers feel that crop predation by humans, pigs and livestock can be curbed with mitigation measures, monkeys' intelligence means that these measures will not work. The farmers state that the only way to resolve the monkey problem is large-scale population control. In the early stages of data collection, the desire to kill monkeys and the killing of monkeys that often occurred at the hands of farmers seemed at odds with the increasing recognition of monkeys' intelligence and similarity to humans. This study shows that it is within the context of changing agricultural practices and land use patterns that this apparent dichotomy can be resolved. St. Kitts monkeys' transgression of the literal forest/farm boundary and figurative human/animal boundary makes them extremely dangerous and means that the only way to mitigate the problem is to control their population.

The Political-Economic Context

This thesis shows that a lack of land ownership on the part of most farmers in St. Kitts exacerbates "the monkey problem." This complex human-environment relationship has been made possible in part by St. Kitts' colonial history. The English (in 1623) and the French (in 1627) colonized St. Kitts as a means to become established in the New World (Hubbard, 2002), and sugar production followed soon after. The country was typical of colonial Caribbean islands in this regard; however, it was unique in both the lengthy duration of sugar production and in the intensity with which sugar production outcompeted any sort of diversified agricultural system. In fact, St. Kitts' history is riddled with attempts to diversify agriculture as a means to replenish the soil, generate

local income and reduce food imports. Pre-emancipation, planters rejected these attempts because planting cane generated more income. Post-emancipation, planters rejected these attempts because they knew that giving estate workers an alternative means of income would keep them from working on the estate. St. Kitts' monoculture was so extreme that complaints about food imports go back as far as 1664 (Mims, 1912 in Merrill, 1958). The 4 billion dollar food import bill for the region illustrates that the severity of this situation continues today (statement at the opening of Capisterre Farm, February 4, 2011).

Because St. Kitts produced sugar with such intensity for so long, it was not until 2005 that small-scale Kittitian farmers were no longer restricted to land inaccessible to tractors in the ghauts and at the base of the mountain, above the cane apron. Unlike many other Caribbean islands with colonial plantation histories, in St. Kitts, cane lands (approximately 15,000 acres) were kept in the hands of the European plantation owners until nationalization in 1976 when ownership was transferred to the government. Virtually no land was available for the establishment of a peasantry. Therefore, unlike other post-colonial Caribbean islands, including its sister island, Nevis, St. Kitts is full of "landless" people (Merrill, 1958; Inniss, 2005).

This "landless" status has led many scholars to generalize Kittitian farmers as a homogenous, underdeveloped, non-cohesive group, having no ties to farming or their land. Indeed, in the past, Kittitians were forced onto the worst land within a system that did not value diversified agriculture, leading to a significantly unequal distribution of power. Kittitian farmers have inherited impoverished land due to the longevity of sugar production. The results of this study provide some evidence to support these

generalizations. On the part of the farmers, there is some resistance to investing in the land (e.g. putting up fencing and planting fruit trees), there is talk about a lack of cohesion among farmers, and there is concern about the negative status of farming and little youth interest in agriculture. However, the ethnographic data collected in this dissertation highlight the existence of long family histories and strong ties to the land. Additionally, newspaper articles and conversations with farmers reveal concerns on the part of some Kittitians about the sale and mortgaging of Kittitian land and how these changes may impact the future of farming. And while issues regarding youth and cooperation among farmers still exist, this work shows increasing trends of youth involvement, farmer collaboration within cooperative societies and the use of cooperatives to secure one's place on government-owned land.

This work exemplifies the benefits of engaging environmental anthropology theory in ethnoprimateological investigations. It shows that the human-animal relationship that is "the monkey problem" in St. Kitts has another layer: a dynamic human-environment relationship. A major facet of "the monkey problem" is conflict over land ownership and associated power, a product of the island's global and political history. At the local level, this situation has manifested itself into heterogeneous and complex relationships to the land on the part of the government and the farmers, and one must engage these dynamic human-animal and human-environment relationships to fully understand conflict with monkeys in St. Kitts.

CHAPTER 2: PRIMATOLOGY

Introduction, Background and Hypotheses

Crop damage by vervet monkeys has existed in St. Kitts since the monkeys first arrived on the island more than 350 years ago. While the general behaviors of St. Kitts vervet monkeys are fairly well studied up until the 1980s (Sade and Hildrech, 1965; Poirier, 1972; McGuire, 1974; Fairbanks and Bird, 1978; Chapman and Fedigan, 1984; Petto and Povinelli, 1985; Chapman, 1985; Chapman, 1987; and Chapman et al., 1988), descriptions of the monkey's crop raiding have always been anecdotal. Sade and Hildrech (1965), Poirier (1972) and McGuire (1974) explain that even in the early days of habitation on St. Kitts, vervet monkeys were serious crop raiders, but relatively little was written about their patterns of crop raiding. One notable exception is the effect of season. An informant to Sade and Hildrech (1965) explained that the monkeys were more commonly seen in the lowlands during the dry season, so they hypothesized that the monkeys may be attracted to the garden plots planted at the forest edge during these times, as wild fruit may be less abundant.

The literature shows general trends in the factors that affect primate crop raiding around the world. One of the most important variables is the location of farms relative to the forest boundary, with farms closer to the boundary often experiencing more crop damage (Naughton-Treves, 1996; Naughton-Treves, 1997; Hill 1997, Naughton-Treves, 1998; Linkie et al., 2007; Hill, 2000; Saj et al., 2001; Priston, 2005; Nijman and Nekaris, 2010). This relationship has broadened, and more crop damage has been observed on farms closer to wildlife refuge areas (Else, 1991; Warren et al., 2007) and areas that provide cover for primates (Horrocks and Baulu, 1994). Season is another important

factor. Crop damage on farms can be affected by monthly patterns (Naughton-Treves et al., 1998), periods of rainfall (Musau and Strum, 1984; Linkie et al., 2007) and patterns of wet and dry periods (Tweyho et al., 2005). Often, crop raiding increases when wild fruit availability decreases (Biquand et al., 1992; Siex and Struhsaker, 1999; Warren, 2003; Tweyho et al., 2005), though this can be crop specific. For example, Naughton-Treves et al. (1998) found that a shortage of wild food availability resulted in an increase in banana consumption but not maize consumption. Preventative strategies and guarding behavior on the part of the farmer are also important. Hunting (Naughton-Treves, 1997; Naughton-Treves, 1998) and farmer vigilance (Maples et al., 1976) have been shown to decrease the amount of crop damage by primates, and Warren et al. (2007) suggested that hunting had the potential to reduce crop damage by primates (and other animals) near Gashaka Gumti National Park, Nigeria. Other important factors that affect primate crop raiding patterns are: crop type (Maples et al., 1976; Else, 1991; Horrocks and Baulu, 1994; Naughton-Treves et al., 1998; Gillingham and Lee, 2003; Priston, 2005); troop size and individual characteristics of the primates (Mohnot, 1971; Maples et al., 1976; Oyaro and Strum, 1984; Forthman-Quick, 1986; Strum, 1986; Strum, 1994); number of neighboring farms (Naughton-Treves, 1997; Hill 1997; Hill, 2000; Priston 2005); human density (Mascarenhas, 1971, Newmark et al., 1994); primate density (Siex and Struhsaker, 1999); presence of nearby roads (Priston, 2005) and the amount of crops under cultivation (Boulton et al., 1996).

The impact of these variables is not always significant, so the factors contributing to primate raiding behavior must be assessed on a case-by-case basis. For example, the proximity of farms to areas of natural refuge for monkeys and the Selous Game Reserve

do not have an impact on primate-crop damage problems (Gillingham and Lee, 2003) and the amount of alternative food availability does not have an impact on the raiding behavior of tonkean macaques (*Macaca tonkeana*) in Lore Lindu National Park in Sulawesi, Indonesia (Riley, 2007). The effect of farmer's preventative strategies and hunting on crop damage was not clear at the forest edge in Entebbe, Uganda (Saj et al., 2001) and not effective in Kerinci Seblat National Park (Linkie et al., 2007) or Lore Lindu National Park (Riley, 2007). Finally, investigations have shown that the relationship between crop type (Saj et al., 2001) and human density (Naughton-Treves, 1998) on the degree of crop damage is not always significant.

The goal of this stage of analysis is to methodically document crop damage by vervet monkeys in St. Kitts and evaluate the possible role of these and other relevant environmental variables in predicting a farm's risk of crop damage. Primate crop raiding has been extensively studied within the fields of primatology and human-primate conflict; however, there are few models that predict primate crop damage. This work builds upon preliminary GIS approaches (Webber, 2006; Hashim et al., 2009) and epidemiological approaches (Priston and Underdown, 2009) predicting patterns of primate crop damage. Webber (2006) and Hashim et al. (2009) establish the relationship between crop damage and predictive variables and then use these data and GIS to generate risk maps of primate crop raiding. Webber (2006) predicts the likelihood of primate crop raiding based on crops grown, distance to the forest and human presence. Hashim et al. (2009) use land use type and estimated macaque populations to assess risk. Webber (2006) and Hashim et al. (2009) show that certain environmental variables can be used to effectively predict primate crop raiding, but they do not generate predictive

models that have been tested and proven effective on new data. Priston and Underdown (2009) create a predictive model, but only on a selected subset of farms close to the boundary of the forest and only with a subset of predictive variables. This study aims to assess the risk of any farm or piece of land on the island and to utilize information on every predictive variable possible.

The literature above provided the rationale for some of the hypotheses generated regarding which variables affect a farm's vulnerability to crop damage by vervet monkeys in St. Kitts. From the general literature, it was hypothesized that farms would be more vulnerable to primate crop damage when they are closer to the forest boundary, further from roads, have fewer neighboring farms, when farmers spend less time guarding their crops, when preferred crops are grown and when there is less alternative food available in the monkey's environment. From the St. Kitts literature, it was known that there is marked seasonality in the availability of natural food sources (specifically, mangoes). Thus, it was hypothesized that farms would be more vulnerable to crop damage during the non-mango season, as it is likely that monkeys will raid crops less often when they have a significant, alternative, natural food available (Table 1).

Three additional hypotheses, specific to the environment of St. Kitts, were tested. Previous work on St. Kitts vervet monkey behavior (McGuire 1974) has shown that vervet monkeys utilize the ghauts for travel, so it was hypothesized that farms would be more vulnerable to crop damage when they are closer to water sources (ghauts/ravines). Finally, to account for variation in farmer planting behavior as well as season, it was hypothesized that: farms would be more vulnerable to crop damage when the farmer has crops planted during more months of the mango season (May through August) and farms

are more vulnerable to crop damage when the farmer has crops planted during more months of the non-mango season (September through April) (Table 1).

<u>H1</u> : Farms will be more vulnerable to primate crop damage the closer they are to the forest boundary.
<u>H2</u> : Farms will be more vulnerable to primate crop damage the further they are from roads.
<u>H3</u> : Farms will be more vulnerable to primate crop damage the fewer neighbors they have.
<u>H4</u> : Farms will be more vulnerable to primate crop damage when the farmers spend less time guarding their crops.
<u>H5</u> : Farms will be more vulnerable to primate crop damage when they contain crops preferred by monkeys.
<u>H6</u> : Farms will be more vulnerable to primate crop damage when there is less alternative food available (i.e. during the non-mango season).
<u>H7</u> : Farms will be more vulnerable to primate crop damage the closer they are to water sources.
<u>H8</u> : Farms will be more vulnerable to primate crop damage when they have crops planted during more months of the mango season.
<u>H9</u> : Farms will be more vulnerable to primate crop damage when they have crops planted during more months of the non-mango season.

Table 1. Hypotheses tested.

Methods

Site Selection Lists of registered farmers were provided by the St. Kitts Department of Agriculture. The department's crop extension officers, who visit the farms regularly and provide technical assistance to farmers, generated these lists. Two crop extension officers were assigned to this project and were present during almost all data collection. This was especially important in the early stages of the project when learning how to identify young crops.

St. Kitts has nine parishes, some of which have significantly more farms than others. One-third of the farms in each parish ($n = 65$) were selected to be in the study (Figure 1). This sample size was the largest that could be monitored accurately and

represent of all of the farms in St. Kitts. These farms were chosen at random with the exception that farms larger than 15 acres were not included, as there was not enough time to monitor farms this large. All of the farms in each parish were assigned a number, and the numbers were randomized using the statistical program R (R Development Core Team, 2008). Starting with the farm that was randomly assigned number one in each parish, the farmer was contacted and asked if he or she would be willing to participate in the study. If the farmer declined, or the farm was no longer in use, the next farmer on the list was contacted until farmers from 33% of the farms in each parish granted their permission. Participating farmers were told the details of the study and informed that the research was purely academic and scientific, and that the data would be used to determine which farms and crops are at greatest risk of primate crop raiding. They were told that there was no guarantee that any action would result, including compensation for crop loss, in order to minimize the likelihood of damage being exaggerated.

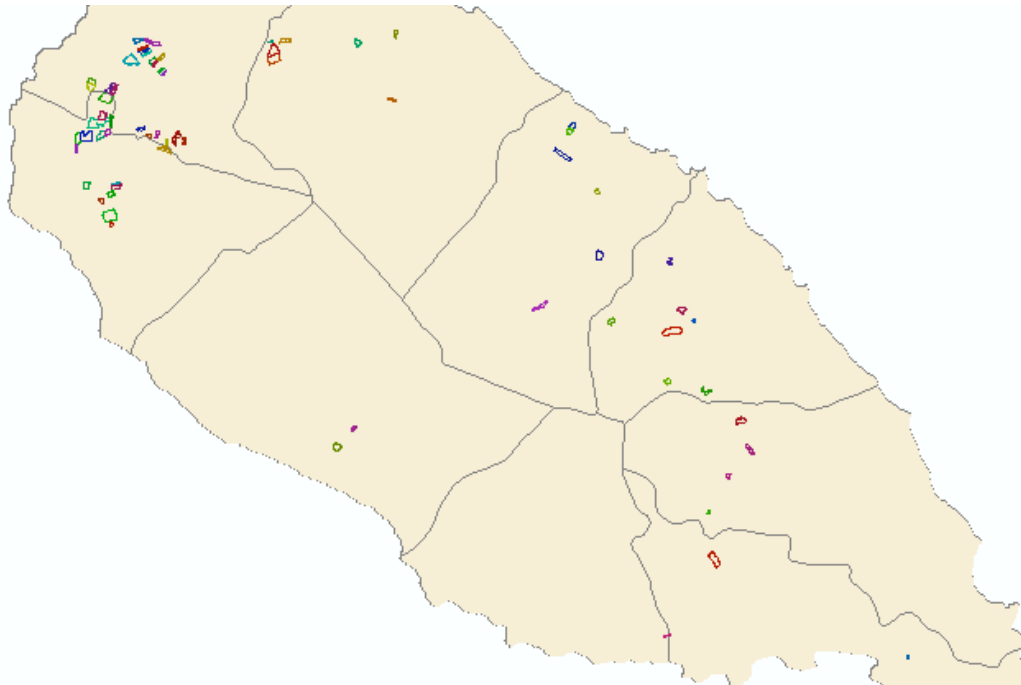


Figure 1. The nine parishes in St. Kitts and the 65 farms selected to be in the study.

Monitoring Crop Loss In the literature, a number of methods have been used to quantify primate crop damage. These include: measuring the percentage of damage over a large area with a grid system (Naughton-Treves, 1996; Linkie et al., 2007), sampling specific crop stands (Naughton-Treves, 1997; Naughton-Treves et al., 1998; Hill, 2000; Warren et al., 2007), using vegetation transects or plots (Siex and Struhsaker, 1999; Priston, 2005), questionnaires (Gillingham and Lee, 2003; Tweyho et al., 2005) and farmer's records checked by enumerators (Linkie et al., 2007). For this project, a grid system is used due to the nature of farm distribution in St. Kitts and the goal to survey the entire island.

More specifically, the grid-based system used in this study is adapted from Sitati et al. (2003), who investigate the variables that predict human-elephant conflict in a 1,000 km² area adjacent to Masai Mara National Reserve in Kenya. In their investigation, they use a grid-based GIS with a 25km² resolution to assign the locations of conflict incidents before exploring the spatial relations with underlying variables (distance to road, distance to water, area under cultivation, forested area, distance to market centers, elevation and human population density). To establish the relationship between these variables and human-elephant conflict, first, univariate correlations were conducted using Spearman's rank correlation. Then, conflict was binary coded into presence and absence and multiple stepwise logistic regression was used for the analysis (it was not possible to use linear regression to identify multivariate correlates because the dependent variable exhibited highly skewed distributions). The relative contribution of the variables to the model was estimated by the *R* statistic, and Spearman's rank correlation was used to examine the relationship between predicted probabilities of conflict from the logistic models and

actual intensity of conflict in grid cells. Data were divided into a training set to build the model and a testing set to evaluate its performance. Model performance on the testing set was evaluated by calculating the area under the curve of receiver operating characteristics (ROC) plots.

The results of Sitati et al. (2003) show that crop raiding is clustered into distinct conflict zones and that the occurrence and intensity of crop raiding could be predicted on the basis of the area under cultivation and, for male elephant groups, proximity to major settlements. This work is important and relevant to the methods utilized in this study because the authors argue that their techniques have “the potential for widespread comparative application” (Sitati et al. 2003: 668) and their work shows that the environmental factors contributing to damage from wildlife can be determined with GIS techniques.

Therefore, a half-acre grid (the size of the smallest participating farm) was constructed and placed over the island using ArcMap, a geographic information system (GIS) (See Figure 2), prior to the start of data collection. Crop damage was assessed at the level of the grid cell and at the level of the farm on each farm for 12 sequential months. Farms were visited in the same order each month. This order was determined randomly, again with the statistical program R (R Development Core Team, 2008). Farms were visited Monday-Friday each week. On average, four to five farms were monitored daily for 16 days each month.

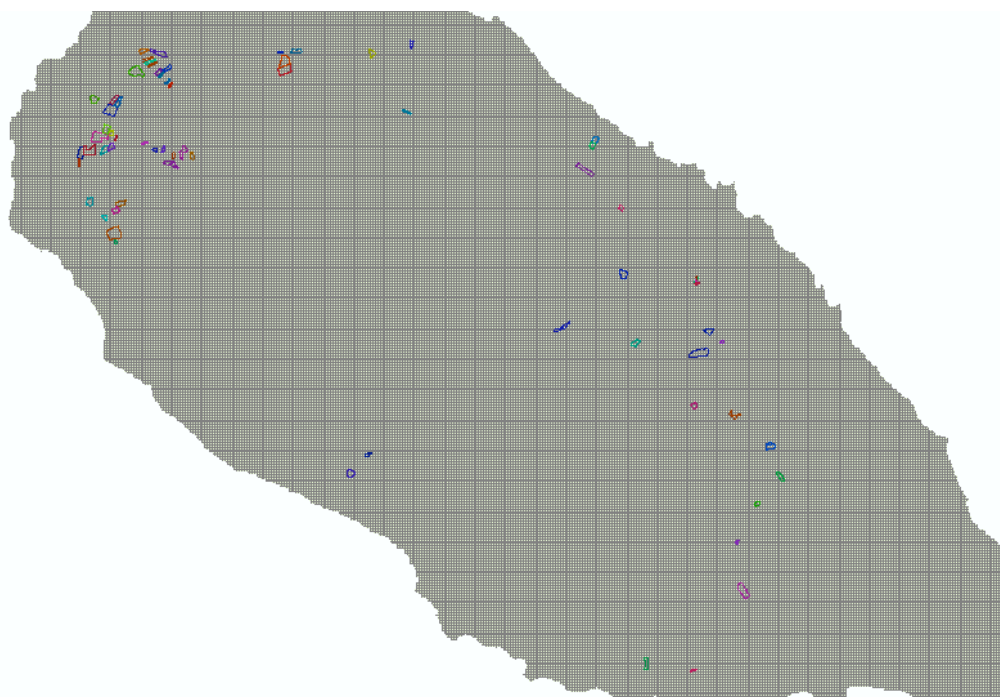


Figure 2. The island of St. Kitts superimposed with the half-acre grid used for this study (individual grid cells are impossible to see at this scale).

On the initial visit to each farm, the farm's location and area were recorded with handheld Garmin Venture HC GPS units. Often, the farmer described the crops that were being grown, at what times each crop was planted and when it was going to be harvested (see Table 2 for a list of all the crops mapped during the course of the study).

5 finger (Carambola)	Ginger	Plantains
Ackee	Golden apple	Pomegranate
Atney	Gooseberry	Pontserrat
Avocado	Grapes	Pumella grapefruit
Basil	Greens	Pumpkin
Bok choy	Guava	Red peas
Breadfruit	Hot pepper	Sea grape
Breadnut	Irish potato	Seasoning pepper
Broccoli	Lemon	Shaddock
Cabbage	Lettuce	Skinny tree (canape)
Callaloo	Lime	Sorrel
Carrots	Mango	Soursap
Cashew	Morocco	Spinach
Cassava	Noni	Squash
Cauliflower	Nuff nuff	String beans

Celery	Okra	Sugar apple
Chives	Onion	Sun melon
Coconut	Orange	Sweet pepper
Collards	Papaya	Sweet potato
Corn	Passion fruit	Tangerine
Cucumbers	Peanuts	Tea bush
Custard Apple	Peas	Thyme
DET (Dasheen, Eddo, Tannia)	Pidgeon peas	Tomato
Eggplant	Pineapple	Watermelon
Fig	Pink grapefruit	Yams
		Zucchini

Table 2. Crops mapped on study farms (September 2010-August 2011). Data compiled by field assistant Lindsay Mahovetz.

On each farm visit, the entire farm was checked for crop damage, often with the farmer's assistance. If crop damage was only superficial, and the farmer could still reap the crop item or it could spring back, then the item was not counted as raided. If any part of the crop item was damaged, then the entire item was considered damaged (the percentage of the individual crop item, e.g. number of corn kernels on one ear of corn, was not recorded). Vervet monkey crop damage is easy to identify, as the animals typically only take a few bites out of the item. While vervet monkeys are significant crop-raiders, wild pigs, cows, sheep and goats also raid crops in St. Kitts. Therefore, evidence of pig and livestock damage was also collected with these methods. This damage is distinctive from the vervet monkeys who take a few bites of fruit and leave the rest: wild pigs uproot ground vegetables and sheep and goats eat the vegetation.

The percent of crop damage was assessed at two levels: on the farm as a whole and within each individual cell. At the farm level, the percent of crop loss to each crop was calculated by dividing the number of raided crop items by the total number of crop items on the farm (or, for ground crops (e.g. sweet potato), as the area uprooted over the total area of the crop on the farm using the area calculation function on the GPS unit). At

the individual cell level, crop damage was recorded in grid cells that fell within the farm and did not contain crops from any other farm (any grid cells that contained crops from multiple farms were excluded from the study). Using handheld GPS units, the corners of each grid cell were located on the ground and marked with yellow ribbons that were removed after each visit. Then, the percent of each damaged crop in the cell was determined using the same methods as at the farm level. On the rare occasion that crop damage was so severe that the farmer had already re-plowed and replanted the field with a different crop at the time of the monthly visit, the incident was noted, but the degree of damage was not estimated and the data were not included in the analyses.

After each monthly visit, all of the damaged crops were collected and taken off of the farm to avoid repeatedly counting the same crop as damaged on more than one occasion. These crops were weighed to estimate the pounds of crops lost to the animals. To estimate the weight of the ground crops that were lost, the damaged area was multiplied by the average pounds per acre reaped of that crop in St. Kitts (data given by St. Kitts Department of Agriculture: sweet potato = 7,000 lbs./acre, peanuts = 1,500 lbs./acre, yams = 8,000 lbs./acre; data not available for carrots or onion). So, for example, if 0.5 acres of sweet potato were damaged, then approximately 3,500 pounds of sweet potato were lost.

Quantifying Environmental Predictors GIS maps of St. Kitts' land cover (Figure 3), water drainages (Figure 4) and roads (Figure 5) were obtained from the St. Kitts Planning Department. In the GIS, the forest boundary was digitized using the land cover map, which clearly defines the apron of forest surrounding the volcano, Mt.

Liamuiga. The program Hawth's Tools (Beyer, 2004) was used to calculate the center point of each grid cell in ArcMap. The map with grid cell center points was spatially joined to the forest boundary, water source, and road maps, prompting the GIS to give each point the attributes of the closest line. This created a large table with all grid cell centers and distance attributes (to the nearest forest boundary, water source and road, respectively). These distances were transferred to a separate data file containing the 699 grid cells contained within the 64 farms specific to the study. The number of months the cell contained crops was counted and this number was also transferred to the data file. The three distances and the number of months with crops planted were specific to each grid cell.

To measure the effect of neighboring farms, the surroundings for each farm were visually inspected for neighbors and assigned a value of 1-4, with 4 being the greatest number of possible neighbors. All grid cells that fell within the farm were assigned the same value for "neighbors," so this variable is specific to each farm. To measure the effect of guarding behavior on crop damage, during interviews, farmers were asked the number of hours per week they spent on their farm. Based on this number, confirmed with personal observation and whether or not they had dogs, guns, fencing or traps, farms were assigned a number out of 8, with 8 designated for farmers that spent the most time protecting their crops. All grid cells that fell within the farm were assigned the same value for guarding.

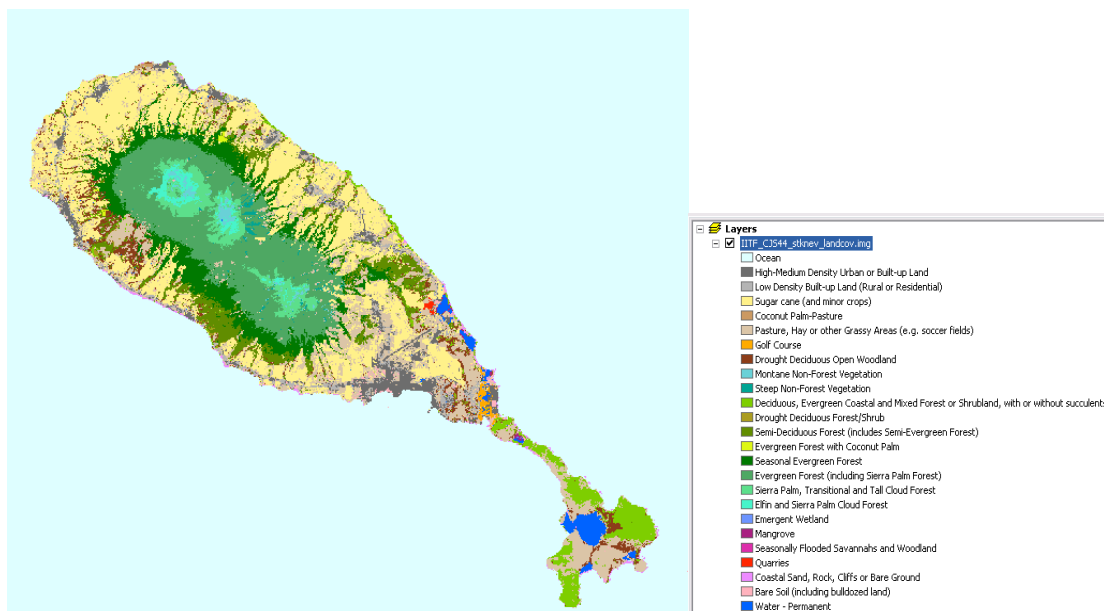


Figure 3. Land cover on St. Kitts (assessed from satellite images by Helmer et al., 2008).



Figure 4. Location of water sources on St. Kitts. Data available at: http://www.oas.org/pgdm/data/gis_data.htm



Figure 5. Location of roads in St. Kitts. Data from the St. Kitts Planning Department.

Crop preference was determined by utilizing Naughton-Treves' (1998) technique to compare observed to expected frequencies of crop raiding in order to obtain crop preferences for the predictive model. Naughton-Treves (1998) does not generate a predictive model, but uses multivariate analysis to test predictors of damage, including human population density, guarding, hunting, sight distance and distance from the forest at both the field and village level. Her work shows that distance from the forest edge explains the greatest amount of variation in crop damage.

The observed frequency was calculated monthly as the percent of damage to the damaged crop divided by the percent of damage to all crops that were damaged during that monthly visit. The expected frequency of raids for each crop was calculated monthly as the area of the damaged crop divided by the area of all crops available on the farm that

month. The most preferred crops have the highest positive deviations of observed from expected frequencies. For the purposes of the predictive model, each cell was assigned a preference value that corresponded to the most preferred crop in the cell that month. Like the three distances and the number of months with crops planted, crop preference was specific to each grid cell.

The environmental predictors presented thus far are spatial in nature. The temporal effect of season/alternative food availability was also evaluated in this study. Crop loss during September-April was considered to have occurred in the non-mango season and crop loss during May-August was considered to have occurred the mango season. The effect of season was assessed at the grid cell level in order to determine the effect of season on crop damage for each grid cell.

Model Development: Hierarchical Linear Models (HLM) and Hierarchical General Linear Models (HGLM)

Hierarchical linear models Due to the nature of data collection techniques utilized for this study, a standard linear regression assessing the contribution of the predictive variables to crop damage was not possible. This is because data were collected at the level of the grid cell, and grid cells are nested within farms. In other words, grid cells within farms are more similar to each other. Standard linear regression models require independent data points (e.g. monitoring randomly selected grid cells from all over St. Kitts).

Hierarchical linear modeling (HLM), or multilevel modeling, is applicable to situations where the data have a nested structure. This is common with behavioral and

social data where context is very important. For example, a child's classroom, school, and school district will influence his or her education (Luke, 2004). Individuals interact with and are influenced by the social context to which they belong. In HLM, the individuals and their groups are conceptualized as a hierarchical system of individuals nested in groups; the individuals and groups are defined at separate levels of this hierarchical system. One can define variables that may or may not influence each of these levels. Investigating the relationship between variables that characterize individuals and variables that characterize groups is generally referred to as multilevel research (Hox, 2010).

Multilevel models are necessary because when data are hierarchical, the assumptions of basic multiple regression are violated. Using the standard example of students nested in schools: you take a sample of schools and then a sample of the students in the schools. The students cannot be viewed as independent samples, because students from the same school tend to be more similar to each other. Students in the same school are more likely to have the same socioeconomic status, for example. Because of this, the average correlation (the intraclass correlation) between variables measured on students from the same school will be higher than the average correlation between students from different schools. Standard statistical tests rely heavily on the assumption of independence of observations, and when this is violated, the estimates of standard errors are much too small. This results in spuriously 'significant' results (Hox, 2010).

Understanding multilevel modeling begins with a basic two level model. The goal is to predict values of some dependent variable based on a function of predictor variables at more than one level. Using a standard example, one might want to examine

how student performance on a math test is influenced by both characteristics of the student (e.g. socioeconomic status) and characteristics of the classroom (e.g. teacher age). The student is measured and modeled at Level 1 and the classroom at Level 2.

For the predictive models generated for this study, crop loss was quantified at two levels: the entire farm and within individual half-acre grid cells. Thus, using a multilevel means that one can examine how a farm's likelihood of experiencing crop damage is influenced by both the characteristics of the grid cell (e.g. distance to the nearest water source) and characteristics of the farm (e.g. how much time the farmer spends guarding his or her crops; this variable is the same for all grid cells on the farm). The grid cell is measured and modeled at Level 1 and the farm at Level 2. The following multilevel model shows this two-level structure with one predictor variable at each level:

$$\begin{aligned} \text{Level 1: } Y_{ij} &= \beta_{0j} + \beta_{1j}X_{ij} + r_{ij} \\ \text{Level 2: } \beta_{0j} &= \gamma_{00} + \gamma_{01}W_j + u_{0j} \\ \beta_{1j} &= \gamma_{10} + \gamma_{11}W_j + u_{1j} \end{aligned}$$

The Level 1 portion of the model is essentially a typical ordinary least squares multiple regression model. However, a different Level 1 model is being estimated for each of the Level 2 units; the j subscript is for the Level 2 units (classrooms/farms) and the i subscript is for the Level 1 units (students/grid cells). The difference from the usual regression model is that it is assumed that that each classroom/farm has a different intercept coefficient (β_{0j} , average student score/average percent of crop damage) and different slope coefficients (β_{1j} , the regression coefficient for the variable (X_{ij}); in other words, the effect of the variable (i.e. socioeconomic status/distance to water source) on the student performance score/degree of crop damage, Y_{ij}). r_{ij} is the usual residual error term. The residual errors are assumed to have a mean of zero and a variance (τ_p^2) to be

estimated. Most multilevel software assumes that the variance of the residual errors is the same in all classrooms/farms (Hox, 2010; Luke, 2004). This formula allows the intercept and slope to vary across the Level 2 units (because the intercept and slope coefficients are random variables that vary across the classrooms/farms, they are often referred to as *random* coefficients). This is the critical conception in multilevel modeling – that one can treat intercepts and slopes as outcomes of Level 2 predictors (Hox, 2010; Luke, 2004).

The next step in the hierarchical regression model is to explain the variation of the regression coefficients by introducing variables at the classroom/farm level (Level 2). The top line of the Level 2 equation above indicates how each of the Level 1 parameters is a function of both Level 2 predictors and variability. β_{0j} is the Level 1 intercept in Level 2 unit j (in other words, the average performance of the students in the classroom/the average degree of crop damage of the grid cells in the farm). The equation predicts average student performance/degree of crop damage in a classroom/farm by the Level 2 variable (W , i.e. teacher age/level of guarding by the farmer). γ_{00} is the mean value of the Level 1 dependent variable, controlling for the Level 2 predictor (W_j), and γ_{01} is the effect (slope) of the Level 2 predictor (W_j). u_{0j} is the error, or unmodeled variability, for unit j . Thus, if γ_{01} is positive, the average student performance is higher in classrooms with older teachers (or the average grid cell damage is higher on farms with more guarding) and the opposite is true if γ_{01} is negative (Hox, 2010; Luke, 2004).

The interpretation of the bottom line of the Level 2 equation is similar, but this equation models the Level 2 effects on the slope of X_{ij} : β_{1j} is the Level 1 slope in Level 2 unit j ; γ_{10} is the mean value of the Level 1 slope, controlling for the Level 2 predictor, W_j ;

γ_{11} is the effect (slope) of the Level 2 predictor (W_j) and u_{1j} is the error for unit j (Hox 2010). This equation states that the *relationship* (i.e. slope, β_{1j}) between student performance/degree of crop damage (Y) and socioeconomic status/distance to the nearest water source (X) depends on the Level 2 variable teacher age/farmer's guarding behavior (Z). If γ_{11} is positive, the effect of socioeconomic status on student performance is larger with older teachers (or the effect of distance to the nearest water source on degree of crop damage is higher on farms that have more guarding). Conversely, if γ_{11} is negative, the effect of socioeconomic status on student performance is smaller with older teachers (or the effect of distance to the nearest water source on degree of crop damage is lower on farms that have more guarding). Thus, "teacher age/farmer's guarding behavior" acts as a *moderator variable* for the relationship between student performance and socioeconomic status (or between degree of crop damage and distance to the nearest water source). This relationship varies according to the moderator variable (Luke, 2004).

The regression coefficients for the Level 2 variables (γ_{01} and γ_{11}) do not have a subscript j next to them. This is because they are not assumed to vary across classrooms/farms; in other words, they apply to all classrooms/farms. For this reason, they are referred to as *fixed* coefficients (versus the *random* coefficients from the Level 1 equation). The between-classroom/between-farm variation left in the β coefficients after predicting these with the classroom/farm variable Z_j is assumed to be residual error variation. Note that the residual error terms u_j have the subscript j to indicate to which classroom/farm they belong (Luke, 2004).

The three Level 1 and Level 2 equations, with one student (grid cell)-level and one classroom (farm)-level explanatory variable can be combined into one, complex regression equation:

$$Y_{ij} = [\underbrace{\gamma_{00} + \gamma_{10}X_{ij} + \gamma_{01}W_j + \gamma_{11}W_jX_{ij}}_{\text{FIXED}}] + [\underbrace{u_{0j} + u_{1j}X_{ij} + r_{ij}}_{\text{RANDOM}}]$$

This combined model clearly illustrates which part of the model is composed of the fixed effects and which is composed of the random effects. In the context of ANOVA, random effects are often defined as independent factors that are a random sample drawn from a larger population. In the context of multilevel modeling, it is more useful to think of random effects as additional sources of error and variability. In this example, there is the traditional error term, r_{ij} , as well as two additional error terms: u_{0j} is the variability of the relationship of student performance between classrooms and u_{1j} is the variability of the relationship of socioeconomic status to student performance between classrooms (or the relationship of distance to the nearest water source to degree of crop damage between farms). So, a multilevel model will generally have random effects that are tied to Level 1 and Level 2 units (Luke, 2004).

Hierarchical generalized linear models Most of the grid cells monitored during the course of this study did not receive damage, which necessitated a predictive model to account for a large number of zeros. Therefore, for the first predictive model described, the dependent variable is binary (presence/absence; 1/0). Multilevel modeling can be extended to handle a wide variety of dependent variables like this, including those that are non-continuous and non-normal (binary, count, proportion and ordinal variables). Hierarchical generalized linear models (HGLMs) work by including a necessary

transformation and appropriate error distribution for the DV into the statistical model. In the first predictive model, the DV is binary. Untransformed, this DV is bounded by 0 and 1 and is highly non-normal. It can be assumed that the underlying probability distribution is binomial with mean μ . Our estimate of μ is p , which is interpreted as the probability of the event occurring (in this case, the probability of incurring crop damage). A typical transformation for a binomial model is the logit:

$$\text{logit}(p) = \ln\left(\frac{p}{1-p}\right)$$

Figure 6 illustrates why the logit transformation is so useful.

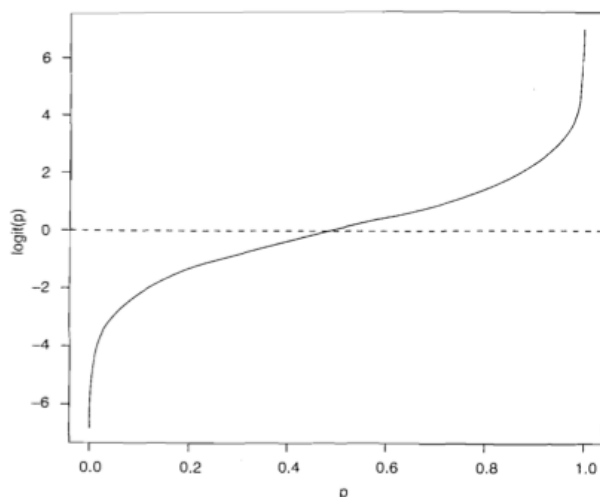


Figure 6. Illustration of logit transformation (Luke, 2004).

While p is bounded, the logit of p is not and the density of logit (p) is much closer to normal. In HGLM, this type of transformation is called a *link function*. First, a transformational link that connects the untransformed dependent variable (Y) to a new transformed variable η is set up. So, our link function is:

$$\eta = \text{logit}(Y)$$

We then set up a traditional Level 1 prediction as described previously:

$$\eta = \beta_0 + \beta_1 X_1 + \dots + \beta_k X_k$$

for k predictor variables. There is no term for the Level 1 error variance because for binary variables, the variance is completely determined by the mean, and is not a separate term to be estimated. Level 2 models that predict the Level 1 betas can then be constructed as before (Luke, 2004).

Using this multi-level, hierarchical approach allows the predictive model of St. Kitts vervet monkey crop raiding behavior created for this dissertation to refine the spatial scale at which previous predictive models of animal raiding behavior have been conducted. It assesses the impact of environmental variables down to individual half-acre sections of individual farms, but the multi-level nature of the model also considers the characteristics of the farms in their entirety.

Results

Crop Damage A total of 215.23 acres on 64 farms were monitored (one farm was not cultivated during the study period). Crop damage from monkeys was recorded on 53% (34/64) of the farms in the study. Compared to pigs and other livestock, incidents of crop damage by monkeys occurred much more frequently: 176 incidents of crop damage by monkeys were recorded compared to 16 by pigs and 12 by livestock (see Tables 3 and 4 for means and standard deviations). Importantly, however, while monkeys destroyed 4,853 pounds of ground crops and 7,860 individual crop items during twelve months of visits, pigs destroyed 10,475 pounds of ground crops and 51 individual

crop items during the same time period (livestock destroyed 1,021 individual crop items and 2,834 pounds of ground crops). This shows that while monkey damage occurs much more frequently, pigs do significantly more damage per raid.

	Monk Above	Monk Below	Pig Above	Pig Below	Live Above	Live Below
Jan	33.31	0.00	0.00	0.00	0.00	0.01
Feb	10.45	0.00	0.00	0.00	0.55	0.00
Mar	8.30	0.00	0.00	0.00	0.00	0.00
Apr	7.63	0.00	0.00	0.00	0.00	0.00
May	1.02	0.00	0.00	0.02	0.00	0.00
Jun	1.17	0.00	0.00	0.00	0.00	0.00
Jul	0.47	0.00	0.00	0.00	1.88	0.00
Aug	0.17	0.00	0.00	0.00	0.00	0.00
Sep	5.36	0.00	0.80	0.00	0.00	0.00
Oct	24.80	0.00	0.00	0.00	0.00	0.00
Nov	10.89	0.01	0.00	0.00	0.00	0.00
Dec	19.47	0.00	0.00	0.00	13.69	0.00

Table 3. Mean crop damage by crop pest (monk=monkey, live = livestock), differentiated between above ground crops (measured by individual crop item) and below ground crops (measured in acres).

	Monk Above	Monk Below	Pig Above	Pig Below	Live Above	Live Below
Jan	123.24	0.00	0.00	0.00	0.00	0.04
Feb	65.76	0.02	0.00	0.02	4.38	0.00
Mar	43.10	0.00	0.00	0.00	0.00	0.00
Apr	28.36	0.04	0.00	0.01	0.00	0.00
May	3.62	0.00	0.00	0.10	0.00	0.00
Jun	7.55	0.00	0.00	0.00	0.00	0.00
Jul	3.75	0.00	0.00	0.00	15.00	0.00
Aug	1.38	0.00	0.00	0.00	0.00	0.00
Sep	20.83	0.04	6.25	0.01	0.00	0.00
Oct	99.85	0.00	0.00	0.03	0.00	0.00
Nov	39.87	0.03	0.00	0.01	0.00	0.00
Dec	68.86	0.01	0.00	0.00	109.50	0.00

Table 4. Standard deviation in crop damage by crop pest (monk=monkey, live = livestock), differentiated between above ground crops (measured by individual crop item) and below ground crops (measured in acres).

Damage was monitored on a total of 699 grid cells nested within the 64 farms. Of these 699 cells, 125 were affected by crop damage by monkeys at some point during the year (18%). Damage in cells did not occur evenly across months. Figure 7 shows the decline in the number of cells affected by crop damage during the mango season (from May-August).

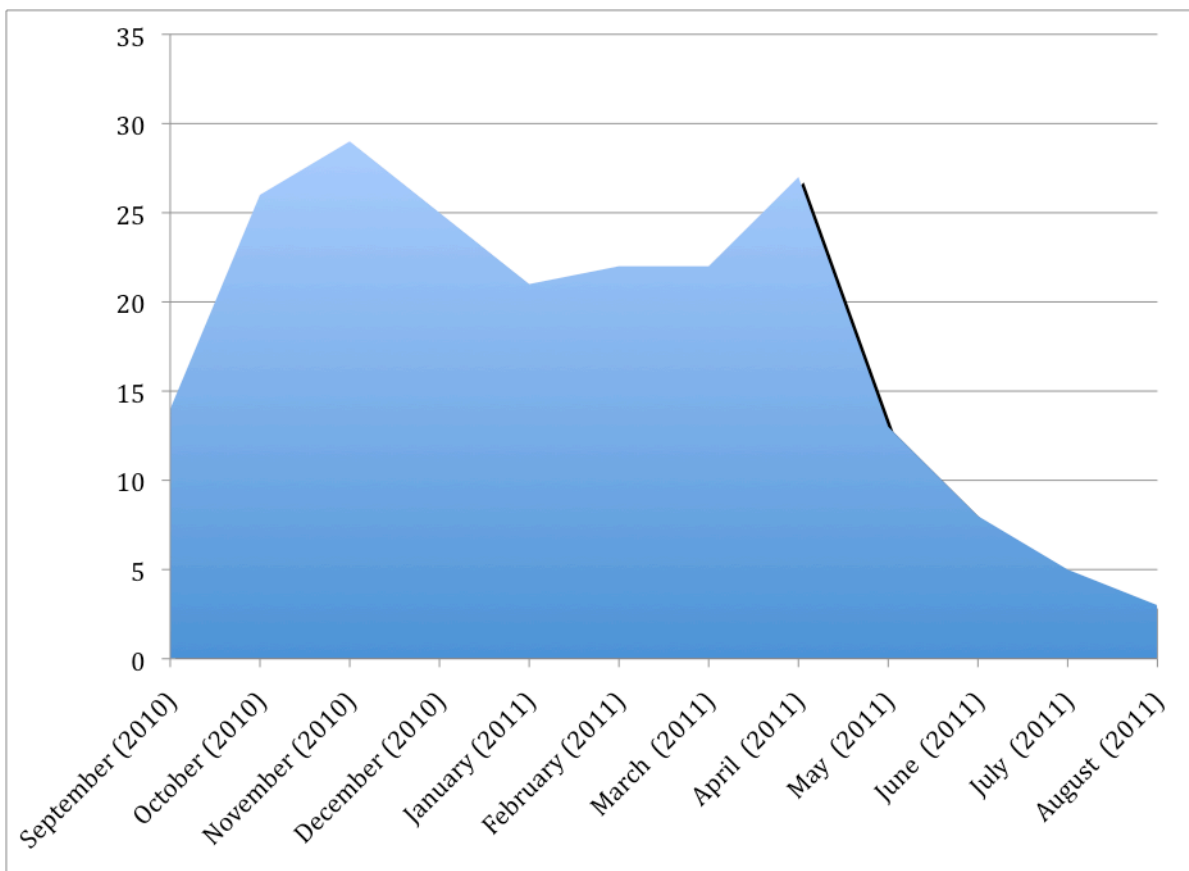


Figure 7. Number of grid cells affected by monkey crop damage during the twelve-month study period.

Crop preference results are in Table 5. Fruit was the most preferred crop, followed by squash, eggplant, cucumber, corn, watermelon, okra, pumpkin, sweet pepper, tomato, peanut, cabbage, fig and sweet potato. Crops with only one incident were placed

low on the scale regardless of their observed/expected ratio, with the exception of fruit, because sweet fruits were combined into one category. The “value assigned” column explains how the values were assigned to crops based on their observed/expected ratios. These are the values that were assigned to individual grid cells each month. To reiterate, all 699 grid cells were assigned a separate value each month, based on the presence of the most preferred crop. So, if, in January, a grid cell contained corn, green pepper and squash, it was assigned a “9” for the month of January.

<u>Crop</u>	<u>Incidents</u>	<u>Crop</u>	<u>Obs/Exp</u>	<u>Value assigned</u>
Pumpkin	22	Pink Grapefruit	12158.63	10
Watermelon	16	Orange	1728.2	10
Tomato	16	Soursap	1035.1	10
Peanut	15	Atney	270.5	10
Okra	14	Papaya	116.19	10
Eggplant	12	Passion Fruit	113.03	10
Sweet Pepper	11	Squash	70.6	9
Cucumber	11	Eggplant	64.09	9
Sweet Potato	8	Cucumber	48.03	8
Cabbage	8	Corn	26.78	7
Squash	6	Watermelon	13.56	6
Fig	6	Okra	9.17	5
Corn	4	Pumpkin	8.54	5
Sea. Pepper	2	Sweet Pepper	7.19	4
Passion Fruit	2	Tomato	4.48	4
Papaya	2	Peanut	2.59	3
Pink Grapefruit	2	Cabbage	2.53	3
Onion	2	Fig	2.26	2
Atney	2	Sweet Potato	1.79	2
Dasheen/Eddo/Tannia	1	YAM		1
Zucchini	1	NONI		1
Yam	1	SEA. PEPPER		1
Soursap	1	ONION		1
Orange	1	DASHEEN/EDDO/TANNIA		1
Noni	1	ZUCCHINI		1
Lime	1	LIME		1
		NO PREFERRED		0

Table 5. Crop preference data.

Predicting the Likelihood and Severity of Crop Damage Dan Sewell from the Illinois Statistics Office generated the predictive models presented below using the program R (R Development Core Team, 2008). To review: randomly selected farms were partitioned into cells and then used to obtain measurements of crop damage, and the following nine variables were measured regarding these cells: distance to water source (water), distance to nearest road (road), distance to forest (forest), most preferred crop in cell (pref), number of months with crops planted in the non-mango season (months of September to April) (moSA), number of months with crops planted in the mango season (months of May to August) (moMA), and whether the measurement was taken during the mango season (mango). These are Level 1 variables, specific to each grid cell. For each farm, the number of neighboring farms (neighbors) and the guarding behavior (guarding) was measured. These are Level 2 variables, specific to the farm in its entirety and thus the same for all grid cells within the farm.

Stage 1: predicting the likelihood of damage For this model, a binary dependent variable (DV) (presence or absence of damage) was necessary because a large number of grid cells did not receive damage. Therefore, there were too many zeros to treat the DV as continuous. A binomial hierarchical generalized linear model (HGLM) with a logit link was used. The model was fit with the h-likelihood method (Lee and Nelder, 1996; Ronnegard et al., 2010). That is, whether a farm cell incurs damage follows a Bernoulli distribution, with a probability p of incurring damage, and probability $1-p$ of not incurring damage. This probability is certainly a function of some or all of the variables mentioned above. The notation here will be as follows:

$$y_{ij} = \begin{cases} 1 & \text{if } i^{\text{th}} \text{ cell of the } j^{\text{th}} \text{ farm is damaged} \\ 0 & \text{otherwise} \end{cases}$$

X_{ij} is the vector of independent variables for the i^{th} cell of the j^{th} farm.

The model considers that the way each of the nine variables (water to mango) affect the probability of damage varies by farm. This means that in the model, the intercept and slopes of the seven Level 1 variables will vary to some degree based on the farm. How these variables vary by farm is dependent on the two Level 2 variables (the number of neighbors the farm has (neighbors) and how much time the farmer spends guarding the farm (guarding)). Additionally, the interaction between each Level 1 IV and mango is included to test whether the variables that predict crop damage vary seasonally. This information results in the following model (model 1):

$$\begin{aligned} \text{logit}(\mathbb{P}(y_{ij} = 1)) &= \beta_{0j} + \beta_{1j}^{\text{water}} + \beta_{2j}^{\text{road}} + \beta_{3j}^{\text{forest}} + \beta_{4j}^{\text{cropPref}} + \beta_{5j}^{\text{moSA}} + \beta_{6j}^{\text{moMA}} + \beta_{7j}^{\text{mango}} \\ &+ \beta_{8j}^{\text{mango:water}} + \beta_{9j}^{\text{mango:road}} + \beta_{10j}^{\text{mango:forest}} + \beta_{11j}^{\text{mango:cropPref}} + \beta_{12j}^{\text{mango:moSA}} \\ &+ \beta_{13j}^{\text{mango:moMA}} \end{aligned}$$

$$\beta_{pj} = \gamma_{p0} + \gamma_{p1}^{\text{neighbors}} + \gamma_{p2}^{\text{guarding}} + r_{pj} \quad \text{for } p = 0, 1, 2, \dots, 13$$

$$\text{where } r_{pj} \sim N(0, \tau_p^2)$$

The numerical fitting of this model is impeded by variance components (τ_p^2) being many orders of magnitude apart. In fact, the model estimates that τ_1^2 (the variance component for water) and τ_3^2 (the variance component for road) were 1,000 and 100,000 times (respectively) smaller than any other variance component, and the iterative numerical model fitting method would not converge when trying to estimate τ_2^2 (the variance component for forest) nor with any of the variance components associated with the higher order mango interaction terms. Therefore, these variances were henceforward assumed to be zero. The resulting model (the full model) can be written as:

$$\begin{aligned}
& \text{logit}(\mathbb{P}(y_{ij} = 1)) \\
& = \gamma_{00} + \gamma_{01}^{\text{neighbors}} + \gamma_{02}^{\text{guarding}} + \gamma_{10}^{\text{water}} + \gamma_{11}^{\text{neighbors:water}} + \gamma_{12}^{\text{guarding:water}} + \gamma_{20}^{\text{road}} \\
& + \gamma_{21}^{\text{neighbors:road}} + \gamma_{22}^{\text{guarding:road}} + \gamma_{30}^{\text{forest}} + \gamma_{31}^{\text{neighbors:forest}} + \gamma_{32}^{\text{guarding:forest}} + \gamma_{40}^{\text{cropPref}} \\
& + \gamma_{41}^{\text{neighbors:cropPref}} + \gamma_{42}^{\text{guarding:cropPref}} + \gamma_{50}^{\text{mo5A}} + \gamma_{51}^{\text{neighbors:mo5A}} + \gamma_{52}^{\text{guarding:mo5A}} \\
& + \gamma_{60}^{\text{moMA}} + \gamma_{61}^{\text{neighbors:moMA}} + \gamma_{62}^{\text{guarding:moMA}} + \gamma_{70}^{\text{mango}} + \gamma_{71}^{\text{neighbors:mango}} \\
& + \gamma_{72}^{\text{guarding:mango}} + \gamma_{80}^{\text{mango:water}} + \gamma_{81}^{\text{neighbors:mango:water}} + \gamma_{82}^{\text{guarding:mango:water}} \\
& + \gamma_{90}^{\text{mango:road}} + \gamma_{91}^{\text{neighbors:mango:road}} + \gamma_{92}^{\text{guarding:mango:road}} + \gamma_{10,0}^{\text{mango:forest}} \\
& + \gamma_{10,1}^{\text{neighbors:mango:forest}} + \gamma_{10,2}^{\text{guarding:mango:forest}} + \gamma_{11,0}^{\text{mango:cropPref}} \\
& + \gamma_{11,1}^{\text{neighbors:mango:cropPref}} + \gamma_{11,2}^{\text{guarding:mango:cropPref}} + \gamma_{12,0}^{\text{mango:mo5A}} \\
& + \gamma_{12,1}^{\text{neighbors:mango:mo5A}} + \gamma_{12,2}^{\text{guarding:mango:mo5A}} + \gamma_{13,0}^{\text{mango:moMA}} + \gamma_{13,1}^{\text{neighbors:mango:moMA}} \\
& + \gamma_{13,2}^{\text{guarding:mango:moMA}} + r_{0j} + r_{4j}^{\text{cropPref}} + r_{5j}^{\text{mo5A}} + r_{6j}^{\text{moMA}} + r_{7j}^{\text{mango}}
\end{aligned}$$

Variable selection Many of the variables turned out to be insignificant when fitting the full model. In other words, not all of the independent variables were helpful in describing the varying probabilities of the farm cells to incurring crop damage. It is not desirable to overfit the model, yet this must be balanced with maintaining a model that adequately describes the response variable. In order to determine those that are most helpful, variable selection over the fixed effects was conducted via backward selection and “p-to-remove” for both models, eliminating the least significant independent variable at each step until every term was significant or was incorporated into an interaction effect which was significant (at the 0.1 significance level).

When the decision was made to remove a variable from the models, the variance component corresponding to that variable was noted (τ_p^2). If that variance was less than $1/100^{\text{th}}$ of the largest variance component, it was also removed. Note that a variable’s interactions with guarding and neighbors and even the variable itself could be removed from the fixed effects, but the model still may include a random component with mean zero corresponding to that variable (the r_{pj} s).

Results There is no colinearity between any of the independent variables

(all VIFs were under 1.24). The variable selection results in the reduced model:

$$\begin{aligned} \text{logit}(\mathbb{P}(y_{ij} = 1)) &= \gamma_{00} + \gamma_{01}^{\text{neighbors}} + \gamma_{02}^{\text{guarding}} + \gamma_{10}^{\text{water}} + \gamma_{12}^{\text{guarding:water}} + \gamma_{30}^{\text{forest}} + \gamma_{31}^{\text{neighbors:forest}} \\ &+ \gamma_{32}^{\text{guarding:forest}} + \gamma_{40}^{\text{cropPref}} + \gamma_{50}^{\text{moSA}} + \gamma_{60}^{\text{moMA}} + \gamma_{61}^{\text{neighbors:moMA}} + \gamma_{70}^{\text{mango}} \\ &+ \gamma_{71}^{\text{neighbors:mango}} + \gamma_{72}^{\text{guarding:mango}} + \gamma_{10,0}^{\text{mango:forest}} + \gamma_{10,1}^{\text{neighbors:mango:forest}} \\ &+ \gamma_{10,2}^{\text{guarding:mango:forest}} + \gamma_{12,0}^{\text{mango:moSA}} + \gamma_{13,1}^{\text{neighbors:mango:moMA}} + r_{0j} + r_{4j}^{\text{cropPref}} \\ &+ r_{5j}^{\text{moSA}} + r_{6j}^{\text{moMA}} + r_{7j}^{\text{mango}} \end{aligned}$$

Tables 6-9 below show the estimated fixed and random effects from the full and reduced models.

	Estimate	Std. Error	t-value	Pr(> t)
(Intercept)	-0.62348	1.45321	-0.42904	0.667911
neighbors	-0.1152	0.503084	-0.22898	0.81889
guarding	-0.95288	0.357812	-2.66307	0.007764
water	-0.00737	0.004289	-1.71886	0.08569
road	-0.01081	0.011417	-0.94674	0.343807
forest	-0.00106	0.001023	-1.03329	0.301511
pref	0.178012	0.119849	1.485306	0.137515
moSA	0.038027	0.199933	0.190201	0.849158
moMA	-0.30736	0.258192	-1.19044	0.233919
mango	1.705235	3.779204	0.451216	0.65185
m:w	-0.01418	0.014944	-0.94892	0.342697
m:r	0.019624	0.028375	0.691606	0.489212
m:f	-0.00888	0.00414	-2.14439	0.032042
m:p	0.215569	0.330174	0.652893	0.51385
m:moSA	-0.26016	0.425998	-0.61071	0.541413
m:moMA	0.763686	1.06549	0.716746	0.473558
neighbors:water	-0.00162	0.001355	-1.19457	0.232302
guarding:water	0.00119	0.000514	2.315784	0.020603
neighbors:road	-0.00161	0.003459	-0.4648	0.642093
guarding:road	0.00211	0.001951	1.081485	0.279525
neighbors:forest	-0.00036	0.000299	-1.18938	0.234337
guarding:forest	0.00019	0.0002	0.950584	0.341854
neighbors:pref	0.020886	0.033654	0.620628	0.534868

guarding:pref	0.004342	0.019654	0.22094	0.825147
neighbors:moSA	-0.01777	0.0744	-0.23883	0.811248
guarding:moSA	0.062409	0.047138	1.323953	0.185569
neighbors:moMA	0.063195	0.092658	0.682022	0.495251
guarding:moMA	0.029748	0.043262	0.687633	0.49171
neighbors:mango	1.320714	1.175549	1.123488	0.261275
guarding:mango	-0.43315	0.840127	-0.51558	0.606165
neighbors:m:w	0.001502	0.004292	0.349868	0.72645
guarding:m:w	0.001027	0.002485	0.413258	0.679432
neighbors:m:r	-0.00438	0.008702	-0.5031	0.614914
guarding:m:r	-0.00035	0.005721	-0.0607	0.951602
neighbors:m:f	0.002133	0.000886	2.407767	0.01608
guarding:m:f	0.001093	0.000492	2.222996	0.026253
neighbors:m:p	-0.0707	0.104565	-0.67612	0.498991
guarding:m:p	-0.01517	0.053303	-0.28456	0.775987
neighbors:m:moSA	-0.02021	0.131137	-0.15412	0.877516
guarding:m:moSA	-0.00578	0.093699	-0.06169	0.950813
neighbors:m:moMA	-0.62232	0.300502	-2.07094	0.038407
guarding:m:moMA	-0.06038	0.231552	-0.26074	0.794298

Table 6. Fixed effects for the full model, including all possible two- and three-way interactions.

Intercept	0.026706
pref	0.017042
moSA	0.017629
moMA	0.021803
mango	0.250038

Table 7. Variance components for the full model.

	Estimate	Std. Error	t-value	Pr(> t)
(Intercept)	-1.82121	0.965972	-1.88537	0.059428
neighbors	-0.34249	0.330821	-1.03527	0.300584
guarding	-0.30919	0.16638	-1.85836	0.063166
water	-0.01044	0.003454	-3.02321	0.002512
forest	-0.00051	0.000976	-0.51891	0.603843
pref	0.236908	0.039999	5.922876	3.34E-09
moMA	-0.11063	0.135747	-0.815	0.415107
mango	3.02136	2.036042	1.483938	0.137877
m:f	-0.01021	0.003498	-2.91843	0.003531
m:moMA	0.253601	0.473334	0.535775	0.592134

guarding:water	0.001312	0.000496	2.6437	0.008222
neighbors:forest	-0.00052	0.000271	-1.91577	0.055441
guarding:forest	0.000128	0.000193	0.662993	0.507361
neighbors:moMA	0.110221	0.080546	1.368428	0.171229
neighbors:mango	0.952392	0.930574	1.023446	0.306138
guarding:mango	-0.80812	0.228487	-3.53685	0.000408
neighbors:m:f	0.002153	0.0007	3.075117	0.002114
guarding:m:f	0.001291	0.000423	3.054211	0.002266
neighbors:m:moMA	-0.67392	0.251163	-2.68322	0.007312

Table 8. Fixed effects for the reduced model. Variables with p values greater than 0.10 are included because they are significant (at $p < 0.10$) in an interaction.

Intercept	0.021517
pref	0.012892
moSA	0.021508
moMA	0.019873
mango	0.19302

Table 9. Variance components for the reduced model.

Due to the large number of interaction terms in both the full model and the reduced models, there are no obvious interpretations that come from the fixed effects. In the reduced model, all of the original variables are important except “distance to road” and “number of months with crops planted in the non-mango season.” The variance components from both the full and reduced models show that how mango season affects the probability of a farm receiving damage varies more than how the other variables affect the probability of receiving damage.

Making predictions We wish to see how well the model fits the data, and also to see how well the model predicts new data. The model fit was evaluated by using the area under the curve (AUC) for a receiver operating characteristic (ROC) curve. Figure 8 shows the ROC curve for the full model and Figure 9 shows the ROC curve for the

reduced model.

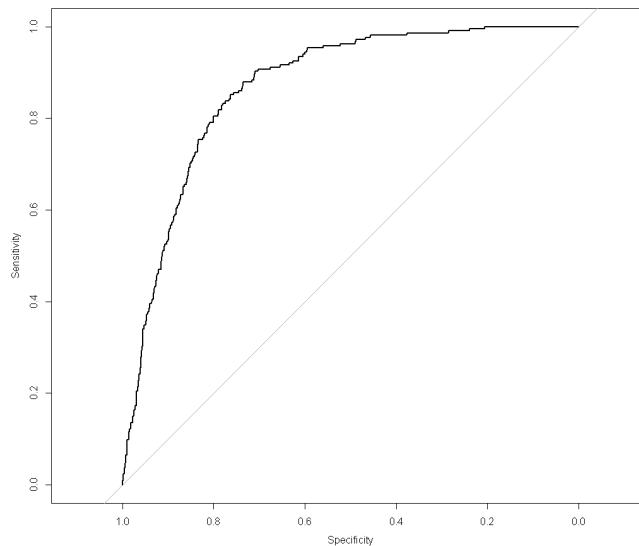


Figure 8. ROC curve for the full model.

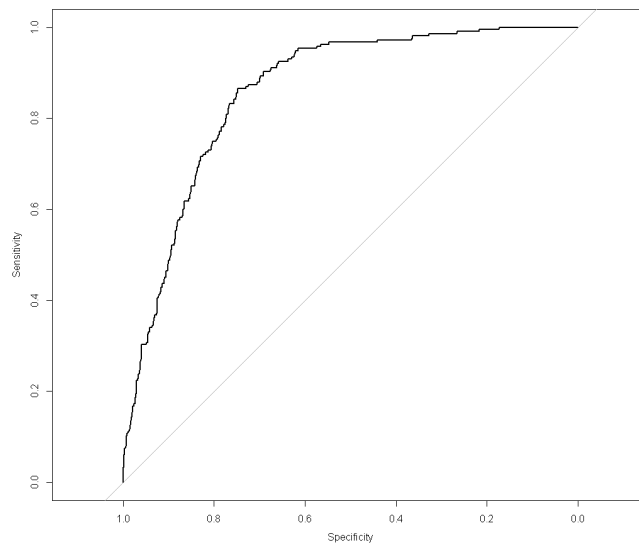


Figure 9. ROC curve for the reduced model.

The AUC for the full and reduced model was 0.8678 and 0.8583 respectively. The fuller model, simply by having more variables, is going to fit the data better, so it is expected that the AUC for the full model is higher. What is interesting is that a 95% bootstrap confidence interval for the full and reduced model is (0.8483, 0.8877) and (0.8365,

0.8772) respectively. So the confidence intervals for the AUC contain the other model's AUC (i.e. they are not significantly different).

ROC curves can be used to determine cutoff values for prediction. That is, the model, whether full or reduced, gives only probabilities that damage will be incurred. Beyond this, one needs a cutoff point to say that if the predicted probability is above X, damage is predicted, and if it is below X, no damage is predicted. To do this, the closest top left criteria was considered (Perkins and Schisterman, 2006), using a cost of 15. This means that the financial cost of predicting no damage and actually getting damage is 15 times more than the cost of predicting damage and actually not getting damage. The value of 15 gives a good balance between sensitivity and specificity and is sufficiently high to reflect the difference in importance of the two types of misclassifications. The resulting cutoff values are 0.0323 and 0.0269 for the full and reduced models respectively.

The prediction was evaluated by using "leave one out crossvalidation" (LOOCV) on 100% of the data and computing the mean square error (MSE), then tabulating the predictions with the factual data. This is the process where, one by one, each observation is omitted from the model fitting and then that fitted model is used to predict the value for the omitted observation. By the end of the process there is an estimate for each observation based on a model fitted without that observation. This is very important because a model can easily overfit the data and seem to be much better than it actually is. So in a sense crossvalidation is like seeing how the model does with brand new data. The MSE from the LOOCV given as $\frac{1}{n} \sum_{i=1}^n (y_i - \text{Prob}(y_i = 1))^2$ was very similar for the full and reduced model, but the reduced gave a smaller value. They were 0.03184 and

0.03174 for full and reduced models respectively. Using the cutoff values from the ROC closest top left criteria described above, Tables 10 and 11 were obtained (again using the cross-validated predictions):

<i>Full Model</i>	True is 0	True is 1
Predicted is 0	4595	47
Predicted is 1	1305	168

Table 10. Predicted/Actual table for full model.

<i>Reduced Model</i>	True is 0	True is 1
Predicted is 0	4517	43
Predicted is 1	1383	172

Table 11. Predicted/Actual table for reduced model.

This gives a sensitivity(specificity) of 0.7788(0.7814) and 0.7656(0.8000) for the full and reduced models respectively.

A script usable in R or Excel has been created which allows one to input the values of all of the necessary variables (those in the fixed effects table) and generate both the probability that damage will occur, and, using the cutoff values from the ROC closest top criteria, whether damage is predicted (YES) or not (NO) (See Appendix A).

Stage 2: predicting the severity of damage Here, the dataset was narrowed down to only the grid cells that received damage. This makes it possible to use the detailed information on the percentage of crop damage in each grid cell and ask the question: of the cells that are predicted to receive damage, what environmental variables predict the severity of that damage? The predictive variables are the same as in Stage 1, but here, the DV is continuous. This results in the following full model (conditional on damage occurring, i.e. predicting “yes” in the previous stage):

$$\begin{aligned}
y_{ij}^{\text{damage}} = & \beta_{0j} + \beta_{1j}^{\text{water}} + \beta_{2j}^{\text{road}} + \beta_{3j}^{\text{forest}} + \beta_{4j}^{\text{cropPref}} + \beta_{5j}^{\text{noSA}} + \beta_{6j}^{\text{noMA}} + \beta_{7j}^{\text{mango}} \\
& + \beta_{8j}^{\text{mango:water}} + \beta_{9j}^{\text{mango:road}} + \beta_{10j}^{\text{mango:forest}} + \beta_{11j}^{\text{mango:cropPref}} + \beta_{12j}^{\text{mango:noSA}} \\
& + \beta_{13j}^{\text{mango:noMA}} + \varepsilon_{ij}
\end{aligned}$$

$$\beta_{pj} = \gamma_{p0} + \gamma_{p1}^{\text{neighbors}} + \gamma_{p2}^{\text{guarding}} + r_{pj} \quad \text{for } p = 0, 1, 2, \dots, 13$$

$$\text{where } r_{pj} \sim N(0, \tau_p^2) \text{ and } \varepsilon_{ij} \sim N(0, \sigma^2)$$

However, the design matrix for the fixed effects is linear dependent in this case, and so the fullest model possible is:

$$\begin{aligned}
y_{ij}^{\text{damage}} = & \beta_{0j} + \beta_{1j}^{\text{water}} + \beta_{2j}^{\text{road}} + \beta_{3j}^{\text{forest}} + \beta_{4j}^{\text{cropPref}} + \beta_{5j}^{\text{noSA}} + \beta_{6j}^{\text{noMA}} + \beta_{7j}^{\text{mango}} \\
& + \beta_{8j}^{\text{mango:water}} + \beta_{9j}^{\text{mango:road}} + \beta_{10j}^{\text{mango:forest}} + \beta_{11j}^{\text{mango:cropPref}} + \beta_{12j}^{\text{mango:noSA}} \\
& + \beta_{13j}^{\text{mango:noMA}} + \varepsilon_{ij}
\end{aligned}$$

$$\beta_{pj} = \gamma_{p0} + \gamma_{p1}^{\text{neighbors}} + \gamma_{p2}^{\text{guarding}} + r_{pj} \quad \text{for } p = 0, 1, 2, \dots, 8$$

$$\beta_{pj} = \gamma_{p0} + \gamma_{p2}^{\text{guarding}} + r_{pj} \quad \text{for } p = 9, 10, \dots, 13$$

$$\text{where } r_{pj} \sim N(0, \tau_p^2) \text{ and } \varepsilon_{ij} \sim N(0, \sigma^2)$$

One of the underlying assumptions when a hierarchical linear model is used is that the data follow a normal distribution, and some or all (as specified by the particular model) of the coefficients follow a normal distribution. So the residuals (ε_{ij} 's) are expected to be normal with constant variance. Figure 10 below gives the normal Quantile-Quantile (Q-Q) plot and the plot of the residuals vs. fitted values, where the top row of the figure corresponds to the full model with damage as the response variable. Clearly the two assumptions on the residuals are not met. However, performing a box-cox transformation on the response leads to better meeting the normality assumption. The best transformation is:

$$y_{ij} = \frac{(x_{ij})^{0.268} - 1}{0.268}$$

where x_{ij} is the original proportion of damaged crops. The bottom row of the figure corresponds to the full model with the box-cox transform of the damage as the response variable. Clearly the Q-Q plot for the transformed response shows that the normal assumption has been met, and the plot of residuals vs. fitted values illustrates that the assumption of constant variance is also being met.

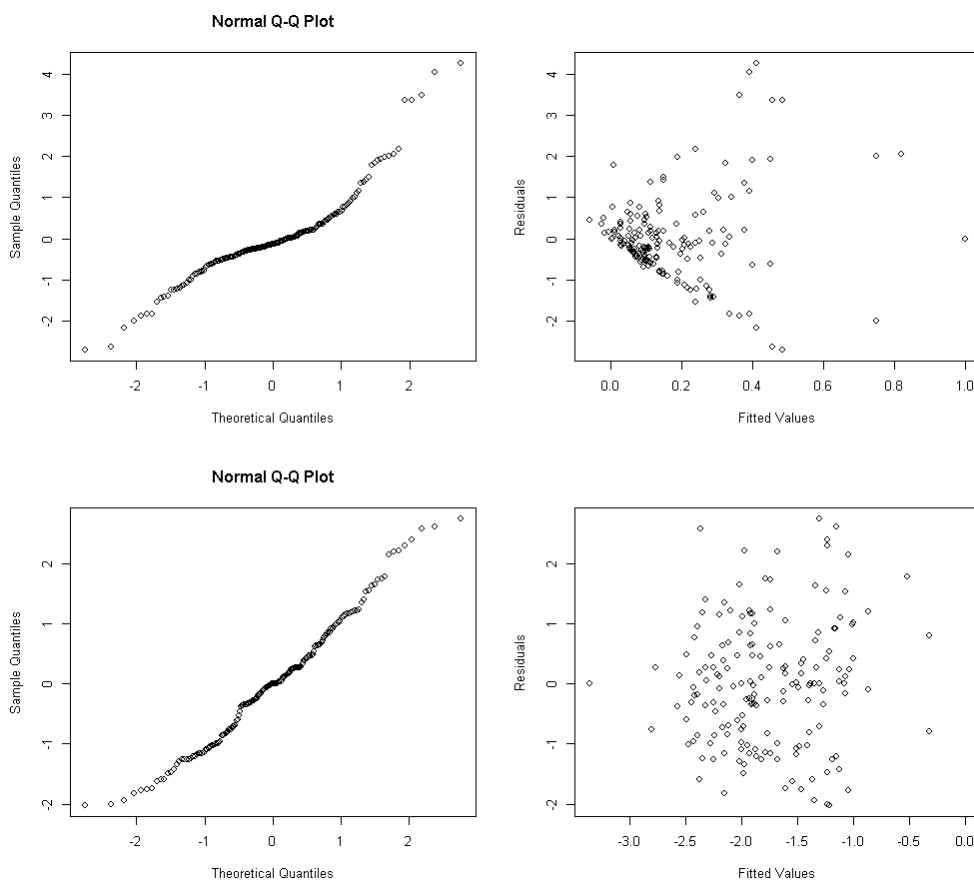


Figure 10. The normal Quantile-Quantile (Q-Q) plot and the plot of the residuals vs. fitted values (top row untransformed data, bottom row transformed data).

Figure 11 below is a plot of the transforming function:

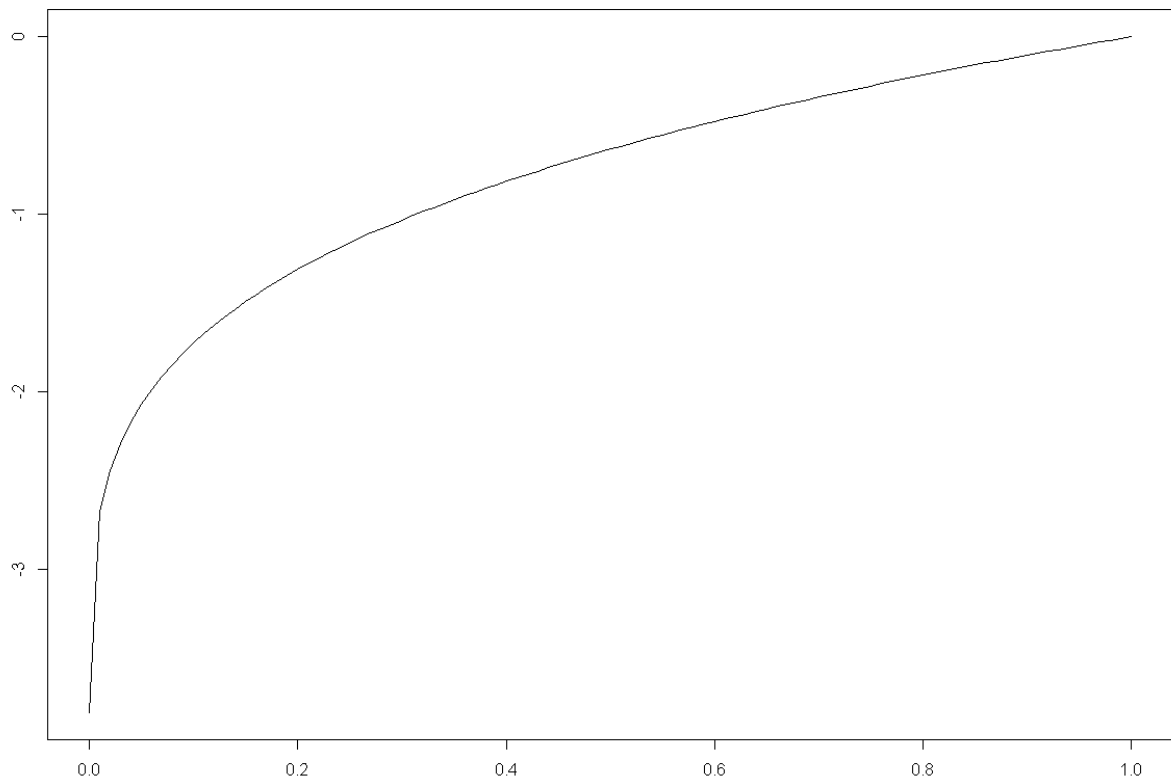


Figure 11. Box-cox transforming function.

Variable selection As in stage 1, many of the variables turned out to be insignificant when fitting the full model. In other words, not all of the independent variables were helpful in describing the severity of crop damage. It is not desirable to overfit the models yet this must be balanced with maintaining a model that adequately describes the response variable. In order to determine those that are most helpful, variable selection over the fixed effects was conducted via backward selection and “p-to-remove” for both models, eliminating the least significant independent variable at each

step until every term was significant or was incorporated into an interaction effect which was significant (at the 0.1 significance level).

When the decision was made to remove a variable from the models, the variance component corresponding to that variable was noted (τ_p^2). If that variance was less than $1/100^{\text{th}}$ of the largest variance component, it was also removed. Note that a variable's interactions with guarding and neighbors and even the variable itself could be removed from the fixed effects, but the model still may include a random component with mean zero corresponding to that variable (the r_{pj} 's).

Results Again, there is no colinearity between any of the independent variables. To check for the effect of spatial correlation, the correlation between two matrices, one on the distance between grid cells and one on the distance between residuals, was computed, yielding a value of -0.02, indicating no positive spatial correlation between the residuals. The final reduced model is:

$$\begin{aligned}
 y_{ij} | \text{damage} &= \gamma_{0,0} + \gamma_{4,0} \text{cropPref} + \gamma_{5,0} \text{moSA} + \gamma_{7,0} \text{mango} + \gamma_{11,0} \text{mango: cropPref} \\
 &+ \gamma_{12,0} \text{mango: moSA} + r_{0j} + r_{(1j)} \text{water} + r_{2j} \text{road} + r_{3j} \text{forest} + r_{4j} \text{cropPref} \\
 &+ r_{5j} \text{moSA} + r_{6j} \text{moMA} + r_{7j} \text{mango} + r_{8j} \text{mango: water} + r_{9j} \text{mango: road} \\
 &+ r_{10j} \text{mango: forest} + r_{11j} \text{mango: cropPref} + r_{12j} \text{mango: moSA} \\
 &+ r_{13j} \text{mango: moMA} + \epsilon_{ij}
 \end{aligned}$$

Tables 12-15 show the fixed and random effects for the full and reduced models.

Fixed Effect	Estimate	Std. Error	t-value	Pr(> t)
(Intercept)	-2.10181	1.388139	-1.51412	0.13256
neighbors	-0.70025	0.511842	-1.3681	0.173775
guarding	0.388383	0.366736	1.059026	0.291663
water	0.006541	0.005654	1.156741	0.24962
road	-0.00368	0.010114	-0.36432	0.716244
forest	-0.00113	0.000894	-1.26208	0.209309
pref	-0.17183	0.105164	-1.63391	0.104834

moSA	0.34875	0.196166	1.777827	0.077903
moMA	-0.26726	0.295078	-0.90573	0.366851
mango	1218.89	1302.597	0.935738	0.351242
m:w	0.030998	0.031286	0.990795	0.323731
m:r	-0.26171	0.288099	-0.9084	0.365445
m:f	0.160679	0.164145	0.978885	0.329558
m:p	253.3957	261.9339	0.967403	0.335241
m:moSA	657.8804	697.3431	0.94341	0.347321
m:moMA	-2198.09	2316.182	-0.94902	0.344474
neighbors:water	0.001352	0.001884	0.717731	0.474284
guarding:water	-0.00108	0.000896	-1.20204	0.231657
neighbors:road	0.004752	0.003429	1.385879	0.168291
guarding:road	-0.00031	0.001851	-0.16774	0.86706
neighbors:forest	2.17E-05	0.000361	0.060203	0.952092
guarding:forest	0.000147	0.000178	0.825844	0.410491
neighbors:pref	-0.0061	0.027047	-0.22536	0.822072
guarding:pref	0.034979	0.018089	1.933772	0.055438
neighbors:moSA	-0.02491	0.069465	-0.35861	0.720503
guarding:moSA	-0.09337	0.048525	-1.92413	0.056649
neighbors:moMA	0.148311	0.073521	2.017277	0.045843
guarding:moMA	0.032084	0.04243	0.756159	0.451
neighbors:mango	208.8024	220.1464	0.948471	0.34475
guarding:mango	-305.23	325.4643	-0.93783	0.350169
neighbors:m:w	-0.05394	0.062103	-0.86853	0.386793
guarding:m:w	-0.00621	0.008651	-0.71731	0.474546
guarding:m:r	0.06564	0.068871	0.953082	0.342418
guarding:m:f	-0.04173	0.042781	-0.97542	0.331267
guarding:m:p	-63.2907	65.51051	-0.96611	0.335882
guarding:m:moSA	-164.503	174.3071	-0.94375	0.347145
guarding:m:moMA	549.5646	579.0155	0.949136	0.344413

Table 12. Fixed effects for the full model, including all possible two- and three-way interactions.

Variance Component	Estimate
Intercept	0.000712
water	5.47E-06
road	5.28E-06
forest	1.71E-07
pref	0.003081
moSA	0.000245

moMA	0.001517
mango	0.002285
m:w	1.99E-05
m:r	6.31E-05
m:f	2.19E-05
m:p	0.000383
m:moSA	0.000491
m:moMA	0.000901

Table 13. The random effects' variance components for the full model.

Fixed Effect	Estimate	Std. Error	t-value	Pr(> t)
(Intercept)	-1.5279	0.379762	-4.0233	9.18E-05
pref	0.020159	0.026886	0.749775	0.454597
moSA	-0.05465	0.051757	-1.05585	0.292779
mango	-0.25444	0.907762	-0.2803	0.779647
m:p	0.36539	0.180259	2.027032	0.044479
m:moSA	-0.42587	0.160634	-2.65115	0.008907

Table 14. The fixed effects for the reduced model. Variables with p values greater than 0.10 are included because they are significant (at $p < 0.10$) in an interaction.

Variance Component	Estimate
Intercept	0.000559
water	9.55E-07
road	1.99E-06
forest	9.49E-08
pref	0.002109
moSA	0.000416
moMA	0.002646
mango	0.001716
m:w	3.66E-06
m:r	3.05E-06
m:f	1.68E-06
m:p	9.83E-05
m:moSA	0.00011
m:moMA	0.000263

Table 15. The random effects' variance components for the reduced model.

The question of whether to use the full or reduced model was again answered by using leave-one-out crossvalidation. As a measure of how well the model fits, the sum of squared differences between the true observation and the crossvalidation estimate, i.e.

$$\sum_{i,j} (y_{ij} - \hat{y}_{ij})^2$$

is computed for both the full and reduced models. The values for the full and reduced models respectively are 133.9 and 86.71. Clearly the reduced model is much better at predicting the extent of damage incurred by monkeys.

The following are certain interpretations that can be gleaned from the reduced model. During the non-mango season, both crop preference (pref) and the number of months with crops planted during the non-mango season (moSA) have a statistically significant effect, and that effect is amplified during the mango season. So higher crop preference leads to more damage, especially during the mango season. Similarly, having crops planted during more months of the non-mango season leads to a decrease in damage, especially in the mango season. The effect of mango season is slightly more difficult to interpret since it is confounded in the two interaction terms, but one can look at the actual numbers and see a table like the following:

<u>moSA</u>	<u>pref</u>
2	<= 3
3	<= 4
4	<= 5
5	<= 6
6	<= 7
7	<= 8
8	Anything

This table, derived from the model output, gives the following scenarios where a farm

will receive less damage during the mango season. It can be read by looking at a particular value for number of months, and then looking at what values of crop preference will still lead to a decrease in damage during the mango season. For instance, if crops were planted for 3 months, then as long as crop preference is 4 or less than the farm will have less damage during the mango season. Likewise, if the number of months is its maximum value of 8, then any value of preference still means that the farm will have less damage during the mango season.

The variances of mango season and crop preference in the reduced model are the largest, implying that the way in which mango season affects damage on farms varies from farm to farm more so than, say, distance to the forest boundary. On average, however, the interpretations of the significant fixed effects (crop preference, number of months with crops planted in the non-mango season, and mango season) hold. A script usable in R and Excel has been created which allows one to input the values for these variables and generate the predicted severity of damage once damage has been predicted (see Appendix A).

Discussion

Human-Primate Conflict and Primate Crop Raiding The work presented here is relevant to the broader fields of human-primate conflict and primate crop raiding. HPC has become an important subfield of primatology due to the impact of anthropogenic niche construction, or the altering, building and/or destroying of niches via the mutual interaction of organisms in their environments (Odling-Smee et al., 2003;

Fuentes, 2012). Humans alter niches as a result of economic, political, and social forces, which bring about things like climate change, deforestation and the depletion of primate primary habitat (Strier, 2011; Fuentes, 2012). Human environmental alterations have led to an increase in the human-primate interface virtually everywhere that non-human primates are found, and conflict often ensues.

Most of the literature on human-primate conflict comes from studies of crop raiding, as this is a widespread and common form of conflict, which directly affects local livelihoods and is recognized as a major conservation issue (IUCN, 2005 in Priston and Underdown, 2009). One of the reasons why “the monkey problem” in St. Kitts is especially challenging is because while primates in general make especially problematic crop-raiders due to their intelligence, adaptability, and opportunistic tendencies (Lee and Priston, 2005), conflict is exacerbated in primate species with generalized diets that thrive in marginalized habitats (or “weed species” (Richard et al., 1989), such as baboons (*Papio* species), macaques (*Macaca* species) and vervet monkeys (*Chlorocebus aethiops*) (Lee and Priston, 2005).

These three species share important characteristics: they have complex social organizations, they eat highly omnivorous diets, and, while they are primarily terrestrial, they are able to utilize arboreal habitats (Else, 1991). Due to these characteristics, raiding among the cercopithecoids is incredibly widespread. Systematic studies have documented that baboon crop raiding threatens field crops in Uganda (Hill, 2000), Nigeria (Pepeh, 1996), Kenya (Maples et al., 1976; Strum, 1994; Strum, 2010), Tanzania (Mascarenhas, 1971), Cameroon (van Oosten, 2000), Malwai (Morris, 2000) and South Africa (Kansky and Gaynor, 2000; Hoffman and O’Riain, 2012). Some argue that

baboons are the most troublesome primate genus (Hill, 2005), but macaques are notable crop pests in over 14 countries (see Lee and Priston, 2005). Additionally, crop raiding behavior is observed throughout vervet monkeys' extensive range: in Sierra Leone (Mackenzie, 1952; Lowes, 1970; Robinson, 1971), Senegal (Dunbar, 1974), Ghana (Asibey, 1978), Nigeria (Howell, 1968), Cameroon (Gartlan, pers. comm. in Wolfheim, 1983), Uganda (Rowell, 1968; Saj et al., 1999a,b), Ethiopia (Dandelot and Prevost, 1972), Kenya (Lee et al., 1986; Eley and Else, 1984), Mozambique (De Boer and Baquette, 1998), Zambia (Balakrishnan and Ndhlovu, 1992), Botswana (Parry and Campbell, 1992), Zimbabwe (Jarvis and La Grange, 1984 in Long, 2003), South Africa (Hey, 1964 and Hey, 1974 in Long, 2003; Grobler and Matlala, 2002) and on the islands of Barbados (Horrocks and Baulu, 1988; Horrocks and Baulu, 1994; Boulton et al., 1996) and St. Kitts (Sade and Hildrech, 1965; Poirier, 1972; McGuire, 1974; Coppinger and McGuire, 1980).

The fields of human primate conflict and primate crop raiding are increasingly assessing the spatial nature of conflict using GIS and GPS techniques. For example, using a buffer analysis in GIS, Sprague (2006) shows that in the Boso Peninsula of Japan, forest accounts for 90% of the land area within 1km of farmland. This means that approximately 90% of the monkey habitat region is located within a one-day travel distance of farmland for a monkey troop, so monkeys can be expected to routinely come into contact with farms. GIS work by Hoffman and O'Riain (2012) reveals that access to low-lying land as a result of increasing urbanization and the mean proximity of sleeping sites to urban habitat explain high human-baboon conflict. Online proposals show that

studies using GIS techniques to study the factors influencing primate crop-raiding will continue (Priston 2008, Mulu 2010, Regmi 2012).

The methods utilized in this study to assess vervet monkey crop damage in St. Kitts are in accordance with this trend. Many spatial tools were utilized to generate the data for the predictive models presented in this chapter. For example, the boundaries and areas of farms and crops were mapped and calculated with GPS units, crop damage was localized within grid cells created in a GIS and located on the ground with GPS units, grid cell centerpoints were established using Hawth's Tools in GIS, and the distance from these centerpoints to relevant environmental features were calculated through a spatial join in GIS.

The results of the predictive models of St. Kitts vervet monkey crop-raiding behavior can be compared to previous studies of primate crop raiding worldwide (Table 16). This work confirms that distance to the forest boundary, season/alternative food availability, preventative strategies, crop type, number of neighboring farms and the amount of crops under cultivation are important variables in determining which farms receive damage from monkeys. Additionally, the models show that distance to nearby water sources is important. This variable has not been assessed in previous studies of primate crop raiding; however, Sitati et al. (2003) show that it is a significant factor with regard to elephant crop raiding. This study does not support the influence of roads on the locations of primate crop raiding.

Three factors that feature prominently in previous studies of primate crop damage were not assessed in this predictive model: human density, primate density, and troop size and characteristics of primates. Human density is not a factor in this model because

the study was conducted in agricultural areas that do not contain more than a few permanent dwellings. The impact of primate density is very important, but the approximate number of primates in St. Kitts is not known, let alone the varying densities of these animals around the island. In fact, questions on the number of monkeys inhabiting St. Kitts have been present for the duration of their existence on the island. From 1965-1980, estimates of the St. Kitts vervet population have gradually increased: Sade and Hildrech (1965) estimated 1,500; Poirier (1972) estimated 5,700; McGuire (1974) estimated 7,000 and Coppinger and McGuire (1980) estimated that there were up to 30,000 vervet monkeys on the island of St. Kitts. In 2009-2010, the St. Kitts government hired Cuban animal scientist Santos Cubillas Hernandez, who estimated the island's vervet monkey population is 15,000. To obtain this value, Hernandez estimated the area of primary forest, secondary forest and summit (mountainous) lands, the average group size in each of these lands and the average number of animals per group in each of these lands and extrapolated these values to the entire island. As his estimates are based on observations made while driving around the island which only occurred over a six month period (November 2009 – April 2010), the general consensus on the island is that this estimate is not accurate and that a systematic, scientific population estimate is needed. Finally, the impact of troops and individual primate characteristics were not assessed here because it was not possible to observe the animals directly; there are no habituated monkeys on the island. The animals are severely disliked due to their long history of crop raiding.

Study	Distance to Forest Boundary/Refuge Areas	Season/Food Availability	Preventative Strategies	Crop Type	Characteristics of Primates and Troops	Neighboring Farms	Human Density/Presence	Primate Density	Distance to Roads	Area Under Cultivation	Land Use Type	Location of Primate Sleeping Sites	Distance to Water	Duration of Crop Planting
Mohnot (1971)					Y									
Mascarenhas (1971)							Y							
Maples et al. (1976)			Y	Y	Y									
Musau and Strum (1984)		Y			Y									
Oyaro and Strum (1984)					Y									
Strum (1986)					Y					Y				
Boulton et al. (1986)					Y									
Forthman-Quick (1986)				Y										
Eise (1991)	Y													
Biquand et al. (1992)		Y												
Horrocks and Bault (1994)	Y			Y	Y									
Strum (1994)														
Newmark et al. (1994)							Y							
Naughton-Treves (1996)	Y					Y								
Naughton-Treves (1997)	Y		Y			Y								
Hill (1997)	Y	Y												
Linkie et al. (1997)	Y	Y	N											
Naughton-Treves (1998)	Y	Y	Y	Y			N							
Naughton-Treves et al. (1998)		Y						Y						
Sex and Struhsaker (1999)		Y												
Hill (2000)	Y					Y								
Saj et al. (2001)	Y			N										
Warren (2003)		Y												
Gillingham and Lee (2003)	N			Y										
Twyho et al. (2005)	Y	Y							Y					
Priston (2005)	Y			Y		Y								
Webber (2006)	Y			Y			Y							
Warren et al. (2007)	Y													
Riley (2007)		N												
Linkie et al. (2007)														
Warren et al. (2007)			Y								Y			
Hashim et al. (2009)					Y									
Priston and Underdown (2009)	Y			Y										
Nijman and Nekaris (2010)	Y													
Hoffman and O'Rain (2012)									N		Y		Y	
Dore (2013)	Y	Y	Y	Y		Y								Y

Table 16. Variables associated with primate crop damage worldwide (Y = significant relationship, N = no relationship, blank = variable not investigated).

It was not possible to directly observe the crop-raiding behavior of St. Kitts vervet monkeys or the effect of crop raiding on their behavioral patterns, but data from previous studies can be used to hypothesize about these effects. Direct observations of primate crop raiding have generated data on primate raiding styles and the primate-specific aspects of raiding events that determine crop loss. For example, a recent study by Wallace and Hill (2012) used direct observations of six crop-raiding primates (olive baboons, red-tailed monkeys, vervet monkeys, blue monkeys, chimpanzees and black and white colobus monkeys) to investigate which aspects of raiding events determine crop loss on farms in six villages along the forest/agriculture interface of Budongo Forest Reserve, Uganda. In accordance with previous direct observations of primate crop raiding by Maples et al. (1976), Crockett and Wilson (1980), Warren (2003), Priston (2005) and Hockings (2007), each species carried out hit-and-run and extended raids. The factors that determine crop raiding by primates in Wallace and Hill (2012) are the number of individuals raiding and the duration of the crop-raiding event. Therefore, the authors conclude that farmers will benefit most from deterrent techniques that discourage raiding by multiple individuals, reduce the size of raiding groups, and decrease the amount of time that primates spend on farms.

These studies show that St. Kitts vervet monkeys likely elicit multiple crop raiding strategies depending on the presence and attention of the farmer, the size and demographic composition of the raiding party, and the crop being raided. It is likely that increased vigilance on the part of the monkeys would be seen during longer raids. Finally, in addition to the environmental variables contained in the predictive model, it is

likely that the extent of crop damage seen on farms is also a product of the size of the raiding party and the length of their raid.

Numerous studies have shown that vervet monkeys change their behavior as a result of consuming human food. Generally speaking, vervet monkeys live in groups of one to seven adult males, two to ten adult females and their offspring (Cheney and Seyfarth, 1990). The mean group size is 25 and adult sex ratios are typically 1.5 females to one male (Fedigan and Fedigan, 1988). While sex ratios remain relatively constant wherever vervet monkeys are found, group size varies significantly with environmental conditions. Relatively stable dominance hierarchies characterize vervet monkey social organization; certain animals outrank others in access to food, grooming partners, mates, resting sites, etc. (Cheney et al., 1981; Whitten, 1983; McGuire et al., 1984). Vervet monkeys live within defended territories of various sizes depending on ecological circumstances, such as the food distribution and availability and the presence of neighboring groups (Struhsaker, 1967; Harrison, 1983; Chapman and Fedigan, 1984). They have male-biased dispersal and female philopatry. Work in Amboseli National Park, Kenya shows that vervet monkey males transfer to neighboring groups to which members of their own group have transferred in the past. In these groups, resident females are likely to be less aggressive and migrants are more likely to encounter brothers or peers that will make useful allies. The benefits of transferring to groups with allies may outweigh the increased risk of inbreeding by transferring with siblings (Isbell et al., 1993).

Under conditions of human food consumption, Lee et al. (1986) shows that vervet monkeys have larger groups (with higher birth rates, lower mortality and fewer seasonal

constraints in their ability to conceive) and smaller home ranges than nearby, unprovisioned groups. They spend less time feeding and moving and more time resting and socializing. Vervet monkeys in a tourist and cultivated area of Uganda also spend more time resting and less time feeding with smaller home ranges when compared to unprovisioned groups (Saj et al., 1999a,b). Higher rates of aggression are found in vervet monkey groups with access to human food, but as aggression rates rise in unprovisioned groups during times of food abundance, it seems likely that when foods of high quality are available, vervets are more motivated and energetically able to act in a more aggressive manner (Lee, 1984; Brennan et al., 1985).

Similar results are seen in baboons and macaques with access to human food. Compared to wild-feeding conspecifics, baboons with access to human food (in the form of a garbage dump) spend less time feeding and travelling. Additionally, their sleeping site and their day route revolve around human food, which is monopolized by dominant animals (Altmann and Muruthi, 1988). In Japanese macaque (*Macaca fuscata*) females, primiparous age increases, birth percentage decreases and infant mortality increases after human food is removed from their habitat (Kurita et al., 2008).

Strum (2010) views raiding as a foraging strategy. Human food has nutritional advantages to natural food (Altmann et al., 1993, Barrett and Henzi, 1997), so raiders get more energy for less effort. This added energy and time allows for more resting and socializing, which leads to faster growth and reproduction (Strum, 1991; Strum, 2010). It also means that the animals can afford to “sit and wait” until preventative strategies, like human presence, are no longer there (Strum, 2010). Since few have documented

increased risks from crop-raiding (but see Tamara et al., 1995), it is not surprising that many primates take advantage of this opportunity if it becomes available to them.

Based on these results, compared to conspecifics that live in the forest interior and do not consume agricultural crops or other human food, crop-raiding St. Kitts vervet monkeys likely live in larger groups and have smaller home ranges that revolve around human food sources (crops). They likely spend less time feeding and traveling and more time resting, socializing, and engaging in aggressive behavior. Additionally, crop-raiding vervet monkeys likely have fewer seasonal constraints in their ability to conceive, with higher birth rates and lower mortality.

Predicting Animal Raiding Behavior The predictive models generated for this study build upon previous models of primate crop-raiding behavior. Webber (2006) and Hashim et al. (2009) show that certain environmental variables can be used to effectively predict primate crop raiding, but they do not generate predictive models that have been tested and proven effective on new data. Priston and Underdown (2009) create a predictive model, but only on a selected subset of farms close to the boundary of the forest and only with a subset of predictive variables. The St. Kitts predictive model is able to assess the risk of any farm or piece of land on the island and to utilize information on every predictive variable possible.

The grid system and some of the predictive variables utilized in this study were adapted from Sitati et al. (2003). However, the grid created for the St. Kitts model was conducted at a much smaller spatial scale due to the small size of St. Kitts (68mi² compared to the 1,000km² (~621 mi²) area surveyed by Sitati et al. (2003)). In addition,

stage 1 of the predictive model generated for this thesis also had to be binary coded due to skewed distributions of the dependent variable, so both projects use testing and training sets and ROC curves to evaluate model performance. Both projects also account for effects of spatial correlation. The St. Kitts model improves on the model by Sitati et al. (2003) because using correlation pairwise doesn't take into account the other variables and using the ranks loses much of the power to determine relationships. The logistic regression done by Sitati et al. (2003) is akin to stage 1 of the St. Kitts model, but simplified since they don't account for how each variable's effect on the probability of incurring damage may vary by location. Finally, the St. Kitts predictive model goes a step further and creates a second model that can predict the severity of damage.

A number of other studies have used environmental variables to predict animal raiding behavior. Stahl et al. (2002) and Wilson et al (2005) do not create predictive models, but they investigate associations between environmental variables and risk of sheep raiding by lynx and the locations of grizzly bear conflicts, respectively. Like Sitati et al. (2003), Stahl et al. (2002) use non-parametric correlations, which don't give much information when compared with stage 1 of the St. Kitts predictive model, namely how these variables relate to incurring damage. Again, the correlations don't account for the other variables, and their logistic regression is also a simplified version of stage 1 of the St. Kitts predictive model. Wilson et al. (2005) randomly sample uniformly from their geographic area in Montana to generate conflict hotspots and then use Monte Carlo simulations to generate distances between these hotspots to things of interest, such as rivers and creeks, sheep lambing areas and fall sheep pastures, cattle calving areas and boneyards. This approach gives a reliable p-value of significance, but doesn't give much

information on the effect of the distances beyond whether the distance increases or decreases the chance of a conflict. The St. Kitts model gives much more detail on this effect and allows one to make predictions.

Tourenq et al. (2001) and Treves et al. (2004) generate predictive models of fields at risk from crop damage by flamingoes and locations of wolf predation on livestock, respectively. Tourenq et al. (2001) use three methods to identify the environmental variables that best explain flamingo incursions: discriminant function analysis, logistic regression, and artificial neural network. Logistic regression was the most accurate model, yielding a 75% prediction success. Again, this method of logistic regression is a simplified version of the stage 1 St. Kitts model, which considers how each variable's effect on the probability of incurring damage may vary by location.

Treves et al. (2004) use a matched-pair analysis of 17 landscape variables in a GIS to discriminate areas affected by wolf predations from unaffected areas at two spatial scales (townships and farms) in Wisconsin and Minnesota. Univariate tests of association were computed with a one-sample t test and a sign test, and any variable that passed one or both tests was included in the second stage of analysis (to which a Bonferroni correction was applied). In the second stage, the authors did a single-sample discriminant-function analysis coupled with another t -test (t_{\max} , see Morrison 1990). A significant t_{\max} meant that one could discriminate affected from unaffected townships, and the resulting vector of coefficients provided the coefficient indicating the relative importance of each landscape variable. This data can be used to predict future risk of wolf predation on livestock, and it was used to generate predictive maps. While the matched-pairs approach is a good idea, the St. Kitts model is doing all of this in one

unified framework (in stage 1) by testing the significant variables. Further, the St. Kitts model considers interactions, which these authors do not (or do not report). Finally, the summary statistic by Treves et al. (2004) only takes into consideration one variable at a time and does not yield a confidence interval or other such statistical inference on the effect as the St. Kitts model does.

In sum, the advantages of the predictive model of crop raiding by St. Kitts vervet monkeys generated here are that it assesses the contributions of all the variables and their interactions simultaneously, it allows the relationship between the predictive variables and the probability of incurring damage to vary by location, it allows one to make predictions and assesses the accuracy of those predictions with confidence intervals, and it takes the additional step in stage 2 of taking into account the severity (or degree, generated as a percent) of crop damage.

St. Kitts Vervet Monkey Crop-Raiding Behavior Finally, the results of the predictive models generated for this thesis must be interpreted in the context of what is known about St. Kitts vervet monkey crop-raiding behavior. The first predictive model provides evidence that a farm's likelihood of experiencing damage is related to all of the variables investigated (except distance to road and number of months with crops planted in the non-mango season): mango season, distance to the forest boundary, distance to water, crop preference, number of neighboring farms, the farmer's guarding behavior, and how often the farmer plants crops (in the mango season). It is not possible to determine the exact nature of the relationships between these variables and whether a farm will experience crop damage (i.e. to support or reject the hypotheses on the

relationship between these variables and crop damage) because of the large number of interaction terms, but it is clear that knowledge of all of these variables is necessary to make the most accurate predictions of a farm's likelihood of experiencing crop raiding by vervet monkeys.

The results of the second predictive model generated for this thesis show that three variables: crop preference, the number of months with crops planted (in the non-mango season (September to April)) and mango season are important in predicting the severity of crop damage a farm will receive. The effect of crop preference on crop damage supports hypothesis five that more crop damage will occur on farms containing monkey's preferred crops. This effect is amplified during the mango season, when the animals can afford to be choosier with regard to what they will raid.

The effect of the next significant variable, number of months with crops planted (in the non-mango season) does not support hypothesis nine. The results show that *less* crop damage occurs on farms with crops planted during more months of the non-mango season, and this effect is amplified in the mango season. In other words, from September-April, the more often a farmer plant crops, the less likely he/she is to receive monkey crop damage, especially during the mango season (May-August). One explanation for this effect may be farmer presence: while this study accounted for farmer presence by asking farmers the number of hours per week they spend on their farm and what type of other guarding measures they use, these behaviors were not broken down seasonally. Generally speaking, the more often a farmer plants crops, the more likely he/she is to be present on their farm. These results indicate that if farmers plant more crops in the non-mango season (and it is assumed they are therefore present on their farm

more often), they are less susceptible to crop damage, especially in the mango season, when again, the monkeys can afford to be choosier in what they raid. This indicates that during the mango season, monkeys are less likely to raid farms that had more crops planted, and an associated active farmer presence, during the longer non-mango season.

Finally, the effect of mango season is not as straightforward due to the interactions with crop preference and number of months with crops planted (during the non-mango season). Generally speaking, the data support hypothesis six that farms will receive more crop damage during the non-mango season, but this effect is related to the monkey's preference for crops on the farm and the number of months the farm has crops planted. While farms generally have more crop damage during the non-mango season, if they have crops planted in very few months of the non-mango season and plant crops highly preferred by monkeys, then this trend does not hold. Collectively, these results indicate that, of the farms likely to experience crop damage from vervet monkeys, seasonal fruiting plays a role in which farms will experience the most severe damage, but that farmers' planting behavior, specifically, the consistency of their cultivation and the crops they plant, have the ability to offset this effect (i.e. if farmers plant non-preferred crops consistently over many months of the year, they will not see a reduction in damage during the non-mango season, because damage will be low all year long).

This chapter attends purely to the primatological portion of this conflict, assessing how the environment and human behavior impact vervet monkey crop-raiding patterns. The ethnoprimateological portion of this investigation, outlined in the next chapter, explores the reasons for these patterns of cultivation by St. Kitts farmers and the impact of vervet monkey crop raiding patterns on human behavior and perceptions. While it was

statistical restrictions that necessitated differentiating between the likelihood and severity of crop damage, an ethnoprimate approach also provides the opportunity to distinctively explore these two aspects of primate crop damage and their role in farmers' attitude towards vervet monkeys.

CHAPTER 3: ETHNOPRIMATOLOGY

Introduction and Background

The results of Chapter Two show that the likelihood and severity of vervet monkey crop raiding in St. Kitts is predictable, but the predictive models do not address the reasons for Kittitian farmers' planting patterns or the farmers' perceptions of vervet monkeys. The ethnoprimateological perspective employed in this chapter reveals that the temporal nature of St. Kitts' landscape plays a significant role in these patterns and perceptions and how they have changed over time. In what follows, the basic framework of an ethnoprimateological approach is explained, including an analysis of ethnoprimateology's engagement with five relevant theoretical areas: the nature-culture divide, human-animal studies, human-primate studies, human-wildlife conflict studies and historical ecology. Background knowledge in these areas is necessary for understanding the ethnographic data generated in this second level of analysis. Next, the specific methods utilized in this analysis and the results obtained from this approach are described. Finally, these results are used to provide historical context to the results of Chapter Two and are discussed with relevant theory.

Ethnoprimateology Ethnoprimateologists consider humans and primates as interconnected and thus assess the perspectives of each of these groups and how they impact each other. An ethnoprimateological approach combines primatology and cultural anthropology and considers ethnographic methods as integral components of understanding the ecological contexts of primates. Leslie Sponsel coined the term "ethnoprimateology" after he searched the scientific journals *American Journal of*

Primateology, *Folia Primatologica*, *International Journal of Primatology*, and *Primates* and did not find a single article based on fieldwork considering humans among the species of primates integral to the faunal community of an ecosystem. Using examples from research on human-primate interactions in Amazonia, Sponcel (1997) shows how cultural anthropology can be relevant, even essential, to primatology, and how the framework of primatology is also relevant to cultural anthropology. “Ethnoprimateology, the interface between human and primate ecology, is a new frontier with enormous potential for basic and applied research in the future” (Sponcel, 1997: 164).

Since the inception of ethnoprimateology, there has been an increasing trend within primatology to consider the interconnections between humans and primates and the cultural conceptualizations of the human groups with which primates share space integral to understanding primate behavior, ecology and conservation (Wheatley, 1999; Cormier, 2002; Fuentes and Wolfe, 2002; Cormier, 2003; Paterson and Wallace, 2005; Fuentes, 2006 (whole edition); Hardin and Remis, 2006; Riley, 2007; Riley and Priston, 2010; Fuentes and Hockings, 2010 (whole edition); Hill and Webber, 2010; Fuentes, 2012). Ethnoprimateological techniques have been used to study the dynamics of landscapes with a long history of human-primate cohabitation, such as the islands of Bali (Fuentes and Gamerl, 2005; Fuentes et al., 2005; Engel et al., 2006; Loudon et al., 2006a; Fuentes, 2010; Lane et al., 2010; Schillaci et al., 2010; Lane et al., 2011; Fuentes et al., 2011) and Sulawesi (Jones-Engel et al., 2001; Priston, 2005; Riley, 2006; Riley, 2007; Riley, 2010; Riley and Priston, 2010; Riley and Fuentes, 2011), and an ethnoprimateological framework has provided nuanced understandings of research questions related to pathogen transmission (Jones-Engel et al., 2001), parasitology (Loudon et al., 2006a; Fish

et al., 2007), folklore (Wheatley, 1999; Fuentes et al., 2005; Riley and Priston, 2010), hunting (Sponsel, 1997; Cormier, 2006), conservation (Fuentes and Wolfe, 2002; Cormier, 2002; Shepard, 2002; Estrada, 2006; Nekaris et al., 2010, Lee, 2010) and conflict with primates (Priston, 2005; Lee and Priston, 2005; Riley, 2007; Hill and Webber, 2010).

As a whole, ethnoprimateological work has shown that long-term sympatry between humans and nonhuman primates (millennia in some places (Tutin and Oslisly, 1995) can create a complex web of behavioral, ecological, epidemiological and economic relationships (Fuentes, 2006). Therefore, ethnoprimateologists argue against the traditional view that human impacts on the environment are perturbations of “natural” states. In fact, human impacts may be drivers for specific behavior patterns, and some behaviors that are considered “normal” in primates may actually be the result of anthropogenic impacts (Fuentes and Hockings, 2010). The results of studies that ignore the interconnections between humans and primates can be misleading:

Strong apriori primatological models for patterns of behavior that do not include recognition of this interface can provide false affirmations or refutation of prediction due to missed variables. Ethnographic models and ecological assessments of humans that ignore the potential role and impact of nonhuman primates risk oversimplifying the ecological and symbolic contexts and overlooking epidemiological and historical relationships that may significantly impact human populations. Observed patterns in both human and nonhuman primates may reflect adaptations or behavioral strategies that can only be fully understood when both participants are included in the analyses. A truly engaged anthropological context includes human-nonhuman primate relationships (Fuentes, 2006: 7).

Thus, the ethnoprimateological approach of the second stage of this dissertation operates from the standpoint that vervet monkeys and Kittitian farmers are interconnected.

Investigating the St. Kitts “monkey problem” from this perspective means understanding

that monkeys are not “wild” or unaffected by the humans around them and that sharing space with monkeys impacts Kittitian culture.

The Nature-Culture Divide For over fifty years, the nature-culture dichotomy has been a central dogma in anthropology (Descola and Pálsson, 1996). This dichotomy makes it seem like common sense that parks are set aside from people and that real nature is not found in cities. The underlying narrative says that people degrade nature and therefore nature must be saved from culture (Dove and Carpenter, 2008). This belief has real policy implications, as the nature-culture divide underlies much conservation and sustainable development policy.

Anthropologists doing fieldwork among peoples for whom the nature-society dichotomy is utterly meaningless have triggered a shift away from this dichotomy in ethnographic discourse. Escobar (1999) explains the different ways other societies view what is natural:

A local model of the natural may exhibit features such as the following...specific categorizations of human, social and biological entities (for instance, what is human and what is not, what is planted and what is not, the domestic and the wild, what is innate and what emerges from human action, etc.), boundary settings, and systematic classifications of animals, spirits and plants. It may also contain mechanisms for maintaining good order and balance in the biophysical, human and spiritual circuits (Descola, 1992; Descola, 1994) or a circular view of biological and socioeconomic life ultimately grounded in Providence, gods or goddesses (Gudeman and Rivera, 1990). There may also be a theory of how all beings in the universe are ‘raised’ or ‘nurtured’ out of similar principles, since in many nonmodern cultures the entire universe is conceived as a living being with no strict separation between humans and nature, individual and community, community and the gods (Grillo, 1991; Apffel-Marglin and Valladolid, 1995) (p 8).

For example, Descola's work with the Achuar Jibaro of the Upper Amazon shows that they "consider most plants and animals as persons, living in societies of their own, entering into relations with humans according to strict rules of social behavior: game animals are treated as affines by men, while cultivated plants are treated as kin by women" (Descola, 1996: 7). Descola (1996) goes on to give other examples, including relationships between the Makuna, another people of the Upper Amazon, and their environments: for them, humankind represents a particular form of life, participating in a wider community of living beings regulated by a single and totalizing set of rules of conduct.

In order to understand that the perception of nature varies among human societies, one must realize that nature itself is a human idea. Popular in Western thought is the idea that nature is a stable, holistic, homeostatic community capable of preserving its natural balance more or less indefinitely if only humans could avoid disturbing it. This is far from true; in fact, "the work of literary scholars, anthropologists, cultural historians and critical theorists over the past several decades has yielded abundant evidence that 'nature' is not nearly so natural as it seems. Instead, it is a profoundly human construction" (Cronon, 1996: 25). In other words, "the idea of nature contains an extraordinary amount of human history" (Williams, 1980: 70).

Williams (1983) has called nature "one of the most complex words in the English language" (p 219). In defining this term, one must include certain assumptions about the world and look for an essential principle that explains the multiplicity of things and of living processes. Williams (1980) traces the abstraction of nature through history, arguing that early reductions of nature to a singular identity are tied to the development

of Western monotheism, reducing the multitude of diverse and variable manifestations of “pagan” gods or spirits to one true God. This idea of “nature as minister” was quickly changed by the scientific notions of natural selection shifting the metaphor to “nature as selective breeder.” In this shift, men were prepared to dispense with the idea of a singular God but not a singular nature.

These “more secular and more rational” human conceptualizations of nature depended on a new and very singular abstraction: the abstraction of man (Williams, 1980: 75). Nature was now decisively seen as separate from men. Mankind developed with confidence in our capacity to intervene with nature, indirectly illustrating the belief that it is possible *not* to intervene. By the 18th century, the idea of nature became a principle of order and right reason. Ironically, those who interfered most with nature began to claim a necessity of non-interference; those who drew the most profit from industrial processes went back to an unspoiled nature (on their purchased estates and country retreats). Williams (1980) argues poignantly that the separation between man and nature is a function of man’s increasing real interaction with nature. In current Western complex dealings with the physical world, it is very difficult to recognize all the products of our own activities and easy to miss the immense impacts they make.

Dove and Carpenter (2008) provide examples of the type of nuanced data that can be obtained by removing the nature/culture divide. Doing this allows anthropologists to obtain a deeper understanding of the people they are studying and their relationship to their environment. Both Posey (1985) and Fairhead and Leach (1995) work in similar environments: forest-savanna edges, and examine similar human livelihoods: swidden farming (also known as shifting agriculture or slash and burn agriculture). In both

contexts, anthropogenic forest islands, or man-made forest islands, were created.

Anthropogenic forest islands confuse the nature-dichotomy because they look natural but are in fact cultural, and also because they are cultural in a subtle way (“managed” according to Posey or “enriched” according to Fairhead and Leach). Due to this, in both cases, the belief that people inherently degrade nature came through, and it was assumed that these islands were remnants of larger forests destroyed by the people studied when, in fact, the savanna surrounding the forest islands were “natural” and the forest fragments “cultural” (Dove and Carpenter, 2008).

Human-Animal Studies and Human-Primate Studies Mullin’s (1999)

overview of human-animal studies shows that anthropology’s colonial origins have shaped its perspective on the distinction between humans and animals and created an authoritative discourse of difference. While medieval Europeans tended not to separate nature from culture, by the 16th century, a “modern sensibility” about nature emerged, turning nature into a realm from which humans were thought to stand apart, or, more specifically, above (Thomas, 1983 and Gurevitch, 1992 in Mullin, 1999). With animality posited as something inferior to humankind, and as something to be conquered and exploited, then people thought inferior to others – women, the insane, the Irish, American Indians, Africans, poor people, etc. – were apt to be associated with animality. And, as the church taught that animals were created to be exploited by humans, it was not a far step to rationalize that the enslavement and exploitation of peoples during colonization was keeping with their nature and a divine plan (Pagden, 1982; Palencia-Roth, 1996; Thomas, 1983 in Mullin, 1999).

The inferior, and distinct role of animals was reinforced through the extensive role of animals in colonial enterprises, from the use of animals bred and trained for use in war and tracking to domestic species brought to aid in colonial settlement. Additionally, wild animal products provided economic motivation for imperialism and reinforced the ideology of domination through the collection and display of exotic species (Mullin, 1999). And while Darwin's theory of natural selection challenged the notion of divine creation and in some ways replaced the idea of a fundamental separation between humans and animals with that of similarity and kinship, the hierarchical pattern remained secure: the perception of inferiority (and superiority), as well as colonialism, were now justified in terms of evolution (Ritvo, 1987: 39-42 in Mullin, 1999).

Mullin (1999) argues that while many are trying to depart from the colonialist program of identifying the essential nature of cultures, the authoritative discourse of difference in anthropology has remained. In one of the earliest overviews of an academic, anthropological engagement with human-animal relationships, Shanklin (1985) explains that anthropologists investigating humans' relationships with animals typically perceive them from one of two approaches: symbolic or structuralist. This notion could also be described as "good to think," (Lévi-Strauss, 1963) like in work by Douglas (1957) and Leach (1964), from material, economic, utilitarian perspectives, or "good to eat," (Lévi-Strauss, 1963) like in work by Harris (1974). This contrast between "good to think" and "good to eat" illustrates the differences in approaches often described as intellectualist/utilitarian, symbolic/materialist, and the ubiquitous culture/nature.

Shanklin's (1985) argument for an integration of these dichotomies seems to have been widely shared, for many studies concerning humans' relationships with animals

have explicitly sought to close gaps between the dichotomous approaches described above (Mullin, 1999). Martin (1995) suggests that this interest may be inspired by the considerable amount of boundary crossing going on in the contemporary world, not just between humans and animals but involving other categories such as humans and machines, and society and nature (p 269 in Mullin, 1999). Mullin (1999) argues that it is not only these crossing of boundaries that are of interest, but also the way they are subject to continual redefinition and conflict:

Whereas it was once common to assume that some sort of conceptual boundary between humans and animals, like that between culture and nature, was universal among humans, recent scholarship notes a greater degree of cultural and historical diversity in this regard. As categories, both animals and nature are now much more likely to be described as culturally and historically specific, with some scholars arguing that in many non-Western societies, nature is not a category that ordinarily can be opposed to culture or society (p 202).

In other words, like the distinction between nature and culture, the separation between humans and animals has blurred.

In many ways, perceptions of and relationships with primates have followed the historical trends just described with regard to human-animal relationships. The thirty-two papers presented at an interdisciplinary symposium entitled *Ape, Man, Apeman: Changing Views Since 1600*, held at Leiden University, The Netherlands, provide detailed descriptions of these trends with regard to humans' perception of primates (Corby and Theunissen, 1995). As previously stated, prior to the 16th century, medieval Europeans tended not to separate man from society. Thus, when Aristotle observed *Cercopithecoid* monkeys, baboons and macaques on the southern rim of the Mediterranean (described in his *Historia animalium*), he followed the trend of the time to anthropomorphize these creatures, describing them as "apes," in the same vein as man,

even though the anthropoid apes of Africa and Asia were not known until the mid-17th century (Spencer, 1995). St. Augustine echoed this trend, noting in his *De civitate dei*, “if we did not know that apes and long tail monkeys...are not human beings...those same natural historians who take pride in curious lore might with unscathed vanity foist them upon us as diverse distinct tribes of men” (Book XVI: vii-ix in Sanford and Green, 1965: 49 in Spencer, 1995: 13).

The “modern sensibility” about nature and primates emerged by medieval times, with the ape appearing in the literature as a grotesque human caricature. Viewed through the lens of Christian theology, the ape image was transformed into a *figura diaboli*, in which the absence of a tail assumed metaphysical significance (Janson, 1952). As tails were assumed to be a feature of all animals, the tailless ape was regarded as an impostor, whose state was indicative of its desire to rise above its natural station. Human-like primates, previously anthropomorphized for their likeness to humans, were now categorized as distinct. After studying the cadaver of an infant anthropoid ape in 1698, Edward Tyson (1650-1708) argued that these creatures were “not men, as formerly pretended” (Spencer, 1995: 15).

Like with human-animal relationships, a renewed interest in the distinction, or lack thereof, between humans and primates has been initiated in recent years. In fact, human-primate relationships have proved to be a revealing component of anthropological studies of human-animal relationships. Due to the anatomical similarities between the two groups, relationships between humans and primates are likely to occupy “‘border zones’ between nature and culture, providing ‘origin stories’ for ‘man’ and a means of defining what is human” (Haraway, 1989; Haraway, 1991; Haraway, 1997; Noble, 1999;

Strum and Fedigan, 1999 in Mullin, 1999: 213). In other words, investigating a group's relationship with primates is an informative way to investigate the boundary (or lack thereof) between nature and culture, because primates exemplify the appeal of watching animals to measure “the oscillation between ‘like us’ and ‘not like us’” (Mullan and Marvin, 1999: 159). An example of this is Ohnuki-Tierney's (1987, 1993) work, where she examines how Japanese macaques and their performance with “special status people” (outcasts, or people regulated to a marginal position in society) have served to define what it means to be human and what it means to be Japanese and how these perceptions have changed over time. In relation to specific cultural and historical contexts, anthropological studies of human-primate relationships are an especially valuable means to study other aspects of human societies as well as how these relationships are influenced by humans' relationships to each other (Mullin, 1999: 219).

Ethnoprimate investigations address the nature-culture divide by engaging the results of human-animal and human-primate relationship studies that maintain an awareness of the fluidity and entanglements between humans and other animals (e.g. Cormier, 2002; Cormier, 2006). Fuentes (2012) explains that sociocultural anthropologists who see alloprimates as nested in human lives and vice versa have become central players contributing methodological and theoretical infrastructure to ethnoprimateology. “They have deployed and expanded ethnographic tool kits to move beyond the boundary of the human and give agency, in symbolic, social and ecological senses, to the human-alloprimate interface” (p 104). As such:

Ethnoprimateology accepts nature as a constructed, constructive process in which humans and others are core contributors. Rather than assert a privileged perspective of scientific objectivity, ethnoprimateology seeks to move primate studies toward a scientific and ethnographic integration, one

that is comfortable dealing in primatological data as well as the social, political and economic interpretation (Fuentes, 2010: 602).

Originally, the goal of primatologists was to study the behavior of primates in “natural environments” free from human influence. Now, ethnoprimateologists recognize that living in close proximity to primates has characterized much of our evolutionary history, and challenge the existence of natural environments from which humans are separate (Riley, 2006). The hallmark of ethnoprimateological research is an integrated, inextricably linked, human and non-human primate community.

Human-Wildlife Conflict While cultural anthropology has a long history of engagement with human-animal relationships, conflict with them, per se, typically falls within the theoretical realms of applied zoology, applied ecology, wildlife management and other related fields. A notable exception to this is work by Knight (1999, 2000a, 2000b). The introduction of *Natural Enemies: People-Wildlife Conflicts in Anthropological Perspective* (Knight, 2000a) explains the human-wildlife problem, why anthropology is well suited to study this problem, and the main themes that emerge from an anthropological engagement of human-wildlife conflicts. Additionally, Knight’s work on human-macaque conflict in Japan (Knight, 1999) is a relevant example of an anthropological approach to human-primate conflict in practice. In what follows, both of these works are explored more fully.

Many forms of human-wildlife conflict exist, including attacks on people; attacks on livestock; crop-raiding; forestry damage; competition for wild forage with human gatherers, with livestock or with game animals; competition for prey with human hunters; house and other building infestations (roosting birds, rats, mice, etc.); threats to other

natural species and to biodiversity (environmental pests) and others. These conflicts exist as either competition for food between humans and the animal species in question (indirect) or as wild animal predation on people (direct) and are often the result of environmental displacement as a result of human settlement. They continue because of the appeal presented by human spaces to wild animals, leading to significant amounts of human effort being dedicated to protecting themselves, or their crops, from animals. Conflict with wildlife is culturally institutionalized in other ways as well, through ritual, festivals and childrens' games. Thus, while the conflict itself is twofold (direct or indirect), so is the experience of human-wildlife conflict: it is directly experienced through the confrontation itself and the protective labor required, and/or it is indirectly experienced through the cultural practices and performances that refer to it (Knight, 2000a).

Anthropologists working on human-wildlife conflict are not only concerned with the material dimensions of this type of wildlife pestilence, but also with their social and cultural dimensions. Five themes emerge from an anthropological engagement with human-wildlife conflicts: the socially constructed character of pestilence discourses, the relationship between wildlife pestilence and conservationism, the symbolic dimension of the wildlife threat, the moral specification of dangerous animals, and the variety of ways in which conflicts with wildlife overlap with conflicts among people (Knight, 2000a).

A number of case studies from *Natural Enemies* point to the fact that pestilence discourses are often inaccurate, exaggerated or ill-founded. Among others, Knight (2000b), Marvin (2000) and Song (2000) “challenge the self-evident status of pestilence discourses by setting them in their wider social context and analyzing them alongside the

cultural symbolism of the animal in question” (Knight, 2000a: 9). Additionally, they show that wildlife pestilence and the threshold of tolerance to damage can change over time. Pestilence discourses are dualistic in character: they are premised on a dichotomous view of human-wildlife relations. As outlined previously, the nature-culture dichotomy has been well studied in cultural anthropology and has demonstrated that this dichotomy, as well as the concept of nature and wild animals, is subject to variation in other cultures. Thus, anthropological approaches to pestilence claims both analyze the reality of the situation and question the assumptions underlying the discourse in general (Knight, 2000a).

Wildlife pestilence is also related to conservationism. Both the socially constructed character of pestilence discourses and the relation between wildlife pestilence and conservationism are premised on a separation of humans and animals. While pestilence discourses exclude wildlife from the human realm, conservationist discourses exclude human beings from the natural realm. The background to both of these themes is habitat depletion and animal displacement, but pestilence can be exacerbated, or even generated, by conservationism. One example of this is the creation of national parks and the local sense of inequity that can arouse (Campbell, 2000). The result is often hostility toward wildlife conservation on the part of the local people – the opposite of what is intended. This can extend to the protection of animals that either raid crops or kill livestock. Strong outside concern for this wildlife can alienate local people from the animal in question (Lindquist, 2000).

The most famous studies of the symbolic relationship between humans and animals in anthropology come from structuralist approaches by Lévi Strauss, who

famously argued against the functionalist explanation of plants and animals, saying that they are not “good to eat,” but “good to think” (Lévi-Strauss, 1963) and Mary Douglas, whose investigation of pollution beliefs argued that pollution, or “dirt,” is merely “matter out of place” (Douglas, 1966: 35). Along these lines, pests are merely animals out of place. Structuralist principles argue that culture consists of ordering the world into classes, and the phenomena that resist this classification are anomalous. Examples of anomalous animals are those that can live on land and in water, those that are domestic (thus straddling the nature-culture boundary) and those that cross spatial boundaries. Examples such as Milton (2000) and Marvin (2000) show that sometimes, wildlife pestilence is as much about boundary crossing as it is about economic consequences (Knight, 2000a).

Many of the chapters of *Natural Enemies* point to the fact that wildlife pests are subject to negative symbolism and attributed an immoral character (Knight, 2000b; Lindquist, 2000; Marvin, 2000; Song, 2000; Milton, 2000). And, if “pestilence is a crime, then pest control becomes a kind of law enforcement” (Knight, 2000a: 16). Pest animals are often killed and displayed, sometimes with an underlying theme of balance and reciprocity. Pests and predators are condemned for greed, gluttony, blood lust and senseless killing. Sometimes, it can work the other way around, where the perception is that those that are subject to predators and pests are themselves immoral. Another way that wildlife dangers point to human-animal immorality is when the predatory potential of human beings is elicited in the belief in human-to-animal shapeshifting (Knight, 2000a).

Knight’s (2000a) final theme is that many apparent conflicts with wildlife have to do with the tensions, divisions and antagonisms between humans. First, human social

divisions are present in conflict *with* wildlife. In other words, the experience of wildlife pestilence is disproportionately experienced by certain groups of people (Campbell, 2000; Rye, 2000; see also Hill, 1997 and Naughton-Treves, 1997). Second, human divisions are evident in conflict *over* wildlife. Human groups, such as hunters, farmers or livestockers, do not necessarily agree on what constitutes a pest (Campbell, 2000; Knight, 2000b; Lindquist, 2000). Taking the second point to the next level, the ways to deal with pests are not always agreed upon by different human groups, so conflict over wildlife can be *generated by* the primary conflict with wildlife (Knight, 2000b; Lindquist, 2000; Marvin, 2000; Song, 2000; Milton, 2000). In this case, pests and/or predators become material *and* symbolic threats. Third, human conflicts are sometimes *projected on to* wildlife. For example, Song (2000) argues that the underlying conflict of the pigeon shoot in Pennsylvania has to do with the experience of marginality among the inhabitants of this part of deindustrializing America (Knight, 2000a).

Knight (2000a) argues that human-wildlife conflicts can serve to both bring people together and create a divide; it can serve to constitute or reinforce in-group boundaries. “Viewed in these dynamic terms, the ‘people’ of the people-wildlife conflict ceases to be a given or fixed category, but emerges in a complex *process* of conflict that may well span local, national and international levels” (p 22). An increasingly important factor is the state: many human conflicts with wildlife are informed by people-state conflict. Often, this relates to the state’s protection of species at the cost of local residents (Campbell, 2000; Knight, 2000b; Lindquist, 2000). The vulnerability on the part of local people can be suggestive of their own marginality in the modern nation-state (Knight, 2000a).

Knight (1999) addresses many of these themes in his anthropological assessment of people-macaque conflict in rural Japan. Two representations of primates come into play with regard to this controversy. Negative feelings towards the monkey are apparent in rural farming areas, where the animals have turned into a serious crop-damaging pest. This supports Ohnuki-Tierney's (1987, 1993) argument that the Japanese create distance between themselves and the monkey by projecting their negative side onto the animal and turning it into a scapegoat.

Crop raiding by Japanese macaques has evoked a national controversy between conservationists and local farmers. The conservationists argue that the monkeys have a special place in Japanese culture, are a common property of all Japanese people and must be protected and rural farmers, who have created monkey-culling campaigns. This supports the argument that Asia is a model of cultural tolerance toward wild primates (Strum, 1994; Malik and Johnson, 1994; Zhao, 1994; Eudey, 1994). This conflict situation is exacerbated by media reports evoking the language of war, describing large groups of attacking monkeys led by the "boss" and patrolling groups of humans protecting their fields (Knight, 1999).

The anthropological model of negative wild primate symbolism (in particular, Ohnuki-Tierney's scapegoat model) seems to offer a possible cultural rationale for the human-wild primate conflict in Japan. A number of Japanese primatologists have explained monkey culling as symbolic of the failure of state-sponsored rural development efforts. Ohnuki-Tierney herself tends to focus on the monkey's physical resemblance to people as the basis of its boundary-transgressing character. Also of symbolic significance is village-forest boundary, which has important status in Japanese folk culture (Yagi,

1988; Yukawa, 1991 in Knight, 1999). Finally, the representation of the rural monkey problem as a war “accords with the anthropological approach to natural symbolism based on the nature-culture boundary and the cultural imperative of maintaining it” (Knight, 1999: 631). But this picture of warring villages licenses “outside conservationist criticism of and intervention in people-wildlife relations in upland Japan” (ibid).

Using ethnographic methods to qualify the monkey “war,” Knight (1999) shows that the farmers involved do not represent a homogenous (anti-monkey) group. In fact, there are a number of gray areas. There is a degree of acceptance of monkey crop feeding in rural Japan, with some individuals designating certain trees for monkeys and believing that monkey damage has to be tolerated to some extent. Wild monkeys are sometimes perceived as hungry animals that come to feed on village crops because they cannot find food in the forest. Voluntary feeding of the monkeys takes place and there is recognition of their striking appearance to humans, especially in their face, gait and hands. Monkeys are often viewed as children. Also, there is local unease about the violent human response to monkey crop damage, with some villagers aware that monkey-culling can be counterproductive by destroying the social cohesion of the group and creating rogue crop raiders. Finally, the recent history of village population decline has created a new view of the monkeys’ movements. Lone crop-raiding monkeys, fragmented from their social group and displaced from their forest home resemble urban migrants who have left their mountain villages for the city and suffer from isolation, loneliness, schizophrenia and depression. Therefore, the inhabitants of the depopulated villages can identify with the monkey, whose movements seem parallel to their own experience (Knight, 1999).

In light of these observations, Knight (1999) argues that we need to reconsider the natural symbolism of a “monkey war.” The negative symbolism of Ohnuki-Tierney’s model ignores any rural sympathy for wild primates. It fixes human dispositions and is “unable to account either for variation in local responses to primates or for change in such responses over time” (p 635). It emphasizes difference, directed at the nature-culture boundary, which ignores human interest in nature-culture continuity and the commonalities between humans and primates. Knight (1999) explains that one of the main critiques of symbol theory is that it is reductionist and idealist and we need to analyze symbols as “constituents of contextually and historically situated social interaction” (Turner, 1991: 122-123 in Knight, 1999: 636). This dynamic approach to symbols allows them to emerge and change over time and be constructed differently by members of the same group. From this perspective, “the monkey’s movements are an *announcement* of the transformation of upland space, as well as an aspect of it. Far from being merely transgressive, monkey mobility is constitutive of the new, more inclusive spatial domain, encompassing village and forest, that increasingly defines upland Japan” (Knight, 1999: 638).

Through this analysis, Knight (1999) calls for the integration of history into symbolism. He argues that natural symbol theory is preoccupied with dichotomies and conflict. In the case of the crop-raiding monkeys of rural Japan, this reinforces the impression of rural populations as anticonservationist and contributes to a growing demand for national intervention to protect macaques. Making the animal national and non-local encourages a dislike of it, rather than fostering conservationist sentiment. This analysis shows that local dimensions of wildlife management are heterogeneous and

cannot be reduced to a simple concern with benefits and incentives. To account for the existence of varied dispositions, we need “a more dynamic approach to culture in which natural symbols are understood not as culturally fixed relative to immutable boundaries, but as historically emergent at new levels of scale” (Knight, 1999: 639).

Ethnoprimateological investigations of primate pests address some aspects of the themes that emerge from an anthropological engagement with human-wildlife conflicts. With regard to the socially constructed nature of pestilence discourse, ethnoprimateological work focuses on the effects of primate crop raiding on humans as well as an assessment of reality versus perception. Primates are often cited as significant agricultural pests, for they cause considerable damage to field and tree crops and impose time and energy costs on the farmers who have to protect their crops (Boulton et al., 1996; Naughton-Treves, 1996; Hill, 1997; Naughton-Treves, 1997, Naughton-Treves, 1998; Hill, 2000; Priston, 2005, Linkie et al., 2007; Marchal and Hill, 2009; Campbell-Smith et al., 2010). However, Priston (2005) explains that farmers’ perception of crop vulnerability often does not match reality. In general, attitudes towards primates are a function of the degree of contact with the animals, though even minimal contact can lead to an attribution of blame that may greatly outweigh the damage (Naughton-Treves, 1996; deBoer and Baquette, 1998; Hill, 1997; Naughton-Treves, 1996; Naughton-Treves, 1997; Hill, 2000; Chalice and Johnson, 2001). Perceptions of risk tend to focus on large, conspicuous species like primates, even if raiding events are rare (Gillingham and Lee, 2003). Staple foods and crops that ripen simultaneously are often viewed as the pests’ preferred foods, when in reality, fruits like bananas are raided preferentially (Naughton-

Treves, 1997; Priston, 2001). In some cases, crop raiding by primates has been shown to actually increase production due to a pruning effect (Siex and Struhsaker, 1999).

The relationship between wildlife pestilence and conservationism is addressed in ethnoprimateology, but from a primatological perspective rather than an anthropological one. Most of the discourse in ethnoprimateology revolves around the fact that anthropogenic habitat disturbance has increased the interface between humans and primates. The argument is that in order to best understand the effect this has on primates (and humans), we must view humans and primates as contained within a dynamic and interconnected system and consider the cultural conceptualizations of primates held by humans living alongside them. The theoretical focus is on how this approach can lead to the conservation of primate species. While primate conservation is important, including more anthropological perspectives, like those seen in Knight (1999) and Knight (2000a), within ethnoprimateology allows for a critical analysis of the focus of the primate conservation efforts and how this perspective may differ from the local/indigenous human groups that live alongside primates (e.g. Sicotte and Uwengeli, 2002 and Shepard, 2002).

With regard to the symbolic dimension of wildlife (primate) threats and the moral specification of dangerous animals (primates), ethnoprimateological studies focus on human attitudes toward and cultural conceptualizations of primate pests more generally (Lee and Priston, 2005; Riley, 2007; Riley and Priston, 2010), while anthropological approaches to human-wildlife conflict focus on the structuralist principles of classification schemes and boundary crossing (Knight, 2000a). There is a degree of overlap, as seen in the work of Hill and Webber (2010), who integrate these two

perspectives. They argue that the bulk of ethnoprimate studies on perceptions of crop damage by primates focus on peoples' perceptions of animals as "pest" or "vermin," so the results reflect cultural constructions of "pest." Using two people-primate conflict case studies from Uganda and Japan, they explore how people from these two countries view the animals outside of the conflict situation itself using a more structuralist approach. They show that in both countries, primate behavior is measured against the same moral framework as humans, and primates that transgress social rules and spatial boundaries are less likely to be tolerated. Thus, perceptions of primates are tempered in Japan, as Japanese cosmology assumes a much less concrete boundary between people and primates.

Ethnoprimate studies have also documented how conflict with primates has to do with conflicts between people. Knight (2000a) explains that this can come in a number of possible forms – social divisions can be present in conflict with wildlife (who experiences it), human divisions are evident in conflict over wildlife (what constitutes a pest), conflict can be generated by the primary conflict with wildlife (how to manage the problem), and human conflicts can be projected onto wildlife. Examples of the social divisions present in conflict with wildlife are most apparent in ethnoprimate investigations, which have documented how different ethnic groups differentially experience crop damage. For example, Naughton-Treves (1997) shows that Kiga immigrants around Kibale National Park in Uganda are disproportionately represented on the forest edge and are thus more likely to experience crop damage by primates. Additionally, Hill (1997) shows that Zairean people and members of the Lugbara tribe

are most vulnerable to crop damage by pigs and baboons in western Uganda because their farms are located closer to forested areas.

Historical Ecology Historical ecology is a research program concerned with the interactions through time between societies and environments and the consequences of these interactions for understanding the formation of contemporary and past cultures and landscapes (Balee, 2006). It is a distinct approach within the broader field of environmental anthropology, a cross-cultural study of the relationship between societies and their environments. The work of Julian Steward (1902-1972) is often cited as key to the development of academic approaches to human-environment relationships, as it was the first to address the place of humans in nature through ecological observations on their cultural behavior. The approach initiated by Steward is referred to as cultural ecology. A more biological approach to cultural ecology followed in the 1960s, when Roy Rappaport (1926-1997) and others transformed cultural ecology into ecological anthropology (Sponsel, 2001). Ecological anthropology relies heavily on evolutionary and ecological theory (Moran, 2006). Ecological anthropologists investigate the level at which a given population can be sustained in a particular habitat without irreversible natural resource depletion and environmental degradation. A number of other approaches to human-environment relationships emerged in the 1980s and 1990s, historical ecology among them (Sponsel, 2001).

The theories and methods of historical ecology arose out of the desire to bridge the social and life sciences (Crumley, 1994; Balée, 1998). Crumley explains that only a few fields can bridge the natural and social sciences, the humanities and the professions,

and anthropology represents one of the most comprehensive and theoretically sophisticated disciplines. Anthropology is appropriate because it is integrative and comparative and it includes temporal, spatial and cultural dimensions; it is dynamic. “The discipline’s historic focus on the dynamics of change render an anthropological perspective particularly appropriate when unraveling complex chains of mutual causation in human-environment relations” (Crumley, 1994: 2).

Prior to historical ecology, investigations of human-environment relationships favored two types of explanations – they were either scientific (framed from the perspective of the Darwinian revolution or modernism) or hermeneutic/humanistic (framed from the perspective of religious doctrine or postmodernism, which says that objectivity is impossible) (Crumley, 1998). Balee (1998) posits a related question: are humans the product of ecology or history? While anthropology has the ability to bridge these dichotomies, one can see the way they manifest themselves within the field today by turning to anthropological discussions of human evolution. Here, a “fundamental contradiction” is present (Crumley, 1994: 2): the early history of the human species is couched in evolutionary and environmental terms, with humans utilizing their omnivorous diet and cultural knowledge (problem solving skills and tool use) to expand the primate niche. Over time, however, the environment becomes less and less important to the story. Soon, the environment no longer matters except as a resource to be commodified, one that we have over-exploited. The message is that culture has triumphed over nature (Crumley, 1994).

Historical ecologists bridge these dichotomies (scientific/humanistic; ecological/historical; natural or biological/cultural) through the concept of *landscape*.

This term is interdisciplinary and helps reengage the debate between biological and cultural determinism (the idea that the environment determines biology and/or culture in a linear, simplistic and direct way) (Balee, 1998). Balee (2006) defines the landscape as “a place of interaction with a temporal distinction that is as historical and cultural as it is evolutionary per se, if not more so, upon which past events have been inscribed, sometimes subtly, on the land” (p 77). Landscape has also been defined as “the material manifestation of the relation between humans and the environment” (Crumley and Marquardt, 1987 in Crumley, 1994: 6). An important aspect of this term is that its relationship with man is dynamic: man affects it and it affects man: you cannot “treat landscape as an object if it is to be understood. It is a living process; it makes men; it is made by them” (Inglis, 1977: 489 in Ingold, 2000). Contained in the landscape is a tripartite array of conceptions of human time, which historical ecology borrows from the *Annales* historical school: 1) *événement* (event), or short-term, episodic phenomena; 2) *conjoncture* (cycle), involving repetitive statistical patterns over a decade, quarter-century, or half-century or so; and 3) the *longue durée*, or empirical patterns of history and prehistory occurring over centuries (Braudel, 1980 and Crumley, 2003 in Balée, 2006).

As a research program, historical ecology contains four postulates. The first of these is that humans have altered practically all environments on earth, even prior to the advent of agriculture. This postulate challenges the notion of pristine or virginal environments and thus is tied to the nature/culture dichotomy previously described. The older ecological anthropology premised a separation of nature and culture through its use of terms like *adaptation* and *niche*: these signify cultural accommodations to an

extracultural, a priori environment (Ingold, 1992). This suppresses the way in which the environment is historically and culturally produced *through* human-nature interactions (Biersack, 1999, emphasis added). The second postulate is that human nature is not programmed genetically or otherwise to lessen or augment species diversity and other environmental parameters. A wealth of data exists supporting this fact: in many circumstances, human activity can increase local diversity, especially through intermediate disturbances like broadcast fire, tree cultivation, settlement and soil enrichment. In this context, landscape heterogeneity induces edge effects that can disturb species that require undisturbed forest, but it can also lead to net increases in diversity by allowing sun to permeate certain areas of the forest or by supporting species that thrive in areas of secondary growth (Balee, 2006). The third postulate is that societies defined by various socioeconomic, political and cultural criteria impact landscapes in dissimilar ways, as some landscapes are less disturbed than others. And finally, the fourth postulate is that human interactions with landscapes, in a broad variety of historical and ecological contexts, may be studied as a total (integrative) phenomenon (Balee, 2006).

Ethnoprimateological theory supports the first postulate of historical ecology by arguing against the notion of “wild” primates free of human influence and the view that human impacts on the environment are perturbations of “natural” states.

Ethnoprimateological work supports the second postulate of historical ecology by showing that landscapes dominated by human activity can favor primate population persistence (e.g. Estrada, 2006). Finally, research by ethnoprimateologists takes place in a broad variety of socioeconomic, political and cultural contexts, supporting the third postulate of

historical ecology by documenting various levels of environmental disturbance by the human populations in these contexts.

Ethnoprimateological research has shown that the *landscape* plays an important role in human-nonhuman primate interconnections. For example, Sprague (2006) has shown that the land use configuration, specifically, the spatial configuration of farms and monkey habitat, in the mountainous parts of Japan, is such that 90% of the monkey habitat region is located within about one-day travel distance of farmland for a monkey troop. The bulk of ethnoprimateological research with regard to the landscape focuses on how human modification and uses of the land have affected the interface between humans and primates (Lizaralde, 2002; Cormier, 2006; Loudon et al., 2006b; Riley, 2007; Fish et al., 2007; Fuentes and Hockings, 2010; Riley and Priston, 2010; Lee, 2010; Fuentes, 2012).

More recently, there has been a shift toward recognizing that impacts on the landscape are not linear or one-dimensional (e.g. humans impact the environment and primates respond). This new approach argues that humans and primates *coproduce* niches (Fuentes, 2010). The best example of this approach is at the ethnoprimateological research site of Padangtegal Temple in Bali, Indonesia, where macaque monkeys and humans share space and have done so for centuries (Wheatley, 1999). Using one of the foundational concepts of historical ecology, Fuentes (2010) explains how this site is unique:

The patterns of social interaction amongst the monkey groups ebb and flow in relation to the presence and activity of the local Balinese as well as the many tourists meandering through the temple complex and forest. Humans and long-tailed macaques are involved in daily rhythms of activity within the social and structural ecologies of this site. Human-monkey interfaces are often described in terms of the shared use of space

or conflict over resources. But these natural-cultural contact zones are instead characterized by subtle behavioral and ecological interactions against the backdrop of the *longue durée* of human histories and paleohistories (p 606, emphasis added).

There are at least 63 sites where macaques reside on the island of Bali (Fuentes et al., 2005), and over 68% of these sites are associated with a temple or shrine. These religious complexes often serve as provisioning sites, as a component of Balinese Hinduism is the regular placing of offerings at shrines and temples. Land use patterns and wet-rice agriculture, combined with these temple and irrigation systems (Lansing, 1991) have resulted in a landscape of riparian forest corridors and small forest islands throughout most of Bali. This landscape is ideal for macaques who prefer riverine pathways and mixed edge and secondary forests and use these forest islands for residence, foraging and dispersal. This landscape has been formed over at least the last millennium and the pattern of distribution of macaque populations across the island suggests the macaques are exploiting it (Fuentes et al., 2005 in Fuentes, 2006 and Fuentes, 2010). Fuentes (2010) explains: “macaque bodies do more than occupy Balinese temples and riverine forest corridors. They coproduce and coconstruct human epidemiological landscapes,” as their pathogens are shared and exchanged across species boundaries (Jones-Engel et al., 2008). This is an example of how organisms with mutual ecologies can coproduce and coconstruct each other’s niches in behavioral, ecological and physiological senses (Fuentes, 2010).

In sum, ethnoprimate research incorporates historical ecology’s concept of the *landscape* into its theoretical tenants and assesses the role of the landscape in human-nonhuman primate interconnections. Essentially, the field has limited the scope of historical ecology from the relationship between societies and their environments to how

the relationship between societies and environments affects human-primate interconnections. It is argued in this thesis, with this study as an example, that the relationship between humans and their environments, *outside of the primates in them*, play an integral role in the interconnected human-primate system at the foundation of ethnoprimateology.

Methods

Ethnographic methods were utilized to investigate the dynamics of the human-primate interface in St. Kitts. Each of the 64 farmers participating in this study were interviewed, using an open-ended approach, about their experiences with vervet monkeys as a whole and on their farm as well as their personal and farm history, their daily struggles, and issues in Kittitian society (see Appendix B; these questions were approved by the University of Wisconsin-Milwaukee's Institutional Review Board (#10.212)). Many of these questions were generated after arriving in St. Kitts and learning more about "the monkey problem" by speaking with members of the agricultural community. The interviews occurred during the same 12 months the farms were being monitored (September 2010 – August 2011). The order of interviews occurred as the comfort level with the farmer increased (i.e. individuals that took longer to get to know were interviewed later in the study). In addition, conversations about monkeys were initiated at every possible opportunity. Cab drivers, people at the grocery store, local friends, farmers not in the study, members of the agriculture department, and more were asked

about their feelings on monkeys, how the situation has changed over time, the effects of the end of the sugar industry, etc.

Results

The Impact of the Sugar Industry on the Interactions Between Humans and Monkeys Conversations and interviews with farmers, members of the agricultural community, and other Kittitians reveal that a full understanding of “the monkey problem” requires an understanding of the past: specifically, how the sugar industry, and lack thereof, has affected human and monkey movements:

One cab driver told me that when he was young, there were a lot more fruit trees in the forest – manziport, guava, sugar apple, custard apple, soursap, etc. In the 1980’s, they filmed a Chuck Norris movie called “Missing in Action 2: The Beginning,” and they cut down a lot of fruit trees in the forest. He thinks that was the catalyst for the monkeys moving to the lowlands – because they don’t have enough food to eat in the forest. (Kerry Dore, field notes, August 7, 2010).

(One farmer) talked about how there used to be rangers that worked for the sugar estates that would kill wild animals like monkeys. Once the sugar industry ended, there was no one left to kill them and now they are down in the villages (Kerry Dore, field notes, August 23, 2010).

A hotel employee mentioned how he noticed that all Kittitians love mangoes but nobody ever plants a tree. I asked if they needed to and he said yes. He guessed that nobody plants a large mango field because if a hurricane comes you’re basically done for (Kerry Dore, field notes, September 24, 2010).

(A farmer from Dominica) said how in his country there would be more wild fruit for the monkeys and how the monkeys here have to come down because there is nothing else for them to eat (Kerry Dore, field notes, September 27, 2010).

In terms of monkey damage, (the farmer) said that before, cane acted as a buffer. I asked if the monkeys really ate cane and he said oh yes, they

extract the juice better than a human. They bite off the skin and spit it out (Kerry Dore, field notes, October 29, 2010).

(The extension officer) was chiming in about how you never saw monkeys before – you had to go up in the mountain to get them. We talked about how the monkeys need fruit trees for food and they don't have any (Kerry Dore, field notes, January 20, 2011).

(Kerry Dore: What keeps you from producing as much food as you can?) Animals mostly, only animals alone, I'll say that. *(And more specifically?)* You really want me to say that? *(Laughing.)* Monkeys. *(I know, like I don't already know! Why are the monkeys a problem?)* They are a problem because, really and truly, nothing really in the wild right now. So, that's the problem really. If something in the wild, that's a different, but nothing in the wild, so they just feast on my crops, over and over and over again. *(Later in the interview...)* *(This next question is, what do you think is causing the problem? Earlier, you said it's because there is not enough food for them. Are there other things that you think might be causing the problem?)* Sometime also I believe...once ago, a lot a people used to be in the hills. Not now. The hurricane and so, they destroy all the trees them and different things, so nobody really be in the bush land like before time. *(So people used to be living up at the base of the mountain?)* Like sometimes we just go and camp and different things, we camp out in the mountain, the monkey them stay up. Because you know we got fun we got roads but now the older folks them die out. The youngsters don't go up in the hills no more. So all that used to keep away the monkeys them. *(So you said something about fruit trees, too? When people were going to the base of the mountain, they were getting fruit and stuff?)* Yeah. *(And there are no more fruit trees there?)* No more fruit trees there after the hurricane mess up all a them. You see before there used to be up in the mountain, it destroy all the orange trees them. *(What other kinds of trees were up there?)* You'll find apple trees and stuff *(like custard apple, golden apple?)* yeah, and pears (Kerry Dore, farmer interview, February 14, 2011).

(Kerry Dore: And how long have the monkeys been here on the island?) Well, years, but as I said, we didn't have that large amount. And, they not travel down here. What they used to be in the hills, because my grandfather and my mother...*(Drawing on paper)* Now, this was the mountain area, and down here you had the food crop. Now, the monkeys used to be between here. They didn't come down to that effect. But they continue coming down now because the older people, my grandfather and so on, they used to work in the mountain. They go up early in the morning, stay up until late, so monkeys didn't have time to do what they are doing now. Right? But because the younger generation said they were not going into agriculture, so, the monkeys come down where they got

food. And I'll tell you more, monkeys reach down all on the garden pen where the sheeps play, right, and this is way down to the road. Sometimes you go on the main road and you find them running across you. You never find that years ago! But they got to look food. And mango season is out right now, it just coming in, guavas, manziport, breadfruit, and these are what they used to feed on. Ah, cherry, and so on. But we have a lot of wildfires that burned some of these crops. Yeah, and now like you're finished with cane up there, you find they used to feed on the cane up there. Well, right now they come down as far as they could. Even in my garden there, I have cane plant and you'll be surprised, you go in there and you'll see how they have their eat. So they follow the food. (Later in the interview...) (*I'm really curious about how things were different during sugar with regard to animal movements. So, how has the end of sugar affected damage from the animals?*) Well, this is where the damage came in. You had damages, but it was not very great, because the people to whom worked on the estate, they control their animals. (*You mean the cattle and stuff.*) The cattle. Because if they did not control them, we impound them. But from since they are finished with the sugar, everybody find it's possible to loose their animals. (*Now what about monkey? How did it change the way the monkeys were moving around?*) Well, monkeys you had on the estate, yes, the sugar cane, they feed on the borders and so on, but because people were travelling, in areas, and you had men shooting monkeys, it control them a lot, so they continue in the hills. (*So they stayed in the hills.*) Yes, yes. (*About how many monkeys were you killing, do you think, during the sugar days? Or, how many per day? Or per week, if you had to guess?*) Well, I never did go into that. As I said, I'll just, a fella would go and shoot, like Mr. (gunaman) would sell them, but if I shoot, I just give it to a farmer or a neighbor who takes them. But I'd give like 25 rounds per month, and you'd have to carry the empty shells to the police to get more. They would refurnish you. (*Were they shooting monkeys every day in the cane fields?*) Every day (Kerry Dore, farmer interview (former estate manager), February 27, 2011).

(One farmer) said there used to be fruit trees in the ghauts, and that the hurricanes took them out. She said that a few years ago, maybe 2005, they had three hurricanes in one year and it wiped them out. I mentioned how nobody is replanting them. She said that farmers joke that they won't be alive to see them produce (meaning they take so long to fruit). She said that what would it have been like for them if the elders had done that? They used to be more cautious about the future (Kerry Dore, field notes, March 16, 2011).

(*Kerry Dore: Now, where are monkeys living on the island?*) Well, that has changed, yeah? Because, before sugar went out, they never used to be down here. But, generally, I think the majority of them be in the mountain, but now, I think they are spreading out a lot. A lot a monkeys

in low lying land. I think they just, like anything else, they need to live and they just trying to eat what they can eat. Wherever they can get it, they'll have to go for it. It's like, survival of the fittest. You go where you can get enough to sustain you. And if it's not in the hill anymore you got to come down in the lowland. I remember hearing stories up Fahies how the monkeys would feed on cane, right? There is no cane anymore, so the monkeys come to the lower section of the island to look food. And I could tell you, too, a lot of the mango trees that I knew as a little boy, growing in the ghauts up here, they is gone, because nobody replanted them. All of those, I think that monkeys used to feed on. But, I don't think they are replanted, so there's really nothing up here for them – when I go jogging up here – when you look, like up behind there, nothing that you can see for the monkeys to eat. (*Where, specifically, are you talking about these mango trees? Where are they?*) Buckley's Ghaut, that's what they call it, Sandy Ghaut, River Field, those are the ones I know of. (Later in the interview...) (*Are there particular times of the year or times of the day when monkeys do a lot of damage?*) I think particular times of the day. Very early in the morning. You know, Kerry, I always wondered, why is it that, even before I leave school, why is it that the old men used to work the lands up here, just above the sugar cane belt, used to leave their house like 4, 4:30. I *always* wonder why they have to go – some of them used to go in the *darkness of night where you cannot see* – they could hardly see but they know where they were going – and I always wonder why, and it's only now that you come, and you get into farming you understand that they *had to be on the land* before the monkeys get there because if they wait, and get there by 7, the sunlight is up, too much damage will be done. And that is why they *go from morning and they leave at night when the sun is already down*. Because they try to back off the monkeys for as long as possible (Kerry Dore, farmer interview, May 27, 2011).

(*So how long have monkeys been in St. Kitts?*) Man, we come with them. I born with them. I'm not able to tell you that. From the time I born I know monkeys, but, you know, they never that popular because only one baby they now get, they allow to get, and it *really* surprise me, these last ten years, monkey increase a lot. When I tell you a lot, a lot. (*So, the last ten years?*) Yeah, the last ten years, monkey increase plenty man. And, they used to live in the mountain, they stop living in the mountain, it's lowlands they live now. Once ago you see a monkey you have to go mountain. Even in the 70s, to see a monkey, you gotta go mountain. But now, the monkey been down here right now (Kerry Dore, farmer interview, July 3, 2011).

(*Kerry Dore: Has the monkey problem gotten worse?*) Yeah, to me the monkey system getting worse. Getting real worse. I'll tell you what the government shoulda been doing. Some of them army men, send them to

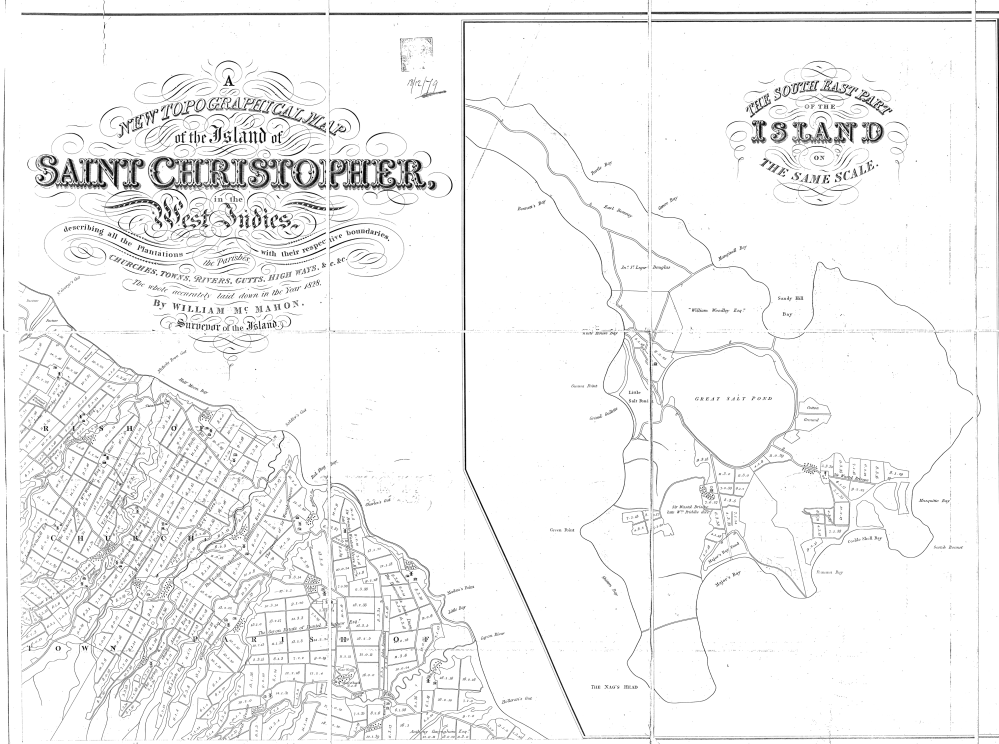
shoot monkeys. To me that's the best way, have the army men shoot them. Cause the gunaman don't really shoot too often (Kerry Dore, farmer interview, July 7, 2011).

(Kerry Dore: One thing I'm really interested in is the fact that, the farmers at the time, when the sugar was in, they couldn't work in the cane fields, so they had to work up high and in the ghauts, is that right?) Yes. *(And how do you think that impacted where monkeys were able to travel? From what I've heard, it created a barrier, keeping monkeys out of the canefields.)* I think that such was the layout of the estates, that at the head of maybe a ghautside, there was a canefield and at the bottom there was a canefield, so before they reach your vegetables, they would have cane, either from the top or from the bottom. So the damage, even then, could have been less, and I think it was the sugarcane they love best. So maybe your place could have been protected by sugar cane, which they would eat before they came to you. *(Very interesting! How many monkeys to you think the estate used to shoot every day?)* Not many. *(Would it even be one per day?)* Maybe more than that. But you know, these gunmen were not paid by the estates. *(They weren't?)* The government used to control that. Government had control over the monkeys, trying to keep the monkeys from the sugar cane. Which gives the indication that they were getting substantial damage, the fact that they had to do that. That alone tells you that. They had substantial damage (Kerry Dore, farmer interview, August 21, 2011).

Collectively, these excerpts from field notes and interviews explain that before the sugar industry ended, problems with monkeys, and interactions between monkeys and people occurred only almost exclusively along the boundary of the forest and cane lands. These marginal lands were unsuitable for cane production, so estates allotted small plots to workers (or slaves before emancipation in 1838). In order to protect the crops in these areas, the workers would be on their farms during all daylight hours. The structure that was present during this time was such that the monkeys had sufficient food along this forest/farm boundary. The smallholding farmers working on the border of the forest and cane land actively maintained numerous fruit trees that provided food for monkeys, and the animals supplemented their diets with crop and cane raiding. In addition to farmer presence and sufficient food, monkeys were deterred from leaving the forest by the

activity of the sugar industry. Tractors, estate workers, and forest rangers/gun men (local term “gunaman”) made the lowlands a dangerous place for monkeys.

Visual representation of the land use patterns described in the ethnographic data can be seen in the four parts of Figure 12. The McMahon Map of 1823 (Figure 12) shows, with incredible detail, the extent to which St. Kitts’ land was organized during the high point of sugar production. This map, divided into four parts, shows the location of every land parcel, every plantation, and every slave village (as the map was created five years before emancipation). This illustrates how every possible piece of arable land in St. Kitts was owned and taken up by activities associated with sugar cane production, so the only land available for small-time sustainable farming was in the ghauts and at the base of the forest. Figure 13 is from the most comprehensive investigation of St. Kitts vervet monkey behavior (McGuire 1974) and shows the location of monkeys at this time: limited to the central forest and southeast peninsula with the exception of a small area on the north coast. Figure 14 shows how the land dedicated to sugar in the McMahon Map was essentially the same just prior to sugar industry closure in 2005.



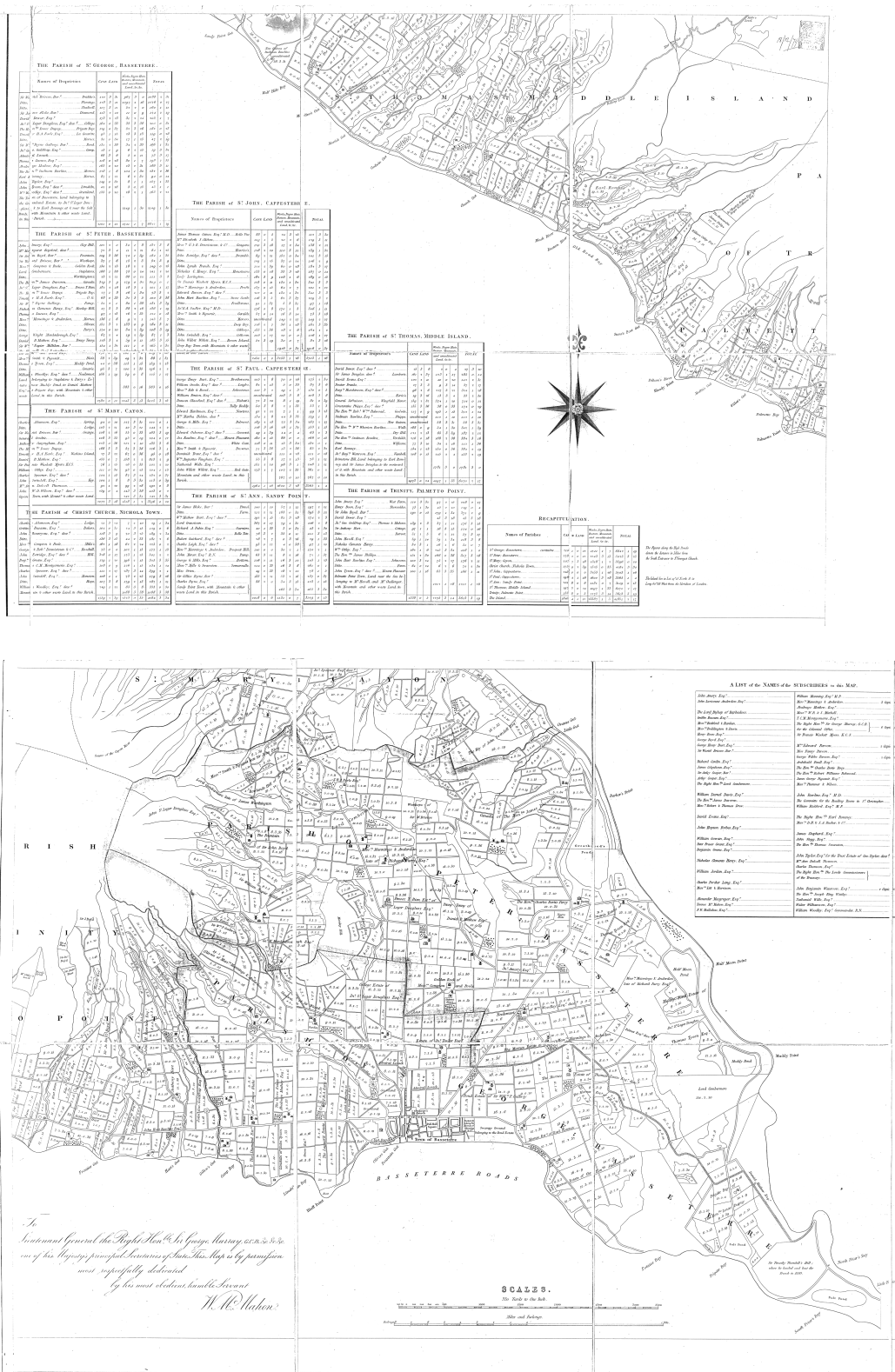


Figure 12. McMahon Map of 1823, presented in the following order: Northeast, Northwest, Southwest, Southeast. Obtained from the St. Kitts National Archives.

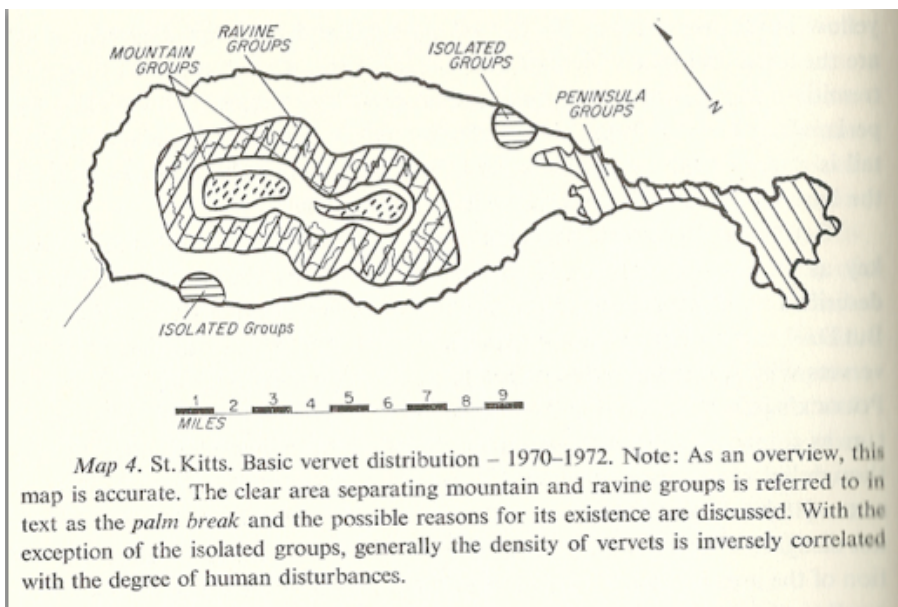


Figure 13. Location of vervet monkeys in 1974 (McGuire 1974).

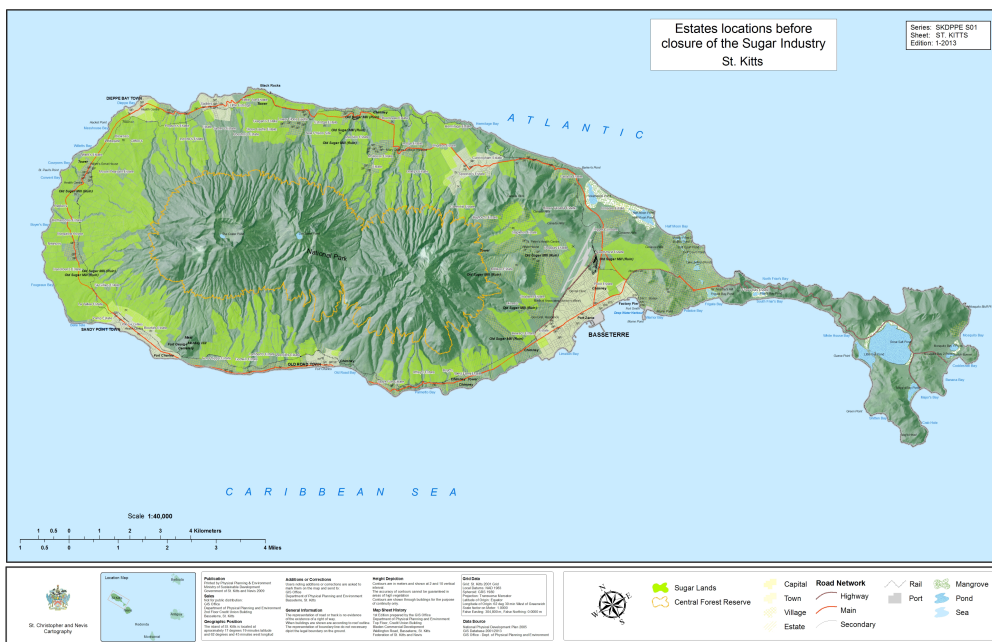


Figure 14. Map of sugar cane estate locations just prior to industry closure in 2005 (made by Eduardo Mattenet from the St. Kitts Planning Department).

While this study was conducted 5-6 years after the closure of the sugar industry, almost all agricultural land in St. Kitts is still referred to by its former estate name (e.g. Sir Gilles, Belmont, Ogees, Shadwell). Additionally, village and farm locations still reflect pre-2005 estate infrastructure. Villages are located on the main road that runs along the perimeter of the island. These villages are remnants of the need for estate workers to live close to their estates, which were located inland from the villages. Today, the bus system makes all of the lowlands easily accessible, but for the most part, farmers still work on land in “the mountain” located closest to their village. This is because when the sugar industry closed, former sugar workers who took the initiative to apply for land were typically given pieces from the estates for which they used to work.

While these remnants of the sugar industry remain, the ethnographic data reveal that the closure of the sugar industry dramatically changed land use patterns in St. Kitts and significantly increased the level of interaction between humans and monkeys. In post-2005 St. Kitts agriculture, there is no longer large-scale production or associated activity, including the presence of guns, on the land that was formerly in cane. Few farmers work at the base of the forest, as the closure of the sugar industry has made better land, and land closer to the villages, accessible. As a result, the major food sources that sustained the monkeys in the mountain have been lost: farmers no longer maintain fruit trees in the mountain, fruit trees destroyed by hurricanes and wildfires have not been replanted, and there is no longer any sugar cane for them to eat.

A post-sugar industry map with these new land use patterns does not exist. Figure 15 was generated by the St. Kitts Planning Department for this study, and is as close to a current land use map as is available. The base map is the proposed future use of the land.

This map was generated in 2005. From this base, new housing developments were added, because they do not necessarily line up with what was proposed in 2005. Additionally, the boundaries of all 65 farms from this study were added to this map to show that much of the former sugar land proposed to be used other purposes, such as development, is still being used for agriculture.

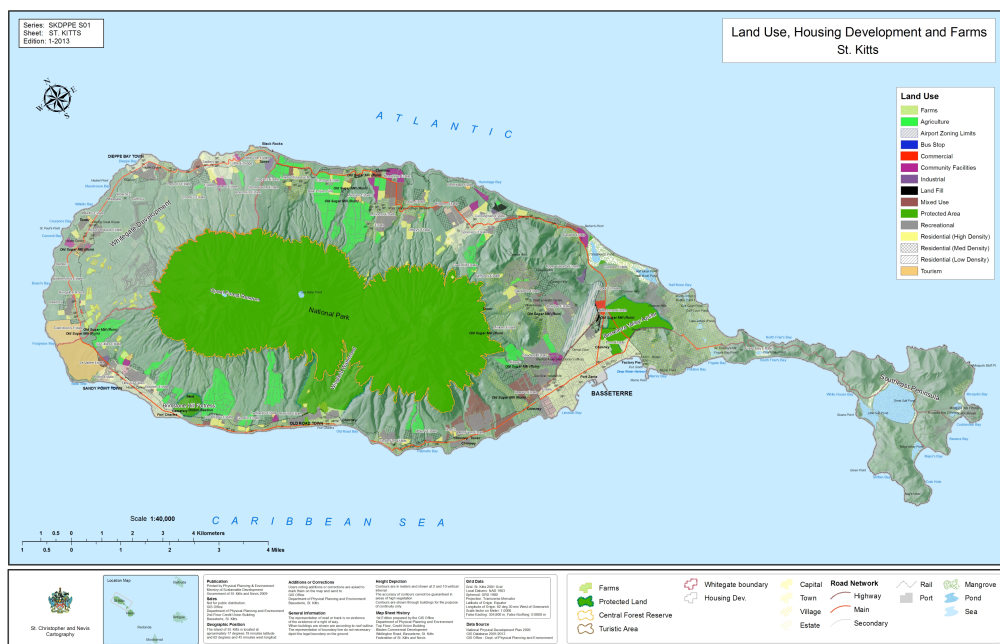


Figure 15. “Current” St. Kitts land use map (“farms” = farms studied in this investigation).

The ethnographic data and these maps explain why, prior to 2005, to see a “wild” monkey, one had to go into the mountain, but now, monkeys are all over the island - in the forest, the farmland, the villages, along the water, and even in town (Basseterre). Monkeys have had to leave the mountain in search of food. They are finding it, relatively easily, in the areas that were the focus of this investigation: the pieces of former cane land that have been distributed to small-scale farmers.

In a broad sense, these results answer one of the questions asked as part of an ethnoprimateological approach: how do humans affect nonhuman primate behavior and ecological patterns? The ethnographic data just presented show that human agricultural activity has *historically* impacted monkey behavior. Human land use patterns and agricultural practices previously restricted most of the mainland monkeys to the high altitude, interior habitat of St. Kitts, and the collapse of the sugar industry and its infrastructure and control has allowed these monkeys to move out of the mountain and into the agricultural areas and villages.

Additionally, the predictive models in Chapter Two show that human agricultural practices and land use patterns *currently* affect monkey crop-raiding behaviors, as farmers' guarding and planting behavior and neighboring farm presence play a role in which farms monkeys raid. The ethnographic data confirm these results. Many farmers spoke about reasons for their vulnerability – the mango season, their location near the ghauts or the forest boundary, the fact that they could not be on their farm all the time, or because they had no neighbors to act as a buffer:

(One farmer) said his father used to have a farm higher up the mountain but the monkeys were really bad so he moved further down. (Kerry Dore, field notes, August 24).

I told (the farmer) that I need to study farms that experience damage and those that don't to see why it is that some have damage. He said it's simple: he's in the lowlands and he's fenced, which prevents monkey and pig/livestock damage respectively (Kerry Dore, field notes, August 25, 2010).

(One farmer) told me that the monkeys come from both directions and that he's the only one farming in his area, so he is particularly vulnerable (Kerry Dore, field notes, August 26, 2010).

(The farmer) showed me how his farm is in between two ghauts and explained that is why he gets so much damage. He said that there are so

many of them that there's not enough food and now they're eating everything. He's going to start spending more time on the farm to keep the monkeys away. He told me a story about how he would walk to one end of the farm to cook for the dogs and by the time he comes back the monkeys have eaten the crops. He's going to start catching them. When the tomatoes just start to get red, that's when they take them (Kerry Dore, field notes, September 3, 2010).

Monkeys don't want no walk no land, just wanna jump from tree to tree. I think that's why I got so much monkey problem, because I'm so close to the ghaut. The closer you be to the ghaut the more monkey damage you get. (Later in the interview...) (*Kerry Dore: What times of the year or times of the day do monkeys do a lot of damage?*) Of the year when no mango in. They learn your schedule and they learn it well! Even better than you! If you're supposed to be gone and you're there they make noise! (Kerry Dore, farmer interview, November 27, 2010).

(The farmer) can't get relief, it's so bad. She said they come from all over, but pointed out the specific trees that they like to hang out in. She also noted that she doesn't have any neighbors and there's lots of tall grass around her. It's so hard talking to people like her, who are getting hit so badly. It's hard to end the conversation and to know exactly what to say (Kerry Dore, field notes, February 15, 2011).

(*Kerry Dore: Do you think you get more or less monkey damage than other farmers?*) Oh, I think I get more licks than other farmers. You see, as I said, most farmers on the other side of the island work together. Now, you would believe it's only been the last...year I've been having serious monkey problem. Just on the other side over there, there used to be an old gentleman and he used to be there...the older guys used to go up on the land from the morning until night. And he used to be there from 5:00 until 7. Just beyond here. And that's where the monkeys come from most of the time. That used to protect me – that was a buffer zone. It was *very rare* that they come through (Kerry Dore, farmer interview, February 28, 2011).

I met (farmer)'s husband on her farm. He was clear that the further up the mountain and the closer to a ghaut you are, the worse off you'll be with regards to monkey damage (Kerry Dore, field notes, June 29, 2011).

Thus, farmers understand how their past and present actions have affected monkey behavior.

The Impact of the Sugar Industry on Kittitian Farmers' Cultural

Conceptualizations of Vervet Monkeys

Pre-2005 The selected quotes from the previous section explain how, prior to 2005, monkeys were rarely seen in the lowlands. Data from historic, academic and ethnographic sources reveal that during this time, conceptualizations of monkeys were twofold: they were *pests* in the mountain (at the forest/farm boundary) and they were *food* in the lowlands. It was only a small set of farmers who cultivated crops along the forest/farm boundary and in the ghauts that experienced *monkey as pest*. Descriptions of monkeys as pests to this group of farmers go back as far as written accounts of the monkeys existence on the island: in the first account of vervet monkeys on St. Kitts in 1700, French priest Father Labat states: “monkeys stole cane, potatoes and other crops until it was necessary to stand guard day and night in order that they should not carry off everything that had been planted” (Sade and Hildrech, 1965: 68). Reverend William Smith, of Nevis, published a collection of letters to a friend in 1745. In one letter, he says that the thick woods in St. Kitts “swarm with wild Monkies who venture down in the dark Night to steal Potatoes and other Provisions with so much cunning or craft as to give rise to several strange incredible Stories about them...” (Smith, 1745: 35 in Sade and Hildrech, 1965). In addition to describing historical accounts of vervet crop-raiding, these authors also cite personal experiences with crop-raiding vervets. Poirier (1972) states that: “most cultivated crops are targets for the monkeys. Supposedly, many farmers are driven from their land because of the intense competition by the monkeys for the crop” (Poirier, 1972: 43).

Two doctoral dissertations, Merrill (1958) and Mills (1974), provide details about the farmers that worked at the forest/farm boundary, how they fit into St. Kitts agricultural organization prior to sugar industry closure, and the challenges they faced. Merrill (1958) explains that aside from the dominant sugar industry, there were two forms of “Negro agriculture” in St. Kitts in 1958: agriculture within the small villages and provision agriculture of the mountain land. Individual houses in the villages usually had yards of a quarter acre or more, and these were used for the production of foodstuffs, most notably fruit trees (coconut, soursop, sugar apple, papaya, limes, bananas, plantains and avocados). Ground provisions, such as cassava, pigeon peas, and beans were common, as were yams, sweet potatoes and tannias, and many villagers used land for flower gardens, so various flowering shrubs and colorful crotons were common in front yards. These plots were more subsistence than commercial in nature. Provision agriculture is described as a remnant of slavery days and sharply limited to the forest margin above the cane fields and to the steep-sided ghauts. Merrill (1958) states that these lands are “as old as the inability of these islands to produce enough food for the inhabitants” (p 112). Many estates rewarded their most dependable workers by permitting them to work land in the mountains rent-free. There was considerable variation in the method of provision agriculture, but commonly, starchy tubers played an important role in the provision grounds and composed the bulk of the crop on these lands (Merrill, 1958).

Merrill (1958) does not make explicit mention of the challenges faced by individuals in provision agriculture. His reference to animals comes from the perspective of how humans have disturbed the island’s flora and fauna. He explains how man is

especially culpable in the case of purposeful introduction of animals like the mongoose and the green monkey. The mongoose was brought to the island in an effort to control snakes and rats, but it brought about the extinction of many species of mammals, birds and reptiles. Merrill (1958) compares the effect of the mongoose introduction to that of the green monkey:

Somewhat less harmful has been the much earlier introduction into St. Christopher and Nevis of the Green Monkey of West Africa, *Cercopithecus sabaesus*. Labat stated that the animal was introduced to the islands as a house pet by the French in the seventeenth century. Later it escaped into the mountains, where it exists in numbers today (p 36).

This quote shows that while the presence of monkeys was well known at this time, the impression was that their effect on the environment was less than that of the mongoose.

Sixteen years later, Mills (1974) describes the major farming systems of St. Kitts and their challenges somewhat differently. Again, there is the dominant sugar industry and what Merrill (1958) described as “provision agriculture” (what Mills (1974) calls “smallholding”), but Mills (1974) is more specific than Merrill (1958) with regard to the smallholding group, dividing this farming system into “sharecroppers,” “privileged tenants” and “cash renters.” All of these individuals were tenants, since all arable land was held within the plantation sector. The largest group at this time was sharecroppers, making up 55% of the smallholding sector. This group gave 23-33% of their crop to the landlord. The difference in the percentage of crop owed lay mainly in the capability of the soil – individuals working on better land had to give up more of their output. Privileged tenants made up 22% of smallholders at this time. These farmers did not pay any form of rent. The landlord gave this special privilege to those who labored on that particular estate for several years. The final group, cash-rent tenants, composed 23% of

the smallholders. This relationship often occurred on larger estates with more available cultivable land, and the amount owed depended on the area of land rented. The third farming system described by Mills (1974) was a new sector known as commercial food-crop agriculture. At this time, the fortunes of sugar production had diminished, reducing the acreage planted in cane and making it possible for these entrepreneurs to lease the land from individual landowners. This system of farming differed from the sugar industry because it was a mix of vegetable products and a smaller functional unit and it differed from the smallholding style of farming with its agronomic, commercial approach. The farms varied from 5-15 acres with a mix of about six different crops, including Irish potatoes and peanuts. This form of farming was limited to individuals with means – producing five acres of Irish potatoes cost ~\$3,200 and producing five acres of pineapples cost ~\$21,800. At this time, a smallholder's annual income was ~\$1,500 and a middle-class entrepreneur's income was ~\$6,000 (Mills, 1974).

Mills (1974) assessed the challenges faced by smallholding farmers in St. Kitts, citing issues with soil fertility, access to water, insect pests, the costs of chemicals (fertilizers, herbicides) and marketing. With regard to animal pests, he states: “no lasting deterrent has been applied to the widespread attacks of the larger pests, particularly the monkey...the rat and mongoose inflicted minor damage to food crops over the years, but that of the monkey has been considerable...the situation has taken on serious proportions because the more frequent attacks on smallholders' lots caused some of these to be abandoned entirely” (p 209). In terms of a solution to problems with monkeys, Mills (1974) explains that prior to 1968, there was at least one gun on most sugar estates, and these men, as well as sport hunters, contained these pests in the forest or bush areas and

out of the farm plots. However, in 1968, a State of Emergency imposed severe restrictions on the use of firearms. Mills (1974) argued that lifting the constraints on the use of firearms on estates and by sport hunters could permit the protection of farms against “the worst ravages of this ubiquitous herbivore” (p 210). This quote shows that an awareness of the challenges faced by farmers with regard to monkeys has become apparent at this time.

In the early 1980s, the government of St. Kitts and Nevis asked the British government to provide consultants to: 1) formulate a ten year plan for the sugar industry in order to put it in a sound financial position and to 2) carry out an agricultural sector review with a view to the possible expansion or improvement of non-sugar agricultural production. The product of this assignment is The Booker Report (1984), which was obtained for this study by the St. Kitts National Archives. This report explains the state of smallholding farmers at this time and some of the challenges they faced. The authors of the report conducted a survey in 1981 and found 898 persons involved in small scale farming, with just over half of these individuals also working on a sugar estate. Most farmers were older men, as younger men did not seem interested in farming. Excluding the residents of Basseterre, one family in six was doing this type of farming. Plots were small, typically less than one acre. The report explains that the land was unsuitable for sugar cultivation and was located either in the foothills at the base of the mountains or on the sides and floors of the gullies (ghauts). There was no shortage of this land at this time, but the report explains that a number of factors discouraged this type of farming, including crop stealing by humans, damage from monkeys and marketing problems.

As previously explained, before the closure of the sugar industry in 2005, to see a “wild” monkey, you almost always had to go into the mountain: to the cane/forest boundary above the cane apron or to the central forest. Therefore, individuals saw living monkeys either inadvertently while working the land or they actively looked for them in the mountain for the purpose of shooting them. Many of these shooters were rangers employed by the sugar industry to keep monkeys out of the cane fields. The ethnographic data show that many of the current St. Kitts farmers remember this time, when “gunamen” would go up into the mountain and shoot monkeys on a regular basis:

(Kerry Dore: Do you know people who are killing monkeys to defend their farm?) You mean people who shoot them and so? *(Yes.)* Mr. Lake used to do some shooting, I don’t know if you know him. Winston Lake. He works at Kittitian Hill now. An old guy. He used to do some shooting, but mostly when we were on the estate. They give him a gun. He shoot them very often. *(Very often?)* Yeah! *(Kerry Dore, farmer interview, February 26, 2011).*

(Kerry Dore: How long have monkeys been in St. Kitts?) From the time I know meself. I born, a baby. I know because me mother used to plant way up and monkeys was up there then. And that was when I was small and I’m fifty-odd years old. So, they was there before, but the thing about it, they wasn’t that plentiful. Because since I was a school child, I remember this guy, used to come across the road, I think it’s Trinity? Mr. Williams. We used to call him “the monkey man” because he used to go with the gun. And every time you see him pass, this long shotgun behind his back and a motorcycle and you know definitely, well then, that we have the monkey man going now. So you know he going to destroy the monkeys them. So we never used to have them so plentiful. *(When was that? What year would he be going in there and doing that?)* That would be like ’73, ’74. *(Kerry Dore, farmer interview, February 26, 2011).*

But they need to do something to cut back on these monkeys. When I was younger, they used to shoot them! They used to got a man on a bike, he used to go in the mountain and shoot the monkeys. Every afternoon, I coming from school, all I could see the monkey man coming. *(Kerry Dore: Do you know what his name was?)* His name Mr. Williams, he live in Palmetto Point. He used to just come down with he burn bag over here and a monkey to the back. *(Kerry Dore, farmer interview, May 9, 2011).*

(Kerry Dore: Do people use guns to defend their farms?) The only person I know have gun was the young man over there. Who used to come around. *(Mr. Williams?)* No. I think it's Connor. He's a gunman. He shoot the monkey. *(Is he a farmer?)* Yeah, he supposed to be a farmer. Lenroy Connor. (Kerry Dore, farmer interview, May 9, 2011).

(Kerry Dore: Do you know anyone who is killing monkeys to defend their farms? What about anybody using guns?) Farmers themselves using guns? *(Yeah.)* Not plenty, but there were a few that would resort to that. We have this guy that used to do farming down here Cranstoun, Connor? Lenroy Connor. He also have a gun. *(And he used to go around and shoot a lot, right?)* Yeah, well, he used to assist farmers, especially with pigs. *(So he had another job and he just did this to help?)* Yeah. Basically, he said 'everybody be calling me.' *(So, pig mostly, but he would also shoot monkeys).* Yeah, but mostly on his farm. Because right there they had monkeys, right there at Cranstoun Ghaut. (Kerry Dore, farmer interview, May 17, 2011).

(Kerry Dore: What about guns? Is anybody able to shoot monkeys?) Well, they used to have a fella that would go around and do that. *(Who was that?)* A fella named Cleever. He used to go around and shoot, but now you have to be careful about who has guns, so I don't think they gone do it no more. It's a shame, because when he came into a area, and he started to shoot, they keep off for a long time. You don't got a problem for a good while. And he would come back every week and so. *(Just shooting.)* Yeah, because the minute they hear the bullet, they go. Let me show you how smart the monkey be. When he used to come around, he used to drive a tractor. And from the time the monkey see him on the tractor, they ran away. But he had a technique. What he used to do was park the tractor in an area, and walk all the way up here. And I don't know how he get that technique, but he had a sound that he used to make, when he hide himself, and they come out to him. *(Somebody else told me about him! Was it the sound of a young monkey?)* I don't know. He make a kind a sound that get them to come out. (Kerry Dore, farmer interview, August 15, 2011).

William F. Dore, former Permanent Secretary of Agriculture and head of the field division of the sugar industry, confirms the use of rangers by estates during this time, and explains why this practice no longer exists:

(Kerry Dore: I want to get back to get back to when you said that you had SSMC (The St. Kitts Sugar Manufacturing Corporation) divided into twelve subdivisions and each subdivision had a gun man. Those subdivisions were just basically sections of the island, estates?) We took

the total sugar plantation area. We cut it into four, and we installed an area manager for each of those four places. Each quarter was sub-divided into three field operations, each with a field superintendent and two field assistants. And overall atop this structure, we had an agricultural manager, operating out of my central office, an agronomist, sugar agronomist, out of my office, a food crop agronomist out of my office and an agricultural engineer out of my office. So that each area manager was responsible for seeing depredations to his cane and organize appropriate shootings and so on in the area. (*This I'm really fascinated by because there are discrepancies in what I've heard. Approximately how many monkeys do you think were being killed?*) That I can't tell you. (*Was it a lot, or a little...*) Well, it was enough to prevent depredations to the crops! (*I think too, not just so much the actual killing of monkeys, but the presence of guns and the sounds of guns just in and of themselves was enough to keep monkeys away.*) That's right! Scare them! Because these fellas were itinerant! He's an employee of the area and, you know, he's a mountain ranger. And, every time he shoots off the gun, he doesn't shoot one, but, he has the effect of chasing them to other areas. (*Well, yes, this is something I've thought about and mentioned – why can't we try to mimic that again?*) Well, you see, cost. Cost. That was absorbed in my production of sugar cane. Weedicides, insecticides, depredations by monkeys and rats and so on, all of that, *part of my protection of my product to sell to the factory!* So that was absorbed in that. *We budgeted for it!* (*Wow.*) So now, there is no organization, there is no budgeting, I mean, those people we had were *trained!* We sent them by the defense force to learn to shoot so they would be more accurate! (Kerry Dore, interview with William F. Dore, October 2012).

A study by Coppinger and McGuire (1980), conducted in 1972, also confirms the ethnographic data that the pre-2005 conceptualization of monkeys by people living in the lowlands was *monkeys as food*. The goal of Coppinger and McGuire's study was to assess the rate of human predation on St. Kitts vervet monkeys as a means to determine the minimal population size that could support such rates. Data collection for this work included an evaluation of the "widespread practice" of monkey hunting (p 2) through interviews with monkey hunters identified by forest rangers and sugar industry managers and observations of monkey hunting by two of the most prolific hunters.

The study provides a review of the history of monkey hunting in St. Kitts from 1962-1972, explaining that there has been a bounty of \$0.12 for dead monkeys since the 1800s (although they could not locate the original statute). Tails were used as evidence of a dead monkey. Estates would often double the \$0.12 fee for a monkey tail provided by the St. Kitts government. While this law still stood at the time of Coppinger and McGuire's (1980) writing, few estates bothered to go through the paperwork for such a small fee.

The study goes on to explain that nearly every estate had a monkey hunter in the 1960s, and the estate provided the hunters with guns and ammunition. By 1972, however, guns and licenses for guns were extremely difficult to obtain in St. Kitts, especially for young people (see the State of Emergency, cited by Mills (1974), above), and cartridges had to be obtained at the police station. While gun licenses were \$3.00 before 1970, at the time of Coppinger and McGuire's (1980) writing, the rare holders of licenses were charged \$25.00. These changes had a direct effect on rates of monkey hunting:

Every hunter and estate manager interviewed, without exception, firmly stated that due to the conditions of gun registration and licensing, vervet mortality due to human predation has decreased greatly over the past five years (1967-1972), thus thrusting vervet numbers into an upward climb (Coppinger and McGuire, 1980: 5).

Additionally, while trapping vervets to protect crops was taking place at this time, this practice had also decreased due to the decline in kitchen gardens as urbanization was taking place. Finally, the authors projected monkey predation by humans to continue to decrease, as the average age of the monkey hunters they interviewed was well over 50

years; the authors acknowledged that these individuals would have to retire soon due to poor eyesight and failing physical condition (Coppinger and McGuire, 1980).

Coppinger and McGuire (1980) identified sixteen monkey hunters and extensively interviewed 12. “The most amazing finding” (p 5) of their study was the effectiveness of the hunters: their ability to see monkeys in the forest and the fact that they never missed a shot. With regard to hunting style, “particular habitat made little difference for they were always on the alert for monkeys except in the lowlands in mature sugar cane where they talked freely as they walked, becoming silent as they looked into the ravines or as they approached the ecotome between agricultural land and forest” (p 5). Hunters made extensive use of their ears, using monkey vocalizations to determine the size of the group and direction of its movement. One hunter claimed to be able to smell out the monkeys’ sleeping trees. Both of the hunters they observed mimicked monkey vocalizations and shook branches in the manner of dominant male monkeys in order to call the troop in. “One hunter had many vocalizations and knew what each meant in behavioral terms (i.e., alarm calls, territorial defense calls), and used these calls to elicit the appropriate responses from the monkeys” (p 5). Hunters would hide in bushes and avoid eye contact with the juveniles until the adults arrived, and after shooting an adult, the hunter would issue a series of vocalizations that would quiet the troop and cause them to return to the same spot, where the hunter could shoot another adult. One hunter shot 16 monkeys using this system. An estate manager that helped carry the monkeys out of the forest corroborated this fact.

In addition to these techniques, Coppinger and McGuire (1980) explain that *monkeys as pests* in the mountain meant that traps and dogs were also responsible for

monkey predation. Effective, working traps were found in upland gardens, and dogs were seen both hunting and staked to gardens as protection against monkeys. While mortality estimates were impossible to assess from these sources, “the amount of energy expended by trappers and dogs, the working condition of the traps (the senior author was caught in one), the embattled condition and scarred backs of the dogs and the enthusiasm with which they chased and killed monkeys” caused them to increase the figure they obtained based on active hunting predation, 1,813, to 2,000 monkeys (primarily adult males) killed each year in St. Kitts. The minimum population required to support such numbers was defined as 12,000, although the authors argue that the population was likely two to three times this value (Coppinger and McGuire, 1980).

These data show that prior to 2005 most of the monkeys seen by Kittitians were dead monkeys, the product of these shootings. Thus, while smallholding farmers experienced *monkeys as pests*, Kittitians’ primary experience with monkeys in the lowlands was *monkeys as food*. Dead monkeys, a product of the shooting efforts just described, were “an important protein supplement for the population... monkey meat (was) a much desired commodity among the local population” (Coppinger and McGuire, 1980: 3). In 1972, monkey meat was \$0.50-0.60 a pound, and in a random sample of 52 people, 48 had eaten monkey meat, 46 liked it (describing it as “sweet”), and 40 had eaten it within the last year (Coppinger and McGuire, 1980). Numerous references made during the course of the study confirm the fact that monkey meat used to be eaten a lot.

For example:

A female farmer asked me about eating monkey. She said she used to make it for her father all the time and that he lived to be 90, so maybe she should start eating it! I asked where they got the monkey, and she said

they would go closer to the forest and trap them. She said it tastes like mutton (Kerry Dore, field notes, July 25, 2010).

Thus far, this section has shown that, before 2005, vervet monkeys were seen as *pests* in the mountain and *food* in the lowlands, and living monkeys were rarely seen below the forest/farm boundary. The year 2005 marked the end of the sugar industry: approximately 15,000 acres of agricultural land that had produced sugar cane for 350 years were sold to the St. Kitts government and ceased being cultivated on a large scale. The previous section outlines how this agricultural shift altered monkey movements - monkeys are now found all over the island. The second half of this section explores how this increased visibility has changed Kittitians' cultural conceptualization of vervet monkeys.

Post-2005 The post-2005 cultural conceptualization of vervet monkeys in St. Kitts is that of *boundary-crosser*. During the course of this study, conversations about vervet monkeys inevitably revolved around two themes: their recent appearance in the lowlands and their humanness. One of the ways that monkeys are boundary-crossers is their transgression of the forest/farm boundary. During the course of the sugar industry, the factors previously mentioned (sugar industry infrastructure (rangers, human presence and agricultural activity, including cane for monkeys to eat), sport hunters, and smallholding farmer activity (all-day presence, traps and dogs, maintenance of fruit trees for monkeys to eat)) created a boundary at the forest/farm line, keeping the monkeys in the forest. Today, monkeys easily and necessarily transgress this boundary in search of food.

Monkeys are also boundary crossers in their human-like behavior, blurring the boundary between human and animal. Monkeys' similarity to humans was not previously common knowledge, as few people saw "wild" monkeys. Conversations with Kittitian farmers about vervet monkeys reveal that as monkeys have become more visible in the lowlands, their human-like qualities have become increasingly apparent, often to the point of anthropomorphism:

The cab driver told us some funny stories about the monkeys. One story was about the monkeys pulling carrots out of the ground and replacing the top plant so it doesn't look like anything was taken. He said that sometimes the monkeys will do silly things to mess with the farmers, like move their shoes! Another story was that when he was young and would go to the forest to gather fruit, monkeys would throw mangos at him! According to him, it's because he was in their territory (Kerry Dore, field notes, August 7, 2010).

(Kerry Dore: Do you have any stories about monkeys?) There was one woman who has passed on now, who was about 90 years old, maybe. And she's totally convinced, I'm sure as she's gone to where ever the dead goes, she's going to ask who made them. Because she told me the *devil* made them, couldn't be God, she said! They're too bad. I'm sure she's asking them who made them! (Kerry Dore, farmer interview, November 12, 2010).

One of the stories we used to hear when we were growing up, is that, they were saying that, after God made man, the devil wanted to copy God, and he tried to make man, but he stop at the monkey! That's why they are so clever, because everything a monkey see, they will do the same as you. So God made man and the devil trying to show God that he could make man too, and he end up making a monkey! (Kerry Dore, farmer interview, November 29, 2010).

The extension officer was saying how he thinks the monkeys gossip – that they talk to each other. They never used to eat things like pumpkin but now they do, for example. Monkey see monkey do! He said that monkeys are just like human beings (Kerry Dore, field notes, January 20, 2011).

Our Kittitian friend said that St. Kitts has the smartest monkeys - the monkeys are just like humans – they don't speak because then we would put them to work! He said that's a saying here (Kerry Dore, field notes, January 22, 2011).

I used to work at Brimstone Hill. And one day, I sitting at the gate in the afternoon about 5:00. I see 25 monkeys behind the other, like they burying somebody, like they going funeral. Twenty-five of them I counted! Like they going funeral. I said, ‘my God, what with this.’ They were going in a line, one behind the other, like people going funeral. No lie! (*Kerry Dore: What do you think they were doing?*) They going to look food. When they go on the scene, they send the coronel down there to see what’s going on. And when you hear him say ‘Jacka! Jacka! Jacka!’ that mean nobody around. Sometimes they’re up in the tree, and you watch them, they take a bush, put it in front of they face. (*Hide themselves.*) Yes. If they feel like you no watching them, they move it so. When you see them again, they put it back so again. (Laughing). They are very naughty, they are *sensible*, except that they can’t talk (Kerry Dore, farmer interview, February 7, 2011, emphasis added).

They don’t leave their children, you know. They bite you up. They get at you wild with that. They protect their children (Kerry Dore, farmer interview, February 27, 2011).

(*Kerry Dore: How are monkeys most like human beings?*) People would say they get their period. I never experience that, I don’t know. People would say they see monkey using cheney bush to cover, to cover them. (*To cover like as clothing?*) Yes, but I never experience that. (*What’s cheney bush?*) A big, broad leaf, like a fig bush. They say they will see them using that (Kerry Dore, farmer interview, March 20, 2011).

(*Kerry Dore: What do you think about evolution, that says that monkeys and apes are our closest living relatives – that we are more like monkeys and apes than other living animals?*) Well, to me, I understand they have their monthly thing like human! Yeah man, you know, that’s a part of it. (*A lot of people know that, a lot of people talk about how they get their periods. That is a lot like humans.*) In old times, the older people used to carry their kids on their backs, a monkey does that. You know, just like a human. (*So the way they hold their babies.*) They act like human. And they go out, get food to feed their babies. You see? They’re just like humans (Kerry Dore, farmer interview, May 9, 2011)

(*Kerry Dore: Do you have any stories about monkeys?*) Monkey come in your ground and bare you, turn your bottom and they get you. (*They show you their butt?*) Yeah! Oh I tell you, monkey just like people, you know! *Monkey is people!* We are not smarter than them, you know! (Kerry Dore, farmer interview, July 11, 2011).

(*Kerry Dore: What else do you know about monkey behavior? What do you know about how they behave, how they interact with other people in*

their group? What do you see them doing?) They are like human being with their child, their child under their belly hug up. Monkey beg just like people too! You ever see a monkey beg for mercy? Yeah! I tell you, monkey do everything like a human being. *(So would you say they are smart?)* Yeah, monkey smart man. They have sense, so by that we say monkey is a *school boy!* (Kerry Dore, farmer interview, July 11, 2011).

(Kerry Dore: How are monkeys different from other animals?) They look like people (laughing). And they operate more or less like people, the only thing is that they jump like a frog. Because of the female ones, I have a look at them some times, and you know, females they get their period, and I saw a monkey with a branch a bushes under it. *(Really? Like, cleaning herself or she was actually wearing something?)* Wearing something. *(Really??)* Yes. *(No way!)* Up in the mountain, I saw that. *(You saw a monkey wearing leaves like a diaper??)* Yes! *(Where?)* I saw that up Fahies Mountain (Kerry Dore, farmer interview, July 15, 2011).

Monkeys' human-like qualities have also become more apparent because monkey pet ownership has increased. Generally speaking, pet ownership of any kind is not very common in St. Kitts. The former St. Kitts Minister of Agriculture, Dr. Timothy Harris, explains that even dogs are viewed more as workers than companions:

We talked about monkeys as pets. He said it's not in their way of life to have pets at all; even dogs are used more to protect the land. He said "monkeys as pets" is more of a recent, tourist thing (Kerry Dore, field notes on meeting with Dr. Timothy Harris, October 22, 2010).

Previously, monkey pet ownership was rare, but it did occur. Coppinger and McGuire (1980) state "infants taken alive are valuable in that the hunters sell them for pets at a price of twenty-five dollars. (The hunters) say that it is difficult to shoot a female and get the infant alive, but one infant was taken during the study period" (p 4). Two farmers that participated in this study had pet monkeys in the past, and one other farmer mentioned a pet monkey in Old Road ("Patties") that would follow children to school when he was a young child. But for the most part, monkey pet ownership is a recent

phenomenon. The quote from Dr. Harris explains that monkey pet ownership has increased as a result of the economic shift to tourism that has occurred with the closure of the sugar industry. Monkeys have become pets to a subset of Kittitians (known as “monkey men”) because tourists are willing to pay money to have their picture taken with these animals. This trend contributes to monkeys’ increased visibility and the increased recognition of their humanness; however, in this context, the focus is on aberrant behaviors that are likely a product of captivity:

My son had a cage right there, with two of them inside there, Kerry, a man and a woman. My neighbor there had some chicken. The mesh was small. One of the chicken went under. The man monkey kept the chicken, Kerry, I was there. Take the chicken, put it in he lap and he start work up on it. When he done, he smooth down the feather, he work up again, he smooth down the feather, and when the chicken dead, and by God, he turned around and eat it. (*Kerry Dore: He turned around and ate it?*) He ate the chicken. (*How did he eat it?*) When it dead. From working up on it. And when it dead, he turn around and eat it. My wife went there, with she glasses on, me and the man there standing up. The monkey cage had in a mirror, a piece a mirror. He take my wife glasses off she face, put it on and look at he self in the mirror. The man said to me, ‘well, God damn, if I wasn’t here, and you tell me so, I gone say you lie.’ Put the glasses upon he face and look in the mirror. That’s a sensible animal (Kerry Dore, farmer interview, February 7, 2011).

You will be outside, taking a bath or something, hosing down yourself, and the man monkey start play with he thing and so. (*Kerry Dore: For a human?*) Yeah. (*Really?*) I see that happen, more than once. (*So a male monkey watching a human female?*) Yeah (Kerry Dore, field notes, February 14, 2011)

(*Kerry Dore: What sort of things do monkeys do that tell you they are intelligent?*) Well, the monkey watch you when you trying to get them off. (*So they’re standing up to you.*) They’re picking a fight. (*What’s the smartest thing you’ve ever seen a monkey do?*) One thing that really surprise me, they masturbate. (*Another farmer told me how a pet monkey would masturbate whenever women would change.*) Yeah, down in the project down there, we used to catch monkey, but we had a big one tied. When the girls would wash their skin, he would start doing that. Anything you would eat, he would want. He use a bowl and a spoon. And he had a mirror. (*That’s the second time I heard that!*) He use to use it and touch

he face. (*Another farmer told me he saw a monkey have sex with a chicken, kill it, and then eat it.*) Yeah. I see one of them bust off a chicken's head, drink he blood and eat it. I see another one crack the egg and drink it (Kerry Dore, farmer interview, February 21, 2011).

You see them with the glass, you know. (*Kerry Dore: Yes, using mirrors! I've heard about that. You've seen it with your own eyes?*) Yes, yes! Fellas used to get pieces of mirror, put here, and then, they go, take it up and, they do this (mimicking looking into a mirror). (*So they look at themselves. Do you think they recognize themselves?*) Yes, they recognize themselves (Kerry Dore, farmer interview, February 27, 2011).

(*Kerry Dore: Do you have any stories about monkeys?*) When we used to live Fahies, I was small, eh? Mr. Weeks had a big skinny tree there. In the skinny tree they had a monkey cage. My mother used to leave from below to go up by the cistern, that wall of concrete used to have water for use. And a monkey was right in that cage and somebody give my mother a half a bread with pepper in it and she didn't know. She said 'why don't you go and give the monkey that?' And my mother went and give the monkey and the monkey take it, and when the monkey bite, and the pepper burned, it mark my mother. Later, when the monkey get out, she came across and bite she bum. That is a true story! (*Because your mom gave him the hot pepper, she came right for her.*) Yes, they are very spiteful! (Kerry Dore, farmer interview, July 2, 2011).

(*Kerry Dore: Do you have any stories about monkeys?*) Things I see? What I know about them, they are very close to human. (*Why do you say that?*) Because I witness a monkey one time, got a piece a bottle, and got a piece and (making the motion of shaving his face). (*What was it shaving with?*) Just a piece of glass. Because he see somebody was doing it. It was over there in this man's yard, and the man had just done his own shaving. And the monkey came out and started doing it. (*So this was a pet monkey?*) Well, yeah, it was tied in the yard there. (*Wow.*) (Kerry Dore, farmer interview, August 15, 2011).

The increase in monkey visibility is a result of the increase in pet ownership and the monkeys' transgression of the forest/farm boundary and has affected monkey consumption. People still eat monkeys in St. Kitts (or "tree mutton," see Figure 16 and 17):

I started talking to the farmer and he said that there had been some monkeys around recently and that he shot one yesterday. He said that two

men heard the shot and came back and were fighting over the monkey – I guess it was 21 pounds! He said he threw it in the back of their truck and let them fight over it. He said that they were going to cook it at the construction site. He said that's the best way, to burn it (they used a special word) and then cut it up and cook it again. I remembered how he said curry was good (Kerry Dore, field notes, September 30, 2010).

The farmer told me that there are a lot of people who like to eat monkey but they are afraid to say it. He said he isn't afraid and made some sound effects about cutting/eating it (Kerry Dore, field notes, October 20, 2010).

I talked with my neighbor about eating monkey and he told me a place in town where you can go and buy one to eat that's already cleaned out (Kerry Dore, field notes, January 22, 2011).

When we were at the Department of Agriculture's Open Day, they announced over the loud speaker that they had "tree mutton" samples, to come by. We went to check out the monkey meat. We saw a large pot full of the meat. I asked what parts you usually eat, just the arms and legs? He said yes, though some people eat other parts (Kerry Dore, field notes, April 28, 2011)

(Kerry Dore: What about guns? Is anybody using guns to kill monkeys?) Yeah, that is monkey meat up there (pointing to the back of his truck). Yeah, I know a guy in Sandy Point. Got this fella, he just shoot monkey for meat. *(Does everybody know to go to him if you want monkey meat?)* Yeah. *(So, where did you go pick this up?)* He bring it for me there by Best Buy, because he has a container there where he store his tools, he into construction. So he come there, and I just pick it up. Otherwise I go Sandy Point for it. *(So, did you call him and say 'I want some?' or did he call you and say 'I have some?')* No, what really happen, every year, there is a church in Mansion, right on the hill there, Estridge Moravian, has a food fair, and these are a part of some of the stuff we sell, monkeys. It's a food fair. All day. *(When is it?)* The last Saturday of this month. And I would like you to come. *(I would love to!)* (Kerry Dore, farmer interview, May 17, 2011).

The monkey meat was gone already! Supposedly it's always the first thing to go! I saw the farmer from my study and he said yes. Later, he told me it was 50 lbs of monkey meat (Kerry Dore, field notes, Food Fair at Estridge Moravian Church, May 28, 2011).

(Kerry Dore: do some people kill monkeys for food?) Yeah. *(How are they killing them?)* They skin them. *(Do you skin them while they are still alive?)* No, they knock them out. They take off the skin. Then you cut out the belly and head and throw that away. You use the meat. *(So where*

does the meat come from?) The arms and the legs, and the sides (Kerry Dore, farmer interview, July 16, 2011).



Figure 16. Evidence for monkey (“tree mutton”) consumption in St. Kitts.



Figure 17. Evidence for monkey consumption in St. Kitts.

However, due to the increased recognition of monkeys' similarity to humans, this behavior has decreased significantly:

People used to eat them, people still does eat them. When I be small I used to eat them too because my parents would bring them. But after I became bigger and acknowledged...they move just like people, they hold things like people, they eat, they hold their little one just like people and so forth and they has *breath* just like people. They're very smart, you know! (Kerry Dore, farmer interview, November 21, 2010).

I can remember that me grandfather bringing home monkey and eating it. You find that the older folks used to eat monkey. I eat monkey because that was the only protein available! But now I see how smart they be, you hear me 'boy aw you're smarter than me' I'm not supposed to eat that! Yeah, but I eat monkey because sometimes that's the only meat you got inside the pot. And you gotta eat. Whaddyou gonna do, starve? (Kerry Dore, farmer interview, November 27, 2010).

The farmer told me that she won't eat monkey meat because after seeing how they operate, she noticed that they do everything like people. She said they are half people! (Kerry Dore, field notes, January 22, 2011).

(Kerry Dore: When people in St. Kitts, or really just people here in Newton Ground, are talking about monkeys, what kinds of things are they saying about them?) Well most people, like they used to, they will catch them and eat them. *(OK, yeah. What do you think about that? Do you think it's OK to eat monkey?)* Well, I ate it when I was younger, but now I'm a man, I won't. *(Now you won't eat it? Why not?)* Because of what I see. *(What do you mean?)* Like the one having the menstruation and looking like people, I'm saying 'no man.' It turn my mind (Kerry Dore, farmer interview, July 15, 2011).

In sum, monkeys' transgression of the forest/farm and human/animal boundaries makes them less likely to be consumed as food. Kittitians recognize monkeys' intelligence and human-like qualities because they now observe monkeys and their behavior on a regular basis. This has led to a decrease in monkey consumption because some Kittitians feel it is wrong to eat something that looks and acts so much a human being.

The Impact of the Sugar Industry on the Unique Nature of Monkey Pestilence

Discourse The primatological stage of this dissertation (Chapter Two) quantifies tremendous damages to farmer's crops by animal pests, but the ethnographic data reveal that, as a whole, conflict between Kittitians and animals in St. Kitts is really conflict between Kittitians and the state (the government). More than complaints about animal damage, the pestilence discourse in St. Kitts relates to issues with the government. Some farmers say that the government is not doing enough to support the farmers:

(The farmer) said he's thinking about quitting farming. The damage is too bad and he doesn't get any support. He said that he wants the department to show some effort and understand the potential and do something to move the sector forward. He reiterated that the only way to move a country forward is through agriculture. He said that he's thinking about meeting with the prime minister about the farming problems (Kerry Dore, field notes, December 6, 2010).

(Kerry Dore: What should the future of farming be like in St. Kitts? What do you think should be done to improve farming in St. Kitts?) Well, to improve farming here there is a lot of things you could do you know because, number one, look after the farmers and try to help them (Kerry Dore, farmer interview, January 29, 2011).

More specifically, the need for government assistance with infrastructure (tractors, marketing/seeds and water) is highlighted during conversations with farmers. After infrastructure, the next most common point of discussion with farmers is about crop predators: humans, livestock, pigs and monkeys. Again, some of the farmers say that the government needs to do more to help farmers manage these problems. The ethnographic data on farmer's challenges with crop predators and their mitigation measures are outlined below, and the data on farmer's challenges with infrastructure are discussed in Chapter Four, which focuses on Kittitian farmers' relationship to the land.

Crop Predators After issues with infrastructure, the next biggest challenge cited by farmers is crop predation. Damages to crops come in a number of forms. The data collected during the course of this study show that the most significant crop predators in St. Kitts are: humans, livestock (cows, sheep and goats), pigs, and monkeys. The nature of problems with each of these pests is discussed below.

Humans Human stealing of crops and livestock have been a problem in St. Kitts for a long time. In his explanation of limitations to agricultural development, Mills (1974) cites praedial larceny (human stealing) as one factor:

The prevalence of praedial larceny has had a strong deterring effect among smallholders upon the production of some kinds of food crops and fruits, and especially on rearing livestock. Reasons for this include the ease with which the perpetrators can enter and leave unfenced plots, the facility in disposing of the carcass of small livestock, and a patent disrespect for the private property of the well-to-do that was bred since slavery. On the assumption that capital is available for the erection of secure fences, one can rationally expect a reduction in this disrespectful practice. It is also logical to assume that as the estate system passes away with its gross inequality of the “haves” and “have-nots,” and as wealth among the smallholders becomes more evenly distributed, mutual respect for property will likely prevail. However, in order to reduce it to a tolerable minimum within the immediate future, magistrate’s court may be called upon to levy heavy fines to convicted larceners (p 217).

In the almost 40 years since this was written, this problem continues to be a significant factor in crop production. One farmer explains that she did not have problems with animals, but she did have problems with the “two foot monkey” (i.e. human thieves). Another farmer explains that she used to hire people to help her, but they usually ended up just stealing food. She said: “the monkeys can’t do no better – people can work” (Kerry Dore, field notes, August 24, 2010). In another example, one farmer waits until after his vacation to plant crops because he is worried about people stealing his crops. He

says people take watermelon and sweet pepper especially. William F. Dore shares a funny story about this phenomenon:

Every tree you see on this compound, and several which have been destroyed by hurricanes, there was a time I had six grapefruit, six Washington naval oranges, six Sevilla oranges, 6 tangerines, 6 limes, and some lemons. I had six mangoes, each of a different variety, Jamaica, Trinidad, Barbados. Plums of different kinds and so on. Under normal circumstances, nearly every month I used to be able to get fruits of my own from on the premises. Now, the monkeys and people who come on the premises go and raid them. But they sell them downtown! One morning, my aunt, I have an old aunt she lives down there and she likes a certain type of mango and I was driving around town, I saw the market and I said 'stop!' I said 'How you sell these mangoes?' I said, 'I'd like to get a dozen please, how much for them?' She told me. Little boy beside her said, "Sir, don't pay for them, you know. Her son picked them off your tree." I said, 'Lady, do you have a mango tree? She said 'No.' 'Did your son really pick the mangos from my mango tree?' She said, 'I believe so, sir.' I said, 'OK, well I'll just take these, then.' (Kerry Dore, interview with William F. Dore, October 2012).

It is not known what portion of human thieves are taking crops to feed themselves or to sell on the streets as their own, but based on comments from farmers, it seems that a significant amount of crop theft by humans is for resale.

In terms of mitigating human crop damage, one farmer explains that the government is working on creating identification cards for "real" farmers:

Now, I don't have any problem with monkey cause monkey they just eat, and when they done they go. But its when human go in, you know, human will take, when monkey a come they take one potato. He gone. Pull one, two, three carrots, he gone. But when somebody else go in, you know, it's more than one and two and three. (*Kerry Dore: So would you say your biggest problem is with human stealing? Do you have a lot of that?*) Well, it varies, sometimes you have it and sometimes you don't. Because the government is saying now that they're going to have ID cards for farmers. (*What, you mean in the farming areas, they'll be checking them?*) Not exactly. Like, I am a farmer. And I go to sell anything, if I don't have my ID card...(*Oh! I like that idea!*) If I don't have my ID card, nobody could buy from me. I have to have my ID card to present that I'm a farmer. (*Cause that's really what they're doing, they're not*

eating them, they're selling them.) Good. So that's why they is saying now, they will use the ID card. *(That's really smart. I hope they do that. Where did you hear about that idea?)* Well, they come around, the extension officers, and he take me names, everything, age, everything, and they say they gone get them processed (Kerry Dore, farmer interview, March 20, 2011).

If human stealing is indeed primarily for resale, the identification system should mitigate a significant portion of this problem.

Livestock While this study does not document any human stealing of livestock, there are numerous cases of livestock being poisoned. For example:

(Crop farmer) said he has 25 more acres way up the mountain and he used to have 60 head of cattle up there but someone poisoned them. After we were done, I asked (the extension officer) why someone would poison 60 head of cattle. He said: 'Spite. It happens all the time.' He said that his cattle were probably taking someone's crops, so they poisoned them (Kerry Dore, field notes, August 25, 2010).

In all cases observed during this study, livestock are poisoned because they destroy farmers' crops. One farmer shows documentation of cattle crop damage to his farm totaling EC70,000.

Problems with livestock are compounded by the fact that, almost always, the farmer knows the owner of the livestock. For example, the farmer with EC70,000 worth of cattle damage said he is thinking about taking the livestock owner to court. In previous studies of crop raiding by wildlife, livestock cause considerable damage to crops but farmers seldom complain because they have institutionalized modes of restitution (Naughton-Treves, 1998). This does occur in St. Kitts, but rarely:

(Kerry Dore: Now, what about any animals, do you have any problems with animals?) Well, not now, because I done fence up. Up till this morning I saw (farmer) hold up there in (another farmer) one? They eat up *everything!!!* (The second farmer) vexed so large, she stop, she come down. Everything. *(Which animal was it?)* Sheep. A lotta sheep. *(Did they get to (another farmer), too?)* Yep. Eat them up bad, I tell you. *(I*

saw it myself). Yeah and then (first farmer) give back (second farmer) a sheep and pan a pinda. But that you can't do, because they eat up all, they're gone eat them up again. (*So he did give them stuff*.) Yeah, he give them a sheep an he buy back a pan a peanuts, he give them. But (second farmer) say she want pay everything they eat outta she ground. She don't want no sheep she want back money. (*At least (first farmer) is trying something*.) He just try, it's true. But this morning I tell him, I said, 'Mr. (Farmer), they are losing more than what you give them.' I said 'you must pen up you sheep them good, because you gone pay out too much a money.' I tell him so this morning. (*Do you think he'll listen?*). He tell me he gone do it. (*I hope so*). I hope so too, because he gone lose more than what he gain (Kerry Dore, farmer interview, July 15, 2011).

Many people say that livestock have “no owners” when they do crop damage or are hit by a car, but that the owners come looking for them if they get stolen. In other words, if the livestock do something negative, it is as if they have no owners, because nobody takes responsibility for them. The owners only appear if the animals are stolen. While it is rare for livestock and crop farmers to have “institutionalized modes of restitution” to work out problems with each other, in the case of livestock being hit by cars, at least one system has been created:

(The extension officer and I) talked about how I hit a cow with my car. He told me how they deal with that here. They *take* the cows and hold on to them...after a week the law says they are yours! Then you can take it to the abattoir and get money for the meat! You use that money to fix your car. He said that happens *all the time here*. Wow! (Kerry Dore, field notes, October 14, 2010).

At one point I talked about my accident and one of the guys said: 'Did you take the cow?' Here we go again with the way they handle that here! (The extension officer) was right, that's how people deal with livestock damage to vehicles. The guy said, 'yeah, use the money to fix your car.' (Kerry Dore, field notes, October 16, 2010).

In addition, on your farm, you can shoot the animal, but there are rules about how this is handled:

I learned about the law of shooting domestic animals on your farms. You are allowed to shoot them, but you can't touch it for six hours. You have

to call someone to come get it and give the owner the chance to pick it up as well. You are not allowed to partake from any of that meat (Kerry Dore, field notes, October 16, 2010).

The ethnographic data shows that problems with livestock are worse now than during the days of sugar production:

(The farmer) said that since sugar has ended the cattle have gotten much worse. That's because managers used to take stray livestock and bring them to the pound. Now that they aren't there, people don't need to be as responsible with their animals (Kerry Dore, field notes, November 26, 2010).

(Kerry Dore: And that's because the estate managers had people employed to control animals around the cane?) Yeah. They had overlookers, we call them overlookers. *(And they would impound them, or kill them. And when you say impound, do you mean take them to the abattoir?)* No, put them in a holding area, and then, the owner would come for them and they would charge them a fee. *(Where did they have that?)* They had one up Buckley's and I think they have one down Cranstoun Estate, too (Kerry Dore, farmer interview, November 27, 2010).

(Kerry Dore: How has the end of the sugar industry affected animals on farms?) There are more loose animals. Because them times they used to have a gunaman on the estate so they'd shoot them (Kerry Dore, farmer interview, January 29, 2011).

When sugar was in the order of the day, they use to have pound, like they catch them and they pull them off. But since sugar is out, they don't really take on that, because, number one, you had people used to cut grass, you understand, to feed them, but now that no sugar is there they don't really take on that to that extent (Kerry Dore, farmer interview, March 3, 2011).

Next, (one farmer) asked what he should do about all the cattle on his farm when he knows the owner. Someone brought up an appraisal system and that he needs to go the legal route. Someone mentioned how the animals only have an owner when it's convenient. Ms Kentish (Regional Director the Food and Agriculture Organization) spoke up then, saying that she wants to know how long the livestock has been a problem. In Antigua, where she spent a lot of her life, the problem started after the end of sugar. She said crops don't move; it's funny how we have to protect them from things that do. She said that livestock owners need to take responsibility and registration is the key; we keep starting but not sustaining programs. (Kerry Dore, field notes from the Agricultural Planning and Review Meeting, March 30, 2011).

(Kerry Dore: *Which animals are a problem for you?*) For me now, just recently, the cattles. (*Where are cattle being a problem?*) Right up there. Just Saturday gone, I think there was about eleven, twelve a them was in the ground. I went to the station just recently there to make a report because I know the gentleman who let the animals loose (*You know who it is.*) Yeah but when I went to him he's saying that it's not he alone, and he willing to pay, but he not paying he alone. Those who have their animals let go also they have to pay. (*What did the cattle destroy?*) Well, the potential of the plants. Also, the plastic mulch to help to make the weeding easier. (*Definitely. You have a lot of plastic. Shoot. So this just happened. That's terrible. What did you have planted there? I don't remember.*) Sweet peppers, some watermelon..(*and you had thyme and chives, did they destroy them?*) All over they walk up. (*So they really destroyed everything that was there.*) Yeah they mess up the plastic a lot, too. (Later in the interview...) And even when we had the sugar cane and so, when we had animal, we use to have lot a animal, fortysomething cattle and so, and we never used to have so much access to tie them, you know, here and there and everywhere because the cane them used to be everywhere, and so when they are ready to give out a field we get the opportunity sometimes to tie them in the field, where the young sprout is. But we never had that problem, people very careful, tie up their animals properly and so on. We never even had lots of paddock and them things, tying them one and one and chain. There's a big change now. (*Yeah, absolutely. The livestock are all over the place.*) Before, we would search all day for *one* animal! (Kerry Dore, farmer interview, August 9, 2011).

In sum, the infrastructure of the sugar industry meant that livestock farmers had to be careful about where their animals roamed, as stray animals near or within cane fields were impounded or killed. This system does not exist anymore, and the roaming cattle destroy crops and plastic on farms. This creates conflict between the crop and livestock farmers because the crop farmer usually knows the owner of the animals that have destroyed his farm. Taken to the extreme, crop farmers will poison livestock.

Pigs Another significant animal pest for farmers are “wild” pigs. Pigs straddle the line between having an owner like cattle, sheep and goats, and being truly “wild” and unowned, like monkeys. Wild pigs have become a problem recently, but not as a result of the collapse of the sugar industry like monkeys and livestock. In the case of

the pigs, they were originally domesticated, but either escaped or were let go due to the expense of caring for them. At the start of the study, an extension officer explains:

I asked (the extension officer) about the pigs, and he said that they are definitely a problem. The reason is because the cost of pig feed went up, so people who had pigs (they kept them to sell for meat) could no longer afford to keep them and let them go (Kerry Dore, field notes, July 30, 2010).

At the start of this study, the expectation was that monkey damage would be bad, but many farmers complained that pig damage was their worst problem:

The next area we visited is known as Mansion. We stopped at a large farm that was being tended to by a man, his wife, son, and family friend. They told us that they don't get too much damage from monkeys because they are pretty far from the forest. They talked about the pigs, saying that the pigs were a bigger problem for them. I find it interesting that the pigs keep coming up, and I'm glad that I plan to monitor damage from pigs as well. I have a feeling the pigs are going to be as big a problem as the monkeys are (Kerry Dore, field notes, July 27, 2010)!

While we were driving to (the extension officer's) area of District 3 (Old Road over to St. Paul's), he told us that a lot of farmers were moved out of the "Kittitian Hill" area into Belmont Estate, closer to the towns. This has helped them with the monkey problem, because the monkeys often come out of the forest, which is in the middle of the island surrounding the mountains. As they have moved away from the mountain, pigs are the biggest problem in his area. He said the pigs avoid the high heat, because they can't sweat, and that they like the root crops like potatoes and peanuts (Kerry Dore, field notes, July 28, 2010).

We talked about how pigs are a big problem, too; apparently they take refuge in the old cane fields. During the days of sugar cane, there would be guards on the plantations that would kill wild animals, but they are no longer there (Kerry Dore, field notes, August 2, 2010).

Then we visited the home of (farmer), and his wife was there. She told us to find her husband on the farm, so (the extension officer) took us all the way back up there. He told us that he moved from Mansion, where he had a pig problem, but now he has a monkey problem. He said a monkey problem is much better than a pig problem, because the pigs take everything (Kerry Dore, field notes, August 14, 2010).

He told us that he gets both pig and monkey damage. He said the pigs are worse because they just knock out everything (Kerry Dore, field notes, August 23, 2010).

We met a few women next, both full time farmers. The first woman was very personable and talkative – she grows a lot of different crops on a smaller scale. She sells to the restaurants and it's good to have variety. She said the pigs and monkeys are both a problem, but that the pigs are worse because they don't leave anything. She said the pigs like the soft soil and will root through and take everything. The next farmer we met was a woman with her daughter. They were much more reserved but told us that the pigs are a bigger problem, and that they've only been around for the last two years. The pigs really like sweet potato and the monkeys love peanuts (Kerry Dore, field notes, August 25, 2010).

The quantitative results presented in Chapter Two confirm that pig damage is a significant problem in St. Kitts, and for many farmers, it is their only serious animal pest. The data also confirm farmer's statements that pig damage occurs less frequently but with greater intensity. To battle pig crop predation, farmers poison the pigs, trap them, or stay up all night and try to kill them with their bare hands:

We drove to the top of the Fahies settlement and worked our way back down. On our way there, (the extension officer) told us that some farmers use a poison called lannat to kill the pigs. The Ministry has the poison, and the only way farmers can get it is if the extension officer makes the recommendation that they need it (Kerry Dore, field notes, July 31, 2010).

The guys on the farm called us over, yelling a few times to watch out for the *huge* hole. We walked over and they had trapped a huge hog! It was all tied up. I guess they found it half way in the hole, with a noose around its leg. I felt really bad for the animal, but they're going to bring it to a pen, feed it for awhile, and eventually use it for food. It's hard to complain about that (Kerry Dore, field notes, June 10, 2011).

From there we went to (the next farm). (The farmer) was cutting the skin off some cassava. He showed us the new stuff at the bottom and we mapped it. Then we went up to see the sweet potato damage – the pigs got in. It was mostly at the top. On the way down, he was saying that he's going to sleep on the farm tonight because of the pigs. Every half hour he patrols. He is so hard-core. If he finds a pig, he tries to surprise it from behind and cut off its foot. Then he leaves it there until the morning when he takes it somewhere and slits its throat. He doesn't want to do that right

away because the meat will spoil. I told him that it's cruel, and he said it's cruel that they're taking his potatoes! (Kerry Dore, field notes, January 17, 2011).

To summarize, pigs have become a problem in St. Kitts over the last 30 years as a result of domestic pigs escaping or being released. Therefore, unlike livestock, damage from pigs is not attributed to the irresponsibility of a specific owner. Pig damage is relatively infrequent but is severe when it does occur. Pig damage has gotten worse in recent years because pigs take refuge in old cane fields and the rangers from the sugar industry are not present to shoot them. Methods to prevent pig damage include poisoning, trapping and killing.

With regard to mitigating crop predation by pigs and livestock, you can resolve this issue fairly easily by fencing them out. During initial conversations, dozens of farmers explained that they used to have problems with these animals, but that they have been negated because they invested in wire for fencing. In fact, the ethnographic data reveal that many farmers are not sympathetic to farmers that experience pig and livestock damage, because this damage can be avoided with fencing:

On our way down, just across from (a specific farm), there was a guy who had some pig damage. They had *no* sympathy for him because they said he has a lot of money but didn't bother to fence the area before he started planting. (One of the farmers traveling with me) said how she didn't plant a thing until she was fenced (Kerry Dore, field notes, January 24, 2011).

Of course, fencing is expensive, so this is not an easy investment for some farmers:

We got back to our cars and were talking about how she needs to fence. We talked with (the extension officer) about the cost of wire, and he estimated that it would cost her 5 rolls of wire at \$600 a piece - \$3,000 to fence *half* the farm. (Kerry Dore, field notes, January 27, 2011).

I asked about fencing, and the farmer said he could not afford it. He needs 5½ rolls at \$450 a piece – that's about 2500 EC, or 1,000 USD (Kerry Dore, field notes, April 7, 2011).

Some farmers complain about the scarcity and expense of fencing and state that they wish the government could provide wire to assist farmers with fencing:

(One farmer) was saying how she regrets giving out some of her wire because now the department is out of it. She wants to fence the right side of the Fahies farm and do ground provisions (Kerry Dore, field notes, February 17, 2011).

(Kerry Dore: Is there any government compensation for the crop losses you experience?) No. *(Do you think that they should be compensating you?)* Well, I wouldn't say they have an obligation to. What I can say, is that they can assist you more....they should assist farmers with fencing that can help with the livestock. And water. *(I remember we talked about this before, you were saying that they are...)* The most limiting factors in agriculture. They are the most limiting to what you can produce, what you can achieve. Water and fencing (Kerry Dore, farmer interview, May 17, 2011).

Monkeys Much of the nature of conflict between Kittitian farmers and vervet monkeys is explained in the first section of this chapter: due to the land use changes associated with the closure of the sugar industry, crop damage from monkeys has significantly increased. The ethnographic data also provides the details of this effect, showing that the pestilence discourse on crop predation by monkeys is unique for three reasons. First, there is some leniency with regard to monkey crop damage because Kittitian farmers recognize that, due to the land use changes associated with the closure of the sugar industry, monkeys can no longer find food in the mountain, and monkeys need to eat, too:

(Kerry Dore: Which of the wildlife species, the big ones, like monkey, livestock and pigs, are the biggest problem for farmers?) Right now, my biggest problem is monkey. Monkey is the number one thing, but I don't take it on because, what I gone do, I go in their domain so they have to eat. You understand? (Later in the interview...) I don't really take on the monkeys to that extent. I'll tell you why. I know I am the person that goes where they are. Because I go where they are. I know no trees, we destroying them, we cut them down and we don't plant them back. That's

the problem. So like, long time days, when I went mountain, we had passion fruit up there. So when the passion fruit ripe, they eat them, but because we destroy everything, it make it difficult. (*I think you are unique that you have the information that you are going into their space.*) We are going into their space. Our space is here, there space is up there. If we go up there, we going into their own, so if they start destroying our crop, we shouldn't get vexed (Kerry Dore, farmer interview, March 3, 2011).

(*Kerry Dore: Now, why are monkeys a problem?*) OK. You need forest rangers, trappers, right? Because we don't got that anymore. We need trappers or forest rangers. You know, people visiting the area, sorta thinning them out or driving them back. Now, food, again, for them, like guavas and stuff, that there kinda scarce, and you know, that mango there is kinda seasonal. I mean, they gotta eat, you know? (Kerry Dore, farmer interview, May 17, 2011).

(*Kerry Dore: What do you think is causing the problem? Why are monkeys coming in and eating the crops?*) I will say that they are willful, but this is animals that need food too. You understand? And you know, how the scripture said, the bird and the sparrow gone work but yet they have the heavenly master feed them. You know? So I have a mango tree and when I look at that scripture there in the Bible and I say it's right, because you can't get all, the bird pick them out. You know? You can't blame the birds. So, the monkey want something to eat too. But what we are saying is that there is *too* many now! Too many (Kerry Dore, farmer interview, July 2, 2011).

(*Kerry Dore: So, why do you think they are doing this? What is causing the monkeys to come and do farmers so much damage?*) What happened with the monkeys them, there's no food for them and they have to feed heavy. They feed heavy. (*So, they just need food?*) Food, yeah. They need food (Kerry Dore, farmer interview, July 3, 2011).

Another reason there is some leniency with regard to monkey crop damage is because while crop damage from livestock and pigs have also gotten worse since the closure of the sugar industry, monkeys are "natural" animals that do not have owners that should be taking responsibility for them, as is the case for some pigs and all livestock:

(*Kerry Dore: Which wildlife pest bothers you the most?*) I'll say monkeys. Pig does me a lot of damage, but the difference between the monkey and pig, the pigs have owners, the monkeys don't. So if the owners of the pig would begin to manage it, then it's much easier on me. But they don't really care, they don't look for them for days, so they're

going to roam and wherever food is they're going to find it. So I'm going to say monkey based on that situation. (*So monkeys bother you most, because you feel like pigs wouldn't be as much of a problem if people would take care of them.*) Yes (Kerry Dore, farmer interview, November 29, 2010).

(*Kerry Dore: When you hear about people getting damage from monkey, from pig, from cattle, which one bothers you the most?*) You know what bothers me the most? It's the pig and the cattle because the monkey is just a natural thing. The pig and the cattle have owners, the monkey do not have them. They are just wild animals. But then the pig and the cattle have owners, and people do not take responsibility for them, so that is the problem. That's where the problem comes. (*And it must be hard when you know who owns the animals who are mashing up your crops.*) But you know, nobody owns the monkey so people are a little more lenient (Kerry Dore, farmer interview, March 6, 2011).

Third, the pestilence discourse surrounding monkeys is unique because of monkeys' status as *boundary crossers*. The increased recognition of monkeys' intelligence and similarity to humans has manifested itself in the expectation that monkeys will behave with human-like manners in their crop raiding. Exerts from interviews show that anthropomorphic terms are used to describe monkey's "bad manners" while crop raiding:

(*Kerry Dore: How are monkeys different from other animals?*) Very *wasteful*. Very very *wasteful*. One mango can satisfy them and they'll pick all off. Take one bite and drop it. They will pull up one peanut tree, peanut tree has on ten, they eat four, drop it. Pull the next one, eat two, drop it. Pull the next one, eat one, drop it. They are *wasteful*. Very very *wasteful*. They can take two peanut tree, eat them all, and be full (Kerry Dore, farmer interview, November 12, 2010).

(*Kerry Dore: Why do you think monkeys are doing this? Why are they raiding crops?*) Survival. And plus they have a *bad mind* (Kerry Dore, farmer interview, November 29, 2010, emphasis added).

The farmer said that when his dad is harvesting potato, so are the monkeys! Just right near him. He said they are *willful* animals, that they are consciously doing it and they are terrible. He mentioned how they just bite up everything and pull up potato vines even when there is nothing below them (Kerry Dore, field notes, January 27, 2011, emphasis added).

The farmer said the monkeys are bad minded – how even when nothing is below they just pull them up (Kerry Dore, field notes, February 25, 2011).

They're so *wasteful*, too, you know. The monkey, they be very wasteful. They come and bite everything and they throw them a ground. They're wasteful. (*Kerry Dore: Yeah, it's so sad when I see one bite out of so many fruits. I don't know why they do that.*) Monkeys *wasteful* (Kerry Dore, farmer interview, May 9, 2011).

We started talking about giving the monkeys a humane death. He said he doesn't care. He said the monkeys *know they are thieving*, why else do they act the way they do? (Kerry Dore, field notes, June 29, 2011, emphasis added).

(*Kerry Dore: Tell me about the crop damage from monkeys you are experiencing. What kind of damage are you dealing with?*) Monkeys are willful man, when they do come, you have a crop, or say like, carrots, and they realize they aren't up to eat, they pull up all of them. They pull them up. (*So they're willful*). Yeah. And the pumpkin, them? They bite all. Watermelon, the same thing (Kerry Dore, farmer interview, July 3, 2011).

(*Kerry Dore: So tell me about the problems you are having with monkeys on your farm.*) Well, they come, they terrorize the food them, even if they're young. As long as they feel like they could eat, or they smell like they could eat, they gone pick them up and throw them down. That's the one main problem I got with them. They're *wasteful*. They like to pull up things. They're *spiteful*. Like them a tell themselves, up here a mine! Trying to get me out (Kerry Dore, farmer interview, July 26, 2011).

(*Kerry Dore: Of all the pests that farmers deal with, like monkey, pig, livestock, rats, birds, insects, which one bothers you're the most?*) Monkeys is everything that got me vexed. (*Why?*) Cause they destroyful, and spiteful. (*What do you mean by spiteful?*) Like, they will come and bite something and then they aint eat it. (*Just bite.*) Mmm hmm. (Kerry Dore, farmer interview, July 29, 2010).

The fact that monkeys do not meet farmers' expectations to behave in an appropriate manner leads to increased frustration on the part of the farmers and exacerbates conflict.

The increased recognition of monkeys' intelligence has led to the belief that mitigation measures that work for humans, pigs and livestock will not work for monkeys.

Monkeys watch you, learn your schedule, look for indicators that you are coming, use

watchmen, actively hide from you, return after you leave your farm (especially if you chase them off), and assess the ripeness of your crops to determine the best time to raid:

The farmer said that the monkeys come in and test the peanuts to know when to come back when they are at the right ripeness. She said they do *everything like a human* (Kerry Dore, field notes, October 15, 2010).

I'll tell you one thing for sure, monkeys seek cover among other animals. If you have like sheep and goats around, they are eventually going to develop that relationship. Because whenever there is a threat to the monkey, the goat or the sheep alerts them, and they're gone. Even among my cows. (*Kerry Dore: So the monkeys have befriended the livestock enough so they look after them?*) Yeah, let's say there is a dog or something attacking, and the monkey sees the dog before the cow, it's going to jump up and alert the cow that something is coming. So it's back and forth, hand in hand. Not only dogs, for example, ok, if I go on my farm right now, you're going to meet at least a monkey among the animals. But as soon as the animals pick up my scent, they are going to alert the monkey. Whether they are going to be scratching or mooing or, you know, and right away, the monkey going to pick up, well, this is not normal, so they gone (Kerry Dore, farmer interview, November 29, 2010).

(*Kerry Dore: What do you know about monkey's behavior?*) Well, most of the time, when I see them in action, or catch them, like, if you find two big ones fighting from tree to tree, but to say, well, see them react funny and never look at them. But they is very clever. The monkey will come right here in front of me and you, the small one them distract you, and then when you are paying attention to them there, the others them out in the backyard doing whatever they want to do. (*Really? So would say they are smart?*) Very very clever, they ain't smart, they're clever. (*What's the difference?*) As I told you, you could be right here and they will come down, once they want to go in the yard to interfere with the stuff, one or two will come right on the fence and they will be fighting, and when you are paying attention to them, they're in the back yard doing what they want to do. They're very clever, man. And a monkey will watch you. If they are accustomed to come at your place, know when you gonna go or when you're there. (*So they learn your schedule.*) Yeah. (Kerry Dore, farmer interview, February 21, 2011).

(*Kerry Dore: So what do you know about monkey behavior? What kinds of things do you see them doing?*) That's why I know they are very spiteful. You are surprised to know that you are in your farm working, and a group of them, they always have one as watchman. One of them or maybe two, they are way up in a tree, and they're watching you move, so the minute you're out, they just call the rest, and they're heading for your

farm. Yeah! And one thing I learned about monkey, too, well, I don't know how true this is, but I always say it as a small boy coming up and it seem to be true to me, even though I haven't really seen it personally. What I understand what is happening when monkey, too, if, when they go and they say 'nobody in there' in the farm and so, and they have a watchman there to watch, and when they make their move, and they've been caught, like, say, the owner of the farm see them, that monkey, the watchman, cannot go back to the group, you know. (*Like if they don't do their job, then they get kicked out?*) Exactly! (Laughing.) (*So what's the smartest thing you've ever seen a monkey do?*) They watch you, and if they feel like if they can't make a move, they'll go and hide, and if they feel like you're gone, they're back (*So they hide from you.*) Yes. They're very sensitive (Kerry Dore, farmer interview, February 26, 2011).

The farmer said that if they don't get to the crops that night, if he keeps them off, you know he has to get there first thing in the morning because they'll go for them again (Kerry Dore, field notes, March 4, 2011).

(*Kerry Dore: Of all the pests, like monkey, pig, livestock, rats, birds, which bothers you the most?*) Well, the monkey especially, because, when the monkey come and pull up, and destroy, you don't get nothing. (*So it's the way they do it, the wastefulness.*) I would say they don't have no conscience! (*So, how are monkeys different form other animals?*) I think they have a sense of humor! They is very smart, you understand? They'll get there, if you bust up on a monkey, unexpectedly, he'll run up behind the grass and do like this, watching. They're peeping at you until your gone. To me, they have a sense of humor! Some people say they come as if they gone to college! (Kerry Dore, farmer interview, July 2, 2011).

(*Kerry Dore: How are monkeys different from the other animals?*) Monkeys just like a human being. A monkey will sit up upon a tree there, and wait until you go out your ground, and then they'll come down. So they know what they're doing. So they're just like a human being. (*But you wouldn't say the same about other animals?*) No, you would drive them, they not going to come back now, maybe they'd come back next week or day after tomorrow. But monkey, you repel them, and they do like they gone, and they come back, you know? Monkey just like a tiger, he run full speed, you think he gone, he circle right around back! (Kerry Dore, farmer interview, July 11, 2011).

(*Kerry Dore: Are monkeys smart?*) Smart, very smart. (*What kinds of things do they do that tell you that they're smart?*) They time you. (*Do you mean they learn your schedule?*) Good (Kerry Dore, farmer interview, July 15, 2011).

Due to monkeys' intelligent behavior, farmers believe that no mitigation measures will prevent their crop damage for long. This does not mean that they do not try; during the course of this study, Kittitian farmers used a number of different strategies for dealing with crop loss from monkeys. Some farmers have considered fencing, but they recognize that it is not worth the cost if your primary source of damage comes from monkeys, since they can just climb over:

Sometimes you are in the ground, and when you look at the other end, you see monkey over there, you know! (*Kerry Dore: Right on the farm with you.*) They're smart you know. The monkeys are human. Human. (*I hear a lot about how monkeys are just like human beings.*) Uh huh! You know, this fencing, you fence it from pigs, but you *really* can't fence it from monkeys, because the monkey still coming over the wire coming in! So me, I tell meself, I buy the wire to fence, but I tell meself, I'm not going to fence it right now, because monkey still coming in (Kerry Dore, farmer interview, May 9, 2011).

The most common practice used to prevent monkey crop damage is the use of dogs. Of the 64 farms studied, 28 have dogs. Dogs are either tied at various places around the farm or are able to roam freely. Of these 28 farms, only four farms have untied dogs. Dogs are tied to prevent them from leaving the farm. Also, with a lot of livestock roaming freely after the end of the sugar industry, untied dogs have a high risk of being poisoned for going after livestock. Farmers also say that untied dogs can be detrimental to the crops themselves because the dogs may walk, dig, or urinate/defecate on or near the crops. Farmers explain that the monkeys are so smart that they have figured out how to deal with dogs:

But you see, the monkeys have developed systems to deal with the dogs. A dog will be tied on a wire, that runs along on the ground, and it's always alert: some of them do not sleep, they just look for the monkeys, because they seem to understand that that's what they are there for. And so, there are monkeys who have measured the distance that the dog can reach, and stay there and harass that dog until it die! Yes. And each time it quiet

down, it make a fuss. It eat right in front of their face. They harass that dog until it die, and then they got in the ground and do what they want (Kerry Dore, farmer interview, November 12, 2010).

I said something about having dogs on leads all around, and the farmer said that eventually the monkey befriends the dogs so it doesn't work (Kerry Dore, field notes, January 20, 2010).

The monkey trapper and I talked about how the monkeys build a relationship with the dogs – some dogs see the monkeys more than they see the farmers!!! What a great point (Kerry Dore, field notes, February 1, 2011).

If you have a dog tie here, and you allow the chain to reach here, the monkey will stay on the tree there, and bark and bark and play with the dogs. When the dogs play awhile, they get tired. So they go and rest, and the monkeys go and do the damage. They tire out the dogs. The monkeys are so prevalent now with the dogs, that they go on the dogs back riding. I see that! They jump on the dogs and run around with them (Kerry Dore, farmer interview, February 27, 2011).

(Kerry Dore: So what's the smartest thing you've ever seen a monkey do?) OK, I remember, even the dogs, you tie dogs in your ground to keep them off, and they play with the dog, and tame the dog. *(How do they do that? How do they tame them?)* Probably go and play with the dog. *(I've heard so much about this, like monkey riding on dogs back.)* Yes! *(So you've seen this with your own eyes?)* Yes. (Kerry Dore, farmer interview, July 15, 2011).

The farmer told me of a guy who used to butcher animals and had vicious dogs that he would feed really well. Still, he came and found the monkey on one of the dog's backs! He said people were really scared of these dogs, but the monkey tamed it. Dogs don't help, they become friends (Kerry Dore, field notes, August 9, 2011).

Other practices for keeping monkeys off of farms (in order from the most often to least often observed) include: placing foul smelling things around the farm (e.g. queline, rotting animal meat, fish guts, dead monkeys), putting plastic materials on the border of farms (because monkeys don't like the sound when this blows in the wind), and constructing human-like statues/scarecrows and placing them on the farm. Many more farms were observed than were studied, so there is not detailed data regarding the success

of these practices; however, the ethnographic data show that farmers believe that most of these practices will only last for a short period of time before they are no longer effective.

For example:

A Kittitian friend told me that people used to do a scarecrow with galvanized that would bang against it with the wind, but it doesn't work anymore. He said he's seen the monkeys jumping on the scarecrow's shoulders, pulling the clothes off! He said it's like the *monkeys have a college degree!* That's the second time I've heard that phrase now (Kerry Dore, field notes, July 7, 2011).

And one, too, sometimes you put up statues, they even go and (laughing) sit on the statue and look around while the others are feeding. (*Kerry Dore: So they use the statue as a lookout point?*) Yes! (Laughing.) (*Well, that definitely defeats the purpose, doesn't it?*) (Kerry Dore, farmer interview, July 15, 2011).

The last two monkey mitigation measures in St. Kitts are shooting and trapping in order to control the animals' population. Farmers cite these methods most often with regard to what should be done to help with the monkey problem. Like issues with infrastructure and crop predation by humans, livestock and pig, some farmers expect that the government should do more to help farmers with monkey control:

(*Does the government compensate you for any of the damages you receive from monkeys?*) No. I don't even think they care, personally. (*So do you think they should be compensating you?*) Well, I prefer to be realistic. I don't expect compensation, but I would have liked if they could be more concerned, and empathize more and help us to get some control, and just don't continue to say it for years, but do something (Kerry Dore, farmer interview, March 12, 2011).

As previously explained, shooting was used much more often in the past, primarily by rangers and sport shooters employed by the sugar estates. Today, it is now very difficult to get a gun and/or gun license. Only one of the farmers in this study has a gun and actively shoots monkeys around the farm, and his farm did not experience crop damage over the year. While many farmers in this study are optimistic about the

effectiveness of this strategy and wish that it would again become common practice, there are many others who believe monkeys are too intelligent, even for this technique. For example:

Another outstanding thing about monkeys. They know a gun. If you have a gun, and you walk with it, monkey know it. One of the best monkey catchers, by guns, in St. Kitts, is a guy called Cleever. And when I had my farm up in the mountain there, up Fahies, government would pay 75 dollars for each monkey caught in a farming area. And he came up there one day and saw some monkeys. I said ‘boy, some big monkeys up here.’ I said, ‘come up and shoot them, you could make 75 dollars and you get the monkey to go away,’ cause he could sell the monkey meat and people eat monkeys and what not. And he came up one morning and I went on the farm and I met him there. He used to drive a tractor then, cause the sugar was still going. He park the tractor, went over in the forest, and in less than a half hour, you hear ‘pow!’ He came out with a large monkey, 27 pounds of meat. He cut off the tail, so he could take it to the department and get his 75 dollars. Came back the next day, and he went over that bush, and *didn’t even see one monkey all day!* Up to the top, in the ghaut, down, outside the ghaut, and not even one monkey did he see. Did it again, and he didn’t see one monkey. He parked the tractor down by Fahies, and he walked it up, and he didn’t even see one monkey for the whole day. They *know the gun*. The soldiers from the camp went up there one morning, parked their vehicle down at the building, and went up there with their guns over their shoulders, and they stayed up there, and they didn’t see one monkey. (*So the monkeys see the guns, it’s not just hearing them.*) They *see* the gun and they know it (Kerry Dore, farmer interview, November 12, 2010).

Two forms of trapping exist in St. Kitts. The first is on a small scale, where individual farmers will trap monkeys individually on their farms. Five of the farms in this study use this kind of trap. This is not a very widespread practice because most farmers argue that it is too hard to trap monkeys because they are too intelligent:

The farmer said that he used to have really bad monkey problems, and he said he was at the point where he was planning to fence in his farm and get a generator to shock any monkeys that tried to get onto his farm. He talked about how smart the monkeys are, and how you can only trap them a specific way one time, because after that, they learn how to avoid that trapping method. For example, he knows of a guy who put up a big net

and fed monkeys beneath it for a few days. When there were about 30 monkeys eating under the net, he dropped it and caught most of them. After that, he tried to do it again. This time, the monkeys went under the net one by one and brought the food out to the group! Pretty amazing. (Kerry Dore, field notes, July 25, 2010.)

Farmers that do use this method usually kill the trapped animals and hang them on their farm as a means to deter more monkeys from entering. Since it is very hard for farmers to get guns, these monkeys were often killed inhumanely, for example, by beating them with a steel rod or letting them starve to death.

The second form of trapping is on a much larger scale and was developed for the purpose of supplying monkeys for biomedical research. In 1968, the Behavioral Sciences Foundation was established in St. Kitts to utilize the excessive population of these virtually disease-free primates (their African counterparts carry very serious diseases such as the Marberg virus. The only potential disease threat in these Caribbean vervets is the bacteria shigella). In 1976, an export market was developed for polio vaccine production and a professional trapper was brought in to train locals and develop optimal, humane trapping methods. This trapping method is still used in St. Kitts today. The trap is approximately twenty feet long, ten feet wide and eight feet high (see Figures 18-21 for examples). It is baited for weeks while the animals become comfortable feeding inside the trap. When it is time to trap the monkeys, they are chased into a corner, which forms a funnel. The animals are squeezed tightly and the trappers are able to easily and humanely sedate them with ketamine via injection. When this method was developed, trappers were suddenly able to trap up to 30 animals at one time, which was unheard of with previous trap models.



Figure 18. Humane monkey trap.



Figure 19. Humane monkey trap.



Figure 20. Humane monkey trap.



Figure 21. Humane monkey trap.

In 1982, a second primate lab was developed, the St. Kitts Biomedical Research Foundation, which increased the market for healthy, undamaged animals. Trapping in this fashion went on consistently for many years until the United States was hit with the financial crisis and companies stopped buying monkeys. Trapping has picked up slightly in the last year with a few small buyers, though exporting monkeys for research has been a big challenge due to animal right's activists. They stalk the CITES website, which lists the transportation of primates, and have harassed Amerijet employees to the point where the airline will no longer transport primates. Thus, while trapping methods and skills are mature in St. Kitts at this time, there are a cadre of trappers whose expertise could be organized for better population control, and many of these traps are in place on the island (Figure 22), this technique is time-consuming and trappers often avoid trapping until the biomedical facilities are purchasing animals.

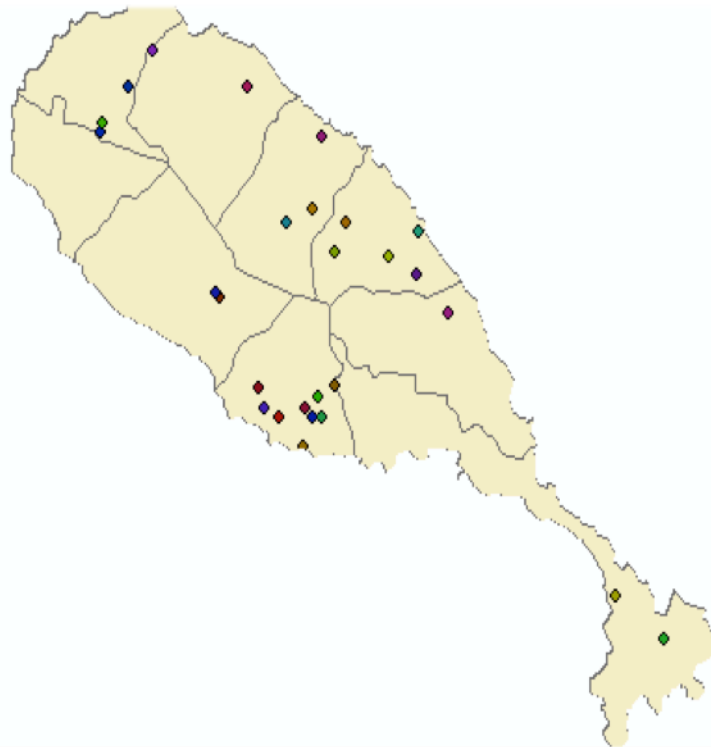


Figure 22. Location of some of the large-scale humane traps in St. Kitts.

Early in the study, the desire for monkey control as the number one means of mitigating the monkey problem and a number of instances of monkey killing seemed at odds with the increased recognition of monkeys' intelligence and similarity to humans shown in the ethnographic data. It was unclear how you could see an animal as so human-like on the one hand and then, on the other hand, want to kill them, sometimes in an inhumane way:

I think it's particularly interesting how farmers hate the monkeys so much but they still appreciate their intelligence. One farmer told me that he saw a group of monkeys one morning when he was walking up to his farm and that he chased them away. He said that now they would go after his crops. I told him that I thought he was anthropomorphizing, or attributing human-like qualities to the monkeys. He said: "monkeys do have human-like qualities!" I said of course they do, but not to that extreme. It's one thing to say that they will do two weeks worth of damage on your farm if you keep them off of it for that long (which I've heard a few times), but it's a whole other thing to say that monkeys are going to seek out a particular farmer's crops because that farmer previously chased them away. That would require that the monkeys know which farmer belongs to which crops. The farmer's response was: "they will go after my crop and not my neighbor's." The same farmers that attribute that kind of intelligence to these animals are the ones that will kill them. It's an incredible dichotomy (Kerry Dore, field notes, August 23, 2010).

While I have an incredible amount of crop data already, I have almost an equal amount of ethnographic data. Most Kittitians don't know the details of evolution and have a creationist perspective of the planet and man. This is definitely going to play a role in how they view primates. It's a difference between lumping them as your cousin or with all of the other animals. I have to say, though, there is an incredible amount of respect for the intelligence of these animals and their similarity to humans – there is just not an evolutionary context. I find the dichotomy between respecting the monkeys and wanting to kill them extremely interesting and I plan to continue exploring this topic (Kerry Dore, blog post, end of September, 2010).

This month I also had to deal with a situation that epitomizes the problems I hear about on a daily basis. I was visiting a sweet, old farmer that I adore, only to find a dead monkey hung up in the middle of his farm. He told me that he killed it and put it there to keep the other monkeys away. In his defense, this man has very bad monkey problems; during that visit

alone we found 175 cabbages that the monkeys had destroyed. I asked him the details of trapping the monkey and he showed me his trap. I asked him how he killed the monkey and he said he beat it to death in the cage with a steel rod. We estimated the potential yield from that cabbage to be 3,000 EC, or about \$1300 USD. That's a lot of money, and that, combined with the time invested in growing that crop, is what can drive a sweet old man to kill a monkey in such an inhumane way. To me, it's such a *lose-lose* situation. It's what I think about when I'm tired and don't want to go to work. There has to be a way to protect these farms and control the monkey population so that there is space for monkeys and space for farmers (Kerry Dore, blog post, end of October, 2010).

It is from the perspective of *monkeys as boundary-crossers* that this apparent dichotomy can be resolved. The monkeys' transgression of the human/animal boundary makes them less likely to be consumed as food, because some Kittitians feel like it is wrong to eat something that looks and acts so much like human beings. Monkey's humanness also makes them extremely dangerous crop pests, because humans recognize that they have less of a competitive advantage in terms of intelligence than they do with other crop pests. Monkeys' transgression of the forest/farm boundary also makes them extremely dangerous because there is a sense that humans have lost control over monkey movements. Therefore, even though Kittitian farmers recognize that monkeys are very similar to humans, their status as intelligent, out of control crop-raiders makes them so dangerous that the only way to stop them is to kill them.

Discussion

St. Kitts Vervet Monkey Crop-Raiding Patterns The ethnoprimateological framework employed in this stage of analysis reveals the limitations of the predictive models generated in the first, primatological stage of analysis in this dissertation. While

the models explain the predictive nature of current primate crop raiding, the ethnographic data explain the history behind this problem. Interviews and conversations with Kittitian farmers and members of the Kittitian agricultural community highlight the importance of the temporal nature of the landscape, more specifically, the land use changes associated with the end of the sugar industry in 2008, on the patterns of small-scale farming and farmers' perceptions of vervet monkeys. Small-scale farms were previously restricted to the marginal land in the ghauts and above the cane apron, below the forest boundary. Now, they are scattered all over the island on former cane land. Farmers have always had negative perceptions of vervet monkeys, but since these land use changes have occurred, these perceptions have worsened with the observation that monkey crop damage has significantly increased and that the monkeys themselves are no longer restricted to the forest.

The predictive models from Chapter Two distinguish between the factors that predict the likelihood and severity of St. Kitts vervet monkey crop-raiding. The ethnographic data generated here shows that the severity of the monkeys' crop raiding plays a greater role in farmers' negative perceptions of vervet monkeys than does the likelihood of the monkeys' crop raiding. Again, the sugar industry plays a significant role in this result. Kittitian farmers are keenly aware of the significant changes that have occurred since the closure of the sugar industry and how they have affected the monkeys. They recognize that the animals are raiding crops because they can no longer find the food necessary to sustain themselves in the mountain like they could during the industry. This plays a role in the fact that farmers are willing to share some of their crops with the monkeys. When farmers are asked about the nature of primate crop raiding, they respond

that they are primarily frustrated by the monkeys “wasteful” behavior, not necessarily the raiding itself. Farmers can spare three cucumbers, but the severe, negative perception of monkeys results when the farmer comes to his/her farm to find that the monkeys have taken one bite out of 30 different cucumbers.

The Nature/Culture Divide Viewing the St. Kitts “monkey problem” from the perspective that there is no divide between nature and culture is most relevant to the first set of results presented in this chapter, those on the effect of the sugar industry on the interactions between Kittitian farmers and vervet monkeys. It means that the “boundary” between forest and farmland that contained most monkeys in the mountain and separated monkeys from humans (nature from culture) was a façade created by the sugar industry. The smallholding farmers working at the base of the forest, the food that they maintained, and the activity of the sugar industry kept monkeys in the mountain, facilitating the impression of a “natural” forest with monkeys and “cultural” farmland and village without monkeys.

The ethnographic data show that a divide between nature and culture exists among Kittitian farmers, even though they are aware that, as a result of the closure of the sugar industry, the forest/farm “boundary” no longer serves to restrict monkey movements and that the monkeys must leave the mountain to find food. The island’s geography is still referred to as “mountain,” “lowland” or “village,” with mountain reserved for monkeys, lowland for agriculture, and village for people. This is confirmed by the constant references to monkeys invading the “lowlands,” and how before, you had to go into the “mountain” to see them. The mountain is nature and the lowlands/villages

are culture, and there is a sense that things are out of control because the forest/farm boundary is no longer maintaining this separation.

Kittitian farmers share the traditional Western perception that there is a divide between nature and culture and that nature is separate from man, but they do not share the perception that people degrade nature. Instead, there is the perception that nature is invading culture; monkeys are invading human space. St. Kitts does not contain a traditional indigenous population, as the Carib Indians were killed shortly after the arrival of colonialists. All Kittitians are descendants of African slaves, European colonialists, or immigrants that arrived after the 17th century. Within a very short period of time after European arrival, agriculture dominated all of the arable land in St. Kitts. Therefore, for Kittitians, an environment dominated by agriculture is the “natural” condition. The “cultural” shift out of sugar production has allowed nature/monkeys to degrade the “natural” agricultural condition through their crop damage.

Human-animal studies and human-primate studies The perspective that there is no divide between humans and primates is relevant to the second set of results presented in this chapter, those on the effect of the sugar industry on Kittitian farmers’ cultural conceptualizations of primates. This work shows that St. Kitts vervet monkeys are currently transgressing two boundaries: farm/forest and human/animal. The analysis from the previous section shows that the farm/forest boundary is a façade created by the sugar industry, but nonetheless, this boundary plays an important role in the monkeys’ transgression of the second boundary, the boundary between humans and animals. This is because, prior to 2005, this “boundary” served to keep living monkeys out of sight to

most Kittitians, preventing them from experiencing the monkeys' physical and mental similarities to humans. Monkeys' transgression of the farm/forest boundary has led to their transgression of the human/animal boundary, since Kittitians now see monkeys on a regular basis for the first time. This supports the notion that primates occupy border zones and shows that the line between humans and primates blurs with increased observations of the animals.

This work also supports human-animal and human-primate relationship studies by showing how primates can be used to study origin myths and how cultures define what it means to be human. Most Kittitians are Christians and have a creationist view of the world. This makes the two interview excerpts from page 30, which document beliefs about the origin of monkeys, particularly compelling. One farmer explained how a woman he knew used to always say that God couldn't have created the monkey; they are so bad that it had to be the devil. Another farmer explained in more detail that after God created man, the devil wanted to copy God. He tried to make a man, but he stopped at a monkey. The farmer explained that this is why monkeys copy whatever they see humans doing. These stories illustrate Kittitians' creationist beliefs about human beings as well as the way they distinguish humans from monkeys. Humans are seen as superior, for they have the distinction of being created by God and they behave with manners. Monkeys are distinguished from humans and viewed negatively because they exhibit unreasonable and devilish behavior (they are wasteful, spiteful, willful, bad-minded, etc.)

Importantly, while this story distinguishes humans from monkeys, it also associates the two. By saying that the Devil tried to create man but instead created monkey, this story indirectly says that monkeys are closer to man than the other animals.

This fact is supported by all of the ethnographic data explaining how human-like monkeys are - the way they hold their babies, have lookouts, learn the farmer's schedule, etc. While most Kittitians don't believe in evolution, they clearly understand that monkeys have more human-like behaviors than other animals do. One could argue this story says that monkeys are *almost* human, as the Devil was trying to create man but didn't quite get there.

Human-wildlife conflict The third set of results presented in this chapter, those on the impact of the sugar industry on the unique nature of monkey pestilence discourse, address three of the themes that emerge from an anthropological engagement with human-wildlife conflicts: the symbolic dimension of the wildlife threat, the moral specification of dangerous animals, and the variety of ways in which conflicts with wildlife overlap with conflicts among people. While most ethnoprimateological investigations look at cultural conceptualizations of primates more broadly (positive or negative, tolerance or intolerance, kin or non-kin, etc.), this study takes a more anthropological approach by incorporating structuralist theory and the symbolic dimension of primate pests. Crop raiding by vervet monkeys in St. Kitts exemplifies Knight's (2000a) argument that wildlife pestilence can be as much about boundary crossing as it is about economic consequences. In this case, vervet monkeys are transgressing both the forest/farm and the human/animal boundaries. Structuralist principles argue that phenomena that cannot be ordered into classes, such as those that cross spatial boundaries, are anomalous. The monkeys are "matter out of place" (Douglas, 1966) because they are "natural" animals (without owners, unlike their

domestic pest counterparts, pigs and livestock) in “cultural” (agricultural) spaces. In their transgression of the forest/farm (nature/culture) boundary that was maintained by the sugar industry for hundreds of years, vervet monkeys in St. Kitts have become anomalous animals. Their forest/farm transgression coincides with their increased visibility in the lowlands and makes them increasingly dangerous due to their humanness (transgression of the human/animal boundary).

Knight’s (1999) work on crop raiding by rural macaques in Japan is also highly informative with regard to the symbolic dimension of vervet monkey crop-raiding. While St. Kitts vervet monkeys are viewed negatively and as dangerous due to their transgression of the forest/farm and human/animal boundaries, this study shows that hatred for monkeys is not universal among St. Kitts farmers. As there is among rural Japanese farmers, there is local variation in perceptions of monkeys, and many farmers recognize that the monkeys have come to the lowlands in search of food because “they have to eat, too.” These results support Knight’s (1999) call for the integration of local variation and history into symbolism: St. Kitts farmers recognize the effects of the sugar industry closure on monkey food sources and monkey movements. Therefore, vervet monkey movements out of the forest are, like the movements of rural Japanese macaques, an announcement and an aspect of the transformation of upland space. Their mobility is constitutive of St. Kitts’ new, inclusive spatial domain, one without sugar industry infrastructure dominating the landscape and keeping monkeys in the mountain.

The ethnographic data presented in this chapter show that in St. Kitts, monkeys are subject to negative symbolism and attributed an immoral character (Knight, 2000a). Because monkeys crop-raid with manners that do not fit the expectations of the humans

they exemplify in so many other ways, monkeys become immoral (i.e. “bad-minded,” “spiteful,” “wasteful,” etc.) and conflict is exacerbated. Being human-like means monkeys are expected to behave with human manners, and it also means that they are so intelligent that their crop damage cannot be mitigated with any method other than control (i.e. trapping/killing monkeys). This supports Knight’s (1999) notion that, when pestilence is a crime, pest control becomes law enforcement and a means of maintaining balance.

Finally, this work exemplifies how conflict with wildlife can overlap with conflicts among people. In St. Kitts, farmers experience crop damage disproportionately based on their geographic location, but this difference in crop damage levels does not relate to different kinds of people (like Naughton-Treves, 1997 and Hill, 1997). Additionally, other studies have shown conflict among those experiencing wildlife pestilence regarding what exactly constitutes a pest and/or what to do about that pest, but in St. Kitts, there is little disagreement about the argument that monkeys are pests and that the best way to mitigate their damage is to control their population to some degree. In St. Kitts, conflict with primates overlaps with conflicts among people in the sense that human conflict, more specifically, conflict between some farmers and the government, is being projected onto wildlife. Even though this study is about crop damage, farmers’ comments focus on the need for government assistance with infrastructure: tractors, marketing/seeds and water. The desire for government assistance features prominently in conversations about crop pests as well. Farmers explain that identification cards for farmers, fencing, and population control could mitigate human, pig/livestock and monkey damage respectively. Knight (2000a) explains that, in situations like this, when human

conflicts with wildlife are informed by people-state conflict, it is often the result of a feeling of vulnerability and/or marginality on the part of local people. It is argued in Chapter Four that, in St. Kitts, these feelings stem from a lack of land ownership on the part of farmers.

Historical ecology Engaging the broader perspective of historical ecology in the context of this study means recognizing that there is not a linear relationship between Kittitians and their environment. People have had an effect on the St. Kitts environment through processes such as deforestation, agricultural production and development, and the St. Kitts environment has affected people in different ways throughout history. There is a mutual and ongoing human-environment relationship, manifested in the landscape. This perspective means that the island's central forest is not "pristine," "untouched" or "undeveloped," and it is no different from the more obviously "human-impacted" agricultural land. People have had an impact on the entire island, just in different ways, and, in turn, the environment has had differential impacts on people according to their specific cultural context. A historical ecology perspective on the St. Kitts landscape means acknowledging the fact that the agricultural development that has played such a large role in the current, visible landscape is not necessarily "good" or "bad." It is unknown exactly when human contact was established on St. Kitts, but it is clear that humans impacted the environment well before the establishment of agriculture. Finally, engaging the theoretical perspective of historical ecology means that the human-environment relationship in St. Kitts, investigated in this study, is specific to the island's

unique and dynamic history but is relevant to a broader, cross-cultural, comparative historical ecology.

This work presents a dynamic view of the human-environment relationship in St. Kitts by assessing the temporal, spatial and cultural dimensions of the landscape. This is accomplished through the use of historic, academic and ethnographic sources. The historic and academic sources, including the McMahon Map (Figure 12), the work of Merrill (1958), Mills (1972) and McGuire (1974), the Booker Report (1984), the map of sugar estates just prior to closure (Figure 14), and the “current” land use map (Figure 15) can be used to assess the temporal and spatial dimensions of the St. Kitts landscape. These sources document the significant landscape changes that have occurred in St. Kitts over the last eight years. Pre-2005, virtually all of the arable land in St. Kitts was used for sugar production and associated infrastructure. During this time, the spatial organization of St. Kitts existed according to the land’s ability to grow sugar for the former sugar industry. With the exception of land set aside for housing, only land that was inaccessible to tractors was not used in sugar production. Villages were located in such a way that their members were able to get to the estates easily for work. The academic works of Merrill (1958) and Mills (1972) confirm this historic data through their descriptions of the various forms of agriculture in St. Kitts and the dominance of the sugar industry during their fieldwork.

Today, the St. Kitts’ landscape is much more difficult to decipher due to the pace at which changes are occurring. The one thing that is clear is that the transition out of sugar production in 2005 is the catalyst for these changes. Figure 15 is the closest thing to a current land use map that exists in St. Kitts. The problem is that the base of this map,

the proposed future use for St. Kitts land, was created in 2005 after the sugar industry ended, but did not incorporate the current uses of the land. Additionally, since this time, new developments have come about that do not conform to what was proposed in 2005. In an attempt to make this map as current as possible, these recent developments and the locations of the farms in this study have been added to the map. The farms in this study represent only one-third of the registered farms in St. Kitts, but their boundaries provide information about the location of current agricultural activities.

While not exact, this “current” land use map of St. Kitts is still highly informative. On the one hand, it shows how the shell of the spatial organization generated by the sugar industry remains embedded in the St. Kitts landscape. First, the map shows that the most of the land use changes that have occurred since 2005 occur on the large plots of former sugar land that are now available for alternative use (this can be seen by comparing the “current” land use map of St. Kitts to the land use map from just prior to industry closure (Figure 14)). Second, by incorporating the current locations of the 65 farms from this study, this map shows that agricultural activity still remains on much of the former sugar land, even though the base map shows that this land has been slated for development.

On the other hand, this map illustrates dramatic changes to the spatial dimension of St. Kitts landscape since the end of the sugar industry. Figure 14 is covered in light green, which represents sugar land, while Figure 15 has very little land designated as agriculture (colored bright green). Significant portions of former sugar land appear to be laying fallow, as it has not been designated for future development. The most significant change comes in the northwest corner of the island. While the study farm boundaries

show that much of this land is still used for agriculture, the base map designates this land for development.

The fact that no current land use map of St. Kitts exists is informative in its own right. It shows that the spatial dimension of the St. Kitts landscape is currently and quickly shifting. This map shows a disconnect between the past, present, and future of St. Kitts' land. The smallholding farmers in St. Kitts, many of them former sugar workers and participants in this study, are currently utilizing much of the former sugar land to grow food. The past use of this land has made it possible for it to become available to these individuals, but the proposed future use of the land shows that this situation may not exist for long, as development projects feature strongly in the proposed future use of the land.

The cultural dimension of St. Kitts' landscape, revealed through the ethnographic data, confirms the temporal and spatial assessment from the historic and academic sources above. The data show that 2005 marked a time of extreme change in St. Kitts (as conversations about agriculture always included a comparison of "before" and "after" sugar) and they provide important details not seen in historic and academic sources (i.e. the location of the smallholding farmers at the base of the forest during sugar production, the effects of their activities, and the post-2005 shift toward working on former cane land closer to the villages). Second, the ethnographic data show that Kittitians' relationship to the landscape still revolves around the spatial organization of the sugar industry. All agricultural land is referred to by its former estate name and references to the land always include a spatial component, such as "lowland" or "mountain." Finally, the ethnographic data show that many St. Kitts farmers have opinions about the shift from agriculture to

development. This topic is discussed in detail in the next chapter, which is dedicated to how the political ramifications of the island's colonial history have made it possible that the future of significant portions of this island's land is unknown.

CHAPTER 4: THE POLITICAL-ECONOMIC CONTEXT

Introduction and Background

The ethnoprimateological level of analysis in this dissertation, outlined in Chapter Three, expanded on the primatological analysis from Chapter Two by utilizing historical ecology to address the temporal nature of St. Kitts' landscape and the role this has played on the symbolic relationship between Kittitian farmers and vervet monkeys. The third and final level of analysis, presented below, shows that a more robust understanding of "the monkey problem" can be obtained by engaging the broader political-ecological context of St. Kitts agriculture. The ethnographic data collected for this project reveals that St. Kitts' history, and the lack of farmer land ownership it created, play a significant role in this human-primate conflict.

Understanding the "landless" status of most Kittitian farmers requires an understanding of the island's colonial history, why it is unique, and previous studies that have assessed how this history has affected Kittitian farmers and Kittitian society. In addition, background knowledge in political ecology theory is necessary to address how the ramifications of this history are revealed in the ethnographic data. After describing this important background information, the ethnographic data, obtained by using the ethnographic methods described in Chapter Three, are presented. These data relate to the lack of land ownership in St. Kitts and how this impacts Kittitian farmers' relationship to the land, each other, and agriculture as a whole. (These data represent the views of those quoted. They are *not* the views of the author and they are not representative of this large and important debate.) Finally, these results are used to show the benefits of an ethnoprimateological engagement with these aspects of environmental anthropology.

The Early History of St. Kitts Christopher Columbus “discovered” St.

Kitts in 1493 on his second voyage to the New World. Upon his arrival he was met by a relatively small population of about 1,000 Carib Indians, as he arrived well past the high point of Indian occupancy in this area (between 500 and 600 AD). The Caribs possessed a mixed economy of cultivation and fishing with a complex array of hooks, lines and traps. Connections with South America were particularly strong in terms of agricultural plants used, and their cultivars included manioc, sweet potatoes, yautia, peanuts, arrowroot, pineapples and numerous other fruits (Merrill, 1958). Their agriculture was especially successful in St. Kitts, which they called Liamuiga, the “fertile island” (Joyce, 1916 in Watts, 1987).

Following Columbus’ initial landing, 150 years passed during which St. Kitts and other islands in the Lesser Antilles remained unsettled by Europeans. During this time, Spain was the dominating colonial power and was drawn towards the mineral wealth of Hispaniola, Cuba and the mainland (Mexico and Peru). The lack of Spanish interest in the Lesser Antilles made way for settlement by the English, French and Dutch. In 1620, Ralph Merfield and Thomas Warner applied for and received a Royal Patent to settle the Leeward Islands and begin a colony. Thomas Warner arrived in St. Kitts on January 28, 1623 with 15 settlers. He and the local Carib Chief Tegremond came to terms and Warner’s colony was established. It was the first English settlement in the Caribbean (Hubbard, 2002). Warner was soon joined by his boyhood friend, Major John Jeaffreson (relative of Thomas Jefferson), who was granted 1,000 acres of land for a plantation. This plantation, Wingfield Manor, still survives in St. Kitts. Later in that same year, the French Navy arrived in St. Christopher with thirty-five men in order to repair a damaged

ship. In 1627, the English and French divided the island equally into four quarters (the English taking two in the center part and the French the two at opposite ends of the island) and lived together for more than four decades under the dual threat of Spanish and Carib attack (Merrill, 1958; Hubbard, 2002).

Initially, the English and French colonists took to raising tobacco, cotton, indigo and ginger. Tobacco became the first staple export crop, and it was raised to the exclusion of most others between 1627 and 1631, creating a shortage of provisions (Watts, 1987). By 1639, the country faced too much competition with Virginia for the product to be profitable (Mills, 1974).

The relationship between the English and French settlers and local Caribs were cordial at first. In fact, Thomas Warner had a Carib mistress. As more and more settlers, both English and French, poured into St. Kitts and started clearing land for farming, confrontations between settlers and Indians increased. In 1626, Chief Tegremond came to the decision that the Europeans had to be eliminated. He called on Caribs from other islands to come to a designated area at night, where they would collectively kill all of the settlers. Reportedly, an Indian woman gave the English and French colonists advanced warning of this plan, so they decided that a pre-emptive strike against the Indians was necessary. The French and English threw a party for the Indians with large amounts of alcohol, and when the intoxicated Indians returned to their village, the Europeans attacked by night. Approximately 120 were killed that night, and the next day, they drove 2,000-4,000 Caribs into a ravine through which a stream flowed. A bloody battle ensued, and about 100 Europeans were killed. When the surviving Indians attempted to surrender, an estimated 2,000 were systematically executed and the rest escaped to the

mountains. This ravine ran red with blood for two days and is known today as “Bloody Point.” Around 1640, all remaining Indians were removed from St. Kitts and sent to Dominica, where a handful of descendants survive today (Hubbard, 2002).

A Sugar Island The Caribs were known to have treated the land as a communal resource, with no concept of private land ownership. The land was to be utilized fully, within the limits of their technology, but sensibly and conservatively, in order to provide a range of foods. This concern and care for the preservation and maintenance of the land stands in stark contrast to the events that followed (Watts, 1987). It was within a very short period of time after the removal of the indigenous population that sugar production and slavery became institutions in St. Kitts.

The initial motive for contact between the metropolitan countries of England and France and St. Kitts was the opportunity for profit from the production of raw material, and the countries transferred capital, management and labor for this purpose. The English retained some measure of control over the islands settled in the name of the Crown by regulating trade, production and property and in dispensing titles of land ownership to favored persons. These individuals became Lord Proprietors, chosen noblemen who had the right to tax and raise duty on their produce. Lord Proprietors farmed out their rights to stock trading companies, as they were the only units of enterprise capable of mobilizing the necessary capital. The products of this system were grown exclusively for trade with England and France (Ferryhough, 1974; Mills, 1974).

Merrill (1958) and Watts (1987) describe the process of land acquisition in St. Kitts. The earliest colonists took up land “without any authority but their own” (Merrill,

1958: 59) before the first Lord Proprietor arrived in 1627. Because of the disorganized original settlement pattern, it became common for immigrants in St. Kitts to work under land lease, with a quit-rent (or tax in the form of agricultural products) to be paid to those responsible, rather than to try to confirm ownership. For decades, much of the land changed hands. It was not until 1664 when proprietary rule ended and a Crown Colony was established that conflicting claims were resolved.

After European settlement and before the establishment of the crown colony, there was a gradual period of agricultural transition from tobacco to sugar (Merrill, 1958). It was around 1650 when the first systematic production of sugar cane came to St. Kitts. The Spanish and Portuguese had discovered the process of crystallizing the sugar by boiling the juice from crushed cane in a large line of large pots (coppers), adding lime and skimming the waste off of the top as the juice thickened into syrup. The syrup was poured into flat evaporating pans where it would crystallize into brown “muscovado” sugar which was packaged into 65 imperial gallon barrels called hogsheads (Hubbard, 2002).

Mills (1974) explains how the shift to sugar cane brought with it three important economic changes. First, sugar cane became the staple crop of the island and muscovado sugar, rum, and molasses became the main export products. Second, the small farmer of the first few decades disappeared and the land use changed drastically from small tobacco holdings to large sugar estates. Third, white European labor was replaced by slave labor, as sugar cane production required large areas of land and sizeable gangs of skilled and unskilled workers.

From the late 17th to the early 19th centuries, St. Kitts was defined by sugar production and war (see Hubbard (2002) for details on imperial conflicts). In brief, France and England fought bitterly in the Caribbean during this period; Brimstone Hill Fortress stands as an example of the need for strategic military positioning. St. Kitts became an English territory in 1713 with the Treaty of Utrecht, but it fell again to the French in 1782 when the American Revolutionary War created an opportunity for France in the West Indies. The Treaty of Versailles returned the island to the British in 1783 (Merrill, 1958).

The wars did not prevent the sugar colonies from reaching their peak of prosperity. It was during this time that the saying “as rich as a West Indian planter” came into use. While the first Caribbean island to shift to full sugar production was Nevis in 1652, followed shortly after by Barbados in the early 18th century, St. Kitts moved to the forefront of sugar production and became the wealthiest of all the Leeward Islands. At the outbreak of the American Revolution in 1776, St. Kitts was, per capita, the richest colony in the British Empire (Hubbard, 2002).

At this time in the early 1700s, St. Kitts was a sugar-cane colony with only the most inaccessible forest zones untouched. The island was converted from an insular, multi-species ecosystem to a semi-industrial production unit with field arrangements, settlement patterns, and communication networks all focused on the production of a single crop: sugar cane (Richardson, 1983). A huge increase in slave labor allowed for land conversion and massive production of cane. In 1708, St. Kitts had a population of 1,747 whites and 2,861 slaves, but by the end of the century, there were 4,000 whites and 26,000 slaves (Merrill, 1958).

There were a few important consequences of this total land reformation. First, the focus on a single crop meant that the fertility of the soil was being depleted. Intense fertilization on behalf of the St. Kitts planters in the 1800s allowed them to maintain a higher yield per acre and better sugar quality than even Jamaica (Ward, 1988). The intense monoculture also meant that little else was being grown to feed the island's inhabitants. As early as 1664, one observer proclaimed that the colonies of the Lesser Antilles were planting so much sugarcane that insufficient foodstuffs were being grown (Mims, 1912 in Merrill, 1958). The shortage of agricultural land meant that planters and slaves were almost completely dependent upon imported food paid for by the planters. During times of war, the supply of provisions was often disrupted, and slaves were poorly fed as a result (Merrill, 1958). It was during this time that the first systematic attempts at diversification were initiated: one slave act obliged every land proprietor to keep cultivated in root crops one acre for every ten slaves. Such a law, which was never enforced, was intended to reduce the need for importing food and stabilize the economy (Crist, 1959).

The second important result was that, in order to save money on food imports, the planters gave the slaves provision plots that were set aside in non-arable areas in the mountains and ghaut (ravine) sides. They were given Saturdays off to work these plots and they planted crops such as yams, sweet potatoes, cassava and dasheen. These crops were sold at a weekly market from sunrise to nine on Sunday mornings (Merrill, 1958). Archibald (2008) explains how the Sunday market was the commercial extension of the small plot and completed the productive activity of the African, combining primary production with marketing. During slavery, the Sunday markets were held at designated

locations in town but there were also many wayside stalls set up by certain enterprisers who wanted to avoid the competition and the noise of the regular market. This market was a powerful movement, and while attempts were made to reduce its growth, the white wives relied on these markets for their weekly domestic supplies, so the planters had no choice but to watch the movement grow into a potent economic and social institution. The market was only marginally profitable, but it was still a useful economic activity “because it embraced a large number of people who entered the market voluntarily and provided them with employment within a free economic enclave, which developed within the perimeter of the basic slave economy” (p179). The street vendors of today are the descendants of the Sunday market and “are one of the few enduring features of our black Caribbean culture, perpetuating the great tradition of our ancestors” (p 180).

Third, the wealth incurred from the complete land reformation meant that many planters had made enough money to leave the island and return to Europe. Absentee landlords became very common (Blume, 1985). By 1744, absenteeism among sugar planters had reached 50% (Pitman, 1967). While planters living at home created a protection of their interests in added strength in the sugar lobby, it eventually led to mismanagement and decline. Absenteeism drained the colonies of much of the money that might have gone into further economic, agricultural and social development, and management efficiency normally declined markedly in the absence of the owner.

The 18th century witnessed both the peak as well as the decline of development for St. Kitts and other West Indian sugar islands. The decline of the planter aristocracy began in the last quarter of the 18th century, and by the middle of the 19th century, it was complete. Many estates were abandoned by the late 1800s (Merrill, 1958). Myriad

factors contributed to this decline. For example, the West Indies was no longer the focus of European politics (Watts, 1987), the abolition of the slave trade in 1807 and the full emancipation of slavery in 1838 meant that labor became an issue, and beet sugar had been developed and was able to be produced in temperate climates, reducing the need for Caribbean-produced sugar (Inniss, 2005). Merrill (1958) cites Ragatz's (1928) list of other important factors:

The distress was attributed to many factors: the extension of cane cultivation in foreign tropical areas, above all, Cuba and Brazil, where the soil was rich and the labor supply ample and cheap; the existence of a world surplus of sugar; the admission of foreign muscovado into the British refineries; the competition of new British colonies favored with fresh land; the admission into the British market of East Indian sugar; the lack of free commerce with America; the high cost of shipping sugar to England; the restrictions on refining operations in the colonies; ... the decrease in white population in the islands; the marketing through creditors; and the end of preferential treatment in the home market (p 86).

Thus, by the mid-nineteenth century, mercantilism (or trade and shipping exclusively within the network of one nation) succumbed to the aggressive new economic philosophy that was “free trade:”

Sugar consumption, and the government income it provided, had finally become so important to British capitalist development that sugar production was no longer allowed to depend upon the mercantilist-nationalist arrangements that had formerly controlled it. By removing barriers to “free” trade...by making it possible for the world's cheapest sugars to reach the widest possible market in Britain – the leading sectors of British capitalism sold out their planter-capitalist fellows (Mintz, 1985: 70).

In other words, sugar “had become too important to permit an archaic protectionism to jeopardize future metropolitan supplies. Sugar surrendered its place as luxury and rarity and became the first mass-produced exotic necessity of a proletarian working class” (ibid: 46).

The attempts to resurrect the declining sugar industry manifested themselves in the continuous amalgamation of farms and increased mechanization. Figure 23 illustrates how the spatial organization of the farms changed from 1650-1850; the number of farms decreased but the size of the farms increased. Most mills were converted into steam. Only one out of a total of 52 were not using this mode of power by the end of the 19th century (Paton, 1888 in Watts, 1987). Additionally, the use of natural fertilizers in the form of guano came into practice, as the intense production of sugar for over 200 years continued to take its toll on the land's fertility (Watts, 1987).

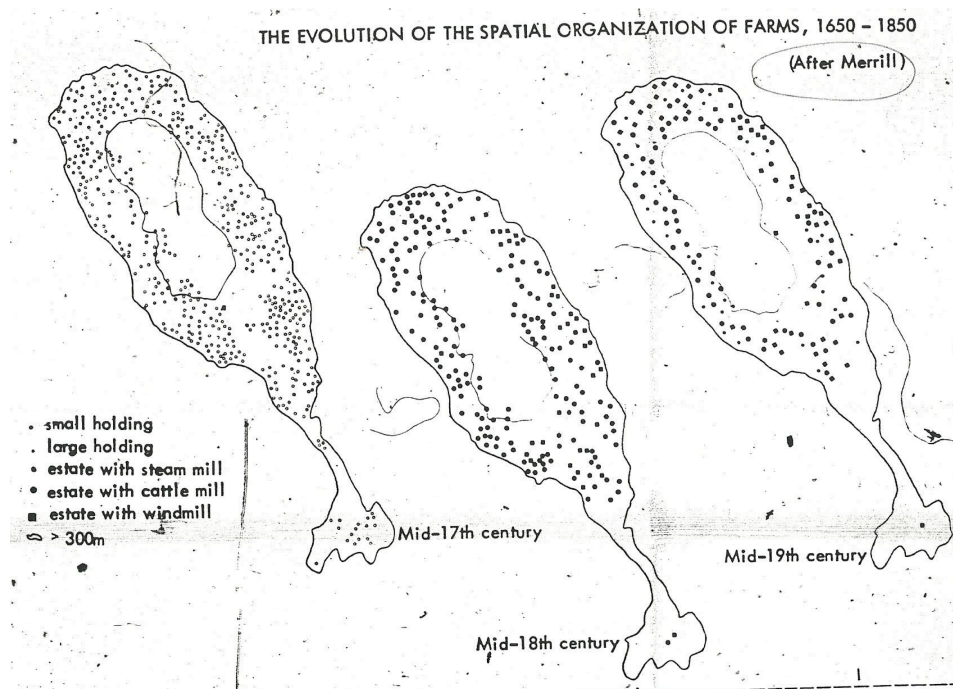


Figure 23. Continuous amalgamation of farms in St. Kitts from 1650-1850 (in Mills, 1974, adapted from Merrill, 1958).

The newly emancipated slaves in the Caribbean had gained the right to refuse to work, and in many locations, such as Jamaica, Trinidad and mainland colonies, a critical

shortage of labor resulted. In St. Kitts, the emancipated slave had little opportunity to take up land and work for him/herself, as all public land was taken up in cane (Merrill, 1958). Thus, most of these cultivators had to continue working on estate lands because the overwhelming portion of cultivatable land was already owned (Mills, 1974). Black people were specifically prevented from owning land. In 1868, white attorneys that managed the estates voted to abolish elections into the island's Assembly, effectively barring black people from entry into politics (Archibald, 2008).

There was still a need for additional labor post-emancipation, and the Leeward Islands sought a solution through the introduction of labor from England, Africa, Madeira, India and China. The most significant source of immigrants to St. Kitts came from Portuguese Madeira. These immigrants were bound to the planters from one to three years, depending on the circumstance (Merrill, 1958). The Portuguese were never allowed to become part of the political elite, but they did not remain agricultural laborers for long. Many of them left, but those that remained became successful businessmen. By the 1890's, notwithstanding their small numbers (around 400), they controlled the greater part of the retail trade of the island (Inniss, 2005).

Tensions between the blacks and Portuguese began to stir as the Portuguese were given easy and favorable access to capital and credit. Even though they were never fully assimilated into the white European society of the island, blacks regarded them as part of the system whose rapid advancement had been achieved at the price of their retrogression (Inniss, 2005). One of the most successful Portuguese men in St. Kitts in the late 1800s was Joaquin Farara. By 1880 he owned several sugar estates in St. Kitts in addition to substantial commercial interests in Basseterre. His estates included Needsmust and

Greathead (1128 acres), Mornes and Pond (778 acres), Fahies (326 acres), Farm (593 acres), Chalk Farm (180 acres) and Vambelle (460 acres). At this time, wages for cane cutting had recently dropped by 25%. Farara had modernized some of his estates with crushing mills and clarifying tanks, and his workers contended that they would have to work harder and demanded higher wages. Farara refused, and on Feb 17th, 1896, the shops of the Portuguese merchants were set on fire and looted. The “Portuguese Riots” were a form of protest against the conditions of poverty and deprivation under which the workers labored (Inniss, 2005).

In the weeks after the Portuguese Riots, a Royal Commission was appointed to inquire into the conditions of the West Indies sugar industry and the laboring classes. This is referred to as the Norman Commission, after one of the commission’s members, Sir Henry Norman. The Norman Commission made three main recommendations: 1) the settlement of the laboring population on small plots of land as peasant proprietors; 2) the diversification of agriculture by the establishment of minor agricultural industries other than sugar; and 3) the establishment of central sugar factories with loans from the imperial government, if possible (Inniss, 2005). These recommendations came from important observations, including:

(T)he cultivation of sugar collects together a larger number of people upon the land than can be employed or supported in the same area by any other form of cultivation. In addition to this, it also unfits the people, or at any rate gives them no training, for the management or cultivation of the soil for any purpose other than that of growing cane. The failure therefore of a sugar estate not only leaves destitute a larger number of workers than can be supported upon the land in other ways, but it also leaves them without the knowledge, skill or habits requisite for making a good use of the land (in Watts, 1987: 516).

Governments were castigated for their failure to settle more peasants on the land and asked for positive action in this direction, but in the end, little was done to change the emphasis of production away from cane.

Talk of increasing the efficiency and profitability of the sugar industry was widespread at the start of the 20th century; poor weather conditions made the crop of 1900 the smallest of the decade. Falling sugar prices made sugar production less profitable, and acreage under cultivation fell. In keeping with one of the recommendations of the Norman Commission, the St. Kitts (Basseterre) Sugar Factory, Ltd. was incorporated on Dec 15, 1910, and a formula was agreed upon between the factory and the contracting estates for paying for the canes supplied (Inniss 2005). The factory took its first crop in 1912 and was successful by the standards of the time. By 1926, the Basseterre Sugar Factory encircled the whole island (Inniss, 2005; Richardson, 1983).

Direct metropolitan corporate control over the industry meant even fewer local jobs for resident black workers. It did not free lands for subsistence purposes. It reduced local employment opportunities and meant that all negotiations had to be taken up with corporate persons. As Richardson (1983) states: “consolidation of the St. Kitts sugar-cane industry from 1911-1926...profited English corporations, reinforced land control by a local plantocracy, and called upon black Kittitians to bear the dual burden of both 19th century inequality and 20th century efficiency” (p 137).

During the railway’s expansion period, life was especially difficult for Kittitians. Even though the price of sugar increased steeply due to a world shortage of the commodity, and there was a small increase in salaries and wages, these increases were outdistanced by the phenomenal rise in the price of imported goods and the general cost

of living. No figures are available to indicate the precise increase, but a comparison can be made with Guiana, which set up a commission in 1919 to investigate this very matter. It is likely that this experience was not atypical of other British West Indian islands, including St. Kitts. There, the cost of basic necessities increased on average by 118% from the outbreak of the war in 1914 to its end in 1918. The increase in cost for rent, clothing and food was given as 50%, 200% and 120% respectively (Inniss, 2005).

Emigration seemed the only route of escape (Inniss, 2005). This was not a new strategy: a post-slavery migration culture had already been established. In the mid 1800s, the planters of Trinidad and British Guiana lured workers to their large plantations, and this was a valuable outlet for black Kittitian men and women who sought economic independence from the planters of their home islands. Remittances from abroad became extremely important to St. Kitts' local economy. At this time, since no land was available for subsistence plots of truly independent village communities, a "migration adaptation" served a function roughly analogous to a "village adaptation" (Richardson, 1983: 6).

Politics and the Slow Death of Sugar It was against the background of extreme hardship, exacerbated by the rapid rise in the cost of living and an acute food shortage, that an attempt was made in 1916 to form the first Trades and Labour Union in St. Kitts. Unfortunately, the formation of trade unions was prohibited in St. Kitts at the time, but Mr. Joseph Alexander Nathan and Mr. J. Matthew Sebastian formed the St. Kitts-Nevis Universal Benevolent Association, a Friendly Society, in its place. The association started publishing a monthly magazine called The Union Messenger, where

members of the society could write freely about the evils of the plantocracy, Crown Colony rule and the associative socio-economic conditions: low wages, poor housing, inadequate health facilities and lack of educational opportunities. This newspaper played an important role in awakening the working people's consciousness to the means by which their conditions could be improved (Hubbard, 2002; Inniss, 2005; Archibald, 2008).

In 1932, middle class Kittitians, such as businessmen and other professionals of means and status, formed the Worker's League. Championing for the same cause, the Benevolent Association and the Worker's League printed their thoughts together in The Union Messenger. In 1934, a petition was created in favor of the creation of representative government, which quickly went to vote. It was rejected, making St. Kitts the only island left in the Eastern Caribbean without constitutional advancement. In other words, Kittitians were the only West Indians still incapable of sharing in the management of their own affairs (Inniss, 2005).

On January 28, 1935, the Buckley's Riots occurred, bringing three distinct but interrelated conflicts in St. Kitts to a climax: the ever-increasing conflict between the laboring workers and the crown colony; the conflict between the planters, or cane-suppliers, and the Sugar Factory; and the conflict between the ruling class, the planters, and the professional businessmen (members of the Worker's League) who had been working to restore representative government (Inniss, 2005). Following these riots, which originated at Buckley's Estate when workers were denied a wage increase, workers continued to show defiance to authorities. Soon after, contrary to the wishes of the plantocracy (the ruling class of plantation owners), the Secretary of State reintroduced

the elective principle into St. Kitts-Nevis. This allowed the country to manage its own affairs, although the electorate was limited by the requirements that you needed to own land, pay taxes, and have a certain salary in order to vote. Nonetheless, working-class issues dominated the 1937 elections. The Worker's League went up against the planters and won (Inniss, 2005).

Due to the influence of the Worker's League, the imperial government sent forth another commission, the Moyne Commission, to investigate the social and economic conditions of the West Indies. Lord Moyne recommended a land distribution scheme that would help to eradicate poverty among the masses (Archibald, 2008). This never occurred. He also recommended that colonial governments in the West Indies enact legislation to allow the formation of trade unions. On February 8, 1940, the St. Kitts-Nevis Trades and Labour Union was formed (Inniss, 2005).

All of this was occurring during World War II, and the cost of living was extremely high. Workers at the sugar factory asked for a wage increase and received a 10% "war bonus." The workers felt that this was inadequate and asked for more, which was refused. The sugar factory workers were the most zealous trade unionists in St. Kitts, and 648 of them walked out and did not return for seven weeks (Inniss, 2005; Hubbard, 2002). Unfortunately, the union was still unregistered at this time and was not able to protect its victims, and the factory dismissed eleven of the "ringleaders," including Robert L. Bradshaw. This proved to be a significant event in the history of both the labor movement and St. Kitts itself, as Bradshaw would go on to become the first leader of the union and then the first elected leader in St. Kitts (Hubbard, 2002).

The union showed its strength for the first time in 1948, when 10,000 workers participated in a strike which lasted for 13 weeks (Hubbard, 2002). This “long strike” was “the defining moment in the sugar industry” (Archibald, 2008). It left the landowners with great losses and immersed in debt, and it disturbed the existing rhythm of borrowing to finance the crop and repaying from the sale of cane. Some landowners were forced to sell pieces of land to the growing middle class for housing (Archibald, 2008).

In 1951, a momentous event occurred. For the first time in history, popular suffrage was granted to the people of the Leewards and islanders were able to vote and control their own destiny. Not surprisingly, the labor movement gave birth to the first political party in St. Kitts, with Bradshaw at the head. Bradshaw was both the leader of the party and the head of the union (Hubbard, 2002).

The sugar industry survived 1948 by the massive accumulation of debt, and from 1948-1973, the trade union, now a political force, tried to get as much as they could from the sugar industry, hoping that it would survive (Archibald, 2008). In fact, St. Kitts experienced the island’s highest ever output in 1953 (Inniss, 2005). While the industry seemed to be doing well, Merrill argued at the time that: “the present prosperity of the sugar industry in St. Kitts is more the result of an artificial price for sugar abroad under the protection of Great Britain than the efficiency and heavy production of sugarcane at home” (Merrill, 1958: 104). Merrill is referring to the fact that, during this time, agricultural commodities were sold to the UK under special long-term marketing arrangements. Sugar was exported under provisions of the Commonwealth Sugar Agreement (CSA), which lasted from 1951 to 1974 (Worrell, 1987).

Two important things were happening in the mid 20th century: emigration continued to be a force in St. Kitts and additional attempts were made to diversify agriculture. As British subjects, Kittitians could travel with British passports to the mother country, and it was eventual large-scale emigration to England that helped ameliorate postwar economic desperation in St. Kitts. In the early 1950s, a few prosperous Kittitians made their way to England, where they established a social foundation and network for thousands that would follow. During the decade from 1955 on, Basseterre records indicate that 15,000 individuals from St. Kitts, Nevis and Anguilla left for England. This was a greater migration from St. Kitts than ever before, and while remittances from England helped those that stayed behind, most of those that left never returned (Richardson, 1983).

Efforts to diversify agriculture continued at this time. Mills (1974) explains that the first direct intervention dates to 1966 with the passage of the Local Food Production Ordinance, which attempted to reduce food imports with the local production of vegetables and livestock. He cites the ordinance, which directed the estate owner to “plant, cultivate and harvest...not less than two and not more than twenty per centum of the total arable acreage of his estate...in vegetables” (p 51). There was a general non-compliance from the estates, arguing that there was a shortage of labor, unreaped fields, dry spell, insufficient seeds and poor marketing arrangements. Additionally, the Agriculture Department had no extension staff to manage this assignment.

In 1972, the trade union government of Robert Bradshaw took over the administration of the sugar lands (Hubbard, 2002), and soon after, the government formed the Sugar Industry Rescue Operation (SIRO). This put the Minister of

Agriculture in charge of the direction of the industry and all management aspects for the 1973-1974 crops. Mr. William Ferdinand Dore, permanent secretary under the Minister, chaired the working committee with five assistants. Capital of 3.5 million dollars was raised through three local banks (Mills, 1974).

“Willie” Dore revised the management of the sugar lands, centralizing them for cost efficiency and introducing new methods of planting cane designed to yield bigger bunches of cane and increased tonnage per acre. Additionally, he launched an aggressive program of agricultural diversification. Canefields became gardens of peanuts, onions, white potatoes, sweet potatoes and pineapples. Fourteen acres of irrigated land were cultivated with watermelons, cabbages, cauliflower and cucumbers. Molineaux estate had so many pineapples that tractor loads were taken to Basseterre for sale on the street. Bananas and citrus were located at designated sites at Wingfield and Old Road. Peanuts were the premier crop. They yielded up to 2,000 pounds per acre and were so bountiful that silos were built on various estates to store them. They became an exportable commodity, with demand in Barbados and Trinidad. One batch reached a peak of 240,000 pounds (Archibald, 2008).

It took years to come to an agreement on the sale of the sugar lands from the planters to the St. Kitts government. In 1974, the government insisted that the maximum it would pay would be US \$10 million but the owners held out for US \$25 million. The discussions continued for five years until Premeir Bradshaw’s death in 1978, with neither side budging from its position (Hubbard, 2002). Even though an official sale had not occurred, cane lands were nationalized (the state took control) in 1975 with the passage of the Sugar Estate Lands Acquisition Act. Control of the sugar factory followed shortly

after in 1976 (Richardson, 1983; Hubbard, 2002). The government formed the National Agricultural Corporation (NACO) to take over the production of sugar cane and other crops grown on cane land, and in 1976, the St. Kitts Sugar Manufacturing Corporation (SSMC) acquired the assets of the factory and railway (Booker Agricultural Review, 1984). There was a surge in enthusiasm for the industry at this time, as it responded to price increases of 1974 and 1975. Cane acreage had decreased by 40% between 1960-1972, but in response to high prices, about half of the disused land was brought back into cultivation. Yields were improved, labor productivity levels were higher, and employment in sugar expanded.

The CSA lapsed in 1974 when Britain entered the European Economic Community (EEC), so commonwealth producers from Third World countries had to negotiate quotas under the Lome Agreement. The Caribbean quotas were substantially lower than for the CSA, which meant a large portion of the sugar had to be sold elsewhere and the industry was even more susceptible to fluctuating world sugar prices (Worrell, 1987). Nationalization accomplished what was expected of it, bringing the people of the island higher pay. However, the old plantation system was essentially still in place: the government now acted in the position of the planters. And, like their predecessors, they had to deal with falling world sugar prices and wage demands of the workers (Hubbard, 2002).

When Bradshaw died in 1978, Deputy Premier C.A. Paul Southwell, Bradshaw's long-term partner both in the union and Labour Party, assumed the Premiership. Southwell died a year later and was replaced by Lee Moore. Soon after, a by-election occurred to fill Bradshaw's seat, and Labour lost in a close vote to a new political party,

the People's Action Movement (PAM). PAM's leader, Dr. Kennedy Simmonds, took the seat. Labour called another election in 1980, and PAM took three seats to Labour's four, but two Assembly seats from Nevis went to the Nevis Reform Party (NRP). PAM and NRP reached an agreement and a coalition government resulted. Simmonds became premier and for the first time, Labour was no longer in charge of the St. Kitts and Nevis government (Hubbard, 2002).

PAM believed the negotiations for the sugar lands had gone on long enough and decided the matter had to be settled promptly. Ultimately, the parties agreed upon a figure of US \$20 million in 1981. This has not yet been completely resolved: there was a side agreement that some owners would be allowed to sell their lands privately in order to raise cash as the government did not have the money to purchase the lands outright. Additionally, Camps and West Farm Estates were seized when two resolutions were passed in the Assembly in 1987 (Hubbard, 2002).

Not long after PAM took office, St. Kitts and Nevis achieved independence on September 19, 1983. They remained in the British Commonwealth, but for the first time in their history, the islands had self-government and full democracy. PAM won the next election in 1984. Healthcare and education development progressed in St. Kitts. Another election in 1994 was split between PAM and Labour, and again, Nevis became important. The NRPs' opposition, the Concerned Citizens Movement (CCM), would not join Labour, now with a new leader, Denzil Douglas. Thus, PAM remained in power until 1995, when Labour won and Denzil Douglas became Premier (Hubbard, 2002). He remains Premier today.

St. Kitts was the only island in the Caribbean to respond to the rising export prices of the 70s with a noticeable increase in sugar production. Unfortunately, the high prices were not sustained. Gains were only temporary and there was a gradual decline in sugar production in the 1980s with the collapse of sugar prices (Worrell, 1987). It was at this time that the St. Kitts and Nevis Government asked the British Government to provide consultants to formulate a ten year plan for the industry in order to put the industry in a sound financial position and carry out an agricultural sector review with a view to the possible expansion or improvement of non-sugar agricultural production. The product of this assignment is The Booker Report (1984), previously discussed in Chapter Three.

The Booker Report argued that the sugar industry needed to be improved. Decreases in sugar production and increases in factory costs were due to the fact that in the late 1970s, several thousand acres came out of cane (recall Willie Dore's agricultural diversification) and political relationships became the dominant issue, with significant negotiations between the planters and the Labour Government. Additionally, the report argued that it was difficult to find and motivate labor to cut cane and the shift to mechanizing cane loading and transfer meant that a lot of cane was left in the field. Improvements in cane cutter attendance could be remedied by introducing partial mechanized harvesting, which would have lower operating costs than the manual system. It was argued that more sugar should be planted and all of the agricultural equipment should be replaced. SSMC and NACO should merge into the St. Kitts Sugar Corporation (SKSC), as "the alternatives of returning the management of the cane land to its original owners, or its allocation to small farmers, would not improve the profitability of the industry" (Booker Report, 1984: iv). Finally, the report argues that the issue of payment

for the plantation lands and NACO's debts (the result of a government-imposed sugar levy in the mid-1970s) needed to be resolved. The 1975 transfer of lands to the St. Kitts Government was ruled unconstitutional, therefore, NACO did not have good title to the land at this time and the government was not able to pay the agreed price for it. Cash flow from SKSC over the project's duration (ten years) would not be enough to resolve either of these two financial issues (Booker Report, 1984).

The Booker Report (1984) also outlined the causes of the industry's difficulties (political, management, financial, technical, sociological and markets & prices). Political and management difficulties stemmed from the fact that governments of both parties had been exerting considerable influence on the industry since 1975. The government appointed the boards of SSMC and NACO for political rather than commercial reasons, and as a result, the authority of management was diminished. Financial problems were primarily the result of the sugar levy, which meant that substantial liquidity from both SSMC and NACO went to the government rather than towards improving the efficiency of their operations. Technical problems were not considered significant. The sociological problems were primarily lack of attendance by cane cutters, but other grievances from the workers included lack of out-of-crop work. The report stated that cane cutters do not see themselves as bound to the industry; economic independence was asserted by not showing up when alternative sources of income were available (fishing, farming and remittances from overseas). These other means were sporadic, so they would buy from the stores on credit and work from the time the crop starts until they could repay their debts. Finally, the report explained that one of the most serious

problems was the lack of guaranteed markets at prices high enough to cover the costs of production (Booker Report, 1984).

The report goes on to argue that sugar cannot be abandoned because there is not an alternative economic activity to replace it. The reason that NACO was in debt was not due to the industry's operational performance (as it made profits from 1975-1981), but rather from its inability to pay the very high sugar levy that was imposed on it by the previous government. Closing the industry:

(W)ould have far-reaching adverse economic and social effects, and its support is clearly required until an alternative source of employment and other social and economic benefits have been identified...There is no longer any question, at its present level of employment, of its being operated as a national employer of last resort. It is now increasingly economical, forward-looking and deserves to survive (Booker Report 1984, Main Report: 37).

One of the report's Annexes was on the sociological aspects of employment in the sugar industry, and it explained why independent, diversified farming was not a suitable alternative source of employment at this time:

The traditional pattern of land use on St. Kitts has inhibited the development of independent farming. Most of the land is owned by the sugar estates and there has been little opportunity for the general populace to acquire small holdings. Historically, estate workers have had access to small plots of marginal land unsuitable for sugar cultivation, or they have been allowed to plant crops on cane land during fallow periods. Producers were required to give the estate one-third of their produce in return for the use of the land and this practice continued until recent years. Such agricultural production as has occurred has been on a very small scale and has been part of a subsistence strategy geared to family requirements rather than for commercial purposes (Booker Report 1984, Volume 3, Annex 4: 16)

The sugar industry proceeded as it was at the time of the Booker Report for another 21 years. Beginning in the mid-1980s, the industry's difficulties intensified as a

result of increased labor costs, high factory operating costs, lower revenue from exports, and high fixed costs with no possibility to expand the area under cultivation.

Additionally, the industry was affected by a series of hurricanes and flood damage between 1995-1999 followed by an unusual drought in 2002 and 2003. Sugar exports from 1912-2005 are shown in Figure 24. Sugar production became uneconomic, resulting in significant financial losses and accumulation of debt. SSMC sustained financial losses exceeding \$35 million per year after 2002 and accumulated debt amounting to \$315 million at the end of 2004. The sugar industry closed on July 30, 2005 after being in existence in St. Kitts for over 350 years (Ministry of Sustainable Development document “Adaptation Strategy in Response to the new EU Sugar Regime 2006-2013, April 2006).

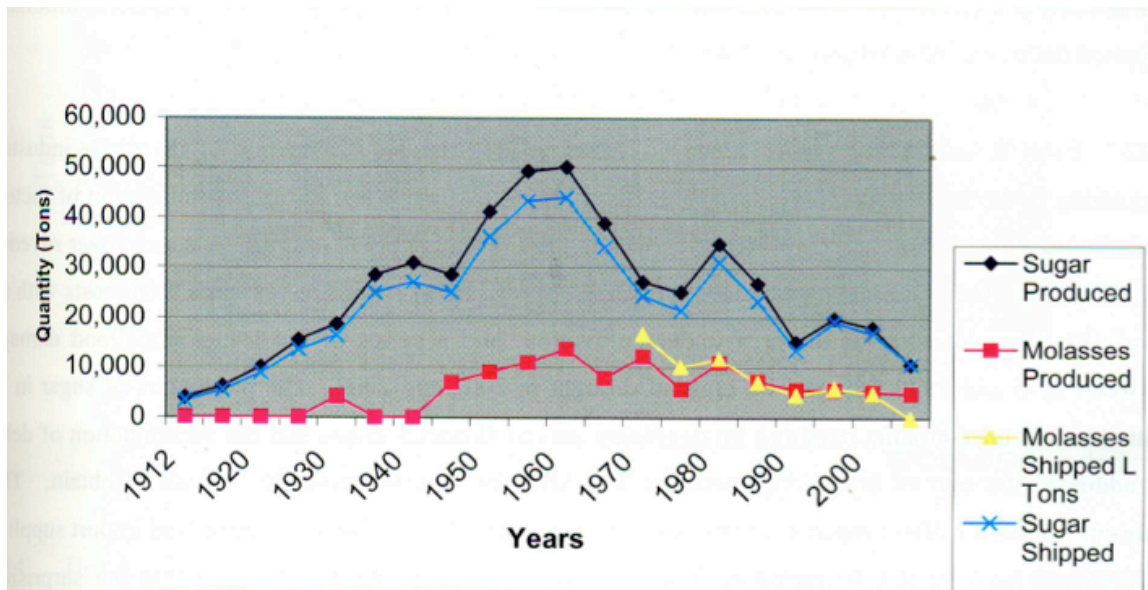


Figure 24. Sugar exports from 1912-2005.

St. Kitts' economic policy included the development of tourism from the mid 1970s onward. The responsibility for developing and managing tourism rested primarily

with the private sector. In 1984, the Booker Report argued that the value of tourism was low because most requirements, other than labor, are imported while profits are for the accounts of overseas investors (Booker Report, 1984). Regardless of this fact, and the fact that Caribbean tourism is extremely vulnerable to boom and recession (Worell, 1987), tourism in St. Kitts began to blossom in 1984 and 1985. Since this time, it has been the main focus of St. Kitts' economy.

Peasants in the Caribbean and Nevis Utilized in the Caribbean context, 'peasant' has a much different meaning to that used in Europe. In Europe, a peasant is a small-scale farmer, either tenant or property-holding, who is essentially self-supporting, with a long association with one particular place coupled with a love and respect for the land. In the West Indies, it refers more to a secondary type of development (Watts, 1987). Mintz (1974) describes West Indian peasants as individuals who had begun their life in some other role – slaves, indentees, maroons or runaways – who became peasants as a reaction against this. They emerged directly as a mode of resistance and response to the plantation system and its imposed patterns of life. West Indian peasant societies emerged in places like Puerto Rico, Cuba, the Dominican Republic, Jamaica and Haiti. These groups became important to the economic development of their countries, as they established 'middle ground' communities, further extending markets, churches and schools and aiding in village life. West Indian peasants became innovators in crop production, focusing on smaller crops. Producing these crops was so successful that they were soon taken up by the planters themselves (Watts, 1987).

Due to St. Kitts' history, and the fact that all arable land stayed in the hands of European planters until the 1970s, a peasantry was never established. Interestingly, a peasantry was established in St. Kitts' sister island, Nevis, even though the islands' histories begin in much the same way. In Nevis, crop production began with tobacco but shifted to cane by 1655. By 1664, so much cane was being grown in Nevis that complaints were being formulated at official levels that local food production was suffering (Mims, 1912 in Watts, 1987).

Planters owned the land on both St. Kitts and Nevis throughout the 19th century, but shortly after emancipation in 1838, distinct differences developed between the land and labor systems. Nevis had always been considered less fertile than St. Kitts; the land is smaller, stonier and steeper than that of its sister island, with a considerable clay component to the soil. Nevisian estate owners had fewer funds post-emancipation, and therefore introduced the metarie method of sugar cane production. In this system, owners allocated portions of land to freedmen, who planted and cultivated the cane for one-third to one-half of the crop's value. Planters still controlled land, vehicles and machinery, and this allowed them to postpone paying workers until the crop was sold (Richardson, 1983).

The metarie system gave Nevisians a greater personal stake in and control over local land than their counterparts in St. Kitts. In the early 1860s, one-third of the cultivated lands on Nevis were already in food (non-cane) crops. By 1901, of the 126 small estates in Nevis, 57 were still based on a metarie system (Leeward Islands *Blue Book* 1901-2, in Richardson, 1983), and sea-island cotton became Nevis' main cash crop by 1920. Cotton production declined in 1924 after a price crash eliminated the hope for it to become a viable cash crop, but during its production there was a corresponding

reduction in the amount of land planted in cane. The cane that was still produced was being shipped to St. Kitts for milling, but the transport costs were high and planters barely profited. The local milling equipment was useless and sold abroad in the 1920s. At this point, no land area or equipment was available to sustain a sugar-cane industry and much of the land was scarred by cotton-induced sheet erosion. This, combined with the absence of outside investors competing for the island's land, meant house plots and farming acreage finally came under control of the black Nevisians themselves.

By 1929, there were 292 landholdings of less than ten acres in Nevis. Five years later there were 363, compared to only 11 in St. Kitts (Leeward Islands *Blue Book* 1934, in Richardson, 1983). "On Nevis, money earned abroad could now be invested in local land plots, where returning labor migrants could settle and farm before passing the land on to their children" (Richardson, 1983: 138). This land tenure difference and reliability of a dependable food supply in Nevis may explain health differences between Kittitians and Nevisians at this time. Nevisians had higher birth rates and lower death rates between the years of 1901-1925 (Richardson, 1983). A Report by Lord Oliver in 1929 explains the striking differences between the two islands:

In Nevis, among small proprietors, there was comparative prosperity and self-respect. In St. Kitts there was squalor and degradation among the great majority of the laboring classes. And concurrently with the resolute adherence to the policy of estates monopoly in St. Kitts, the population of the island has, since 1897, diminished by 45%, conditions of life there having apparently become intolerable to more than two-fifths of the population. That is not prosperity (Oliver Commission Report, 1929 in Inniss, 2005).

Despite the improvements in the livelihoods of Nevisians due to land ownership, the pervasiveness of the belief that having a viable sugar industry equaled prosperity is

highlighted by the fact that a Royal Commission in 1937 recommended the development of a sugar factory and the replacement of sharecropping with sugar cane land settlements (Merrill, 1958).

In 1983, Nevis was an island of small landholders. The land appeared ragged and unmanaged, but it was because individual smallholdings were characterized by variety: yams, pigeon peas, corn, banana plants, citrus trees, etc. This provided Nevisians variety for family use and some extras for sale as well as insurance against pest attack, plant disease and market insecurity. On the contrary in St. Kitts, virtually all arable land was taken up in cane, so the establishment of a peasantry was dependent on the plantation proprietors selling or leasing the land to former slaves/indentees. However, at this time, most planters viewed the inception of peasant farming as an obstacle to their own aims (Watts, 1987). If these workers had enough land to live independently, then they would no longer be reliant upon the estates for work. Additionally, as Kittitian Washington Archibald (2008) argues, “the ownership of land was...an effective key to political influence and power” (p 45). Sir Probyn Inniss (2005), also of St. Kitts, says much the same: “ownership of land was the principle source of economic and political power and the means of achieving upward social mobility” (p 39). In order to prevent such “upward social mobility,” workers were only allowed to keep the marginal land in the ghauts and mountainsides, as this kept the food imports (and black power) from increasing.

The Repercussions of St. Kitts' Agricultural History A number of academic and historic studies of St. Kitts agriculture have assessed the effect of this unique history, and the lack of land ownership it created, on Kittitian farmers and society.

Four major effects are present in these works. With regard to Kittitian farmers, it is argued that this history has led to “underdevelopment,” low social status, and a poor quality of life. With regard to Kittitian society, it is argued that this history has created a lack of pride/commitment/love for the land, a lack of interest in agriculture (especially among youth), and an individualistic mentality/lack of cooperation among countrymen.

Mills (1974) argues that institutional factors related to the plantation system have ensured persistent underdevelopment on the part of Kittitian farmers. While the sugar industry brought infrastructure (in the form of roads, railways, telecommunications and ports, water supplies, electricity, etc.), income (which could be used to purchase goods) and technology to St. Kitts, this significant gross impact did not make up for the poor net impact caused by foreign ownership of plantations and other major resources. The surplus from the industry went to England. Additionally, local people required massive expenditures on imported food because the growth in sugar production was not accompanied by a simultaneous growth in food for local consumption.

Additionally, the pattern of education, the social stratification of the community, access to resources, and the quality of life among the “rural proletariat” (agricultural workers) caused by the sugar industry served to perpetuate the underdevelopment process (Mills, 1974). In the 1950s, the average field worker’s child could not get access to a secondary education because it was a highly selective process based on status and wealth. Since that time, secondary education has become free for all, but Mills argues that in 1974, the content of that education was geared toward clerical and administrative skills and not related to agriculture. It is “largely irrelevant to the environment and the needs of a dynamic society that is embarking on the long, difficult road to development” (p 43).

Mills (1974) explains that social stratification in Kittitian society and accessibility to resources are intertwined. This stratification is based on race and land ownership and there is very little change of social mobility. He argues:

There is thus a very important connection between these economic and social factors: inequality in social status seriously impairs the desire for higher productivity. Leisure thus becomes highly prized when there is little more to be gained by working. The social stratification is thus an obstacle to social mobility, and it therefore materially inhibits incentives among those in a lower status who perceive no possibility of deriving benefits in future work. Since the bulk of the population is denied access to the means of production, especially land and capital, based on class and color, the direct effect is that this stymies the optimization of the economy's human resources and further denies them full participation in the state's development (p 45).

With regard to the quality of life that has resulted from the sugar industry, Mills (1974) says that it undermines the institution of the family and thus the entire social fabric. "Low weekly wages for five months of the year with underemployment or unemployment for the rest, a lack of job security and the need to migrate from village to village or town in search of employment" (p 46) weakens community structure. Additionally, the insecure nature of one's employment and lack of dignity accorded to them from the estate managers and the seemingly transience of one's importance "serve to create a generally demoralized and dehumanized person" (ibid).

Others have argued that, as "ownership in one's land signifies pride, prestige, and sense of rootedness" (Richardson, 1983: 7), St. Kitts' history and the resultant lack of land ownership means that Kittitians do not have a strong interest in agriculture or relationship to the land. For example:

Peasant life in the Leeward Islands is lacking in dignity. The attractive qualities of peasant or native life in the surrounding Indian civilizations or parts of Central America stand in sharp contrast. Respect for their own ways, love of the land, and the lasting qualities of a land use giving

stability through time rather than optimum exploitation in the short run, are characteristics of the latter not found among the former people. The term “peasantry” is employed in the Leeward Islands with reference to the black folk, but it connotes little beyond an agriculturalist of low status. There is nothing in the culture history of these people to identify them with peasant life (Merrill, 1958: 111).

The Kittitian smallholder has no strong ties of tradition or sentiment to the land which he cultivates, and cannot be regarded as the rural dimension of an old civilization (Mills 1974: 67). Perhaps the most distinctive feature in this form of husbandry is that any job associated directly or indirectly with it has the lowest possible status in society. Many regard it as indelibly stigmatized by a harsh slavery. If it is that agricultural work of this kind is so despised, the question that suggests itself is why so many people labor at it...poverty and survival are the simple answers (ibid: 73-74).

Highland garden farming on St. Kitts is strictly a livelihood necessity rather than a commitment to the land. Villagers say that highland agriculture on the island is a throwback to plantation days when mountain plots were allocated for slave farming, and some old men still refer to the estate-owned plots as ‘the nigger grounds’ (Richardson, 1983: 40).

(T)he continuing unavailability of land coupled with the negative history of subsistence farming has led to a negative view of agriculture among Kittitian workers. St. Kitts has no smallholder tradition and there is little commitment to the land (Booker Report, 1984, Volume 3, Annex 4: 16)

The policy of excluding the labouring class of St. Kitts from the ownership of land has seriously affected not only the quality of its economic and social life, but the quality of its very being. His landlessness is one of the conditions which has contributed to making the Kittitian a curiously different kind of human being from the natives of many neighboring islands. Deprived of a stake in his country, he never developed a strong commitment to the land of his birth; in the absence of a peasantry, a new class did not emerge, possessed of the strong pride, independence and self-reliance which are chief characteristics of a peasantry all over the world (Inniss, 2005: 40).

These authors have argued that these tendencies are particularly strong among the youth:

Although black slaves, to be sure, interacted directly with the islands’ physical environments, the forms of this interaction were invariably mediated and determined by a white planter class. The memory of this

imposition, according to agricultural development dogma in the Caribbean, makes young people today 'refuse' to work the land (Richardson, 1983:7).

Mills (1974) specifically investigated the status of youth in relation to farming. He tested the hypotheses that there is a significant unwillingness to farm among young people and that this is strongly influenced by parents and peers. A survey was conducted in the form of a questionnaire among a stratified random sample of rural and urban youth between the ages of 14-20. Among those interviewed, 39% had mothers engaged in farming and 44% had fathers who farmed, but only 30% indicated a willingness to farm. Additionally, it was found that three important factors explained the undesirability of farming among youth: the discouragement of parents, the lack of appeal of farming even with another job and the distaste for farm work with primitive and traditional tools (Mills, 1974).

Finally, it has been argued that the lack of land ownership in St. Kitts is responsible for an individualistic mentality among Kittitians (and Nevisians). According to Richardson (1983), individuality and mobility have been key strategies to adapt to the impoverished environments Kittitians and Nevisians inherited from their colonial history. Migration was a key component to surviving in these impoverished environments, and:

New skills were required of each individual migrant, resulting in the 'occupational multiplicity' so common throughout the Commonwealth Caribbean. Individual Kittitians and Nevisians became roving jacks-of-all-trades...performing 'a large number of diverse tasks' and making do with 'whatever is at hand' (Lévi-Strauss 1962:17). Complexity resulting from an enlarged livelihood space came to reside in each individual – not in the group (p 180).

Richardson (1983) argues that this adaptive trait of individuality makes it difficult to maintain any kind of large-scale group organization because group action has always

been subordinated to individual livelihood and survival. Even the strikes by the planter class in 1834, 1896, 1935 were “more ad hoc, formless group expressions of frustration and despair that articulated, organized reactions to events” (Richardson, 1983: 181) which always occurred when migrants were forced to remain at home. This individualistic mentality manifests itself more recently in insular rivalry within and between islands:

Why...do interisland rivalries exist among the same people who have together resisted colonial domination for centuries?...Tiny insular societies that appear homogenous to colonial officials or even other West Indians display much more internal differentiation at closer sight. And in some ways the vociferous wranglings of small Caribbean islanders may be an advertisement of this differentiation and the individuality that colonial planters denied them for centuries. Probably more important in explaining insular rivalry is that it manifests jealous protection of island resources. On Nevis only in this century, and on St. Kitts only in the past decade, the lands have come under the control of the people who have worked them for centuries. Land connotes freedom and signifies at least partial protection against world economic oscillations. Despite its deterioration on both islands, the land is a crucial medium for survival. Individual access to the land, whether owned, rented from an estate owner, or allotted by a planter, has been vital to individual survival on St. Kitts and Nevis for decades...For people who have only recently gained control over part of their livelihood, the idea of possibly giving it up again – even to fellow West Indians – is difficult to accept (Richardson, 1983: 170).

Richardson (1983) goes on to say that while Kittitians and Nevisians lack group cohesiveness, they have individual strength. Because opportunities are fleeting, controlled by outsiders and constantly subject to change, individuality and flexibility are advantageous characteristics (Dirks, 1972 in Richardson, 1983). Thus:

Unencumbered by stifling or immobilizing dogma, a Kittitian or Nevisian possessed of Keen wit and intelligence has thus responded remarkably well to the hazards and complexities of inhabiting a tiny, work-out and drought-prone island. In short, in a complicated game with few rules, he has emerged a master of survival. Through individual mobility, underspecialization, and above all, through an ability to respond to the continuous yet changing pressures brought to bear by both man and

nature, the people of St. Kitts and Nevis have rarely prospered, but they have survived and endured” (p 181).

These characteristics provide insurance against the “unknown though certainly precarious events that lie ahead” (ibid: 182).

Political Ecology Theory Political ecology is less concrete than historical ecology as a research program. Biersack (1999) states that “as a new, yet vigorous, field, political ecology has no settled paradigm or paradigms” (p 11) and Balee (2006) explains that “political ecology could be synonymous with applied historical ecology, but the term itself is perhaps still used too widely in disparate senses to refer to a single field or theory” (p 80). This does not mean that political ecology is not a distinct approach to understanding human-environment relationships. Being synonymous with applied historical ecology means that political ecology takes off from the “base” that is historical ecology’s research program: the area of *nature as contested terrain* (Cronon, 2006). The application of historical ecology often leaves questions about whose “understanding of what nature means” (Cronon, 2006: 51) should take precedent when making management and policy decisions.

Kottak (1999) defines any society’s traditional set of environmental perceptions – that is, their cultural model of the environment and its relationship to people and society, as an *ethnoecology*. He explains that traditional ethnoecologies are challenged by two originally Euro-American ethnoecologies: developmentalism and environmentalism. These models enter diverse settings, and the setting’s particular national, regional and local forces and their powers of adaptation and resistance influence whether developmentalism and/or environmentalism will spread. Developmentalism and

environmentalism are both on the rise and are significantly related: hazards created by development have been necessary conditions for the emergence of new (environmental) perceptions of the environment. The problem is that “local people, their landscapes, their ideas, their values, and their traditional management systems are being attacked from all sites. Outsiders attempt to remake native landscapes and cultures in their own image” (Kottak, 1999: 26).

Carrier (2004) interprets *nature as contested terrain* as a result of “the problem of translation.” He argues that the ability to socialize our motives into acceptable, public language, to oblige others to use our frames of knowledge, or to impose the terms of the debate, is a form of social power. It is a form of social power because these terms “define what is serious and what is not, what is a problem and what is not, what might be a solution and what is not, what is sensible and what is not. And just as the terms of debate define *what* is serious and what is not, so the ability to invoke and manipulate those terms defines *who* is serious and who is not, who needs to be listened to and accommodated and who does not” (p 8).

Political ecology brings this power struggle to the forefront. As “few places in the world today have not been significantly affected by global flows, colonial projects and the penetration of capitalism (Wolf, 1982)...ignoring how contemporary locales or regions are impacted by colonialism and market penetration, not to mention nation-states themselves, all but discredits any analysis” (Biersack, 1999: 10). Kottak (1999) reiterates this point: “it is...evident today...that there are no isolated ecosystems and...all humans participate in a world system” (p 25). The influence of capitalism on world systems falls into the realm of political economy, and thus, political ecology shares certain concerns

with political economy. “As grand theory and master narrative, political ecology concentrates on the history of capitalism and its critique and in particular on the unevenness of development that that history has produced on a global scale” (Smith, 1984 in Biersack, 1999:10).

Its relationship to political economy means that the roots of political ecology lie in the 20th century variance of traditional Marxism dependency theory and world systems theory. World system theory envisions a global class system, the owners and means of production residing in the First World and the workers located in the Third World periphery. Therefore, while early works in cultural ecology and ecological anthropology focused on local populations, the first generation of political ecology argued that these local communities were embedded in larger political, economic and social structures (Wolf, 1982) and an understanding of local ecologies must be understood with respect to that subjugation. A number of (first generation) political economy works followed, primarily in the realm of geography. Most notable is Blakie and Brookfield’s *Land Degredation and Society* (1987). Here, it is argued that soil erosion cannot be understood purely by physical constraints; the fact that soil erosion is a social problem is a very important part of the equation. They called their approach a “regional political ecology” (Biersack, 2006: 17).

The second generation of political ecology approach encompasses a number of new perspectives, including, but not limited to: the shift away from a dichotomized view of nature, the incorporation of the concept of *place*, and the incorporation of a number of other differences in addition to (Marxist) class (Biersack, 2006). As previously explained, the shift away from the nature/culture dichotomy is a key element of historical

ecology and, more generally speaking, environmental anthropology and cultural anthropology as a whole. This concept is distinctly applicable to political ecology as well. Political ecologists utilize Marxism's structural power (see Wolf, 1999 in Biersack, 1999) and the fact that it makes some behavior possible while others impossible, but this requires a view of only "first nature." First nature is an objective, positivistic view of nature, one that exists in a distinct realm, separate from humans. In other contexts, first nature is referred to as a scientific, modern, ecological, or distinctly natural (outside of cultural) approach. These are in opposition to "second" nature, a nature that cannot exist outside of human influence. With respect to the first nature contexts just described, this is a more hermeneutic/humanistic, postmodern, historical, or cultural approach. The second generation of political ecology tears down three other related nature/culture dichotomies: cognized/operational, materialist/idealist (material/symbolic), and structural/poststructural (Biersack, 1999; Kottak, 1999; Escobar, 1999; Brosius, 1999; Biersack and Greenberg, 2006).

The lines between these dichotomies blur in light of the revolutionary claim of postmodernism and its close ally, poststructuralism. Poststructuralism is the argument that discourse constructs, rather than reflects, reality (Biersack, 2006). In other words, "the theoretical position that language and discourse are constructive of reality and that forms of power are introduced in the socio-natural orders through the production of discourse" (Escobar, comments in Brosius, 1999). By implication, reality is not an objective fact, existing independently of humans; it is itself an artifact (echoing the first core postulate of historical ecology). Reality (and nature) are constructed, in a process

known as constructionism. Second nature is constructed nature, the by-product of discourse and human activity (Biersack, 2006).

The second generation of political ecologists also incorporate the concept of *place*, which is an effort to reconceptualize globalizing processes in nonvertical terms (Biersack, 2006). Avoiding the two ends of the spectrum (global-local), *places* are “*the grounded site of local-global articulation and interaction... (they) are constructed historically in processes that spatially exceed the local and in which the extralocal is as constitutive as the local*” (Biersack, 2006: 16). Places are affected by global forces, but they are still local. They are “a distinct mixture of wider and more local social relations” (Massey, 1993: 68 in Biersack, 2006: 16). Kottak’s (1999) *linkages approach* encompasses the scales that are important in defining a *place*; it “emphasizes the embeddedness of communities in multiple systems of different scale” (p 31). A place-based approach shifts the rotation from Marxism, world-system’s theory and political economy’s vertical and binaristic approach to a dialectical perspective on local-global relations (Biersack, 2006).

This shift to a place-based approach calls for a re-evaluation of development as it has traditionally been viewed. Neo-Marxist political ecology (of the first generation) assumed that global links were created by dominant, Euro-American powers, making (and keeping) the rich rich and the poor poor. A place-based approach does not treat either group as homogenous, and as such, has been able to see the power of grassroots activity in understanding how spaces of globalization (through capitalism and colonialism) are created, reinforced, contested or rebuffed. Going back to the Euro-American ethnoecologies of developmentalism and environmentalism, any a priori

assumption about how these ethnoecologies will impact local communities can obscure more than it reveals. In fact, some indigenous populations have engaged with developmentalism and environmentalism in different ways. Understanding the dynamics of how resistance or social movements manifest themselves and mediate human-nature articulations is central to a place-based political ecology (Biersack, 2006).

Finally, the second generation of political ecologists tend to a range of differences, including (but not limited to) class, gender, ethnicity and race. All of these differences belong to second nature, and have material consequences, empowering actors differently in terms of resource access, control, stewardship, ownership and the division of labor. Additionally, as a serious player in the unequal distribution of power, political ecologists tend to the differences created by colonialism and evaluate them through the place concept (Biersack, 2006).

In sum, the political ecology approach of today treats reality as invested with meaning and produced discursively. It rejects the nature/culture dualism. It places its focus somewhere between world systems and entirely local ecology. It engages with practice theory, attends to the actors and their agency, and addresses the broad range of differences and social inequalities that are created (Biersack, 2006). It broadens the focus from the asymmetries of class relations to the asymmetries of human-nature relations (Biersack, 1999). Political ecologists study manifold constructions of nature in contexts of power (Escobar, 1999). This encompasses the ecological manifestations of capitalism but also incorporates issues of class, gender, race and ethnicity and the politics of difference that they spawn (Biersack, 1999).

Political ecology is not entirely focused on environmental contestations, but its approach is especially well suited to these issues in diverse geographic locations. Moore (1996) provides an especially compelling example of this in his investigation of conflicts over access to resources and land in the Kaerezi area of Nyanga District, in eastern Zimbabwe. His ethnography focuses on three conflicts: the placement and delayed operation of a community cattle dip near a state-defined “protected area,” the demarcation of a national park boundary, and women’s cultivation of prohibited crops on mountain slopes.

These conflicts exist in part because of Zimbabwe’s colonial history. In 1890, Cecil Rhodes from South Africa purchased approximately 40,000 acres in the district now constituting the core of Nyanga National Park’s estate. Shortly after, a Barwe chief named Tangwena settled at the site just north of this estate, called Kaerezi, claiming his ancestral territory included this land. He joined lineages that had lived on that land for generations. Shortly thereafter, a Johannesburg-based company purchased Kaerezi, and the residents were forced to enter the labor market to produce cash for taxes and rents. Rhode’s estate became a national park in 1947 in the wake of growing concern over natural resources. In 1963, one site in particular, Gaeresi Ranch, was cited by a land inspector as having excessive damage to natural resources due to the “squatters” living on the property, inciting long-standing court cases between the government and Tangwena’s son, now chief, who again claimed ancestral rights to live there and have access to Gaeresi. He became a national symbol of defiance to the Rhodesian state during a liberation war (1966-79), which eventually led to independence. Regardless of Tangwena’s claims, in 1972, Rhodesian police burned huts and dispersed around 300

families, some of whom hid in the forests bordering Kaerezi for almost two years, aiding in the escape of Zimbabwe's first president, Robert Mugabe (Moore, 1996).

The Kaerezi Resettlement Scheme began in 1980 as part of the post-colonial state and was (at the time of Moore's writing) home to some 1,000 families. Moore's (1996) ethnography revealed a state highly differentiated by ministries and departments, often putting cross-cutting agendas in their claims to administer the local landscape and its inhabitants. These issues manifested themselves in conflicts over a "cattle-dip," a community resource protecting herds from tick-borne disease, but built within a proposed "protected area," a corridor of approximately 500 meters bordering the Kaerezi River. Bordering on the park, it was not clear to the peasants or administrators who had authority over its use. Additionally, the expansion of the National Park in 1988 led to deep local resentment when it caused the eviction of families thought to be living in the park, as the precise location of the boundary was not clear.

Moore's (2006) work revealed that while the state of Zimbabwe was differentiated, so were the peasants living in Kaerezi. Due to the history of male wage migration labor in the region, there were gendered relationships to the landscape. Women cultivated one crop in particular, *tseza*, in part because the land utilized for this, isolated plots on steep mountain slopes far from arable fields, was mediated neither by patriarchal nor state conceptions of land rights (as much of the other land was). Generally treated as a benign practice, women feared that expansion of the protected area would encourage greater attention to land-use elsewhere in Kaerezi (Moore, 2006).

In the data presented in the preceding paragraphs, Moore (2006) provides us with the material base of these environmental struggles. Importantly, he also attends to the

meaningful in these struggles, the contestations that *constitute* these struggles. In the case of the cattle dip, some of the meanings were revealed in an exchange between white fisherman and National Park lobbyists, vying against its use, and the resettled farmers, vying for its use. The resettlement officer is pinned in the middle: accused by the farmer as wanting the whites to take over again. When remarking that the land is not the whites', but the government's, the officer is forced to defend the national park's goals, as it is a branch of government. This represents the complex alliances and conflicts among different state agencies, sometimes represented as unified and other times depicted as "us against them." Moore (1996) argues that the farmer uses the "divide and rule" tactic back on the state officials, drawing on symbolic capital from a legacy of racial exclusion.

In the case of the national park boundary, the eviction of the families (supposedly living) on the wrong side of the boundary prompted a meeting attended by a state official, a local Member of Parliament (MP) and Chief Tangwena. Tangwena invoked the memory of the evictions from Gaeresi Ranch by saying that the national park wants to burn huts in his area and that they thought the whites had returned. The MP responded that the government recognizes property boundaries as they are written in title deeds, not as they are remembered in oral traditions. Moore (1996) explains how this shows how cultural practices can create two different versions of the same place: the cultural practice of recording property boundaries on a map underpins the MP's belief in Kaerezi as a commodity owned and administered by the state, while the chief invoked an alternative cultural vision of place, property and territory by claiming an ancestral inheritance to a chieftainship.

Finally, Moore (1996) attends to the meaning behind local women's relationship to the land, highlighting the fact that the relationship to the land among peasants is not uniform. In defending their *tjenja* production, women invoked the discourse of *nhaka*, or rightful inheritance, arguing for the birthright of "freely cultivating" without intervention from state officials or conservation regulations. Many recalled "suffering for the land" in the evictions from Gaeresi Ranch, refashioning *nhaka* as a claim to land rights validated through historical struggle rather than patrilineal inheritance.

In attending to the material and meaning behind these struggles surrounding Kaerezi, Moore's (1996) work provokes critical reflection in understanding the continuous interplay of history, culture and power. It shows that we need to move away from the over-simplified "virtuous peasants and vicious states" (Bernstein, 1990: 69 in Moore, 1996: 133) and that macro-structural accounts that treat the state as unified and consistently miss local differentiation among resource users. Micro politics unravel how competing claims to resources are articulated through cultural idioms in the charged contests of local politics. Here, Moore shows that that when the state itself is differentiated, is a site of struggle, then "the state can be opened as a theatre in which resources, property rights, and authority are struggled over" (Watts, 1989: 4 in Moore, 1996: 133).

This example highlights why political ecology's approach of stressing complexity and heterogeneity rather than homeostatic systems is especially provocative. It also exemplifies the argument that popular beliefs are cultural forces. Cultural meanings are *constitutive* forces, shapers of history, and not simply reflections of a material base. However, Moore (1996) argues, paying attention to culture does not mean neglecting the

controlling context of power. “Culture is laced with power and power is shaped by culture” (Rosaldo, 1994: 525 in Moore, 1996: 139). Relationships to environmental resources are embedded within a history of myriad symbolic and material struggles on a contested terrain, and in order to understand these relationships, political ecology needs to be “grounded in the ‘lived practices of production,’” (Collins, 1992: 186 in Moore, 1996: 139) through ethnographic methods. In fact, what is happening on the ground, the diversity of perspectives and environmental relationships among the actors that we study, that is what makes political ecology such a compelling topic of research: “what lies behind our interest in contestation is the idea of regarding no perspective or account as authoritative but viewing each in the context of a much larger set of engagements, conversations, discourses, and other forms of negotiation” (Brosius, 1999: 303).

Results: A Unique Relationship to the Land

The ethnographic data collected for the third stage of this study relates to the lack of land ownership on the part of Kittitian farmers and how this situation impacts their relationship to the land, each other, and agriculture as a whole. Below, the current spatial distribution of land ownership and number of land-owning farmers in St. Kitts is outlined. Then, the ethnographic data are described in detail. Conversations with Kittitian farmers revealed challenges and issues with land in the following areas: payment, squatting and security; infrastructure (tractors, marketing/seeds, and water); youth, finding labor and the status of farming; politics; and the economic shift to tourism and selling/mortgaging the land.

The Spatial Distribution of Land Ownership in St. Kitts Figure 25 shows a 2006 map of the distribution of land ownership in St. Kitts. It is clear that the bulk of the land is government-owned. A few patches of privately owned land stand out. On the Caribbean (southern) side of the island to the west is the national park Brimstone Hill National Fortress, surrounded by privately owned land. Just south of that, also on the Caribbean side of the island is the village of Old Road, with Romney Manor and Wingfield Estate, the first English settlement in the Caribbean, just inland from the village. This is a tourist attraction and is also privately owned. Just west of Basseterre is West Farm village, and the piece of land that runs inland from there is also privately owned. West Farm estate was supposedly seized when two resolutions were passed in the Assembly in 1987 (Hubbard, 2002); however, farmers call it “confusion land” and say that this land is not government-owned because it was never paid for. According to a local farmer, the government does not know who to pay, as all the previous owners have died (Kerry Dore, farmer interview, November 12, 2010). Just north of Basseterre are the privately owned lands comprising the village of Monkey Hill, and between this area and Cayon, on the northern (Atlantic) side of the island is an individual farmer (Kiethley Armstrong)’s 40 acres and other privately owned residential land. All of Frigate Bay and the southeast peninsula are also privately owned.

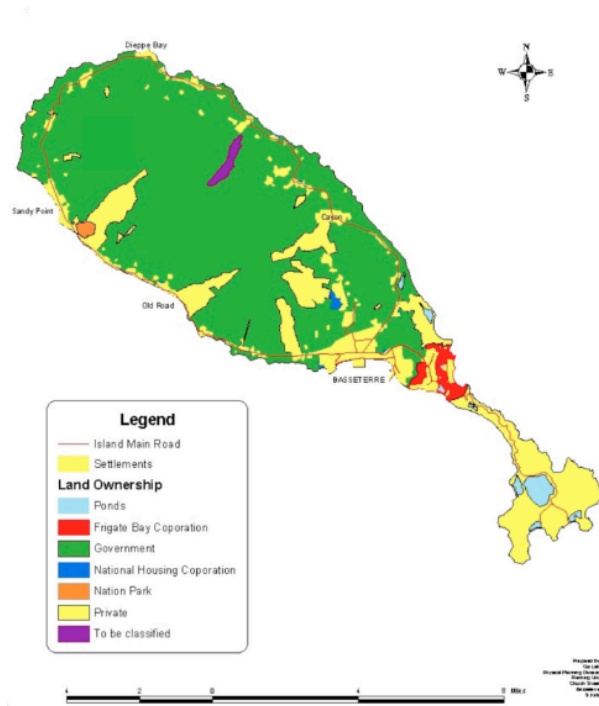


Figure 25. Distribution of land ownership in St. Kitts. (Map created in 2006 by the St. Kitts Planning Department with data from 1994).

Land-Owning Farmers in St. Kitts The 64 farmers that participated in this study were randomly selected, so it is assumed that their demography can be extrapolated to the farming community of St. Kitts as a whole. There are three types of farmers currently working in St. Kitts: those working on government land, land owners, and former sugar workers that are partially supported by the government and assist farmers working on government land. Only farmers from the first two groups participated in this study, as members of the third group are not assigned to any particular piece of land.

Farmers working on government-owned land comprise the bulk of Kittitian farmers at the present time. Of the 65 farmers originally selected for this study (recall one farm was never cultivated), 60 fall into this category. Of these 60 farmers, only one was working on (someone else's) privately owned land. The majority of these farmers

are former sugar workers ($n = 53$). The remaining 11 farmers are: farmers who chose to get into farming after various other forms of employment ($n = 4$), agricultural department employees ($n = 3$), individuals who came from other countries ($n = 2$), working professionals who also do farming ($n = 1$), and the last “farmer” was a cooperative group of farmers composed of former sugar workers and young individuals who chose to go into farming.

Four farmers in this study owned their land. Two of these individuals migrated to England in the 1950s and were gone for decades before they returned and purchased land. The third individual worked in the sugar industry for 15 years but was also a successful businessman. Because of this, the farmer was able to purchase land in 1972 and began farming it ten years later. The last individual is working on land that he inherited from his family.

It should also be noted that a number of farms were ineligible for this study because they were too large (more than 15 acres). Kittitian farmers own a number of these larger farms. For example, Kiethley Armstrong has 40 acres in Green Hill, Roland Mill has 20 acres in Profit, James Thompson has 20 acres in Belmont and Lenroy Connor has 20 acres in Cranstoun. William F. Dore explains that Armstrong and Mill were “stalwarts from the beginning” and they were able to purchase the land, likely from the government, as the government was acquiring land in the Land Acquisition Act of 1975 (William F. Dore, personal communication, July 31, 2013). Agricultural extension officers explained that Thompson and Connor obtained their lands as a family inheritance.

Issues of Payment, Squatting, and Security Most Kittitian farmers are working on government land and are engaged about issues relating to paying for the land. In one of the first interviews conducted for this study, one farmer explained some of the history surrounding land payment and squatting in St. Kitts and the current situation where many farmers are not paying to lease their land:

You see, the laws governing lands on this island: if you squat on land for seven years, you own it, without paying anybody. (*Kerry Dore: That was a PAM party thing, right?*) No, from beginning! That was there from ever since, from the beginning of our time. That's why they were so strict in making sure you pay, even one dollar per week, or per month, they had their book, where you sign, land rent and where your house was. The owners used to do that. But the rule is that you cannot squat on government-owned land, they call it 'crown land.' You have to squat on it for 99 years, then it can be yours! (*Laughing.*) And you cannot squat on it for 60, and your son come and squat for 39, you can't get it! You cannot get crown lands in that way. So whether you pay or not, as long as it's government owned land, you cannot get it. So, all the people who are squatting and not paying, every one, nearly every one of them (I can't say every one because I know one guy who wouldn't sign no agreement with nobody), when they got this new scheme going with lands for farming, signed a paper to say 'we lease so much acres and we agree to pay so much.' But a lot of people have let it run and not paid anything (Kerry Dore, farmer interview, November 12, 2010).

Thus, farmers have always had to pay to lease the land. Before, they paid the estate owners, and now, they pay the government. When the government took over the sugar lands in 2005, farmers who were given land had to sign a lease agreement that they would pay to use it; however, many of them have not followed through.

The issue of payment came up very early in the study. Prior to collecting crop loss data, the boundary of each farm in the study was mapped (these boundaries are visible in Figure 1 from Chapter Two). GPS units were used to map the boundary and the exact area of each farm was calculated. It became immediately clear that the areas the units generated did not match the acreage the government listed (these government

values were presented in the list of registered farmers compiled for this study by the agricultural extension officers). This caused immediate concern, because farmers pay according to the size of the farm (EC100 per acre per year). Exactly when the payment program started is unclear: one extension officer said 2006 and another said 2009, one farmer said “just recently” and another said “two years ago.” It likely did not occur at the same time all over the country. Either way, because the numbers collected for the purposes of this study did not match the government records, there was fear that this could cause strife between the government and farmers. A conversation about this potential problem with one agricultural extension officer yielded the following:

I talked to (the extension officer) about how we were concerned about mapping the farms and getting different numbers than the agriculture department. (The officer) said that I should ask the farmers whether they actually pay the fees to lease the land. (The officer) said that most farmers don't pay, and that's why the ministry doesn't really worry too much about the accuracy of the measurements. He said that the acreage they gave me is an estimate based on old St. Kitts Sugar Manufacturing Corporation (SSMC) data (Kerry Dore, field notes, August 14, 2010).

Thus, all farmers were asked about the issues of paying for land and squatting (defined as either not paying for land that you are registered to use or taking up land without permission by the government). One farmer says that he/she has applied to the government to be registered on land but nothing has happened, so technically they are squatting, even though the government knows their location. Many cite the fact that nobody has directly asked them to pay, or that nobody comes around to enforce it. Another common explanation is that there are no benefits to paying – those who do pay do not get any special treatment for it (for example, early notice about seeds for sale), so, they argue, why bother? Additionally, many farmers state that they simply cannot afford the rent because they are not making enough money, usually due to challenges with

animal damage (described in Chapter Three) and infrastructure (which is described in the next section). One personal example explains another reasons why some farmers do not pay:

I think that some people have been on land for *years*, from their grandparents. They should be given this land to use. (*Kerry Dore: So you don't think they should be charging?*) No, the land belongs to the people. We aren't living on it, we (are) cultivating it. Why should they have to pay to feed the nation? (Kerry Dore, farmer interview, July 7, 2011).

Another example comes from a farmer who has been working on his land in the Fahies area for over 50 years:

The land that we have from government, it give out with an agreement from the old colonial government. You gone work the land for 25 years, when 25 years up, the land belongs to you. The land is to go from generation to generation. The land is supposed to be OURS now, that's why people don't pay. I ain't paying. A couple years ago I reminded them about it at a meeting up Fahies, and the gentleman said to me, he was a lawyer too, and he was in the government, and he said to me, I said, Mr. (unknown), 'you know the time gone come when we are supposed to own this land.' (He said it's) 'true, but if we turn the land over to you then they're going to sell it and it will be a bother to the government.' That means that they didn't decide to give us the land. So you find that when the land gave out, we were supposed to have it, but they didn't decide and when they come, a couple years after, they say they gone to lease the land. Why you gone lease the land! The land belongs to ours! The land belongs to us the time then up! (Kerry Dore, farmer interview, November 21, 2010).

All in all, a compliance officer for the government (who says that he checks that people aren't taking more land than they should and that they are paying) says that about 30% of St. Kitts farmers working on government land pay the fees (personal communication, October 6, 2010).

One of the farmers cited above points out the fact that farmers are not allowed to live on their farms, which is common explanation from farmers about why they refuse to

pay land fees to the government. One farmer explains why he thinks they should let them live on the land:

(Kerry Dore: Now what about compensation? Does the government help any farmers with the damage they get from monkeys or other animals?)
 No. *(Do you think that they should?)* They can't afford that. But, give us the opportunity to live. *(What do you mean?)* Live on the farm. Give us current, give us water, cable. *(Isn't that pretty expensive, though?)* It will pay off. (Kerry Dore, farmer interview, July 15, 2011).

And another farmer explains why he thinks they won't let them live on the land:

(Kerry Dore: do you think people should be able to live on their land?)
 Sure but I don't think it'll happen. They ain't gone do that. Unless you just build something to catch water when rain come and so. But they ain't gone let you, like, say, build a house, because they feel like if you build a house on the land, they can't take it back. So they just give their lease, and if they want it back they just don't lease it no more (Kerry Dore, farmer interview, August 15, 2011).

When asked why farmers are not allowed to live on their farms, one member of the agriculture department responds: "are we going to pave roads like (specific farmer)'s for 5 people? What about emergency services? An ambulance couldn't get up there" (personal communication, May 16, 2011). When this reason was given to a farmer, she laughed and said "people are up there all the time anyway!" (personal communication, May 23, 2011). Whether farmers should live on their land or not is a very complicated situation that is not addressed here. This factor is included here because it is a reason some farmers give for why they are not paying for their land.

Living on one's farm is an issue because the few farmers who do own their own land often live on their farms. One example from this study shows how this is possible. As previously explained, four of the farmers in this study own their land. One of these farms is in Fahies Settlement, and is owned by one of the farmers that came back to St.

Kitts after living in England. He explains how he came to own this land, right in the middle of the government-owned Fahies settlement:

(Kerry Dore: How did you go about getting the land here?) I was renting a house in Newton Ground and then I realized that I like agriculture. I came up here and decided, since I can't get a job, the way I want, and with the little money they was paying me, I decided to get this land. I went to a lady, Mrs. Jarvis, who owned the land. The land from here go the way up was all in grass apart from (specific farmer), for they used to plant cane. But when I come, the government wasn't really buying their cane, so it was all in grass. I went to Mrs. Jarvis and I offered her some money, and she said yes, I could have the land. Her husband was dead and she didn't have no need for it. *(And Mrs. Jarvis was Kittitian?)* She was a Nevisian woman but she had married a Kittitian. People used to call me 'crazy professor' for cultivating this land. *(When did you get this land?)* I started here in 1989, right after Hurricane Hugo came. *(When did you start living on the farm?)* I had no money, I had no job, I told myself I had to build a house. I began to build in 1991, I built one room first and I lived in it before it was even finished. It took me about five years to finish it (Kerry Dore, farmer interview, March 29, 2011).

This situation is possible because the government acquired a few estates, like Fahies, before the closure of the sugar industry, and allowed farmers to live on the land. One farmer, who lived on Fahies land as a child and still works the land today, explains what it was like:

(Kerry Dore: You used to live in Fahies?) Yeah we had a house there. *(How long ago was that?)* I think it's from '47, you know? Because I born in '42 at Newton Ground Village and then daddy moved up his little house from there to put it on the farm that he could have it more near to do his work, eh? It's when we get bigger, we turned back to the village down here. That was about 15-16 years ago, about 1995. When Fahies had give out, every man had a three-acre plot. We had the Phipps, they lived there, then come back down we had the Weeks, husband and wife and children, they were living on their farm, come back down you have a man by the name of James Samuel, he and his family and below that was my father, we were living there on the plot. Below us was a man named Jarvis. The government had a lot of land up there, a lot of French people used to live on it. They had little houses make there and they do different works and things, some used to do the same farming, until after awhile they started moving out and down to the villages because of lack of water and electricity. It was a pleasure living up there, you know? *(Do you wish you*

could live up there again? Of course I wish. (But you're not allowed?) No. (Kerry Dore, farmer interview, July 2, 2011). ("French" people are individuals from French St. Barts.)

William F. Dore explains the story behind the purchase of Fahies and Saddlers estates:

When Saddlers and Fahies estates proved uneconomic for the European owners, mainly because they were small estates and stony, with irregular land area, they offered those states to the government. The government bought them and made what they called 'land settlements' and rented out or sold acreages to people in the area to do agricultural production. They put an agricultural officer on each of those projects to advise and assist those small farmers. So you would have found a number of small farmers in those areas, with 2 to 5 acres, and those are from the original government land settlements areas on two estates which they bought (William F. Dore, personal communication, July 31, 2013).

As Dore explains, acreage at Fahies was rented out *or sold* to people in the area to do agricultural production. Mr. Jarvis had purchased the land at this time, and his wife could therefore sell it to the farmer from this study. In the interview, this land-owning farmer explains that he started out by planting pigeon peas on his land. Hugo destroyed many crops around the island, but he had a lot of grass around his farm, which saved the peas. Therefore, he was one of the only farmers on the island to have pigeon peas and could sell them for a good price. He used the money to buy a lot of fruit trees. These trees are still present on the farm and are his major source of income today.

This farmer is unique; few farmers in St. Kitts have the luxury of farm ownership and the permanency, security and stability that this provides. In fact, many farmers explained how they were removed from pieces of land that they and their families had been working on for many years in order to make way for development projects. These development projects include Kittitian Hill in Belmont, the horse track in the Profit and the new high school in Saddlers. In many of these cases, the farmers were promised compensation for the fruit trees that were present on their farm. One farmer, not in the

study, said that he used to make EC5,000 a year from his trees and he was not given any money for them. The majority of the data on this topic comes from field notes and interviews with farmers currently working in Belmont mountain, because many of them were moved there after working in Willard's mountain, the current site of Kittitian Hill:

(The farmer) wanted to know what's being done and said that Belmont farmers aren't getting *any* help. He wants seeds to plant, etc. I guess when he was moved from the area where they're going to put Kittitian Hill (he called it Willard's Mountain), the government promised to give them money for what they had there, especially fruit trees. They also said they would pay for seeds and fertilizer for the first year. He said he had a nice cut of peanuts up there and they just plowed right through them, he almost cried. He brought up the point that the government encouraged them to go into farming, but then they aren't supporting them (Kerry Dore, field notes, January 26, 2011).

(Kerry Dore: Does the government compensate you for any of the damages you experience?) Nothin at all, nothin at all. Up in the mountain we had a lot a pear trees and mango trees and fig trees and this and they say they gone give us something. Up to yet. Up to yet not a right cent. Nothing at all. *(Now all those fruit trees that you had up there, what happened to them?)* They are there still. *(They're there still. Are they still bearing?)* Yeah. I just go up there I pick pear off a dem. *(Oh, so you just go up?)* Yeah right now I got three big bunch a fig up there, but monkey a eat dem, yeah? Right up there was so nice man. I got the Nevis mango? And some big pears and tings (Kerry Dore, farmer interview, May 28, 2011).

(Kerry Dore: So my first question is, how long have you been working on that piece of land up in Belmont?) Since we get it up there? Oh, about six years now. *(And where were you before that?)* Uppa side in me father ground before that. *(Your father's ground. Is that in Kittitian Hill?)* Yeah. *(A lot of farmers here were moved out of Kittitian Hill. All that area in Belmont, is that mostly farmers that were over in Kittitian Hill and got moved?)* Yeah yeah. *(And how long were you working on that other land there before this one? Your father's land?)* About ten years or so, yeah. *(So your father's land, how long did he have that?)* He had that since he young, when he about fiftysomething years till he about eight years, he work. *(So about what year do you think he started working in Kittitian Hill?)* A long time when me going small, I used a go a school still. *(You used to go up there before school, after school...)* We used a help him, yeah. We used a help him, me and me other sisters, but only me wan a take it over. Me sons, them a take it over now. *(So it's safe to say*

you come from a farming family?) Yeah me father, me mother, yeah. (One of the things I've learned is that the farmers that were in Kittitian Hill and got moved over here, they were told that they were going to get money for fruit trees. Is that true?) Yeah, they say so but they ain't give any body none. (But they told you they were going to give you money for fruit trees?) Yeah they say so. They count the fruit tree we had all in the ground and whatever and they say they gone pay but they no pay all we. (They actually went and counted the fruit trees you had on your farm?) Yeah, fig tree, pear tree, mango tree, all the tree them that used to bear, they still but they not give away nothing (Kerry Dore, farmer interview, July 15, 2011).

A similar story comes during an interview with a farmer currently working in the Brotherson area. This farmer used to work in Profit mountain, the home of the Beaumont Park Race Track:

(Kerry Dore: Tell me about your farm. How long have you had been working it?) Since when they give it to us I guess. When they sell out the cane field. (That's like 5-6 years ago?) No...So long? (Well...the industry ended 6 years ago...) No, I've been on me farm now for like 3-4 years (And how did you get it?) The government. (Did you apply for it?) No, we was in the mountain, and when they sell out the mountain, unlease the mountain, to do the horse track, they just move us down, strait down. So from you see where I be right now, I used to be strait up in the mountain. (That sounds similar to what some other farmers were telling me about getting moved out from where Kittitian Hill is going. All the farmers in Belmont had to be moved out of there). Yeah, dem had to move. (Those farmers told me that there were a lot of fruit trees up where they were and that they were told they were going to be getting money back for them.) Yeah, me too. I had a lot of fruit trees. (Did they say they would compensate you for those trees?) Yeah, they said they were going to compensate us...I had two pear tree, I had two nice mango tree, I had a lot a green banana tree, I had a jelly (coconut) tree. They didn't compensate me for dat (Kerry Dore, farmer interview, May 23, 2011).

And in a final example, another farmer was moved off of her ground to make way for Saddlers High School:

We moved on to Saddlers and went up to (the farmer)'s farm, mapped two things there, then went to talk to her. She talked to me for a long time. We talked about how she was relocated when they put the high school in and was promised stuff that she never got. Same story! (Kerry Dore, field notes, June 7, 2011).

These relocations make farmers feel that they can be moved out of their ground at any time. One farmer summarizes it well: (the farmer) brought up fencing, but said why fence when the government can suddenly tell you that they're going to put a housing project there? (Kerry Dore, field notes, February 22, 2010).

Farmer insecurity regarding land ownership, tenancy and payment was also evident at the beginning of the study, during the initial mapping of farms. Some farmers expressed concerned about this formal documentation of farm location and acreage:

We did have two farmers that were concerned about us mapping the farms, because they see that value could be turned into something that could be held against them. For example, they could be taxed based on the exact amount of land that they have or something like that. It doesn't happen here, but there was some concern. (Kerry Dore, field notes, Sept 22, 2010).

Therefore, in interviews, farmers were asked about why some farmers might not want to participate in this study. Here is one particularly telling response:

(Kerry Dore: Why do you think some people might not want to be in a study like mine?) OK. Most people feel like the studies, is that the government is, uh, bringing in people to look and see who all using de farm, and if they're not *using* de farm, they'll take it away from them. *(Ohhh. So I'm like the government check up.)* Yes. But people *need* their farm. Or if, OK see now you're from America, right? *(Mmm hmm.)* Ok we will think, in a way, that you will have contacts, overseas, and people will come, who are interested in the lands, and they could come and take out dis lot from you, take dis lot, and take dis lot...*(So like, someone from America would come and take their land?)* Yes. *(But it's government land! How would we do that?)* No but, people think, just thinking, in general. Because, OK, in America most people do farming, and we have the land here *wasting* so to speak. *(Oh.)* You see what I mean? *(I do.)* So you got the opportunity to say, well, boy, these people aren't using the land so we can have this, we can go and we can do this, we can do that. So, that's one of the aims. *(I see. They'll say, 'oh, I'm not really using it so much right now, I don't want her coming and seeing what I'm doing. OK.)* And take my land. And I have children, so maybe my child might be able to be interested in farming. *(So they want to hold onto it for later, even if they're not using it, which they should be able to do...)* But if they

live on the farm it will be better. (*Yeah, that's true, because it's yours. It's like your backyard, and nobody can say anything about that.*) Yes.

At the heart of these conversations about land ownership is anger and an uncertainty about the future:

(*Kerry Dore: I'm just trying to learn about how people accrue lands here, and the history of the way lands are being distributed, because I think that's really going to affect where animals are going.*) Here is what a bad place about land. Because de Anguillans them they have they lands, de Nevisians them have they lands, de Monsterratans them have they lands. Only here in St. Kitts, people don't own de land. (*Even in Nevis they own the land?*) Yeah, man, everybody got they land in Nevis! Before they gran them done born an all, de land is theirs. Oh, this land from my grandfather, this from my this, and a lot of land, too. (*So they own it.*) They own de land, yeah. (*Yeah, I think that's really interesting in St. Kitts, because it's mostly government owned.*) Yeah, but it shouldn't be, it shouldn't be. It shouldn't be because, what I was saying earlier, when they bring de slaves them here, you know the slaves them, they were our parents and our foreparents, yeah? When they bring them, they used to put them on the ghaut side...because the good part is where they gone put de sugar. So we find that we come outta ghaut land, hillside. It so happen that, people, they say, that when the masters them, the white people them from England, when they done come and they done take the land up, even some of the land where the white man done left, they say let me give my son this, let me leave some for me daughter, but Kittitians they never do that. And up to when Bradshaw, our first Premier, he a take this land, he say the land for de people. The land for de people them. (We) give away de lands them, undercover, to all kinda, you look around and see the galvanized, nobody knows who they sell de lands to, nobody know. All de salt pond sold away, it's foolishness! (Kerry Dore, farmer interview, July 3, 2011).

Infrastructure

Frustration with agricultural infrastructure was another reason why some farmers are unable or unwilling to pay for their use of government land. Producing food requires a number of steps. Farmers need tractors to plow the land. Then, they need seeds to plant and water to nourish the seeds. As the crop is growing, in addition to manpower weeding the area around the plants, farmers need to protect their crops from animals and human thieves. If the crop makes it to this point, then the farmer

needs a market in which to sell the food. Kittitian farmers express frustration with every aspect of this infrastructure. Problems with crop predation are discussed in Chapter Three. Here, issues with the tractor and with seeds and marketing are discussed first, as these were the most commonly discussed problems, followed by a discussion of access to water for irrigation.

Tractors Of the 64 farmers in this study, only five harrow the land exclusively by hand. The remaining 59 farmers pay EC150 per hour (in advance) for a government tractor to come harrow their land. Then, another tractor comes to make the land into banks where seeds could be planted. It became clear that issues with the tractor were a challenge for farmers immediately after the initiation of data collection (September 2010), because at this time, many farmers were not growing anything. When asked why, they would say they were “waiting for the tractor.” Many farmers explained that they had been waiting months for the tractor to come. They expressed frustration that they were missing out on making money because they could not plant anything and because sometimes they had to pay twice if the banker did not come soon enough after the harrow. For example:

The reason (farmer) really isn't growing things right now is because the tractor didn't come. He's waited months for it to come. He's saving up \$7,000USD for a brand new small tractor so he can plow his land when he needs to and doesn't have to wait months and months and lose out on making money (Kerry Dore, field notes, August 24, 2010).

(Farmer) said that he biggest issue that most farmers have is the tractor. We talked about the tractor for a long time. I didn't realize that if you pay to have your land harrowed, but the tractor doesn't get there in enough time to do the banks and the weeds grow back again (and this doesn't take very long), then they have to pay for the harrowing again (Kerry Dore, field notes, Oct 16, 2010).

One farmer explains that, during the sugar industry, there were a lot of tractors, so if there was a tractor down, they could get parts easily. He went on to say that now, there are only two tractors used to help farmers, but nobody knows where they are (Kerry Dore, field notes, October 29, 2010). Another farmer, who used to work as a mechanic in the sugar industry, explains that the tractors from the sugar industry were sold because the government needed the money to buy the sugar lands in the 1970s, but that the tractors were useless by that time, anyway:

(Kerry Dore: How many tractors were used?) They had a total at one time, over 100 tractors harvesting cane. (And what happened to them?) Well the life of the tractors, in the older times, like in the 80s, were ten years. And the kind of work they did, some times they did not last that long. Because it's 5-6 months of continuous work transporting cane from the field. But now, the modern ones they have now, they don't last 5 years. The newest tractor that they had in the fleet were bought in 1995. They did work maybe up until 2000. (So it's not like they had all these great tractors lying around and they got rid of them, the tractors themselves were...) Obsolete (Kerry Dore, farmer interview, November 12, 2010).

William F. Dore provides additional insight about why the tractor situation is challenging for the government to manage:

Nobody rent a tractor to plow 3 acres! You do 20 acres a day if you're an effective operator. And you've got 40 applicants. And one fella is over here, he want two acres plowed this week, and this other guy, he's over here. And how you get wear and tear on the road. And costs is no longer here but there because fuel and road time and all this. You have to pay a tractor driver a day's pay for travelling 15 miles per hour on a tractor, to move around? Uneconomic! *(Kerry Dore: Yeah, you are going from this centrally controlled operation to having all of these little plots...)* And lots of applications! Letters to be read through, and files kept on all kinds a people, and they owe you forty dollars and, and they won't pay the forty dollars and you have to write and make ten phone calls to them to get them to pay you forty dollars and all that kinda thing. So *you* are uneconomic and *they* are uneconomic on the other end (Kerry Dore, interview with William F. Dore, former Permanent Secretary of Agriculture, October 2012).

Around early February 2010, farmers start saying that the tractor problem is significantly improving. One of the farmers in the study who works for the agriculture department and is responsible for land cultivation explains the change:

So you'll find, for now, since we have two new tractors, if you have to look at de work I have to do now, for this week, it's like 6 to 8 hours work for de whole week, because we already complete de work we had a do. So now we're trying to encourage farmers to come in and give some money you want work done, so, we kinda stayin on top a it. We were behind because the program we had in place was two tractors, they were older, but one would harrow, strait around the island, one harrow strait around the island and the other one would bank. You know? So, we change our program now, and bust the island in two. So, we focus on one half with one tractor and the other tractor...we use a different approach now. It's working now (Kerry Dore, interview with Dion Weekes, February 7, 2011).

In addition, a fellow farmer and mechanic purchased his own tractor and farmers were able to pay him directly for his work. At least ten farmers pointed to this as a reason why the tractor situation had improved in their area.

Marketing and seeds Another significant challenge that came to the forefront during interviews and conversations with Kittitian farmers was that of finding a place to sell the crops they produce. There are a number of options for St. Kitts farmers to sell their food. Virtually all farmers sell their produce in their home village, to their neighbors for subsistence purposes. Additionally, some farmers will sell in town in the markets or on the street or will sell to neighbors who do this. This type of market has a long history in St. Kitts. As previously explained, during sugar production, planters gave slaves (and later, workers) plots on land that was not suitable for sugar production in the ghauts and steep slopes below the forest boundary. Slaves were given Saturdays off to work these plots. The resulting produce was sold at a weekly market from sunrise to nine

on Sunday mornings (Merrill, 1958). This practice was allowed because it saved the planters money (as they could buy less food for the slaves) and helped to reduce the food import bill.

Many farmers in this study sell their produce at the weekly market, a tradition that continues today, although now it is held in Basseterre on Saturdays. Again, there is a designated location, a large building along the main road, but the stalls spill out all over the streets of Basseterre. In addition to the weekly market, farmers' produce appears on the stands of street vendors that are present every day in town, selling produce and local-style prepared food.

Another option for farmers is grocery stores. The largest of these are in town (Horseford's, Bird Rock Rams, Port Zante Rams, Bird Rock C&C, the C&C on Cayon Street in Basseterre and Best Buy on the western end of town). In addition, there are three medium sized grocery stores outside of town: one in Cayon village and two in Sandy Point, and there are small shops in virtually every village. Farmers are relatively successful selling their food in this way. A number of farmers in this study that might be considered more commercial producers (approximately a dozen) are able to sell their produce to grocery stores on a regular basis, and it was not unusual for more subsistence/village producers to sell some of their crops to a grocery store on occasion.

Farmers can also sell their produce to hotels and restaurants. However, this is a serious point of contention among the agricultural community, especially with regard to the Marriott Hotel in Frigate Bay. The following excerpt from a speech by Dr. Timothy Harris, then Minister of Agriculture, at the opening of Capisterre Farm in January of 2011, highlights this issue:

(Dr. Harris) brought up Guyana and how at the fancy hotel, you get breakfast and it's *all* local. Restaurants and hotels want to have local produce and products. He said that we have seasons, and that we don't always have food, but he wants it to be such that when we have it, they will buy it. He said he met with the Marriott a couple of weeks ago (Kerry Dore, field notes, January 28, 2011).

It is not entirely clear what happened, but anecdotal evidence suggests that early on, a relationship was established between the Marriott and the St. Kitts Farmers Cooperative, but this fell through because the hotel was not happy with the consistency of the supply:

When I asked (the farmer, member of the St. Kitts Farmers Cooperative) why a farmer would want to be in the coop, (the farmer) told me that they have bargaining power. They need to come together as one voice. They were able to start selling to the Marriott, and she didn't want to talk too much about the details, but that fell out for some reason (Kerry Dore, field notes, August 9, 2010).

A few days later, an extension officer explained that things fell through because the crops they were giving them weren't consistent enough. A friend who used to work for the Marriott reiterated this point:

(Friend) said that one of his first jobs for the Marriott was to try to work with the local farmers, but that he couldn't get them to work together. They would have *no* tomatoes for weeks and then everyone would only want to sell them tomatoes. He said they should plant stuff every week, so that when they harvest one they start on another, etc. He said that his friend has a restaurant in Hawaii, and the used to import everything, but now they are almost fully self-sufficient. They worked with him to make sure he had a consistent supply (Kerry Dore, field notes, November 26, 2010).

Another friend, an executive chef at a local restaurant, expressed similar feelings:

We talked a lot about why restaurants don't use the local farmers – they find it's inconsistent, so they get their stuff from Dominica. I told him how (a farmer from the study) was talking about going to the Prime Minister and I told him that he should get a group together and go, they are a much stronger force together. Brad said that they should skip out on the political stuff, just get together and go straight to the restaurants. They should have a grid system where certain areas grow certain things – only one or two things on a large scale. Then restaurants would buy the stuff

from them every week. If they didn't need it, they would find someone who did. He said that the restaurants can then invest in the farms (Kerry Dore, field notes, December 10, 2010).

Conversations and interviews with farmers elicited the nature of and some of the reasons for this inconsistency:

(The extension officer) showed us the back plot, and a farmer stopped by and picked up some cabbage (I think). I listened in on (the farmer) and (the extension officer)'s conversation. (The farmer) was very well spoken and was talking about how when there is too much of a supply of something then the effects will be bad. She said that we are about to get into that because they were selling too many seeds a few months before (Kerry Dore, field notes, August 16, 2010).

(The farmer) said that the problem with St. Kitts farmers is marketing – they all grow the same things. Back when she was young, she remembers the older farmers growing things like turnips and radishes – now it's all the same. She said that at one point, she was making jams and jellies and wants to get into that again (Kerry Dore, field notes, October 8, 2010).

(Kerry Dore: How are things different since the end of the sugar industry?) In general, because you have the displaced sugar workers, you have a lot of people in farming. You have a lot of farmers fighting for the same market. You have to get more competitive. You have to do better farming so you can get the edge. It's even harder to get your food sell (Kerry Dore, farmer interview, November 27, 2010).

Today on (farmer)'s farm the cucumbers were way past harvest. (The extension officer) guesses that the market is flooded with them right now so he's just left them (Kerry Dore, field notes, January 12, 2011).

(Kerry Dore: What limits your crop yields? What things keep you from producing as much as you would like?) Marketing. I tell you. I don't know if everybody, everyone, because sometimes I look at it that everybody goes to agriculture department to buy slips, so whatever agriculture department have, whenever everybody plant the same time, and up, everybody have de same thing. If peoples tends to do their own, like bust their own slips and like that, an venture out an different things...*(Well, for example, (farmer's name), I see (the farmer) all the time and last week (the farmer) had SO many tomatoes, (the farmer's) whole shed was full of these beautiful tomatoes, and (the farmer) said, the market is flooded with them, and I can't get rid of them. That is just exactly like what you are saying.)* And, oh, don't even talk about the Marriott. You can't, seriously think about the Marriot. *(Are you part of*

the St. Kitts Farmer's Cooperative?) Yes. Cause we try that already and after the market, you know? (*What was the problem? Why didn't it work?*) You remember they say they had the market crash in America? (*Yeah...*) Yeah, (laughing), well, uh, they stop ordering stuff. (*Also, I was told that they weren't getting things consistently.*) That was the problem too because we used to have problem getting the land prepare. That was the problem. (*Yeah, you can be totally ready, but if your land is not prepared...*) And they don't have the tractor to assist you (Kerry Dore, farmer interview, January 23, 2011).

(*Kerry Dore: What do you think the future of farming in St. Kitts should be like?*) I see St. Kitts feeding the lesser Caribbean islands, feeding Anguilla, feeding St. Maarten, feeding Stacia, all these islands. You ever been to these islands? (*No.*) OK. If you look at these islands, right? We are the only one with volcanic soil. These here are in stone. You know like how the southeast peninsula is? St. Maarten, Antigua, Anguilla, all they can't do a lot a farms. So I see us as a supplier for them. You know? That's how I see us (Kerry Dore, farmer interview, Feb 7, 2011).

During my interview with (farmer), she was bagging up boiled nuts into small brown paper bags to sell at the local field day. She said that peanuts always sell (Kerry Dore, field notes, Feb 26, 2010).

(*Kerry Dore: So what should they do about the tractor problem?*) Well I know they got two new tractors. (*So you think it's going to get better now?*) I really don't know, I tell you they have them, working, but everybody going into farming, so I don't know how de food gone sell. (*Hmm. That's a big issue. Everyone's going into farming, huh?*) Yeah. (*Why?*) Nothin else here to do. (Kerry Dore, farmer interview, March 5, 2011).

I asked (extension officer) what he was up to and he said he was doing some forecasting, seeing what was available for grocery stores, because they prefer to buy local (Kerry Dore, field notes, May 6, 2011).

I can remember de days when I go to the market, you know (person), she from Cayon? (*Kerry Dore: No, I don't think so.*) She's a full time farmer, they sell down de market. Over de bridge? I will sell three bags of pepper while they sell a heap in de thing (*inside the market building*). I'll spend all morning down there, you can't get twenty pounds of pepper sold. I was counting the other day. It used to be (one person), it used to be (another person), that's the one by the old treasury building? (Another person) and (another person). That's all. If you go downtown now, there will be about 12-14 person selling on de road. When I was at the high point of my farming, that wasn't the case. That was never the case. I remember days when I had to like leave my children at the market and

hustle back to the land to take out pepper, hustle back to de land to take out tomatoes, that ain't gone happen again. That's not going to happen again. And the good thing about that high productivity is that a lot of de young fellas, a lot of the production be done by de young fellas. I understand a lot of de young fellas in the country, they're really producing. They're really doing that, they're full timers. That's what's occupying their attention. The thing I hope, boy government would make some serious interjection in balancing the import with the local consumption. Because local production, because you cannot be importing when people have things on the market. That is now where agriculture comes in because a lot of relatively accurate projection has to be done. (Kerry Dore, farmer interview, May 27, 2011).

I was talking with (former member of the agriculture department) and he told me that they did a survey before the industry closed, and found that Anguilla, St. Maarten and St. Eustacia all had a market for pumpkin and sweet potato (Kerry Dore, field notes, May 28, 2011).

(Kerry Dore: I've heard a lot about waiting for the tractor since I've been talking to farmers. Is that a problem for you?) Well, not really, it no really be no problem for me because if the tractor no come, me just hol on till he reach. *(So it doesn't bother you?)* No, because if de tractor gone come by me and come by you, we two a gone plant de same time! So I don't think de tractor stayin long is a problem. Because if de tractor come by everybody dis month, an everybody plant, everybody gone reap, everyobody gone a sell. So if it come by you dis month, and it come by me next month, and you gone plant, I know you in front a me! So, when you go an get off yours, I know I got mine behind to sell. But everybody trying to get de tractor one time and they can't get they food sell. *(That's really smart. I never thought about that. Because that means that the tractor is actually influencing the market.)* So if de tractor come by everybody de same time, everybody got food de same time, you food not gone sell. *(So, speaking of marketing, I've heard marketing is also a big problem for farmers. Is that true?)* Yeah. *(What can be done about the marketing problem?)* They hafta get food outside. *(So we have to sell it outside? Export it?)* Yeah, because everybody planting de same time. It become a big problem. So, the most me gone plant is peanuts, because me know peanuts can store for a while. Me dasheen, me potato an dem, they maybe can stay a two days, three days, me pinda could stay two months, three months (Kerry Dore, farmer interview, August 21, 2011).

(Kerry Dore: It seems like marketing is a big problem for farmers in St. Kitts.) Well, what happen is, since the sugar crop finish, they distribute a load a lands, so a lot of people come on board, and so, make it even more difficult. *(It seems to me that you have been able to get around some of this and really market your stuff.)* Well, you have to be aggressive. You

know, once ago, when there wasn't so many farmers, you could relax, but now you have to be a little more aggressive. (*What's your most valuable crop?*) I think peanuts. (*And why is that?*) I guess, why? Because it's easier to store. And sometimes when the market is on a glut, and you can't get things sell, you can pick the peanuts and preserve them and they last long, you don't have to worry about spoiling. You can get them set up and store them in your house (Kerry Dore, farmer interview, August 8, 2011).

I'll tell you how they compound it (*problems*) at the department of agriculture. They encourage people not to do their own seedlings. And they produce the seedlings at La Guerite (*the agriculture department*). So when tomato seedlings available they announce, and everybody go and get tomato seedlings, and everybody plant. And they'll take 3 months 4 months before they have them, but in this interim period, very few seedlings are sewn. So, you get a crop, and that's it. Everybody has them. Glut, post harvest losses of 50 to 60 percent! (Kerry Dore, interview with William. F. Dore, March, 2013).

Five important conclusions can be made from these conversations and interviews.

First, marketing has become more of an issue for St. Kitts farmers in recent years because there are many more farmers than before the sugar industry ended. Second, the agriculture department's distribution of seeds and schedule of harrowing seems to create market gluts and famine. Third, growing peanuts is one way that farmers can get around these swings in the market. Fourth, farmers have started to use cooperatives as a means to create bargaining power and to get assistance with marketing. Fifth, extension officers have started to forecast farmers' produce for the grocery stores. And finally, farmers have dreams of exporting their crops to other islands.

Dreams of exporting are not so far fetched, especially for older farmers who remember the times of agricultural diversification during William F. Dore's Sugar Industry Rescue Operation (SIRO). This is when peanuts were first introduced to the island on a large scale:

I went into peanut production. I was trying to help the government to wipe out the debts to the banks. So I was looking at alternative croppings which could be done on a fairly large scale which would bring in revenue to reduce that debt. I looked at CARICOM, and there was a protocol called the Agricultural Marketing Protocol, which listed 22 agricultural items, which if they were available in the region, all of the CARICOM countries had to purchase in the region. (*Kerry Dore: I remember this – CARIFTA, right?*) Yes, CARIFTA. And I realized that peanuts looked a possible avenue for me to use. So I introduced peanut production. First year 3 acres, just sample things, 30 acres the following year, not year, growing period, about four months, then 100 acres, then 300 acres, then 600 acres! So in short order, from one year to another year, we were producing 600 acres of peanuts. (*Wow.*) Our peanut production was so high that we had to use the sugar store, at the bulk storage up there to store peanuts. And I had to get the British government to give me four large storage areas for peanuts. One at Buckleys, one at Cranstoun, one at Estridge and some, you might still see some of them around. I think the one at Buckley's is still there. Big aluminum structure in the Buckley's yard. So we got those, the British government gave those at the cost of 64,000 pounds each and those were storage for peanuts. What we did was, I sent off two of my people, one who is still here, Conrad Kelly, you might bump into him, he was a food crop agronomist, and um, another chap, I forget his name, he was an agricultural engineer, and we got, I think it was the Ford Foundation to give a grant for a couple months for them to go up to Florida and Louisiana and move around to peanut production units and see what was going on. And they came back and we got mechanical equipment to plant eight rows of peanuts! And what I remember, at the high point of that peanut production was my shipment of *240,000 pounds of peanuts* in one fell swoop to Barbados! OK! Well, you can't do that if you're planting a quarter acre of peanuts! (Later in the interview – *What happened to CARIFTA?*) CARIFTA became CARICOM! It was a graduation up. When I sold my peanuts, I sold them under that protocol! They could not import peanuts from Egypt and Louisiana and stuff if there were peanuts being grown here (Kerry Dore, interview with William F. Dore, October 2012).

While CARICOM, which stands for “Caribbean Community,” still exists, the marketing restrictions that were present in the 1970s do not.

Water At the end of one interview, a farmer, who is also a member of the agriculture department, was asked if there was anything important that was not covered in the interview questions. His response explains the crux of the water problem:

(Kerry Dore: So, you get the idea about the kinds of things I'm trying to understand, that I'm interested in, are there any things that you think I should have asked about, any topics that you think are important that I didn't cover?) Well, irrigation, you could try to put in more about that, because right now we got the rainy season, and even though we're not making full use of the rainy season, you need to look at the dry season. *(What is the rainy season?)* The rainy season here is from like October-February/March. *(So you think that's a big part of the support that farmers need.)* Yeah. Because I think it's about what, 90%, of the farming is rain-fed here in St. Kitts. About that. Maybe even be 80%. There's not much irrigation done. *(And that's really going to make a difference with how much we can produce.)* Yeah, with the consistency also, through the whole year. Cause, you know, we got our food in the rainy season, but during the summer it's dry. *(So, you can grow food here all year long, but water is the biggest limiting factor.)* Yeah, irrigation is necessary. That includes building dams and that kinda stuff to supply the farmers (Kerry Dore, farmer interview, February 7, 2011).

Very few farmers in St. Kitts have a consistent supply of water for their crops. Irrigation was a common answer for the question "what should the future of farming in St. Kitts be like?" Most farmers are forced to depend on the rain, which is highly seasonal. One farmer explained that her yields drop 60-80% in the dry season and this is a big reason for the inconsistency problem in St. Kitts farming:

People who is not in the farming area can't understand why there is no consistency. When you do this kind of farming, depending on the rain, you can't have consistency! To me, it's like, what the government needs to do is, normally at this time we got a rainy season, *build dams!* Charge farmers if you have to, but store the water! What do you do when it doesn't rain for three weeks, Kerry?! Normally when we don't get no rain I don't go on the farm because it's depressing. You see the starvation in the fruits. When the dry weather come down, my production drops 60-80% (Kerry Dore, farmer interview, November 27, 2010).

Thus, farmers with irrigation have the market during the dry season:

(Farmer) was laying a line for irrigation. He told me that it cost him \$700 for 1,000 ft, but it's lasted him years. I was saying how lucky he is to have it. He said that now is when it really matters, because it's so hot, only the people with irrigation will have stuff, so they'll have the market (Kerry Dore, field notes, June 28, 2011).

The cost for farmers to put in irrigation themselves is significant. One farmer said they were told by a member of the agriculture department that it would cost EC23,000 to irrigate one acre of land (Kerry Dore, field notes, March 16, 2011).

Travelling around with extension officers means that frustrations with water were heard often. Early in the study, on August 14, 2010, a group of farmers spent a long time talking to the extension officer about tapping the water pipe coming down from the mountain for irrigating their farms. Apparently one of these farmers was told by the agriculture department that he had to go to the water department himself. In another context, on March 30, 2011, at the annual “Agriculture Planning and Review Meeting,” one farmer asked a member of the water department about wild springs and how farmers can get access to them. The woman from the water department said it’s possible, but that we need to figure out who will be responsible for the infrastructure – who will invest in the piping, etc. When this fact was mentioned to another farmer, he said that the farmers have been telling them that they would like to access the wild springs for 10 years (Kerry Dore, field notes, April 1, 2010).

The government is aware of the need of water for farming. At the beginning of 2010, the Natural Resources Minister announced a new water policy for farmers. Additionally, after the data collection phase of this study was completed, farmers in Cayon Village gained access to the local water spring.

Issues With Youth, Finding Labor and the Status of Farming These challenges for farmers were another common discussion point. They do not affect farmer’s crop yields; they impact their social status and the future of their livelihood.

Many of the farmers in this study have been farmers for decades. They have a broad understanding of how farming in St. Kitts has changed over time, and they are concerned about its future. Conversations with farmers and other Kittitians reveal that a large part of this concern stems from the inability to find farming labor and the younger generation's work ethic:

(The extension officer) told me that it is very hard to find farming labor in St. Kitts. He said that maybe it goes back to the old times when you had no choice but to do it as a slave. I learned about YES, or Youth Empowerment for Skills, which is an organization that teaches youth skills to work on farms. Apparently this organization is dying out for lack of funds (Kerry Dore, field notes, August 7, 2010).

I've heard this a few times now: the older generation has worked hard their entire lives in factories or on the sugar estates, and the teenagers now don't want to work. They want all the name brand stuff, but they don't want to work for it (Kerry Dore, field notes, August 23, 2010).

I overheard a guy at a bar talking about the trouble with youths in St. Kitts, how they don't want to work. He said they have to have all the name brand stuff and how he used to have generic sneakers. His mom would never get EC100 ones, maybe EC20 ones. He said that kids don't want any food other than KFC, Domino's and Subway (Kerry Dore, field notes, August 27, 2010).

(A woman helping us find an apartment) talked about how you can't get local people to work here. She is a chef at a small restaurant and needs to hire some help, but said that she's probably going to get a Guayanese or Spanish worker. She said that local people just don't want to work. They just think about the money and don't care about the work. She told me about this program (YES) where the government paid farmers EC300 a week to go to these seminars and learn stuff from others. She said they just cared about the paycheck but didn't actually take the time to learn from the people. People just want money so they can buy cell phones and blackberrys, they don't want to learn (Kerry Dore, field notes, November 9, 2010).

Although some farmers explain that it is difficult for people to find work, especially work in which they have serious interest:

We have no land for our younger generation, you know? So, those who coming up now, what they gone do? What they gone farm? What they

gone to do? Where they gone get work? (*Kerry Dore: This is my next question. I keep hearing that there is a younger generation that doesn't want to work. Is this true?*) They cannot find work. I speak to enough, and I know that a lot of these young people now, they can't find work. (*Do you think that there are some that don't want to work?*) Some. (*Some that don't want to, those that do are having trouble finding it.*) Yeah. (*What's causing that problem?*) Number one, the government just get up one time giving people work, when they look, they lay them off. They lay them off! And the people they just get fed up, they no want, because there are some people who are hungry, you know? You just can't get no work. Things hard, right. Right now here people some people gone get lay off this month. Island Hopper an all them (Kerry Dore, farmer interview, May 9, 2011).

(*Kerry Dore: People keep telling me that young people in St. Kitts don't want to work. Do you believe that?*) Who say that! No, I don't believe that! Young people want to work! Young people wants to work. (*What's the problem?*) They aren't able to find work, and I don't know if this island too small for them, but young people wants to work. Most of them. (*What about the increase in crime that I've been reading about in the papers? People have told me that, oh, they want a quick fix, to have money but they don't want to work for it.*) Well, some of them doing the crime they ain't so hard up. And some people who hard up ain't doing no crime. It's probably just the same few that are going around. But most a the young people, they allright. (*So it's not that they don't want to work, it's just that they're having a hard time finding it.*) They having a hard time finding work, it ain't what they want, they ain't getting what they want (Kerry Dore, farmer interview, May 23, 2011).

(*Kerry Dore: People keep telling me that young people in St. Kitts don't want to work. Do you think that's true?*) Well, not entirely true. Some aint working because no jobs are available, or a job where they are going to feel comfortable with everything. You know, if you doing farming and I'm not comfortable in it, I going change me job. I gone work out, 'I done farming, and I gone go do construction.' Or maybe the income your getting, it aint sufficient to feed your family so you gone work out, 'boy, I can't do this no more' cause, you know? My kids them no get fed, and I need more money, more income. (*So then they have to go and get another job?*) Yeah. (*But what about all the people that aren't working? All the youth that aren't working?*) Not enough jobs here, and the government is not trying to make it better (Kerry Dore, farmer interview, July 26, 2011).

Farmers often cite how today's youth do not have any responsibilities compared to when they were their age:

(Kerry Dore: I keep hearing that young people in St. Kitts don't want to work. Why do you think that is?) Farm. Farm work. They won't farm. They don't want no hard work. *(Why? I think it is so fascinating because I get to talk with farmers like you that are so hard working, and this is just one generation down where you have this drastic change.)* What happened is that, in my days, small boy days, I had to farm. My mother was not a direct farmer. My father was a mechanic: repair locomotives and so forth, but my mother was more a housewife. Never really worked, she had no social security. Right? Because we used to live in town, and she got into the people around the village and did part time farming with them. And so I got around the same people and got into the same thing. Cattle helping, whatever. And that's how I got into it. I did it as part time even when I was working, because after she came out of the industrial plants, the chemical affecting her, she wanted to be more environment, free, and so forth. So she decided to take the peanuts, cause in those days peanuts was selling fast. Big money for peanuts. Nobody would plant it big because they couldn't control it. Cause you have to have places to dry it, if it get wet it spoils. We used to dry them on the top of the house in those days! In those days it was big money, fast selling. A hundred bags in seven weeks, you sell them off. Don't work so anymore, more people got into the vending, and more people got into the planting. *(So you had more work to do when you were young.)* Right. It's different now. Before I go to school, I used to take like 13 cows, with calves, to the mountains just above there, tie them out to pasture, and then tie the calves if they were big enough, I had to tie them all, sometimes 25-27 tie, then come back, eat my bread and bathe my skin and go to school! By the time my belly ready for lunch, I had to go get those cows. Right, so you have to tie the cows, put them up in a pen or tie them up so they can't to the mother to suck, and then go on the rest of the morning. And that's how I grow up. We also had to go for a pig, we had a pig in the yard, and we had to get food for the pig, and we had a lot of goats to take up there as well, and, that's how I grow up. But when my children were born, I had goats, but my goats were in a paddock, and they would come with me and assist, but it was never their thing, to take goat as a living. So they was not raised like that (Kerry Dore, farmer interview, November 12, 2010).

Because, it's like, when I used to go to school, I had to get up, weed cane, first I had to get up, catch water, because the water pipe used to be on the main road, you had to fill up the containers them, when you fill up the containers you had to weed, you had to walk, clean up, go school. You had to do it, because if you doesn't do it, what are you going to eat, Kerry? (Kerry Dore, farmer interview, November 27, 2010).

(Kerry Dore: What other jobs have you had in the past?) I work at the Electrofab over at the industrial site, and I weed cane with my mom. *(And you were working in Belmont area? Have you always lived in St. Pauls?)*

I always live in St. Pauls, yeah. (*Did you start weeding cane when you were young?*) I started weeding cane at the age of nine years. (*Wow. Hard work, huh?*) Very hard. (*Would you do that on the weekends, or were you in school then?*) I go to weed early in the morning before school time and I come back down in time to go to school. At school dismiss, I back in the mountain again to weed again. I done hide me hoe, so I just pick up me hoe and I start weeding again. (*That's really hard work. But you know, I hear a lot about how the work ethic among you guys is so strong because you always had to be going, like, before school, after school, you had to take the animals up to graze before you went to school, you had your responsibilities.*) Everybody who had sheep home, you had to carry up them sheep before you go to school. And that is your thing, that when you come from school you go collect back in the animals. (*And now, you don't really see kids that have those responsibilities.*) They don't have anything to do now! They get themselves into too much a problems. I think if they were living like that they don't have no time for guns and all that kinda thing. At my age, nobody my age used to get in a thing, maybe just a little fight in school and we be back tomorrow, that's all. But these young people have nothing to do (Kerry Dore, farmer interview, May 9, 2011).

When asked why the younger generation does not have these responsibilities, or why they seem to have such a different work ethic than their parents and grandparents, many farmers explained that the older generations worked so hard that they want better for their children and thus discourage farming. For example:

(Kerry Dore: people keep telling me that young people don't want to work. Why is this? It seems like grandparents and parents so hardworking and children so different.) You find that what happened is that...we will say, oh, me no want me child to come...you now? It's like, ok look, I wasn't able to finish school. So I'm gone say, ok, I want to give me children them the best. And then sometime in doing that, in giving them the best, you spoil them. You understand? (Kerry Dore, farmer interview, November 27, 2010).

Dr. Harris (Minister of Agriculture) said we need to rekindle a greater awareness of the challenges of the agricultural sector. We need to attract young people to agriculture. Parents have been telling kids not to go into sugar, to find something better (Kerry Dore, field notes from opening of Capisterre Farm, January 28, 2011).

When I started to work with the sugar industry in 1995, the people who worked in the field, they make 25 dollars *a day*. In 1995. (*Kerry Dore:*

*Really? Twenty-five dollars a day. (EC dollars, too, right?) Yeah. And that was 7-3. You know? So, you find people who do that, who work in that, don't want their children to work in that. So you find that they tell their children, you know? That's one of the reasons why. I feel like we shoulda prepare the generation, ok, we know the industry was gonna close for five years – when I go and work in the industry in '95, people always saying the industry doing down, gonna close, you know? So, and they worked there for *ten years*, hearing every year that it gonna close. (*True. Why are you going to encourage someone to go into something if you know it's going to close?*) (Kerry Dore, farmer interview, February 7, 2011).*

*(Kerry Dore: People keep telling me that young people in St. Kitts don't want to work. Do you feel like this is the case?) Yeah, some. What I see is that some parents, right, they don't pass on the responsibility, they don't teach them responsibility. They do everything. I hear of some parents, through the *high school*, still awake them up morning time. Still iron clothes for them. Still prepare breakfast for them. They come home they got nothing else to do. They got no responsibilities (Kerry Dore, February 14, 2011).*

*(Kerry Dore: I keep hearing how we have a younger generation that doesn't want to work. I want your opinion about that. Do you think that's true?) OK, yes, I think the younger generation, they definitely don't want to do the hard work. They don't want this *physical* hard work. I think a lot of it have to do with their upbringing, too. The same parents who worked this hard to bring them up, it's like they wanted a better life for them, so they didn't want them to do this hard work. So I'll say they discourage them from the sugar work - go to school, learn well, get some subjects, go and teach, you know, go and be an accountant, whatever, you know. But there is not enough of that to go around so that's the problem. These same people, whether they are not qualified or they are not enough of that, they don't want to do the hard work because they're saying that its slave labor. You know? And back then, almost every time you eat, it was something out of your farm or your garden, now it's something off the supermarket shelf, from somewhere far away (Kerry Dore, farmer interview, March 12, 2011).*

*(Kerry Dore: People keep telling me that young people in St. Kitts don't want to work. Do you think that's true?) Well, it's a mixed bag. Everybody lazy, but, you know, this quick fix? All people come to like, the microwave effect? That is what happening to most of the young people. They want the quick thing. They need quick money. They ain't *planning*. They are not planning ahead, like, say OK, take for instance, you tell me your thirty years old. When I was in my twenties, I had plans in my head to get in place for when I'm thirty. Right? I wouldn't say I*

have achieved at thirty, but, I was almost there. Some things I was there. Like take, for instance, I wanted to own my own home at the age of thirty, and I work towards it. It was not a posh house, but it was *the start of things*. And the problem with these young people – they want everything quickly. They don't plan to work hard, they don't plan to work long. It don't work so, it don't work like that. (*Well, what I think is so interesting is that you have the older generation like you that works so hard, and I feel like, in a very short amount of time, there has been a big change in personality.*) I'm gone tell ya, too, parents have something to do with it. Because a parent gone watch you an tell you: 'me no want me child a work as hard as how me work.' You bring up de child *lazy* (Kerry Dore, farmer interview, May 17, 2011).

(Discussing the differences between St. Kitts and Nevis with regard to land ownership, and the process with which the St. Kitts government finally paid the estate owners for the lands...) (*Kerry Dore: Now, they (the government) bought the land in Nevis, too, but it was just because it was so much earlier, that, over time, it was able to be sold off to individual countrymen?*) Integrated into the population for small farming production. (*Is there the potential for that here now?*) I'll tell you something else, too. There is a tradition here: the people who work in sugar don't want to continue working in agriculture. (*That's true, I've heard a lot about that.*) Because they were kept *pauperized* on the sugar. No matter what else they tell you. They were kept pauperized. And, say, 50-60 years ago, to work, for example, at the St. Kitts (Basseterre) Sugar Factory was something of a plum job. Above teaching, above civil service operation, but over 40-50 years, government had become more sophisticated, because a number of people with university degrees working and things, more people in teaching. Sugar factory was downgraded, in relation to the types of operation here. So that was no longer a magnet for drawing people; the magnet was civil service and medicine and divinity and law and economics and accounting and so on. So, that became the Cinderella of the economic activity in the country. And there are many people who worked in the industry who got their education and said 'no way!' (*Yeah, I want better for my kids.*) 'No way! No sugar industry for you.' (Kerry Dore, interview with William F. Dore, August 23, 2011).

In addition to parents wanting better for their children, this shift away from an agricultural livelihood also stems from the fact that farming is seen as degrading and as a poor way to make a living:

You find that, here, agriculture got a stigma attached to it. It's like if you into agriculture people look at you - it's because you can't read. Now it kinda changing now because government finished with the sugar and then

government doesn't want to have the burden to try to employ everybody so they're trying to push agriculture. They're trying to push it now. But really, its agriculture has a stigma with it that you're uneducated. I remember a time Jerome (*former director of agriculture*) asked me what caused me to do farming. I said, I told him, don't think I can't read. I have 8 whole levels. I'm doing farming because I choose to do farming. Just like that (Kerry Dore, farmer interview, November 27, 2010).

(*Kerry Dore: People keep telling me that young people in St. Kitts don't want to work. Do you find there is a disconnect between the older and younger people?*) Yeah, like a gap between generations. (*Does this have to do with the end of sugar? Well, not really, because people stopped doing sugar well before it ended, when they didn't have to do it anymore...*) It was looked on as degrading. Like now, I know, even though I work for the department, I've got a contract with Ross University to carry some grass for the animals. And it's like, 'boy, is that what it come to now? You gotta carry grass?' Like it's low (Kerry Dore, farmer interview, February 7, 2011).

Farmers also cite modernization as a reason why the country has seen such a dramatic shift away from agriculture:

(*Kerry Dore: But there's still a lot of people working in farming.*) A lot of people working in farming, but from when we gone out, that's going to be the end of it. Very few people are going to be there. (*It does seem that way. What is going to happen in 40 years?*) Because what happened, what is kinda stifling it to me, is our eating habits. We prefer to have it in a package, microwavable...I say in a meeting one time, they asked what is happening, I said, well, the average woman of a house, three four children or whatever, she leave for office, she comes home, she put her bag on the kitchen counter, she goes to the freezer, gets something that is microwavable, pop it in there, heats it, goes in to change her clothes, she comes out and she share food. Or she comes home with her bag full of Chinese, KFC, or take out. (*That's happening all over the world, that's happening in the US.*) Yes! Yeah, I know! And that's it. That is modernization. And that is killing the farming (Kerry Dore, farmer interview, November 12, 2010).

(After a discussion about marketing and high food imports...) I think what happen, too, the education level in St. Kitts rise that high, so farming kinda, this younger generation look down (*Kerry Dore: look down on farmers?*) Yes. So they don't want to have any interest. Cause my children them here? I go to the farm to pull peanuts – they watching me – they won't come! They don't want to put their hand in the dirt. We came up in that, so we know the value. (*So what's going to happen in forty*

years?) Good. (*Who is going to do farming here?*) It's going to slide out of our hands. Because look at some Jamaicans coming in, Guyanese especially, and you see how their little ones, they doing every little thing, they working in they farm. We here, we not doing it. Now, I don't know how to set up that (pointing to the computer). Can't start it. But the little one you see he got here, he can come and he can do everything. (Laughing.) (Kerry Dore, farmer interview, July 15, 2011).

Despite these trends, when confronted with questions about problems with youth, finding labor, and the status of farming, some farmers are quick to point out that recent years have seen an increase in youth involvement in farming:

(Speaking to one of the founders of the Sandy Point Farmers Cooperative during the Saturday market) This market was dead for like ten years. No vegetables, nothing growing. The majority of these farmers, I'm the oldest. I'm about 40. And the rest of the fellas are younger. Much younger! In their twenties. (*Which is great, because that's not really happening in St. Kitts.*) Yeah you'll meet the farmers, they're much older. (*Something is drawing in the younger people here.*) What we are trying to do is, we realize that there was a gap between the older farmers and bringing up young fellas to continue. So, I don't know what can be done to initiate younger farmers to take over. (*Well, something you are doing here is working better than everywhere else, so what do you think it is?*) Well, what we are doing, as young farmers here, we are incorporating the school. The high school. So, what we, for example, we have a summer camp, a after school program, but we getting problems with the after school program because some parents see us as, we are seeing the negative affects (stereotypes) of Rasta. But we are working around that. So we are planning a summer camp with the high school, to get even 25-30 students to come out, in the summer, if it could be every day or every weekend, to come on the farms, and get training, doing a little employment. There are not much things for the school children to do. So we are trying to introduce it so that will help us also to spring up some young farmers who will carry on. So we are trying to infiltrate the high school, Sandy Point High School, and encourage them to come on our farms and get the practical experience. What we decided as a group to do was to never let what happened to our grandfathers happen to us. Like all of us get old, we can't farm, and no one else farming. (*So that happened to your grandfathers?*) To this community. In this area, you can't count ten farmers at the older stage farming over two acres. What we decide, what I decide and I try to tell the other young fellas in the group with me – we cannot be cannot be farming like our fathers and our grandfathers, like no rain coming so, we gotta change the whole idea, so we can supply the

market constantly, you know? (Kerry Dore, farmer interview, February 7, 2011).

(Kerry Dore: When did you notice people more people start complaining about monkeys?) It's getting more because more people are doing farming and the monkey population is getting bigger. Cause you know normally once ago in me young days I normally like see two old man come up from up mountain or two old ladies, but not now. A lot a young people now doing farming, a lot a people into farming. *(I'm really happy to hear that because a lot of people say the opposite, like, not enough young people are getting into farming.)* It is more than before, but a lot a young people supposed to get more involved. Because normally when I hear about farming, normally it be old people, but not now. Even people who used to teach – I know a fella up Newton Ground who used to be a teacher – he give up his teaching and doing farming. You know? Couldn't find that in the long time days ago. We need more young people to get involved but we have more young people than years before (Kerry Dore, farmer interview, May 9).

(Kerry Dore: People keep telling me that young people in St. Kitts don't want to work. Do you think this is true? Why is this?) I say some wanna work, some don't wanna work. I guess about 50/50? But I guess anywhere you go in the world, people might say the same thing, that young people don't want to work. But you gotta know what young people like and give them to do. *(Like what kinds of things?)* Well to me a lot of young people sound like they want to farm; a lot a them mentioning farming (Kerry Dore, farmer interview, May 16, 2011).

Additionally, in an earlier quote regarding marketing, a farmer pointed out that there is so much more produce on the market now, and most of it comes from younger farmers:

“And the good thing about that high productivity is that a lot of de young fellas, a lot of the production be done by de young fellas. I understand a lot of de young fellas in the country, they're really producing. They're really doing that, they're full timers. That's what's occupying their attention” (Kerry Dore, farmer interview, May 27).

To conclude, broadly speaking, St. Kitts has seen a decrease in interest in agricultural work, and in part, this can be attributed to the older generation's discouragement of this way of life. Due to the fact that agriculture was the primary

means of employment on the island for hundreds of years, there are not a significant number of alternative means of employment, so youth uninterested in agriculture are now finding it difficult to find work. However, the ethnographic results show an increase in interest in agriculture on the part of some youth.

Politics There are two, not mutually exclusive aspects of politics in St. Kitts that arose during discussions with farmers. The first is politics in the broad sense – the island’s two political parties, Labour and the People’s Action Movement (PAM). Additionally, two more political parties have recently been created: The National Integrity Party (comprised of former PAM members) and The People’s Labour Party (comprised of former Labour members). The second political theme that arose in farmer interviews and conversations is the underlying politics between farmers themselves, which is sometimes related to the farmers’ membership in a political party.

The ethnographic data collected for this project with regard to politics has to do with farmer’s cooperation (or lack thereof) with one another. Many farmers and members of the agricultural community talk about the fact that farmers do not work together or that they should work together:

(At the opening of the Sandy Point Market) Dr. Harris (Minister of Agriculture) said that to bring solutions we need to work together and pave the sector forward (Kerry Dore, field notes, October 16, 2010).

You know, personally, you know what I think should happen? OK, I’m part of a farmer’s cooperative, and we’re not very active, really. (*Kerry Dore: Is this the St. Kitts Farmer’s Cooperative?*) Yeah. But I think we should come together as cooperative, as farmer’s group, and look at our problem with monkeys being the main one, and see how we could do it *together*, as a group, and not waiting for government. Because when you wait for government, the people in government, they gone get their salary every month, but we’re going to lose our crops, continually. So I think we

should come together and do something *collectively*. I think that's the way to do it (Kerry Dore, farmer interview, March 12, 2011).

I said how the farmers need to come together and she agreed, but said that there is so much fighting going on between the farmers. They won't support someone because he's big Labour, etc. Wow! She said that farmers are nicer to tourists/foreigners than they are to their own. If she and I both opened a shop, they would rather patronize me than her. She said that's just part of their culture, she doesn't know why. She said I should ask others about it because it's true (Kerry Dore, field notes, March 16, 2011).

(Kerry Dore: *What should the future of farming be like in St. Kitts? What's the ideal situation in your opinion?*) Well, in a way, if we could make a change, how I see it right now, the farmers like, a get selfish, and carry a grudge pon one another. You know what I mean by grudge, right? (Yes.) Yeah, I see enough a dem farmer in St. Kitts doing it right now. They ain't wanna see the next one get up, and I going through a lot a that. (*So that's the only thing that you would really like to change?*) Me just wanna see all live together, an stop carry grudge against one another (Kerry Dore, farmer interview, July 29, 2011).

(Kerry Dore: *In a perfect world, you would have sections of the island – this section does tomatoes, and everybody does tomatoes and that's where tomatoes come from. Every week you start a new crop so that every week they're available. And you do that with the next crop.*) Exactly! Exactly! (*But it doesn't work! I didn't realize how well set up everything was to supply food to the Marriott, and how everything fell apart because...*) Continuity of production. (*My data keeps coming back to Kittitians stepping on each other's toes and not working together.*) It's a hard thing to say, but it's a fact. (*Why, though?*) Because there is this *rugged individualism*. If I can do the production of tomatoes fairly good and I got five acres and can make a living out of it, well, to hell with you! You could make little or nothing, I'm going to do mine. I don't want to join you. (*Rugged individualism.*) Rugged individualism! You see all these things I had to kinda factor in while I was running the corporation! (Kerry Dore, interview with William F. Dore, October 2012).

This lack of cooperation plays a role in the marketing issues cited earlier in this chapter – some of the problems with market floods and famines could be resolved by farmer cooperation, and the fact that the market is so volatile contributes to farmers competitiveness with one another:

(One farmer) talked about how she has helped some other farmers by bringing in seeds for them. We talked about the competitiveness between farmers. She said she wants more cooperation, but they don't want it. They're competitive. We brought up how marketing is the biggest problem, and discussed the fact that perhaps this is why farmers aren't working together – they feel that they need to compete with each other in the market (Kerry Dore, field notes, April 4, 2011).

The existence of the St. Kitts Farmers Cooperative is evidence that some farmers do work together and they are not all completely individualistic. It is not the only cooperative on the island. There are at least three more cooperatives in St. Kitts, the Sandy Point Farmers Cooperative (which has already been mentioned in the context of its market and generation of youth interest in farming), the Fahies Women's Cooperative, and the Gideon Force farmers. The Fahies Women's Cooperative is a group of women farming in Fahies land settlement. They meet approximately once a month in a building on the old estate. They go to agro-processing workshops together and make things like guava cheese and guava jelly fruit juices and wines and sell them at agricultural events such as "Eat Local Day" and the annual Agricultural "Open Day." Additionally, they talk to each other about managing their farms:

(One of the questions I wanted to ask you, in terms of managing your farm, I know you're part of the Fahies Women's Group and also part of the St. Kitts Farmers Cooperative. Does that help? Do you get together and talk about how to manage your farm in the best way, and share ideas?) In the women's group, we tend to normally have a meeting and after the meeting is finished we will just sit around and, you know, discuss what's going on on our farm and them kinda thing (Kerry Dore, interview with member of Fahies Women's Group, November 27, 2010).

The Gideon Force farmers are a group of Rasta men working together in Old Road. They have a few older leaders, but the group is primarily comprised of young men. One of its members explained that this group was formed by its young members' desire to attend to

the Rastafarian concept of farming, and that the older farmers went through the more formal government processes in order to secure their place on their land:

(Kerry Dore: Why did you guys come together as a cooperative?) You know, a lot of the old farmers, they didn't really come up in the time of cooperatives and stuff like that, eh? So, to me, those who are really dealing with cooperatives is the new breed farmers, a new generation, like our group. The older farmers, they don't understand these things so well, so they just stay away from it. They don't work together. They're selfish and singular and small minded. But the new generation, we're trying to push hard to bring a whole new awareness of farming in general. *(What's the history behind the creation of the group? How did you guys, you know, who started it? Did you just know each other from Old Road and decide to form a cooperative?)* Well, what really happen is, it really started with some youngsters who had an idea that, you know, through the Rastafarian concept, the whole Rasta concept is about the fruits of the earth, it's about farming. So, in that respect, the youngsters them didn't really search out the system for work. They said, 'let's just farm the land.' So there was this piece a land and the guy grandparents used to use it for farming, but the grandparents are old, so the land was just there and they started it. Because people like me and Ira (another older member of the group) who were older than them, we went through the system and try to get the land, and then we heard about cooperatives because Sankofa (another member of the group) used to work up agriculture (in the agriculture department), so we had meetings and we was told that if we join the cooperatives, the benefits that we would get, so we decided that that was the best direction to go. So that's how we actually end up in this cooperative, you know, and we still there, doing that. Trying to get whatever benefits are available. *(So, two questions. First, it was some of the younger farmers' grandparents who had that land that I would visit, and that's the land that you are now using?)* Right. That's the land that we are using now. *(And the other question is, what were some of the arguments for forming a cooperative? What were the thoughts about what those benefits would be?)* Oh, well, to get access to more land, was one thing, and two, to get means to use the current land that we're using because, you know, over time, government changes and they have different plans for land and different things. So, it was a form of security in terms of using the land and also, the different programs that goes on with agriculture, you know, we might get some seeds, or wire, as a cooperative, but as a single group that is not part of a cooperative, you know, it's kinda hard to get benefits from government. You know, we're part of the cooperatives, and we benefit tremendously from that. That is the main thing. *(So you do think that you have received some benefits because you are a cooperative?)* Yeah, we have benefit a lot (Kerry Dore,

(phone) interview with Melvin Agard, member of the Gideon Force farmers, August 12, 2013).

This point reinforces the argument made earlier that there is concern among farmers about the permanency of their farms on government land. In working together as a cooperative, the Gideon Force farmers are able to secure their place on their piece of government land. This group is unique, because the other cooperatives mentioned are made up of members working on many different individual farms, but the point is that while politics and market volatility have created an individualistic attitude in some farmers, the existence of these farming groups shows an increasing trend of cooperation among St. Kitts farmers.

The Economic Shift to Tourism and Selling/Mortgaging the Land At the end of Chapter Three, it was explained that after the closure of the sugar industry, the economic focus of St. Kitts went from agriculture/sugar production to tourism. As a result of this shift, sections of land have been sold and mortgaged to foreign investors and an economic citizenship program has been created. These trends are considered here as a challenge for farmers because some farmers and members of the agricultural community express concern about these changes and how they might impact their future in farming.

The discourse on the shift to tourism is that this economic priority is unstable compared to agriculture:

Ashton Stanley (then Director of Agriculture) spoke about the Sandy Point Farmers' Cooperative Society Ltd. Previously, you used to have to trade for goods and you would have to find the source of where things were grown. We're now looking to be self-sufficient and have food security and food sovereignty. We can't depend on tourism, but we can benefit from it. What are we going to fall back on? (I think this is such a huge point. What happens if there's a huge thing like Sept 11 and people stop

travelling? He pointed this out directly.) He said that agriculture needs to be the internal engine that must be fueled by the necessary support for the agricultural sector. Next up was Dr. Harris. He started with young people and how great the Sandy Point people were. This building used to be abandoned and how it's being put to good use, the market is there every Saturday. He said that we need to commit to buying local – he said we only remember the farmers when we can't get no peanuts, pumpkin, tannias, etc. He talked about world hunger and the issues in Pakistan and Haiti. He said that poverty is not as bad here, but one hungry person is one too many. He said that we welcome tourism, but that it is *not ours*, that they take their money elsewhere and live the good life they deserve. You know that the farming community is *yours*. (Kerry Dore, field notes, opening of Sandy Point Market, October 16, 2010, emphasis added).

The farmer was saying that you *have to eat* – why would you only focus on tourism? We talked about how much food we import – they said I should watch on Monday at 2 when the ship from Dominica comes in. (Another farmer) said I can see all the food we're paying for that we can grow ourselves (Kerry Dore, field notes, January 16, 2011).

I don't think those in authority take this agriculture serious. Because, for example, suppose we happen to have a storm, or they have a crisis where plane can't come and boat can't come, how you gonna feed the people? And we have such beautiful soil (Kerry Dore, farmer interview, January 23, 2011).

Despite these concerns by some farmers, the economic focus of the St. Kitts government at this time is on tourism and associated development (confirmed by their plans for future land use, seen in Figure 15). Three recent development projects serve as examples: Kittitian Hill, Christophe Harbour, and Whitegate. Kittitian Hill (<http://www.kittitianhill.com/>) has been discussed in the context of Belmont farmers that were moved out of that area (Willard's Mountain) and promised money for fruit trees. Another large piece of Kittitian land on the southeast peninsula has been sold to another developer, Kiawah Partners, who are building an extensive marina and housing development project called Christophe Harbour (<http://www.christopheharbour.com/>). Reference to the sale of lands for Christophe Harbour is made in a quote cited previously

in the context of issues with land ownership and uncertainty about the future, when a farmer says: “All de salt pond sold away, it’s foolishness!” (Kerry Dore, farmer interview, July 3, 2011). The salt pond is at the end of the southeast peninsula and will be used for the marina. The land for the Kittitian Hill development was formerly government land, while the land for Christophe Harbor was privately owned and sold by individual owners (the land on the southeast peninsula was never government owned and was never used substantially for agriculture).

The purpose of a third development project, known as Whitegate, is more enigmatic. Whitegate is a huge section of land that covers much of the northern end of the island, including Kittitian Hill. One portion of this was set aside for a golf course called La Vallee. Throughout the course of the study, references to this section of the island were vague and anecdotal:

We went to find (a farmer) at work at the Cranstoun Estate, on the side of the road closer to the water. We had to walk all the way in because the gate was locked because the gateman was at lunch! (The extension officer) pointed out a generator and said it was almost as powerful as the ones in town. He said it was there because of a failed foreign investment project. They were going to build the La Vallee Golf Course. (The extension officer) pointed out Whitegate, in between Sandy Point and Dieppe Bay as another failed project. They were going to build a marina and hotel there (Kerry Dore, field notes, September 6, 2010).

(A member of the Sandy Point Farmers Cooperative) explained how the building used to be a slaughter house, but that it was replaced by the abattoir downtown, which had better tools and safety precautions. They hope to sell local meat there at some point. The goal is to have the market be all local, to return Sandy Point to the farming community it once was. He pointed out the La Vallee area and how farmers were moved out for the golf course, yet nothing has been done there. We can’t get nearly as much out of that land as a golf course as we could as agricultural land! (Kerry Dore, field notes from the opening of the Sandy Point Market, October 16, 2010).

Lindsay Grant, the leader of the PAM party, was on the radio talking about the government's problems. He pointed out La Vallee and how nobody knows where the hundreds of millions of dollars went (Kerry Dore, field notes, November 3, 2010).

We talked about big projects where nothing has happened, and I brought up La Vallee. He pointed out how it must have cost hundreds of thousands of dollars to build the fence surrounding that property (the tall green panels) – and for what? (Kerry Dore, field notes, March 20, 2011).

Official documentation on the Whitegate Development Project can be found here:

<http://whitegatedevelopment.com/index.cfm>, where it is explained that the purpose of the project is to “regenerate and attract new development to the Whitegate area, that includes the communities of Newton Ground, St. Paul’s, Dieppe Bay, Parsons, Saddlers, Harris, and Belle Vue.” The website states that: “the government of St. Kitts and Nevis has designated Whitegate as a growth area. This means more houses, more jobs, more income, more facilities and more opportunities.” The master plan, obtained from this website, goes on to explain: “the project has a pivotal role to play in the sustainable development of St. Kitts and Nevis,” and its “vision...is grounded in the belief that development should lead to long-term people empowerment...The Master Plan sets forth the proposed phasing of the project. Phase 1 identifies the areas that have been allocated to Beaumont Park Horse Race and Grey Hound Track, Beaumont Estate Villa Subdivision and Kittitian Hill Golf Course and Resort Development. Phases II and III broadly identify areas for future resort development. Additionally, provision has been made for the establishment of a 1,000 acre agricultural preserve which would also function as a green belt and buffer for existing communities and development areas.” Thus, while farmers argue that Whitegate and La Vallee land should be used for agriculture, the master plan for this development project explains that it does intend to

preserve areas for agriculture. In addition, as can be seen in the published documents found online, the project has plans for historic preservation and conservation, social development, sports and cultural development and infrastructure development.

Dr. Frank Ervin, of the Behavioural Science Foundation, who has lived and worked in St. Kitts since the 1960s, explains more of the history of Whitegate:

(Kerry Dore: Can you explain to me – so, all the planters got together for the most part, sold the land to the government. This is when the lands were nationalized. And then since then – can you explain to me about La Valley or Whitegate?) Whitegate grew out of a fantasy of a British development firm that built apparently an island in the Thames off the city (the city of London). It's called Whitegate, that's where the name came from. This development team was either recruited or made a proposition to the government that they would like to develop the northern end of the island, which would include, among other things, a dock at the Golden Lemon for a catamaran to St. Maarten, a golf course over at St. Paul's (La Valley), and others. It was a long time ago. *(Like, 70s, 80s, 90s?)* Nineties, yeah. Nothing has happened. *(They put up the big green fence!)* Right. Exactly. There used to be an old Brit who actually had an office in Dieppe Bay, I think he's died, or gone back to England or something. There is a Whitegate Commission, local persons. *(Yeah, because I just saw some new signs that say "Whitegate: Opportunity for Investment.")* Yeah, I saw the new sign. So the commission: I, for example, would like to buy this 1.3 acres across the road from me, mostly for security reasons. So I have to appeal to the Whitegate Commission. *(Because that's Whitegate land?)* Yeah. Whitegate stretches from near black rocks to Newton Ground. *(Was Whitegate land sold?)* No no no! *(So they are still part of government-owned land.)* It's mostly government owned land, I mean, some has been set aside for Kittitian Hill, some has been set aside for housing down at the bottom there. *(And there's the racetrack, too.)* There are several things like that. But no, this mountain land that you know up here where the produce is, that's all government land. Is there a master plan? Well, as it turns out, not clearly. There *was* a master plan, which defined produce areas, housing areas, tourist areas, and there was actually a model in this old guy's office in Dieppe Bay, but you know, it was some architect's fantasy (Kerry Dore, interview with Frank Ervin, March, 2013).

Dr. Ervin also explained that Kittitian Hill was designed primarily as a target for economic citizenship by investment. Citizenship by investment and land for debt

swaps/the mortgaging of the lands are two other topics of concern for some St. Kitts farmers and other Kittitians. Economic citizenship by investment is a program where an investment over a designated dollar amount into development in St. Kitts renders the spender a St. Kitts citizen. When land for debt swaps and/or mortgaging of the land occurs, what is happening is the country of St. Kitts and Nevis is borrowing money and using the land as collateral in order to relieve some of the debt owed to banks. Some Kittitians have expressed concern with economic citizenship and the selling/mortgaging of the land. Debates over land can be seen in local newspapers (*SKN Vibes* and the *St. Kitts-Nevis Observer*).

The situation regarding tourism and the sale/mortgaging of land in St. Kitts is highly complex. What is presented here is *not* exhaustive of this situation. It is important to recognize that while some Kittitian farmers and their fellow countrymen have expressed some concern regarding this issue, many others do not share this view. This work does not explore the significant benefits of these economic activities. The point that is relevant to the nature of this study and its results is that ownership and the future of large portions of St. Kitts land is uncertain.

Discussion

An Ethnoprimateological Engagement with Environmental Anthropology Within anthropology, there has been a debate about whether the differing research trajectories of the biological and cultural sub-fields can be reconciled through a cross-disciplinary approach. On the one hand, one of the hallmarks of the discipline of anthropology is its holistic approach to the study of what it means to be human (Howells, 1952 and Peters-Golden, 2004 in Riley, 2006). In fact, the roots of one branch of biological anthropology, primatology, are situated in social theory of cultural anthropology: Irven DeVore, a graduate student of social anthropology, was the first anthropologist to produce a dissertation on the behavior of free-ranging nonhuman primates (DeVore, 1962 in Riley, 2006). Yet a recent survey of *American Anthropologist* found that only 9.5% of the articles represented substantive collaboration across anthropology's sub-disciplines (Borofsky, 2002). This reflects the historical division between cultural and biological approaches to the study of humanity (and the broader nature/culture divide). Cartmill (1994) argues that this division reflects two competing traditions within anthropology: the objective approach, which seeks to discover causes or laws to explain phenomena and stems from the biological sciences, and the humanistic approach, which seeks to explore more subjective knowledge through interpretation and the search for meaning (in Riley, 2006).

As a combination of primatology and cultural anthropology, ethnoprimateology has been hallmarked as a way to reconcile the sociocultural and biological sub-disciplines within anthropology (Riley, 2006). Indeed, ethnoprimateological research has incorporated many contemporary connections between biological and sociocultural

perspectives. Ethnoprimateology's most notable engagement with cultural anthropology theory is the removal of the barrier between culture and nature (i.e. humans and primates) and its assessment of the symbolic relationships between humans and primates.

Additionally, ethnoprimateologists recognize that perceptions of nature (Sicotte and Uwengeli, 2002) and conservation (Shepard, 2002) can vary dramatically across cultures. Finally, ethnoprimateology incorporates some aspects of environmental anthropology theory (i.e. historical ecology) through its support of the predominantly sociocultural idea that there is no such thing as a "natural environment" (or a "wild" primate) (Riley, 2006).

The inclusion of these important themes from cultural anthropology (more specifically, human-animal and human-environment relationships) within ethnoprimateology adds evidence for why this field can bridge the biological and cultural subfields of anthropology. That said, this thesis illustrates the benefits of an ethnoprimateological engagement with a recent trend within biological and cultural anthropology: the global context that comes from incorporating the tenants of environmental anthropology, more specifically, historical ecology and wider political-economic contexts. Riley (2006) argues that one of the objectives of ethnoprimateological studies is to consider "history and power and the role of power relations in conditioning human-environment interaction" (p 78). Indeed, some ethnoprimateological works have documented how colonialism, market penetration and western intrusion have impacted land use, population size and subsistence strategies at the locations they study and how the power relationships created by these systems (e.g. through conservation and development) impact human-animal material and symbolic relationships (e.g. Sicotte and Uwengeli, 2002; Shepard, 2002; Lizzarralde, 2002). Yet these studies do not directly

address how this history has resulted in heterogeneous power relations and why some ethnoecologies are favored over others, and these factors can play a significant role in the relationship between humans and primates.

Human-animal relationship studies and human-wildlife conflict studies are following the trend within environmental anthropology to incorporate aspects of political ecology. To reiterate, environmental anthropology's political ecology is part of the *second generation* of political ecology, epitomized by the concept of *place*. "(P)lace is *not* the local, *not* globality's *Other* but, rather, *the grounded site of local-global articulation and interaction...*(it is) both locational *and* relational... 'each place is a mixture of wider and more local social relations' (Massey, 1993: 67 in Biersack, 2006: 16). Mullin (1999) explains how political ecology is being incorporated into human-animal relationship studies. Indeed, the categories of human and animal and nature and culture are no longer seen as dichotomous, but "the trend has been to pay greater attention to how such categories might vary in their construction and deployment, change over time, and be related to systems of power, inequality and value making" (Mullin, 1999: 208). Anthropological human-wildlife conflict studies also incorporate aspects of political ecology. Conflicts with wildlife are vehicles for social aggregation and division; therefore, pestilence discourses can constitute or reinforce in-group boundaries. To understand the human players in this conflict, we must see them in dynamic terms, meaning "the 'people' of people-wildlife conflict ceases to be given a fixed category, but emerges in a complex *process* of conflict that may well span local, national and international levels" (Knight, 2000a: 22).

Ethnoprimateology has yet to fully engage the trend within human-environment, human-animal, and anthropological human-wildlife conflict studies to incorporate these aspects of political ecology. One example, though not explicitly ethnoprimateological, points to the benefit of an ethnoprimateological engagement with wider political-economic systems. In a recent review of ethnoprimateology, the ongoing work by Hardin, Remis and Jost-Robinson (Hardin and Remis, 2006; Jost-Robinson et al., 2011; Jost-Robinson and Remis, 2012; Remis, 2000; Remis and Hardin, 2007; Remis and Hardin, 2009) has been called “one of the most successful at truly assimilating significant methodological and theoretical contributions from sociocultural anthropology, primatology and human-animal studies and applying them to local management and conservation issues and to larger intellectual debates” (Fuentes, 2012: 109).

Hardin and Remis (2006) combine information and interpretation from biological and cultural anthropology to better understand the interactions between human and non-human primates in the Dzanga-Ndoki Park and Dzanga-Sangha Forest Reserve (RDS) in the Central African Republic. Combining biological and anthropological perspectives provides insight into three aspects of forest change: changing human perceptions and uses of the forest, spatially varied human and animal adaptations to habitat change and a decline in animal densities in the research area. The initially distinct biological approach to this project was advocating for animals against human encroachment, while the initially distinct cultural anthropology approach was advocacy for forest-dwelling humans against conservationist and other regional and global actors. In describing their separate subfield histories, the authors explain that recent cultural anthropology of hunters and gatherers “focuses increasingly on changing economies through colonization,

migration, state formation and global trade” (p 274). They explain how biological anthropologists are increasingly paying attention to dynamic human-animal relationships within the field of ethnoprimateology, but that the perspectives of this field are still primarily within the domain of cultural anthropology:

Perhaps most directly relevant to our work together is the emerging domain of ethnoprimateology (Cormier, 2003; Sponsel, 1997; Wheatley, 1999). In practice, however, few contemporary biological anthropologists or ecologists have joined forces with ethnographers to create biocultural field research programs that capture important trends at smaller scales over time (p 275).

A full engagement with biological and cultural anthropology theories and methods led Hardin and Remis (2006) to a number of important conclusions. First, they documented that the presence or absence of logging can affect game depletion; the mere prospecting for timber provokes dramatic decreases in wildlife populations as a result of the road networks and human traffic. They have also found that the professionalized practices of conservation that have been integrated into this geographic region reward some actors but relegate others to marginal areas where they must compete with other economies and land uses (such as logging and commercial hunting) (i.e. some ethnoecologies are favored over others). At RDS, the different activities of logging and conservation hang in balance. In some locations, logging permits uncontrolled forest access. In other locations, conservation activities alienate local people from the forest (except primarily men who are associated with tourism and research practices). In locations where both logging and conservation are present, local people can seize short-term economic opportunities through the bushmeat trade, but they risk the depletion of wildlife populations and the remarkable variety of forest practices related to their relationship with these animals.

The collaborative fieldwork by Hardin and Remis (2006) provides evidence of “remarkable adaptations by both animals and humans of the gendered dimensions of changing forest use and of the important cultural and ecological differences that economic activities such as logging and conservation can create within a single complex ecosystem” (p 282). Work like this shows that local people can be both “victims and perpetrators of contemporary environmental change” and that their responses can “both shape and reflect the animals around them” (ibid).

Incorporating the Human-Environment Relationship This chapter has shown that the major issue at hand in “the monkey problem” is conflict over land ownership and associated power. To date, studies of this issue in St. Kitts have been within the theoretical constructs of political economy and ecological anthropology. Thus, they have concluded that the colonial history of St. Kitts shifted the power to Europe and left the island in an impoverished state full of underdeveloped, landless, individualistic people with no ties or commitment to their land or to their future in agriculture. Kittitians’ individualism, underspecialization and migration tendencies have been adaptations that have allowed them to survive and endure these conditions left by the colonial state. Under these conditions, Kittitian citizens have never had the power to define what is serious and what should be listened to.

Analyzing the ethnographic data from this chapter within a *place*-based environmental anthropology approach (Biersack, 2006) means tending to the differences in power created by colonialism, but moving away from vertical, binaristic political economy, world-systems theory and Marxist approaches and toward an approach that acknowledges group heterogeneity and manifold constructions of nature that fall

somewhere between the global and the local. Despite continuous attempts, a diversified agriculture has never existed in St. Kitts' colonial history. This situation has decreased the fertility of the island's soil, left the country with massive food imports and debts, and created a situation where most farmers are "landless" and the government has significant power over the future of this land. The discourse in the ethnographic data presented in this chapter shows how this global force is reflected locally, and heterogeneously, among Kittitian farmers and the government. In some instances, Kittitian farmers construct an environment that accords with a vertical, hierarchical global perspective: where the government has all the power, where investment in one's farm is futile due to an uncertain future on the land, where those who work the land are only in it for themselves, and where there is no future in farming because the island's colonial history has stripped the Kittitian farmer of a connection to his/her land and power over his/her future. However, this work shows that in other instances, Kittitian farmers construct an environment laced with history and connections to specific plots of land, where the youth represent the future of farming, where cooperation among farmers helps secure one's place on government-owned land, and where the sale and mortgaging of St. Kitts land is cause for concern.

This study also shows heterogeneity in human-environment relationships within the St. Kitts government. Debates in newspapers show that land ownership discourse plays a major role in the island's current political debates. Opinions vary both within and between political parties regarding whether the future of Kittitian land should focus on tourism and development or agriculture and individual land ownership. In other words,

those in positions of power in St. Kitts are highly differentiated with regard to the future of the land.

This place-based approach shows that human-animal conflict in St. Kitts is a reflection of human-environment issues. In addition to the struggle over crop damage by animals, there is another environmental struggle: the struggle over the future of St. Kitts land. Like Moore (1996), this study attends to the meaningful in these struggles and the contestations that constitute these struggles. In both cases, the contestations are created by discourse. The discourse on crop damage by animals is that the government should be doing more to help. This discourse constructs a reality full of meaning, highlighting the unequal distribution of power present in St. Kitts. This work argues that one of the reasons why farmers struggle to control crop damage by animals is because they lack the power of land ownership and its associated privileges, such as living on the land. Again, whether they *should* live on the land is another (very complicated) question entirely, and not relevant to the results of this work.

The discourse on the future of St. Kitts' land on the part of some Kittitians and members of government is that the current government has replaced the plantocracy and refuses to empower locals through land ownership. Like Moore (1996), these micro politics unravel how competing claims to resources are articulated through cultural idioms in the charged contests of local politics. Here, some Kittitians are evoking the memory of their slave roots and marginalized history. This discourse constructs an undifferentiated state, making it "a theatre in which resources, property rights, and authority are struggled over" (Watts, 1989: 4 in Moore, 1996: 133).

Expanding the human-animal relationship that constitutes “the monkey problem” in St. Kitts to the global and local human-environment relationship that comes from an engagement with historical ecology and the broader political-economic context allows for a more in-depth understanding of the role monkeys play in Kittitian culture. Chapter Three explains how land use changes that occurred in 2005 play a significant role in the symbolic relationship between humans and vervet monkeys in St. Kitts. Monkeys’ physical similarity to humans is a big part of this human-animal relationship, but the reason the monkeys’ appearance has recently become apparent is because of significant changes to the landscape. Land use changes of this scale would not have been possible were it not for the fact that the sugar industry dominated the island’s land for hundreds of years and the power over the future of almost all of the sugar lands has recently changed hands.

Additionally, Chapter Three explains how, in St. Kitts, conflict between farmers and the government is being projected onto wildlife. The ethnographic data presented in this chapter support Knight’s (2000a) assessment that when human conflicts with wildlife are informed by people-state conflict, it is often the result of a feeling of vulnerability and/or marginality on the part of local people. In this case, it is argued that the lack of land ownership on the part of Kittitian farmers, the result of the historical unequal distribution of power, is responsible for these feelings.

This study shows that the relationship between humans and their environments, outside of the primates in them, can play a significant role in the relationship between humans and primates. Through the lens of historical ecology, Chapter Three addresses how the temporal and spatial dimensions of the human-environment relationship in St.

Kitts are revealed in the landscape. The historic and academic sources show the significant role the sugar industry has played in the St. Kitts landscape as well as the uncertain future of St. Kitts' land. Engaging broader political-economic systems within this investigation provides more details with regard to the cultural dimension of the human-environment relationship in St. Kitts. The history of the island is such that the ethnoecologies of those in power (i.e. the planters and the government) have been favored over the smallholding farmer. This history has created a situation where most Kittitian farmers are "landless." This unique relationship to the land affects "the monkey problem" because farmers lack the permanency necessary to properly manage and protect their farm and the security required by many farmers to heavily invest in the future of their farm. In sum, this study shows that a full understanding of the dynamic "monkey problem" in St. Kitts requires an understanding of the island's broader human-environment conflict and how it has been shaped by the continuous interplay of history, culture and power.

CHAPTER 5: CONCLUSION

This work demonstrates the benefits of investigating an environmental problem from the perspective of multiple disciplines. Chapters Two, Three and Four could stand independently, but as a whole, they provide a holistic understanding of this compelling and dynamic issue. Through this multi-disciplinary approach, this work shows that conflict between vervet monkeys and farmers in St. Kitts is inextricably linked to the former sugar industry and the unstable and uncertain relationship to the environment that it has created. In this chapter, the results of this work are summarized, and practical recommendations for the management of “the monkey problem” in St. Kitts are presented by engaging the more applied components of these disciplines.

Summary

The primatological component of this analysis reveals the predictable nature of vervet monkey crop-raiding behavior in the current landscape of St. Kitts. The predictive model generated in this stage of analysis was generated through a number of unique methods that have broad applicability. The model utilizes extensive GIS and GPS technology, techniques that are increasingly being used to ask spatial questions in primatology. The grid system, adapted from Sitati et al. (2003) can also be used widely, in any geographic area and at any appropriate scale to evaluate any human-animal relationships with a spatial component. Additionally, this project is the first to apply hierarchical linear models and hierarchical general linear models to primate crop raiding. These statistical models allow data to be analyzed at very fine spatial scales and also to be aggregated to higher levels without problems with statistical fallacies.

This study tests the generality of primate crop damage across continents by including environmental predictors and testing hypotheses on the likelihood and severity of crop loss based on previous studies of primate crop-raiding in Africa and Asia. These studies show that farms are more vulnerable to primate crop damage when they are closer to the forest boundary, further from roads, have fewer neighboring farms, when farmers spend less time guarding their crops, when preferred crops are grown and when there is less alternative food available in the monkey's environment. This study also tests the impact of distance to water sources (based on the importance of this variable in elephant crop raiding (Sitati et al., 2003) and evidence of its importance to St. Kitts vervet monkeys (McGuire et al., 1974)) and the number of months with crops planted on St. Kitts vervet monkey crop raiding.

While it is not possible to determine the exact nature of the relationships between these variables and a farm's likelihood of experiencing crop damage because of the large number of interaction terms, the first predictive model (stage 1) shows that all of the variables investigated except distance to road and number of months with crops planted in the non-mango season affect a farm's likelihood of experiencing damage (mango season, distance to the forest boundary, distance to water, crop preference, number of neighboring farms, the farmer's guarding behavior, and how often the farmer plants crops in the mango season). The second predictive model (stage 2) shows that, for farms predicted to receive damage, crop preference, the number of months with crops planted (in the non-mango season (September to April)) and mango season affect the degree of crop damage. Generally speaking, these results support hypotheses five (farms will be more vulnerable to primate crop damage when they contain crops preferred by monkeys)

and six (farms will be more vulnerable to primate crop damage when there is less alternative food available), but not hypothesis nine (farms will be more vulnerable to primate crop damage when they have crops planted during more months of the non-mango season). This work shows that the more often a farmer plant crops in the non-mango season (from September-April), the more likely he/she is to receive monkey crop damage during the mango season (May-August). These results indicate that if farmers plant more crops, and are therefore on their farms more often in the non-mango season, they are less susceptible to crop damage, especially in the mango season. This is the time when the monkeys can afford to be choosier in what they raid. This indicates that during the mango season, monkeys are less likely to raid farms that had more crops planted, and thus had an associated active farmer presence, during the longer non-mango season.

In order to understand the impact that these raiding patterns have on Kittitian farmers' perception of vervet monkeys, the second stage of this project analyzes conflict between farmers and monkeys from an ethnoprimate perspective, viewing these humans and primates as interconnected. The ethnographic methods employed for this stage of analysis generated extensive qualitative data. It is through conversations with Kittitian farmers and members of the agricultural community that the importance of the historical and political components of "the monkey problem" became clear. These conversations elucidated the inextricable relationship between "the monkey problem" and the sugar industry.

This work shows that the sugar industry influences the level of interactions between humans and monkeys, the cultural conceptualizations of vervet monkeys, and the unique nature of pestilence discourse on monkeys in St. Kitts. More specifically,

before the sugar industry closed in 2005, the location of smallholding farms and, thus, the interactions between farmers and monkeys occurred almost exclusively at the forest/farm boundary above the cane apron that covered virtually all of the arable land on the island. The ethnographic, historical and academic data show that due to these limited interactions, cultural conceptualizations of monkeys pre-2005 were twofold: they were *pests* to the small group of smallholding farmers and *food* to the majority of Kittitians living in the lowlands.

Post-2005, vervet monkeys are now found all over St. Kitts, including in the agricultural areas, in villages, along the water, and in the capitol city of Basseterre. Thus, the level of interaction between farmers (and other Kittitians) and monkeys has drastically increased. The new cultural conceptualization of vervet monkeys in St. Kitts is that of *boundary crosser*. Monkeys are boundary-crossers in two ways: they transgress the forest/farm boundary, and, due to their increased visibility, monkeys are boundary-crossers in their human-like behavior, blurring the line between human and animal. This has led to a decrease in monkey consumption because some Kittitians feel it is wrong to eat something that looks and acts so much a human being.

Monkeys are one of four main pests in St. Kitts. Farmers also have to contend with human, pig and livestock (cows, goats and sheep) crop pests. While this study documented significant levels of crop damage by these pests, the ethnographic data show that these problems with animals reflect farmers' issues with the St. Kitts State (Government). Farmers complain about the government, and its lack of support for farmers (in overall concern and with infrastructure, like tractors, marketing, seeds and water), more than they complain about issues with animals. Additionally, regardless of

the crop pest (human, monkey, pig or livestock), farmers expect the government to resolve the issue.

Discussions with farmers about the specific nature of these crop pests reveal that the pestilence discourse around monkeys is unique. Farmers recognize that monkeys no longer have the food they need to survive in the mountain due to the aforementioned changes associated with the sugar industry. Monkeys are also unique pests because they are “natural” animals without owners who are accountable for them. Finally, monkeys are unique because of farmers’ newfound understanding of their intelligence. Conflict with monkeys is exacerbated because the animals are expected to behave with human manners in their crop raiding. The monkeys’ intelligence means that while human thieves can be prevented with government-issued ID cards for legitimate farmers, and pig and livestock damage can be prevented with fencing, nothing can stop monkey damage except controlling their populations.

These results have implications for the first stage of analysis. Conversations with Kittitian farmers reveal that the severity of crop damage by vervet monkeys plays a greater role in farmers’ perceptions of monkeys than does the likelihood of their crop damage. While no farmer wants to experience crop damage from vervet monkeys, they recognize that these animals need to eat, too. They understand the important role of the temporal nature of the landscape: animals can no longer find the food they need in the mountain, as fruit trees have not been replanted and those that still exist are no longer being maintained because farmers no longer work in these areas after the closure of the sugar industry. The severity of crop damage is what is most important with regard to farmers’ negative perceptions of vervet monkeys. Many farmers explained that it is not

the act of crop damage by monkeys that is frustrating; it is their wasteful behavior and the volume of crops they destroy.

In addition to primatology, these findings are relevant to five other areas related to ethnoprimateology: the nature-culture divide, human-animal studies, human-primate studies, human-wildlife conflict, and historical ecology. This thesis argues that ethnoprimateology engages the nature-culture divide, human-animal studies and human-primate studies more than human-wildlife conflict and historical ecology. The work presented here illustrates the benefits of a fuller engagement with human-wildlife conflict and historical ecology. Applying the perspectives of anthropological investigations of human-wildlife conflict to “the monkey problem” shows the relevance and importance of structuralist theory and the symbolic dimension of primate pests. The vervet monkeys of St. Kitts are “matter out of place” (Douglas, 1966) because they are “natural” animals in “cultural” (agricultural) places. Vervet monkeys’ transgression of the forest/farm and human/animal boundary has made them anomalous and increasingly dangerous animals. Yet, Kittitian farmers understand that the monkeys have come to the lowlands in search of food due to the ramifications of the closure of the sugar industry. This supports Knight’s (1999) call for the integration of local variation and history into symbolism: the monkeys’ mobility is constitutive of St. Kitts’ new, inclusive spatial domain, one without sugar industry infrastructure dominating the landscape and keeping monkeys in the mountain. Finally, in the context of anthropological theory on human-wildlife conflict, this work argues that conflict with the St. Kitts state (government) is being projected onto wildlife (monkeys and other pests) as a result of a feeling of vulnerability and/or marginality on the part of some of the farmers.

This study also shows the benefits of a stronger engagement with historical ecology within the field of ethnoprimateology. A number of ethnoprimateological studies demonstrate the importance of the landscape in shaping human-nonhuman primate interconnections. However, most ethnoprimateological investigations focus on how human modification and uses of the land have affected the interface between humans and primates. This study demonstrates that the relationship between humans and their environments, *outside of the primates in them*, play an integral role in the interconnected human-primate system at the foundation of ethnoprimateology. More specifically, in St. Kitts, the former sugar industry plays a significant role in the temporal, spatial and cultural dimensions of the landscape. These factors feature prominently in the relationships between Kittitians and vervet monkeys, as prior to 2005, the sugar industry restricted vervet monkey movements and, thus, their interactions with people.

The third stage of analysis in this thesis assesses conflict between Kittitian farmers and vervet monkeys from a broader political-economic context. A core component of this analysis is the concept of *place* (Biersack, 2006). *Place* avoids the vertical approach of world systems and Marxist theory and the two ends of the global-local spectrum. Incorporating this concept means taking into account the global, political forces that have distributed power, but acknowledges that locally these forces have heterogeneous impacts on individuals. Human-animal studies and human-wildlife conflict studies are following the trend of human-environment relationship studies to incorporate these tenets, but to date, ethnoprimateology has not followed suit. Some ethnoprimateological studies have addressed the impacts of colonialism and market penetration on human-animal relationships, but these studies do not directly address how

this history has resulted in heterogeneous power relations and why some ethnoecologies are favored over others.

Incorporating the broader political-economic context within this investigation clarifies one of the historical ecology results from the second stage of analysis: that the future of significant portions of Kittitian land is uncertain. St. Kitts' colonial history has made it possible that the government controls significant portions of the country's land leaving most Kittitian farmers are "landless." The island was so successful in growing sugar that European planters owned the vast majority of the land until 1976 when this ownership was transferred to the government.

Analyzing the ethnographic data from this third stage of analysis within a place-based approach (Biersack, 2006) shows that the colonial forces that have created an unequal distribution of power in St. Kitts are reflected locally, and heterogeneously, among Kittitian farmers and the St. Kitts Government. Sometimes, Kittitian farmers construct an environment that accords with the findings of previous political economy and ecological anthropology investigations, where the island's colonial history has stripped the Kittitian farmer of a connection to his/her land and power over his/her future. In other instances, however, Kittitian farmers construct an environment laced with connections to the land and significant concerns about its future. And, while the government has the power over the future of the land, media discourse shows that they are highly differentiated with regard to its future.

Thus, in addition to the struggle over crop damage by animals, there is another environmental struggle in St. Kitts: the struggle over the future of the land. This situation plays a significant role in "the monkey problem." It constructs an

undifferentiated state, making it “a theatre in which resources, property rights, and authority are struggled over” (Watts, 1989: 4 in Moore, 1996: 133). Because farmers lack the power of land ownership and associated privileges, such as living on the land, their issues, such as those with animals, can be projected onto the government.

Expanding the human-animal relationship that constitutes “the monkey problem” in St. Kitts to the global and local human-environment relationship that comes from an engagement with the second generation of political ecology allows for a more in-depth understanding of the role monkeys play in Kittitian culture. While the ethnoprimateological approach utilized in the second stage of analysis was revealing, the third level of analysis shows that many of these findings are the result of the county’s political history. The interactions between humans and monkeys, which have significantly impacted Kittitians’ cultural conceptualizations of these animals, are the result of significant land use changes that have occurred as a result of this political history: the closure of the sugar industry. Additionally, considering broader political-economic systems helps to clarify how conflict with wildlife is a reflection of conflict with the state (Knight, 2000a). In this case, it is argued that the lack of land ownership on the part of Kittitian farmers, the result of the historical unequal distribution of power, is responsible for feelings of vulnerability and/or marginality on the part of some farmers. Finally, engaging the broader political-economic context within this investigation provides more details with regard to the cultural dimension of the human-environment relationship in St. Kitts. The ethnographic data show that some St. Kitts farmers are concerned about the shift from agriculture to development. From the standpoint of political ecology, the farmers’ inability to control the future of this land is a reflection of

the fact that the ethnoecologies of those in power (i.e. the planters and the government) have been favored over the smallholding farmer.

The tripartite analyses of this thesis draw attention to the benefits of engaging political ecology theory in ethnoprimateological investigations. In other words, this work shows that human-environment relationships can play a significant role in human-primate relationships. Specifically, with regard to the dynamic “monkey problem” in St. Kitts, the problem is complicated by the fact that Kittitian farmers do not own their own land.

Applications

While the results of this investigation have theoretical importance, they also have applied significance. The government of St. Kitts was highly involved in the fieldwork for this project, and they have a vested interest in the project’s results. The most informed recommendations must incorporate the applied components of the literature utilized in the theoretical analysis. These are discussed below, followed by specific recommendations on how these results may be utilized to assist the St. Kitts Government in managing “the monkey problem.”

Primateology, Ethnoprimateology, and Human-Wildlife Conflict Fuentes and Hockings (2010) state: “ethnoprimateological approaches are both a contribution to the core theory and practice of primatology and a powerful tool in our goal of conservation action.” This quote highlights the perspective within primatology and ethnoprimateology that the interconnections between humans and primates are interesting in and of

themselves from an academic standpoint, but they also play an important, applied role. This is the effective conservation of primates. In differentiating between cultural anthropology (or the study of culture in primates) and ethnoprimateology, McGrew (2007) highlights ethnoprimateology's applied focus: "most ethnoprimateology is applied research, especially in the context of ecotourism (Wheatley, 1999) and crop raiding (Paterson and Wallace, 2005)" (p 168). Indeed, primate populations around the world are decreasing, and an ethnoprimateological approach to understanding the diverse array of contexts in which humans and primates share space can significantly contribute to their effective conservation.

The discourse within ethnoprimateology is that humans and primates exist within a shared, integrated ecosystem:

A different kind of intellectual order is now forming, rejecting previous epistemological boundaries, employing a revised primatological practice – an inclusive view that places humans and alloprimates in an integrated, shared, ecological and social space: a space that opens biological anthropology to input from other types of anthropology. That space is ethnoprimateology (Fuentes, 2010: 601).

The idea of a 'human-nonhuman primate community' (Riley 2005), for example, moves beyond the notion of boundaries between humans and nature, and envisions human and nonhuman primates as members of a dynamic ecosystem. By expanding our notion of an ecological community to include humans as part of nature, our understanding of key concepts in community ecology, such as ecological niche and niche separation, are also expanded (Riley, 2006: 77).

Ethnoprimateology, the combining of primatological and anthropological practice and the viewing of humans and other primates as living in integrated and shared ecological and social spaces, is becoming an increasingly popular approach to primate studies in the twenty-first century (Fuentes, 2012: 101).

Ethnoprimateology attempts to integrate the interests and concerns of humans with those of nonhuman primates, and proposes that conservation actions on the behalf of primates need to include this second option; e.g.

conservation measures taken in an ecological framework that includes the human dimension (Fuentes and Wolfe, 2002; Riley, 2007; Sponsel, 1997 in Lee, 2010: 71).

In other words, because humans and primates have been living alongside one another for millennia in some places, we should not view humans and primates (culture and nature) as distinct entities. In both theoretical and applied investigations, we need to conceptualize humans and primates as existing within a singular ecosystem.

The application of ethnoprimate research is most relevant to human-primate conflict situations where appropriate and culturally specific management strategies are needed. Lee and Priston (2005) are often cited with regard to the best strategies for reducing conflict with primates. They provide an extensive list of the advantages and disadvantages of traditional methods of preventing primate crop raiding (fences, dogs, chemical deterrents, playback of alarms, guarding/chasing, noise/bells/shouting, contraception, painting individuals, stones/slingshots/spears and shooting/hunting), and explain that generally, they only have limited success, as “the dexterity, deceptive skills, and intelligence of some primates make containment and control costly, inefficient and ultimately ineffective” (Maples et al., 1976; Strum, 1986; Strum, 1987; Strum, 1994 in Lee and Priston, 2005: 12). In general, raiding is attributed to a cost-benefit scenario whereby the benefits of reduced foraging costs and increased energy balance outweigh the risk of injury in the fields (Strum, 1987; Naughton-Treves, 1998; Forthman Quick and Demment, 1988 in Lee and Priston 2005). The monkey’s perception of risk must be increased to outweigh the benefits of crop raiding if deterrents are to be successful (Lee and Priston, 2005).

Lee and Priston (2005) cite three goals of primate conservation in areas where there are conflicts. First, develop strategies to reduce conflict where it is a genuine problem. This requires an assessment of both the magnitude of the problem and an understanding of how attitudes relate to perceptions and reality. Second, create education programs to promote awareness of the significance of primates, their conservation status, and how humans can help them. Third, initiate local community schemes to increase dialogue and promote positive benefits. Benefits include the conservation of local non-timber forest products, watershed protection and biodiversity. Part of this final point is that revenue generation from wildlife is thought to hold the potential to ameliorate conflict, so primate ecotourism is another means of producing local benefits (Lee and Priston, 2005).

More recently, Lee (2010) states that it is questionable whether any successes have emerged from the neoliberal paradigm of market-driven conservation. Even ecotourism is increasingly unstable when the carbon costs of such tourism are included (e.g. Adams, 2008 in Lee, 2010). Studies of human attitudes toward primates show that indigenous peoples' interactions with primates tend to be predominantly negative in perception and consequence, so perhaps we need to:

(L)isten more and tell less. Unless people can survive alongside primates, and have healthy children with prospects (e.g. de Sherbinin 2008, Redford et al. 2008), then the future is bleak for all of biodiversity. Creating new paradigms for sharing space via the perceptions and perspectives of coexistence embodied by ethnoprimateology, with transparent, overt and sustainable benefits to all, might help effect at least some enduring primate conservation (Lee, 2010: 5).

Hopefully, the values of ethnoprimateology can be utilized to appraise actions and outcomes (and thus critique conservation programs) without the fear of funding loss. The

question remains as to whether ethnoprimateology can change the vision of the human-nonhuman primate continuum as well as that of the people directly affected by primate pests (Lee, 2010), and at this point, “it appears that the human social and economic crises will overwhelm attempts to find sustainable solutions that benefit alloprimates as well as humans (Fuentes, 2012: 109-110).

Like investigations of human-primate conflict, anthropological studies of human-wildlife conflict can be utilized when designing effective management strategies. Understanding the human dimension of wildlife management is important, especially when the culture in question is different from that of the wildlife professional. Knight (2000a) explains that anthropology can document and highlight the existence of local or indigenous knowledge and practices as well as help ensure that wildlife management strategies are culturally compatible with the local context in which they are applied. “By ethnographically documenting local perspectives on wildlife, anthropology provides a cultural contextualization of wildlife that could help achieve a more locally sensitive wildlife management policy” (Breitenmoser, 1998: 288 in Knight, 2000a: 5).

Anthropological investigations of human-wildlife conflict differ from primatological and ethnoprimateological studies by making wildlife management an object of study in its own right, focusing critically on the cultural assumptions underlying it.

The aim is to:

Contextualize and render the reader intelligible the phenomenon of human antagonism towards animals as a step towards reflexively engaging with it. This begins with the conventional anthropological procedure of culturally specifying, and thereby denaturalizing, the object of study – that is, showing the cultural character of ‘natural enemies’ (Knight, 2000a: 24).

As explained at the end of Chapter Three, ethnoprimate work assesses the effects of primate crop raiding on humans as well as an assessment of reality versus perception. However, framed in this broader context, anthropological studies challenge the self-evident status of these conflicts by setting them in their wider social context and analyzing them alongside the cultural symbolism of the animal in question (Knight, 2000a).

There are political ramifications of making wildlife management an object of study. Anthropologists can highlight the existence of local level people-wildlife conflicts by challenging the national domination of the remote peoples they so often study. In some instances, conservation is a form of social domination. In situations where remote peoples are unfairly exposed to assorted environmental risks and dangers, the anthropologist may wear another hat as advocate (Knight, 2000a).

Environmental Anthropology This study engages the theories and methods of historical ecology and political ecology in its investigation of human-wildlife (human-primate) conflict, adding another layer to this problematic relationship: the environmental context in which the conflict occurs. Anthropological human-wildlife conflict studies do not directly address the effect of the physical environment. In ethnoprimate, this environmental context is called the “ecosystem,” and the discourse is that it should be conceptualized as shared space between humans and primates. However, the term “ecosystem” is never explicitly defined in ethnoprimate research. A tradition in Western thought is the premise that there is a “balance of nature,” where a community of species in an ecosystem exists in an equilibrium state. However, over the last thirty

years, there has been a fundamental shift of emphasis in how ecologists conceive of the ecological community. They no longer look for self-contained ecological units that have stable equilibria (de Angelis and Waterhouse, 1987). The equilibrium model has been replaced in anthropology and most of science by a nonequilibrium model. Previously, views of the ecosystem stressed cooperation, social organization, and environmentalism, while individualistic associations, constant disturbance and incessant change characterize the new image of nature (Worster, 1990: 11 in Dove, 2008). By including humans in the ecosystem, ethnoprimateologists have moved beyond the idea that ecosystems exist outside of humans, but whether this “ecosystem” containing humans and nonhuman primates is one that exists in equilibrium (balance) or disequilibrium is not clear.

Historical and political ecology directly address the ecosystem concept.

Historical ecologists use the term *landscape* to situate human behavior and agency in the environment, instead of “ecosystem,” which comes from systems ecology (Balée, 2006). The word “systems” in systems ecology refers specifically to self-regulating systems, i.e. those that exist in an equilibrium state. Balée (2006) explains that utilizing concepts from systems theory was popular earlier in the history of environmental anthropology. Ecological anthropology was an attempt to bring more mathematical rigor to the subject matter by conceiving of human societies as populations having exchanges of energy with other animal and plant populations in ecosystems (Rappaport, 2000). However, systems theory in anthropology, as in ecology, was ahistorical and excluded human agency and intentionality in the landscape (Dove, 2001 and Wolf, 1999 in Biersack, 1999 and Balée, 2006).

Thus, Wolf (1999) argued that environmental anthropology needed to abandon systems theory and become both political and historical ecology to assess changes in relations between human societies and their landscapes. Historical ecology differs from anthropological systems ecology by moving away from a concern with the functionalist adaptations of human behavior to given environmental conditions and steady states of the ecosystem (Wolf, 1999 cited in Biersack, 1999 and Balée, 2006). Human behavior is not simply an adaptation to environmental constraints, nor does it always have a negative effect on the environment:

The behavior of sentient, sapient beings with cultural capacities (do) not just...transform species-rich environments into barrens of low diversity and landscape heterogeneity, which clearly humans can do and have done, but also in certain cases (they) heighten the species diversity of local environments through ongoing resource management practices (Balée, 2006: 81).

This means that relationships between societies and environments are not inherently positive or negative, so landscapes need to be assessed on a case-by-case basis.

Balée (2006) argues that: “applied historical ecology may become the holistic engagement of knowledge from diverse disciplines for the benefit of human societies and selected biota and landscapes” (p 91). This is because the information obtained from a historical ecology approach, which typically incorporates approaches from a number of other disciplines, such as paleoecology and ethnohistory, can supply the reference conditions needed for authenticity of landscape reconstruction for the specific period chosen. The real question becomes political, regarding “who will be privileged in determining the desired time depth (Higgs, 2003; Jones 2004) and the associated state of historical knowledge (Anderson, 2001; Hall 2005) about the landscapes to be restored” (Balée, 2006: 91).

It is at this juncture that political ecology data become important. Like historical ecology, political ecology has rejected the localism of earlier ecologies such as ecological anthropology. Political ecology builds upon a more nuanced understanding of the dynamics of globalization:

The ethnographies of nature that are appropriate in an era of globalization are quite different from Rappaport's ethnography of nature, which was limited to the locality and the immediate region, but they also deviate from a world system perspective in acknowledging the role that grassroots agency and the perceptions, motivations, and values that inform this agency play in human-environment interactions. Human-nature articulations are today forged completely within the transnational spaces of local-global articulations (Biersack, 2006: 25-26).

Biersack (2006) argues that in addition to the relationship between the local and the global, political ecology must also pay attention to the nation-state. The nation-state's intervention in development programs is often quite large, "for the state's capitalizations of nature and development policies set the stage for the local-global articulations that ethnographies of nature concern" (Biersack, 2006: 26).

In order to pursue a place-based political ecology that accommodates the state, the nation, and the nation-state, political ecologists need to decolonize the production of environmental knowledge and develop a critical awareness of their own implications in the dynamics they study. Becoming more reflexive means recognizing that the results of political ecology research have material stakes. While the idea of a constructed, second nature has fueled a debate about whether (first) nature actually exists, Biersack (2006) explains that the idea of no nature, only a constructed nature, has little appeal for most political ecologists, for whom states must be real and material if they are to be fully political. Today's political ecology must address the material stakes of a material world.

It refuses to reduce culture to nature or nature to culture, but operates productively in the space between the two, at the nexus of culture/power/history/nature (Biersack, 2006).

Recommendations The previous section shows that, in a practical sense, recommendations on how to manage “the monkey problem” in St. Kitts can come from seeing vervet monkeys and Kittitians contained within a singular, interconnected ecosystem or they can come from viewing the St. Kitts landscape as the product of a series of historical perturbations with political ramifications. One of the unique aspects of this project is that the monkeys are an invasive species, so they themselves represent a perturbation of the landscape. Because of this, two questions emerge with regard to managing “the monkey problem” in St. Kitts: 1) are the monkeys part of St. Kitts’ ecosystem? And, 2) can “landscape reconstruction” (Balée 2006) reduce conflict with vervet monkeys in St. Kitts?

At the most basic level, interconnections between humans and primates can be distinguished by geography. There are clear zones of sympatry (geographic overlap) in Africa; South, East and Southeast Asia; and South-Central America, where primates have lived for at least the last ten millennia (Fuentes, 2007). Allopatry (lack of geographic overlap) occurs in the rest of the world. The effect of time is also important in characterizing human-primate interconnections, as long-term sympatry involving common usage of habitat can result in a form of “coecology” (Fuentes, 2007: 126) where primates impact human conceptualizations of “nature.” Long-term sympatry can also facilitate distinct patterns of integration and engagement between humans and primates. On the contrary, in areas with less time overlap, especially where overlap is mitigated by

captivity and selective exposure, patterns of strong association and incorporation are not expected to be common (Fuentes, 2007).

Fuentes (2007) organizes human-nonhuman primate interconnections into three broad categories: the wild, the captive, and the in-between. “Wild” interconnections occur in zones of sympatry and “captive” interconnections occur in zones of allopatry where no free-ranging human primates overlap with human zones. Four “in-between” relationships are proposed: primates as prey, primates as pets, primates as social and economic participants in human culture and the special case of macaques at temple sites in Asia.

None of these categories applies to the interconnections between vervet monkeys and Kittitians in St. Kitts. They are not “fully” sympatric, as they have been coexisting for a few hundred years as opposed to millennia. Yet they cannot be considered allopatric, as there is clear overlap in range and evidence presented in this thesis of dynamic cultural conceptualizations of primates on the part of Kittitian farmers.

So are vervet monkeys part of the St. Kitts’ ecosystem? The answer certainly has implications for management, but it is not clear. The real question is: “how long must a species exist in a given environment to no longer be considered invasive?” (Balée, 2006: 90). This is important, as some invasive species may even function as keystone species, and removing invasive species does not necessarily cause the return of an “uninvaded” state (Myers and Basely, 2003 in Balée, 2006: 90). What *is* clear with regard to “the monkey problem” is that the monkeys have been highly successful in the St. Kitts environment. While the exact number of St. Kitts vervet monkeys is currently unknown, the severity of their crop damage and the extent of their range show that their population

is very large, possibly exceeding the island's human population. Thus, from both a practical and ethnical standpoint, *St. Kitts vervet monkeys cannot be eradicated.*

If vervet monkeys cannot be entirely removed from the island of St. Kitts, can the island's landscape be reconstructed in such a way as to reduce conflict? As previously stated, historical ecology can supply the reference conditions needed for authenticity of landscape reconstruction. Utilizing a historical ecology approach, this study has shown that while vervet monkeys have always been crop pests in St. Kitts, the severity of their raiding was significantly lower during the sugar industry. The sugar industry closed for many important reasons, and reopening is not an option; however, *mimicking the land use patterns and human behaviors that existed during the sugar industry might be able to reduce crop damage by vervet monkeys in St. Kitts today.*

Five recommendations can be made that incorporate these two considerations and the results of the three analytical stages of this thesis. These recommendations are based on only a single year of fieldwork in St. Kitts. Further study is required on the feasibility and practicality of these recommendations.

First, farms could be located within large plots of land dedicated to agriculture.

This study has shown that the number of neighboring farms and guarding behavior are significant contributors to a farm's likelihood of experiencing crop damage. These factors also play a role in the severity of crop damage, which plays a significant role in farmer's negative perceptions of monkeys. The predictive model of the severity of crop damage shows that active crop planting (and farmer presence) during the non-mango season decreases the likelihood that a farm will experience severe monkey damage during the mango season, when the animals can be choosier in what they raid. If farms existed

in a clumped fashion, there would be more neighbors and more human presence and activity to deter monkeys from entering all year long. Additionally, St. Kitts agricultural history, investigated in Chapters Three and Four, has shown the benefits of this agricultural pattern in St. Kitts, as this was the layout during the sugar industry, when crop damage by monkeys was much less severe. Finally, if more farms were located in fewer areas, then other means of protection (which will be discussed below) could be offered to many farms simultaneously, reducing overall costs and effort.

Second, efforts to control the monkey population could be reinstated. The exact numbers and rates necessary to sustain the island's monkey population at a manageable level is not clear at this point, so part of this recommendation is to *systematically estimate the monkey population*. An effective and systematic way to determine the population size of St. Kitts vervet monkeys would be to place tracking collars on one monkey from as many troops as possible and from as many different habitats and areas of the island as possible (at the very least, on the southeast peninsula, in the interior forest, in agricultural land, along the forest/agriculture boundary, and in the villages). As vervet monkeys are highly territorial, a smaller range will indicate more troops in the area and vice versa. The number of monkeys per troop could be estimated based on previous research (e.g. McGuire, 1974), observations by trappers (watching the animals from a hide), the total number of monkeys trapped, and the number of monkeys seen with hunting cameras (which could be set up at each trap). Population density could then be calculated by dividing the area of each habitat by the average troop range in each habitat to estimate the number of troops in each habitat. Then, one could multiply by the average number of monkeys per troop in each habitat to estimate the total island population size. The

assumptions of this estimate are that ranges and troop sizes will be the same for troops in the same habitat. Estimating population size based on number of troops and average troop sizes would be the most systematic attempt at establishing the true number of vervet monkeys in St. Kitts to date. GPS coordinates for over 20 traps around the island have already been collected, and connections with local trappers have been established. Using the population estimate and the results of this thesis, monkey numbers could be controlled in areas where their populations are the highest and where they are having the greatest impact on agriculture.

Means of monkey control could be shooting and humane trapping. As William F. Dore explained, during the sugar industry, the island was systematically broken down into sections, and each section had a mountain ranger that was in charge of controlling depredations to the crops. These rangers and other laypersons actively hunted monkeys, representing the only source of primate predation on the island other than dogs. As the monkeys have no natural predators, population control is imperative. Coppiner and McGuire (1980) accurately forecasted that the monkey population would increase substantially without this predation. If recommendation number one were to be followed, then farming would exist in large plots, and each of these plots could have a ranger. Regardless of how many monkeys are actually shot, the simple act of hearing gunshots in an area on a regular basis could help keep monkeys away. (There is governmental concern that this practice is too dangerous and that people could be accidentally killed. If the risk is too high, something else that sounds like a gunshot could be used, as it is really the sound that is a deterrent to the monkeys.) With regards to trapping, as previously

explained, the foundation for a systematic trapping program has already been laid. At least a dozen skilled trappers trained in humane trapping already exist in St. Kitts.

The major issue is what to do with the monkeys once they have been shot or trapped. The goal of the trappers is to sell them to the biomedical facilities, as they pay the most (EC175). However, they are not always buying, and often times, they are only buying a specific demographic (e.g. males or females). Currently, the government pays EC60 for a dead monkey, but the trappers would rather get paid three times as much and not have to kill the animal, so they hold out for the biomedical facilities. As trappers watch monkeys more than any other Kittitians, they have an affinity for them, and personal conversations have revealed that they are not willing to consistently trap and kill monkeys to get money from the government.

Monkeys that have been shot or trapped could be used for food. Many Kittitians still eat monkey and would be happy for a local source of protein. However, if this were to occur on a large scale, then efforts to ensure the safety of the meat would need to be initiated. If these measures were put in place, then monkey meat could be used for human consumption as well as for dog food. Protests from animal rights activists would also need to be considered, so this type of program would have to occur without significant advertisement.

Third, investigate the possibility of a sterilization program. Collaboration is currently underway with John Dascanio (VMD, DACT, DAVBP (Equine), Professor of Theriogenology, Ross University, St. Kitts), Jason Johnson (VMD, Assistant Professor of Theriogenology, Ross University, St. Kitts) and Lowell Miller (USDA National Wildlife Research Center) on the effect of a gonadotropin-releasing hormone (GnRH)

immunocontraceptive vaccine (GonaCon™) on reproductive function in vervet monkeys. The vaccine was developed by the United States Department of Agriculture's (USDA) Wildlife Service's (WS) National Wildlife Research Center (NWRC). It is licensed by the Environmental Protection Agency for use in female white tailed deer (registration #56228-40). The vaccine creates antibodies against GnRH, thus decreasing the effectiveness of GnRH to stimulate follicle stimulating hormone (FSH) and luteinizing hormone (LH) rendering a female animal infertile. In deer, maximum effects as a contraceptive occur two to three months post-vaccination and last for one to five years depending on the individual. With a second immunization the effect is longer in duration and may be permanent. There is no danger of eating deer that have been vaccinated and thus monkeys similarly vaccinated will pose no threat for human exposure.

The effects of this vaccine are currently being tested on captive monkeys at the Behavioural Sciences Foundation in St. Kitts. Once it is shown to be effective in monkeys, this vaccine could eliminate the need for continuous culling of monkeys once the population has reached a manageable level. Currently, the vaccine is administered via injection; however, there is the possibility of an oral vaccine that could be administered through food. The results of the population estimate could be used to determine where and at what scale this technology could be utilized.

Fourth, protect farms. If the previous recommendations were followed, farms would be conferred protection through human presence/activity/neighbors and the efforts of shooting and trapping. Additionally, fencing and dogs could also be utilized. Studies have documented the benefits of using dogs in agriculture, primarily as a means to protect livestock (Vercauteren et al., 2008, Gehrig et al. 2010, Gehrig et al. 2011). In St.

Kitts, most farmers tie their dogs to keep them from leaving the farm. Farmers also tie their dogs because even if the dogs stay in the mountain, they are at a high risk of being poisoned for chasing after livestock. This study finds that farms with untied dogs are more successful at reducing their crop losses than farms with tied dogs. Farms that successfully use untied dogs share two important factors: 1) the dogs are born in the mountain and 2) the farmers are consistent about visiting their farm every day to feed the dogs.

Fencing could be utilized to manage this issue. Farmers do not want dogs running, urinating or defecating on their crops, so a buffer could be created surrounding the plots of farms (i.e. a double ring of fencing). Dogs can be free-ranging within this buffer. To keep the dogs active, food could be in one location, water in another, and shade in another. This has been effectively utilized with invisible fencing to significantly reduce crop predation by deer in Michigan (Peter Robertson, Deputy Chief Scientist, National Wildlife Management Centre, Animal Health and Veterinary Laboratories Agency, UK, personal observation and communication) and may also help farmers in St. Kitts.

Fifth, provide a significant alternative food source for vervet monkeys. One practice that may keep monkeys from entering farms is to offer the animals a consistent, alternative source of food. (Simultaneous monkey control would be imperative for this strategy, because otherwise, more alternative food would simply contribute to an ever increasing population.) This study has shown that when monkeys have an abundant, preferred food source (i.e. mangoes), crop damage significantly decreases. Additionally, the oral history documented in this dissertation shows that during the sugar industry, food

was more abundant for monkeys in the mountains due to the active maintenance of fruit trees by farmers working above the cane apron. These fruit trees are no longer maintained, and many other fruit trees have been lost from natural disasters and have not been replaced. Therefore, trees that fruit year-round, such as banana and papaya, could be planted in the forest and in the ghauts. This would supply food for monkeys as well as Kittitians.

While the multi-disciplinary approach employed here elucidates the nuances of this environmental issue, it cannot propose a simple solution. Engaging the more applied components of the disciplines engaged in this work (primatology, ethnoprimateology, human-wildlife conflict and environmental anthropology) shows that recommendations on how to deal with “the monkey problem” in St. Kitts can come from seeing vervet monkeys and Kittitians contained within a singular, interconnected ecosystem or they can come from viewing the St. Kitts landscape as the product of a series of historical perturbations with political ramifications. The results indicate that, whether or not the monkeys are part of the St. Kitts ecosystem, they cannot be eradicated and, therefore, mitigation measures should focus on management. By viewing the introduction of vervet monkeys to St. Kitts as one of many perturbations on the environment, historical ecology can provide the framework for landscape reconstruction. This work shows that, with regard to the monkey problem, the land use patterns of the sugar industry were highly successful in keeping conflict with monkeys at bay. Therefore, mimicking the land use patterns and human behaviors that existed during the sugar industry might help reduce crop damage by vervet monkeys in St. Kitts.

While the recommendations proposed in this thesis may help manage “the monkey problem,” ultimately, the state of human-primate conflict in St. Kitts depends on future decisions regarding agriculture’s role in the country. Due to the unique human-environment relationship at the heart of this dissertation, the government controls the fate of significant portions of St. Kitts’ land, and at the moment, they are highly differentiated with regard to whether this land should be used for agriculture and/or development. This decision is far from simple. This work argues that a lack of land ownership on the part of farmers is a contributor to “the monkey problem,” but it does not and cannot make statements about whether farmers *should* own their land. This is a highly complex issue that this work is not qualified to address.

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APPENDICES

Appendix A: Excel script.

NEWDATA INPUT	
neighbors	2.22
guarding	4.59
water	211
forest	825
pref	4.22
moSA	6.77
moMA	3.28
mango	0.328

Example: Averaging the values over observations that were:

	<u>Damaged</u>	<u>Not damaged</u>
Probability of Damage	0.032291319	0.005978684
Hard Prediction:	Damage	No Damage
<i>If damage occurs:</i>		
Estimated Proportion:	0.075049672	0.0267819

Appendix B: Interview Questions.

1. General Questions

- a. Tell me about your family and your farm.
 - i. How long have you been farming on your land in _____?
 - ii. Do you have other farms?
 - iii. How many hours per week do you spend on your farm?
 - iv. What are your primary crops?
 - v. Which of your crops is most valuable to you?

2. Extent of Damage

- a. What, if anything, limits crop yields on your farm?
- b. Are there wildlife species that are a problem for you and your family? Which species is the biggest problem? Why are they a problem?
- c. Approximately how many monkeys are in the region? Exactly where do they live?
 - i. How many monkeys live on St. Kitts?
 - ii. Do you know how long monkeys have been in St. Kitts? Where did they come from?
 - iii. What do you call these monkeys?
 - iv. Have you heard any stories about them?
 - v. Do you know any stories about livestock or dogs? I've heard a story about monkeys teaching dogs and livestock to climb.
- d. Do you have problems with vervet monkeys?
 - i. What kinds of problems?
 - ii. When do you experience problems with monkeys?
 - iii. Are there particular times of the year when damage is more likely to occur? A particular time of day?
 - iv. What do you think is causing the problem?
 - v. Which crops do the monkeys like best?
 - vi. How ripe are the crops when the monkeys take them?
 - vii. How much monkey damage is on your farm compared to the other farms in the country? More? Less? Why?
 - viii. What percent of your crops are raided each month?
- e. Which species is the biggest problem for farmers in St. Kitts – monkeys, pigs or livestock?
 - i. Where on the island is the worst monkey damage? Pig damage? Livestock damage?
 - ii. Which pest BOTHERS you the most - monkey, pig, livestock, rats, birds or insects?

3. Thoughts on monkeys and reactions to crop raiding (if applicable)

- a. Why do the monkeys eat human food?
- b. What do you know about monkey behavior? What do you see them doing? Are they smart? How do you know they are smart or not?
- c. What's the most intelligent thing you've ever seen a monkey do?
- d. How are monkeys different from other animals?

- e. How are monkeys most like humans? Do you believe we are closely related to monkeys? Evolution says we have a common primate ancestor.
 - f. What do people think about monkey damage in _____ (name of village)?
 - g. Has this changed over time?
 - h. What should people do about crop damage by monkeys?
4. Economic Implications of Damage (if applicable)
- a. Does crop raiding by monkeys affect your livelihood? If yes, how?
 - b. Have monkeys done financial damage to your crops? If yes, how much?
 - c. What does this mean for you and your family?
5. Mitigation measures (if applicable)
- a. Do you do anything to try to stop monkeys damaging your crops? What?
 - b. How many hours a week do you spend defending your property from monkeys?
 - c. What do other people in _____ (farm area) do to stop monkeys from damaging their crops? Which strategies are most successful and why?
 - d. Dogs – are they helpful in preventing monkey damage? I’ve heard that it doesn’t help if they are tied, but you have to tie them to keep them from eating livestock. How can we use dogs more effectively to prevent monkey damage?
 - e. Why do people poison dogs and livestock?
 - f. Do you know people who have killed monkeys to defend their property?
 - i. If yes, how do you feel about this?
 - ii. Where is this happening?
 - iii. Are guns used to defend properties from monkeys? If so, where is this happening?
 - g. Are there any benefits to living near monkeys?
 - h. Does the government compensate you for the damages caused by monkeys/other wildlife species?
 - i. If no, do you think they should?
 - ii. If yes, how? Could anything be done to improve this?
6. Features of vervet monkeys (rate on Likert Scale of 1-5). STRONGLY AGREE = 1
- a. Monkeys are aggressive.
 - b. Monkeys are intelligent.
 - c. Monkeys make good pets.
 - d. Monkeys destroy crops on purpose.
 - e. Monkeys need human food to survive.
 - f. It is OK to kill monkeys that are destroying your crops.
 - g. Living near monkeys is good.
 - h. It is important to protect monkeys.
 - i. People who kill monkeys should be punished.
 - j. There are so many monkeys that the laws to protect them are no longer necessary.
7. My study
- a. There were some farmers that didn’t want to be in my study. Why do you think this is?

- b. Which of the following variables has the greatest impact on the amount of damage you get on your farm? Please rank the rest in order from greatest to smallest impact.
- A. BEING CLOSE TO A GHUT
 - B. BEING HIGH UP IN THE MOUNTAIN
 - C. BEING FAR AWAY FROM A ROAD
 - D. HAVING TALL TREES NEAR YOUR FARM
 - E. BEING SURROUNDED BY CULTIVATED LAND
 - F. HAVING NEIGHBORING FARMS
 - G. HAVING A FENCE
 - H. HAVING A DOG
 - I. SPENDING TIME ON YOUR FARM
- Any others not listed?
- c. Which of these would help the most with the monkey problem? Please rank the rest in order from most effective to least effective.
- A. PLANTING FRUIT TREES FOR MONKEY
 - B. FENCING FARMS AND HAVING DOGS RUNNING LOOSE
 - C. ELECTRIC FENCING
 - D. SPRAYING BITTER SOLUTION ON CROPS
 - E. TRAPPING AND/OR KILLING MONKEYS
 - F. SCARECROW WITH GUN AND SHOT SOUND
 - G. STERILIZING MONKEY
 - H. HIGH-PITCHED SOUND
- Any others not listed?
8. Miscellaneous Questions
- a. Have you always been a farmer? What other occupations do you have now or have you had in the past?
 - b. Tell me about how things were different during the sugar industry. How has this affected crop damage on farms?
 - c. I've heard a lot about waiting for the tractor since I've been talking to farmers. How does waiting for the tractor affect your farming? What can be done about this problem? Why aren't there more tractors?
 - d. I've heard that most farmers are squatting on their land. Why do you think farmers do not pay?
 - e. Why are the Taiwanese involved in farming on St. Kitts? Are they helpful or harmful?
 - f. People keep telling me that young people in St. Kitts don't want to work. Why is this? How can these young people be so different from their hard-working parents and grandparents? What can be done about this problem?
9. What should the future of farming in St. Kitts be like? What is the ideal situation in your opinion?

CURRICULUM VITAE

Kerry M. Dore

Kerrymdore@gmail.comEDUCATION

- 2013** **University of Wisconsin-Milwaukee** – Planned Ph.D defense (December) (Physical Anthropology), Dissertation title: “An Anthropological Investigation of the Dynamic Human-Vervet Monkey (*Chlorocebus aethiops sabaesus*) Interface in St. Kitts, West Indies.”
- 2010** **University of Wisconsin-Milwaukee** – Certificate: Geographic Information Systems
- 2005-2008** **University of Wisconsin-Milwaukee** – M.S. (Physical Anthropology), 2008, Thesis title: “Genetic variability in three South African vervet monkey (*Cercopithecus aethiops*) populations”
- 1999-2003** **Franklin and Marshall College** – B.A. with Honors (Biological Foundations of Behavior: concentration in Animal Behavior, minor in Anthropology), 2003, Thesis title: “Making explicit the constraints on the spontaneous perception of abstract relations by rhesus monkeys (*Macaca mulatta*)”

Research Interests Human-primate conflict; ethnoprimateology; environmental anthropology, geographic information systems; historical geography; non-human primate behavior; conservation

Member American Association of Physical Anthropologists, American Association of Anthropological Genetics, Human Biology Association, Society for Conservation Biology

CURRENT RESEARCH PROJECTS AND COLLABORATIONS

- Dissertation: generating a predictive model of monkey crop damage risk to farms in St. Kitts
- Dissertation: writing a historic ethnography of agriculture in St. Kitts
- Conducting a systematic estimate of the St. Kitts vervet monkey population; collaborating with local monkey trappers
- Investigating whelk-cracking by St. Kitts vervet monkeys with Caitlin Hannah and Roland Eve (former field assistants)
- Overseeing multiple student projects at the St. Kitts Biomedical Research Foundation and Behavioural Sciences Foundation

- Collaborating with Dr. Roger Thompson, Caitlin Hannah and Roland Eve in an investigation of hook-tool use in captive St. Kitts vervet monkeys
- Collaborating with Dr. John Dascanio of Ross University School of Veterinary Medicine and Lowell Miller of the USDA National Wildlife Research Center to investigate the use of a GnRH vaccine to control the St. Kitts vervet monkey population
- Collaborating with Drs. Steve Rushton, Aileen Mill and Pete Robertson of Newcastle University and the Food and Environment Research Agency in the UK on using biological modeling to create a management strategy for the St. Kitts monkey problem
- Collaborating with Drs. Turner, Grobler, Lorenz, Coetzer, Freimer and Schmitt on South African vervet monkey genetics
- Possible collaboration with Dr. Michael Muehlenbein (University of Indiana, Bloomington) on the knowledge, attitudes and practices of cruise ship tourists visiting St. Kitts
- Possible collaboration with Drs. Jennifer Danzy and Brandi Wren comparing parasite load in South African and St. Kitts vervet monkeys
- Possible collaboration with Delanie Hurst on St. Kitts vervet monkey predator alarm calls
- Possible collaboration with Dr. Brenda McCowan and the Institute for Human-Animal Networks on social network analysis in St. Kitts vervet monkeys
- Possible collaboration with Christophe Harbour Development Initiative and local St. Kitts farmers

WORK EXPERIENCE

January 2012 – Present Part-time Instructor

Marist College, School of Science, Poughkeepsie, NY

- Spring 2012, Fall 2012, Spring 2013, Fall 2013 – “Introduction to Physical Anthropology”
- Spring 2014 – “Environmental Issues in St. Kitts”

August 2010 – Present Consultant, St. Kitts

Food and Agriculture Organization of the United Nations

- Working to use GPS technology to establish vervet monkey troop sizes and ranges around St. Kitts in order to obtain the first systematic population estimate

August 2008 – May 2010 Teaching Assistant

University of Wisconsin-Milwaukee, Department of Anthropology, Milwaukee, WI

- Fall 2008 – Medico-legal Death Investigation
- Spring 2009 – Survey of World Societies
- Fall 2009 – (Two courses) Human Evolution and Variation and Introduction to Anthropology: Culture and Societies

- Spring 2010 – (Two courses) Human Evolution and Variation and Introduction to Anthropology: Culture and Societies

June 2004 – July 2005 Research Assistant

The Howard Hughes Medical Institute, Department of Genetics, Harvard Medical School, Boston, MA

- Perform basic molecular biology tasks involving cloning, PCR, sequencing, and analysis of polymorphic microsatellite markers to help with the mapping and positional cloning of the genes studied in the lab
- Manage an inbred line and transgenic animal colony to facilitate the laboratory's research project on the bacterial pathogen that causes legionnaire's disease as well as the research projects of other members of the laboratory
- Make periodic reports of research progress to the supervisor and other members of the laboratory as well as perform laboratory maintenance such as supply ordering and equipment maintenance

October 2003 – May 2004 Animal Care Technician

Center for Animal Resources and Comparative Medicine, Harvard Medical School, Boston, MA

- Responsible for the daily care of laboratory mice. Basic duties include husbandry and weaning litters. In addition, the position requires observation of abnormalities of animals and deviations in environmental variables as well as administering medications as needed

Summer 2000 and 2001 Primate Interpreter

Philadelphia Zoo, Philadelphia PA

- Work as an intermediary between zookeepers and visitors. Perform daily educational shows on the behavior, feeding strategies, and conservation status of the eight primate species housed at the reserve. These include gorillas, orangutans, black and white colobus monkeys, spectacled langurs, black and white ruffed and ring tailed lemurs, squirrel monkeys, and saki monkeys

FELLOWSHIPS, AWARDS AND HONORS

May 2012 Dissertation Fellowship

University of Wisconsin-Milwaukee, Milwaukee, WI

- \$20,000 stipend and full tuition for the academic year 2012-2013

May 2010 **The Chancellor's Golda Meir Library Scholar Award**

University of Wisconsin-Milwaukee, Milwaukee, WI

- \$5,000 award designed to provide two advanced graduate students with the resources necessary to pursue a year's intensive research in their chosen academic fields
- In addition, recipients receive specialized library assistance for the year

April 2009 **American Association of Anthropological Genetics Student Presentation Award**

- Awarded for poster presented at the American Association of Physical Anthropology Meetings, Chicago, IL, April 4, 2009. Poster title: "Genetic Variability in Three South African Vervet Monkey Populations."

Fall 2005 – Spring 2008 **Advanced Opportunity Program Fellowship**

University of Wisconsin-Milwaukee, Milwaukee, WI

- Three years of \$20,000 stipend and full tuition

Fall 2005 – Spring 2007 **Chancellor's Award**

University of Wisconsin-Milwaukee, Milwaukee, WI

- \$3,000 a semester award for two years

Summer 2003 **Charles G J Mayaud Travel Grant**

Franklin & Marshall College, Lancaster, PA

- Conducted surveys of Tanzanian farmers owning farmland along primate inhabited forest borders
- Worked extensively on an ecotourism project designed to employ local villagers, obtain funding for black and white colobus monkey conservation, and increase the overall awareness of the need for sustainable development

May 2003 **Departmental Honors**

Franklin & Marshall College, Lancaster, PA

- "Making Explicit the Constraints on the Spontaneous Perception of Abstract Relations by Rhesus Monkeys (*Macaca mulatta*)"
- Awarded by two departmental professors and one from an outside department after a two hour presentation and question and answer session

Summer 2002**Hackman Research Scholar**

Franklin & Marshall College, Lancaster, PA

- Worked under the guidance of Dr. Roger Thompson to develop his ongoing project on the concept of sameness and difference in rhesus macaque monkeys
- Responsibilities included daily data collection and analysis as well as making improvements to the experimental apparatus and design

FIELD EXPERIENCE

- 2011-present** Conducting systematic estimate of St. Kitts vervet monkey population
- 2010** Year-long dissertation research studying the conflict between vervet monkeys and farmers in St. Kitts, West Indies
- 2007** One month in South Africa collecting genetic material from vervet monkeys
- 2006** One month in South Africa collecting genetic material from vervet monkeys
- 2002** Return to Tanzania on a travel grant from Franklin and Marshall College to study ecotourism and conservation of black and white colobus monkeys
- 2001** Investigated the behavior of black and white colobus monkeys living in an encroached forest while studying abroad in The School for International Training's "Wildlife Ecology and Conservation" program in Tanzania

PAPERS/POSTERS PRESENTED

- 2013** Chair, Ethnoprimatology Symposium, American Association of Physical Anthropology Meetings, Knoxville, Tennessee
- 2013** Poster, American Association of Physical Anthropology Meetings, Knoxville, Tennessee. Dore, K.M and Sewell, D. Using hierarchical linear modeling to predict crop damage by vervet monkeys (*Chlorocebus aethiops sabaues*) in St. Kitts, West Indies.
- 2012** Poster, International Conference on Comparative Cognition, Melbourne, FL. Dore, K.M., Hannah, C.J., Eve, R.M, Thompson, R.K.R. Non-conceptual hook-tool use in groups of captive St. Kitts vervet monkeys (*Chlorocebus aethiops*).
- 2012** Poster, American Association of Physical Anthropology Meetings, Portland, Oregon. Dore, K.M. Assessing farm risk to crop damage by vervet monkeys in St. Kitts, West, Indies.

- 2012** Poster, International Society of Primatology, Cancun, Mexico. Grobler, J.P., Coetzer, G., Dore, K., Lorenz, J., Schmitt, C., Freimer, N., Turner, T.R. Genetic differentiation in populations of vervet monkeys (*Chlorocebus aethiops*) in South Africa.
- 2010** Poster, American Association of Physical Anthropology Meetings, Albuquerque, New Mexico. Lorenz, J.G.; Grobler, J.P.; Dore, K.M.; Freimer, N.B.; Jasinka, A.; and Turner, T.R. Genetic variation among geographically widespread populations of vervets (*Chlorocebus aethiops*) in southern and eastern Africa.
- 2009** Poster, American Association of Physical Anthropology Meetings, Chicago, Illinois. Dore, K.M.; Grobler, J.P.; Lorenz, J.G.; and Turner, T.R. Genetic Variability in Three South African Vervet Monkey Populations.
- 2007** Presentation, Midwest Primate Interest Group Meetings, University of Illinois-Carbondale. McAuliffe, K.A.; Grobler, J.P.; Lorenz, J.G.; and Turner, T.R. Genetics and Taxonomy in South African Vervet Monkeys.
- 2007** Presentation, Primate Ecology and Genetics Group Meetings, University of Cape Town, South Africa. McAuliffe, K.A., Grobler, J.P., Lorenz, J.G., and Turner, T.R. Genetic Differentiation in South African Vervet Monkeys.
- 2007** Poster, Conference of the Society for Conservation Biology, Nelson Mandela University, South Africa. Grobler, J.P.; Lorenz, J.G.; McAuliffe, K. A.; and Turner, T.R. Genetics, Taxonomy, and Conservation of Vervet Monkeys in South Africa.
- 2004** Presentation, International Conference on Comparative Cognition, Melbourne, FL. Bravo, G. L.; McAuliffe, K. A.; Stahlman, W. D.; White, A.E.; and Thompson, R. K. R. Spontaneous selective attention to stimulus dimensions by rhesus monkeys (*Macaca mulatta*).
- 2003** Presentation, International Conference on Comparative Cognition, Melbourne, FL. Flemming, T.; Follensbee, A.; McAuliffe, K. A.; and Thompson, R. K. R. Implicit stimulus control by same-versus-different relations among multiple arrays by macaque monkeys (*Macaca mulatta*).

PUBLICATIONS

Contracted for a book chapter in the edited volume: *GIS and GPS in Primatology: A Practical Guide to Spatial Analysis*, editors: Christopher A. Shaffer, Francine Dolins, Jena R. Hickey, Nathan P. Nibbelink, and Leila Porter. Cambridge University Press.

Working on an edited volume on ethnoprimateology with Agustin Fuentes (University of Notre Dame) and Erin P. Riley (San Diego State University).

Submitted. Lorenz, J.G.; Grobler, J.P.; Dore, K.M.; and Turner, T.R. Preserving Primate Biomaterials for Future Research: Field Research and the Integrated Primate Biomaterials and Information Resource. In: *Molecular Primatology*, ed. A. DiFiore.

Dore, K.M., Turner, T.R., Lorenz, J.G., Grobler, P.J. 2009. Integrating geographic information into the analysis of the genetic distribution of South African vervet monkeys. *Field Notes: A Journal of Collegiate Anthropology* 1: 112-127.

COURSEWORK

UNDERGRADUATE:

Principles of Evolution, Ecology, and Heredity

Principles of Physiology & Development

Experimental Design & Statistics

Tanzania: Environmental Field Study Seminar

Tanzania: Conservation Seminar

Tanzania: Independent Study Project – The student's ideas manifested in to a three-week independent project. I chose to investigate how black and white colobus monkey behavior was affected by distance from surrounding banana farms. My findings were documented in my final paper "The Behavior of Black and White Colobus Monkeys in an Encroached Forest."

Tanzania: Beginning Swahili

People and Cultures of Africa

The Environment and Human Values

Evolution of Mind and Intelligence

Animal Behavior

Biopsychology

Ecological Psychology

Independent Study – BFB – The student’s individual interests overseen by a faculty advisor. My particular project was year long and resulted in departmental honors, entitled “Making explicit the constraints on the spontaneous perception of abstract relations by rhesus monkeys (*Macaca mulatta*).”

Collaborative Research in Comparative Cognition – Comparative perspectives and approaches to the study of selected topics drawn from cognitive & developmental psychology, cognitive ethology, cognitive & behavioral neuroscience, cognitive science, and behavioral primatology. Independent research projects required; my project was entitled “Implicit discrimination by domestic chicks (*Gallus gallus domesticus*) to color and/or shape.”

GRADUATE:

Survey of Physical Anthropology

Survey of Cultural Anthropology

Perspectives on Prehistory (Survey of Archaeology)

Linguistic Anthropology

Animal Behavior-Ethology

Primate Evolution

Introduction to Anthropological Statistics

Hormones and Behavior

Conservation Biology

Introduction to GIS (Geographic Information Systems)

Evolutionary Biology

Primate Populations

Intermediate Geographic Information Science

Anthropological Applications of Geographic Information Systems

GIS & Society

30 credits of “Advanced Independent Study” or “Research and Thesis”