

Chapter 8

Summary, Discussion and Conclusions

Summary

In chapter one, I established five specific goals for my dissertation research, all centered on questions of *land* and *labor* with regard to Classic Maya intensive agriculture. I have addressed these goals throughout the text of the dissertation, but will briefly summarize the major points here.

Goal 1: To fully document the intensive agricultural features on the Cohune Ridge.

Terraces are widely distributed throughout the Cohune Ridge in a similar fashion to those identified for other portions of the Caracol settlement and the entire Vaca Plateau. *Contour*, *weir* and *valley bottom* terraces were all identified in the web of terracing throughout the settlement (Chase and Chase 1998b). While the terraces are widely distributed, the type, placement, size and quality of construction are primarily dependent upon natural variables such as slope and soil depth and cultural variables such as land use history. In general, the terraces were well constructed of roughly shaped and locally

quarried limestone boulders. Each terrace wall was supported by a construction wall made up of small fist sized limestone chunks.

Due to the undulating topography of the region, contour terraces make up the majority of the features recorded. Weir terraces were the second most prevalent and combined with contour terraces made up more than 95% of all terraces recorded. Terraces were recorded on the valley floors, but represent only a small portion of those identified.

The soils behind the terraces are moderately productive tropical soils exhibiting an ideal pH for maize production. They are all, however, deficient in some critical macro-nutrients such as available phosphorous and nitrogen. Based upon the simulations presented in chapter six, it seems clear that the soil behind the terraces built up from a natural process of erosion that occurred over the course of more than 300 years. From the excavations and soil analyses there is no evidence for significant human modification or manipulation of the soil. Simulations indicate that farmers in the region would have quickly witnessed the adverse effects of soil erosion on productivity soon after they were first cultivated, regardless of the frequency of cultivation.

Based upon these data, I am certain terrace construction commenced early in the agricultural history of the region. Depending upon slope and fallow regime, some plots of land would have been rendered un-cultivable had terraces not been constructed early on. In fact, without terraces more than 70% of the landscape would have been

completely denuded of soil within 50 – 100 years. Instead of a strict Boserupian progression of shortened fallows, I believe that farmers on the Cohune Ridge, and perhaps the entire Vaca Plateau, adopted terrace construction early on, in order to ameliorate the adverse effects of soil erosion on the year-to-year productivity of the landscape.

This does not however contradict Boserup's general model. Farming households on the Cohune Ridge certainly increased their labor input into each parcel of land. This was likely a dynamic process, but the general trend of increasing labor investment aligns well with Boserup's general model. The overall trend of the agricultural simulation also supports the recent hybrid model summarized by Wood. The population certainly experienced Boserupian growth and Malthusian stagnation. If labor investment, or simply the amount of work carried out for subsistence, is a proper currency of well-being, then the agricultural model in conjunction with the labor investment estimates, clearly illustrate some of the general patterns expressed by Wood (1998). The primary pattern observed in this case study was the decrease in well-being (as viewed in terms of labor investment) associated with population growth and pressure, i.e., greater inputs for more stable returns.

The labor estimates presented in chapter five illustrate that the terraces were likely constructed by households and household organized labor. Such a system when viewed through a smallholder approach indicates that terracing would provide an economic

incentive for tying individual households to individual plots of land (Stone 1994). It is my contention that this behavior manifested itself in the material record in the form of east shrines and burials, similar to the Chases' (Chase and Chase 1994a) and McAnany's (1995) conclusions. I argue that all of the terraces I observed were the result of a process of households adapting to regional environmental processes and most importantly, production difficulties associated with soil erosion. The terraces were likely constructed over the course of several generations and would have imposed rather modest labor demands on each household from year to year. Each household would however, have a significant interest in delineating a plot of land, perhaps through the use of ancestral shrines.

One interesting conclusion derived from the labor estimates for terrace construction in chapter five, and for agricultural production in chapter seven, is exactly the distinction Brookfield (1972) made for archaeological studies of intensification. To reiterate, the material remains of intensification are often large complex systems which represent the final stage of intensification, not intensification as an event. Comparison of the labor inputs of terrace construction with the demands of actual cultivation gives Brookfield's (1972) distinction additional meaning. The cultivation practices for any given plot were likely more demanding around AD 650 than the entire labor required to construct the terraces on such a plot.

While the soils can be generally considered productive and the terracing did ameliorate declining yields associated with soil erosion, the intensive and labor demanding cultivation practices simulated during the peak period of population (AD 650) would have ultimately led to severe agricultural declines by the 10th century. These latter declines can be attributed to a loss of soil fertility, not soil erosion. This inevitably brings up the question of collapse and the role of the agricultural system. If I were to answer the question of whether the landscape of Caracol was sustainable, I would assuredly respond yes, but with a caveat. The cultivation practices driven both by terrace construction and by population growth and pressure rendered the system unsustainable by the 9th and 10th centuries, given current population estimates. Can these data explain the later collapse of Caracol's elite culture? I would argue that while the decline in productivity certainly contributed to the collapse of elite culture, I cannot say it was the primary causal agent of the collapse. More work certainly needs to be done, but if the well-being of the elite at Caracol was tied to the available surplus labor or crops of farmers, the system was certain experiencing stress because there was not much of either. One thing is certain, the lack of surplus labor and crops did not ease any of the systemic problems likely present at the onset of the Terminal Classic.

Goal 2: To fully document the settlement and associated features within a previously unknown portion of Caracol.

Consistent with previous settlement research around Caracol, household remains were found continuously and somewhat evenly dispersed throughout my study region, albeit

more widely spaced than in other areas. The data gathered for the Cohune Ridge, while not accompanied by household test pitting or horizontal excavations, have helped to refine some of the broad settlement issues of Caracol. First and foremost the settlement data have helped to refine population estimates for the entire Caracol site. These data are to date the most comprehensive settlement sample from Caracol's periphery (5 kms and further from the epicenter) and also illustrate the benefit of using group or residential unit counts and estimates, as opposed to structure counts and estimates. Independent agricultural estimates presented in chapter six and seven added support for these new estimates.

In their interpretations of the socioeconomic structure of the Caracol settlement, Chase and Chase (Chase and Chase 1992b) have argued for a great deal of variability throughout the Caracol settlement, including the possible existence of a middle status level group. I did not collect the fine data necessary to test this interpretation on the Cohune Ridge, but was able to identify essentially two groups of households, primarily on the basis of visible surface characteristics: the elite households, which had access to a great deal of labor beyond the capacity of the household residents; and the majority of the settlement, which relied on available household labor for its core labor needs. Within each group there is certainly some variation, but the only significant differences I observed were between these two groups. Spatial modeling of the agricultural landscape supported these observations. The differences observed between the Cohune Ridge region and the other Caracol settlement data could point to a cultural pattern that should

be addressed in future research. It is possible that the socioeconomic structure of production does not exhibit the same variability that can be observed by analysis of consumption. Ultimately this is a theoretical question and would benefit from a wide variety of cross cultural comparisons.

Goal 3: To quantitatively estimate the effects of terracing within the Cohune Ridge region and to evaluate the demographic implications of terracing.

The terraces on the Cohune Ridge, and for that matter the entire Vaca Plateau, were designed, planned, and constructed to ameliorate the declines of productivity associated with soil erosion caused by household-level cultivation. The terraces by themselves added no greater quantity of maize or other crops to the subsistence system; they simply leveled the effects of soil erosion and provided farmers with a less-risky and more predictable environment. So while terrace construction was beneficial to the long-term sustainability of the Cohune Ridge households, it did not increase production. In order to meet the rising demands associated with the population growth and pressure of the late Early Classic to early Late Classic, farmers certainly cultivated more frequently. Such practices increased the overall productivity of the landscape, but at the same time decreased their labor productivity (in other words, raising their labor costs). The cultivation practices discussed in chapter six clearly provided more maize as population growth and pressure necessitated, but the intensification of cultivation (on the terraced lands) likely led to further difficulties beginning in the early Late Classic. At that point in time the losses can be attributed to a loss of soil fertility and not soil erosion.

On the question of surplus, it appears that the households on the Cohune Ridge were not able to produce significant surpluses on their own fields during the Late Classic, nor on the fields of others. Two factors constrained the system and kept it 'tight' from a political economic perspective. The high labor demands of agricultural production in conjunction with a shortage of new lands created a system in the Late Classic where most of the food cultivated remained in the hands of the household for primary consumption and future production. Moreover, most of the labor available to each household seems to have been engaged in agricultural activity.

So what were the demographic implications of terracing? Simply, terraces provided a leveled or sustainable environment for the settlement during the first 600 years of the millenium. The Cohune Ridge, and apparently the entire Caracol site, was not constrained (population) by agricultural production. It wasn't until the early Late Classic, when the cultivation practices, and not the terraces themselves, affected demographic patterns. It appears that in the centuries following the defeat of Naranjo by Caracol, the population increasingly applied more labor to plots of land, but extracted less total food from that labor.

Goal 4: To evaluate the social conditions of terracing at Caracol, including how the landscape within the research area was partitioned and utilized and how labor was organized and recruited for agricultural production.

Using spatial modeling and a smallholder framework, I argued that all households on the Cohune Ridge had use rights, if not a sense of ownership to the lands surrounding each household. I first argued this from a theoretical standpoint, illustrating the similarities between Classic Maya farming households and modern smallholders. I then tested this argument first by assessing whether the lands surrounding each household were sufficient for the consumption needs of each household, which they were at least close to, and second, by testing whether each household could meet the demands of agricultural production during the early Late Classic. While there was no direct statistical relationship between measurements of household remains and farm size as modeled using simple and weighted Thiessen polygons, there was a significant relationship between the two major categories of households. The large household groups of elite status exhibited not only a greater quantity of land surrounding the group, but also a greater quality of land in regard to soils and slope.

These data, combined with the peak period labor estimates for cultivation, seem to suggest the following:

1. Agricultural labor was primarily organized and provided by each household.
2. The produce cultivated on lands surrounding the households was consumed almost entirely by the household.

3. The labor demands and ‘tight’ production of very intensive early Late Classic cultivation would have limited the ability of elites to extract resources from each household, either in kind or in labor.
4. Agricultural production on elite lands, such as Chaquistero and Cohune, was likely carried out by a combination of full-time agricultural specialists directly tied to the elite groups and some minimal labor recruitment from households in the surrounding settlement.
5. There was not much in the form of agricultural surplus beyond consumption in the household. Thus, I believe it is unlikely that any significant quantity of agricultural staples was traded or bartered within a market system. The limited production and redundancy of crops would have provided little incentive to do so.

On the whole, then, the subsistence system of the Cohune Ridge Maya was very ‘tight’ from a political economic perspective, beginning in the early Late Classic. Land was at a premium due to previous periods of sharp population growth. But labor was also at a premium due to the high demands of intensive cultivation on the terraced landscape.

Goal 5: To identify how terraces themselves relate to Maya civilization in general, and particularly to dealing with the political economy or ecology of the Caracol rulers, the urban nature of Maya settlements, and traditional conceptions of Maya staple production and trade.

Terracing, wherever it occurs in the Maya lowlands, can be impressive in both form and scale, and this is especially true at Caracol. Because of this, terraces have often been

misinterpreted as massive constructions and centrally organized systems of agriculture. From the Cohune Ridge data, terraces and terraced agriculture provide a contrary conclusion. Terraces were likely constructed not by some centrally organized system, but by individual households. Unlike complex chinampa systems requiring significant dykes or complex irrigation systems, which may require some organized level of construction, terracing does not require or benefit from major public works. Non-irrigated terracing serves one primary purpose, i.e., to ameliorate the declines of productivity associated with soil erosion. They are largely a regional adaptation to the physical environment, as well as land use history, wherever they occur. The terraces, themselves did not serve to increase overall production and did not provide staple financing of empire building as the chinampas did for the Aztec empire in highland Mexico. Terraces, simply served to check the decline of agricultural production and level an otherwise risky landscape.

The adaptive nature of terracing especially that constructed, used, and maintained by households requires or at least benefits from a dispersed settlement system, as has been observed for modern smallholders throughout the world. I believe that there is a functional relationship between the continuous and somewhat even distribution of households on the Cohune Ridge and the entire Vaca Plateau. The placement of households was not necessarily planned; nor was it haphazard. Household location appears to be directly related to primary farmlands, farmlands that were recognizably held by households for multiple generations.

During the early Late Classic (AD 550 – 650) the labor requirements of households were significantly less than those required during the end of the seventh and eighth centuries. Interestingly, this is the period in Caracol's elite history during which they exhibit the most aggressive and far reaching political action. Possibly, the success of the elite during this period was related to a greater pool of labor and resources. But, as time passed, the investment of labor into household plots for subsistence rose exponentially, limiting, if not eliminating, a great surplus of labor for the rulers or administration to exploit. While there is recorded construction in the epicenter of Caracol and the Chases (Chase and Chase 2000) indicate that the settlement prospered, there are no stone monuments recorded for most of the eighth century. Whether the limited labor or resource base is directly related to, or alternatively one of the prime movers, of the decline has yet to be established, but it is a very compelling question that I hope to address in future research. If a system is as 'tight' as the Caracol system appears to be in the Late Classic, such stress could have had a measurable effect on the Caracol ruling elite and ultimately the regional politics of the Southern lowlands.

There is a revival of elite culture at Caracol in the eighth and ninth centuries, as reflected in the epigraphic and archaeological data, which is associated with another possible labor surplus during this period. But the conflicts recorded occur at a much more limited distance than those with Tikal and Naranjo during the 6th and 7th centuries. While overall production is down from previous periods, population estimates appear to be well below the contemporary instantaneous carrying capacity. This is not due to an increase in

productivity, but appears to be associated with an increase in out-migration or mortality that effectively offered temporary respite from demographic misery for farmers. It is possible that the rejuvenated political activity could have something to do with the temporary increase in well-being of households and could explain why a similar decline is not seen in the settlement.

To summarize, I do not believe that the Caracol ruling elite or the administration had a recognizable influence over the year-to-year production and household economy. In fact, I argue the contrary point, that the political economy and ecology of the ruling elite of Caracol was constrained by the changing patterns of labor demands and organization at every household. I would argue that one of the reasons for Caracol's florescence during the early Late Classic was the economic viability or well-being of households during that period.

Discussion

When I first developed my dissertation topic, I had one general goal in mind, which was to evaluate and reconstruct the agricultural history of farmers on the Cohune Ridge. I was interested not only in determining how, why, and when terraces were first constructed, but also in determining what were some of the year-to-year problems that farming households dealt with. Ultimately, this is a 'cultural ecological' study. But I also hoped to view how the changing political environment of Caracol influenced, or was influenced by the thousands of farming households throughout the region during the

Classic Period. I anticipated some association of political activity, as viewed in the epigraphic record, and agricultural activity, i.e., surplus labor and crop demands, basically from a *top-down* perspective. To the contrary, I now believe that it was unlikely that the political action of the rulers or elite had a measurable effect on the year-to-year decision making of farming households. It seems from these data that the opposite is true, i.e., the greatest period of expansion and growth of Caracol, is associated with more surplus labor and productive potential than would be available in the next 100 or more years. Thus I am suggesting that perhaps it is more of a *bottom-up* process.

Discussion of the Simulations

The recent advances in information technology, especially GIS, within archaeology and anthropology provide researchers with a readily available and an increasingly simple means to simulate human behavior and decision making. The models and simulations I used here are obviously somewhat limited. They do not account for human agency, major climate changes, or a wide array of cultural variables beyond land use and management. They are, however, a foundation that I hope to build upon in order to create a data rich simulation environment that will address the acknowledged limitations. But, I do believe that through these simulations, we not only begin to view generalized patterns of diachronic processes, but also begin to identify critical variables that can be incorporated into future simulations and reconstructions of past behavior.

Future Research Considerations

There are two directions that I would like to take with this research. First, I hope to further develop the simulations and spatial models presented here in order to incorporate the simplified or lacking variables. Second, I hope to investigate some of the micro-processes occurring at the households on the Cohune Ridge through intensive household archaeology. Such research could provide a great deal of data concerning the structure of households and household labor, the lifespan of the households, as well as the changing composition of household labor and how that may have influenced agricultural decision-making from year-to-year.

