

THESIS

THE STEPS OF KINGS: TERRACED LANDSCAPES IN THE
LAKE PÁTZCUARO BASIN, MICHOACÁN, MÉXICO

Submitted by

Florencia Lorena Pezzutti

Department of Anthropology

In partial fulfillment of the requirements

For the degree of Master of Arts

Department of Anthropology

Fort Collins, Colorado

Summer 2010

COLORADO STATE UNIVERSITY

May 15th, 2010

WE HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER OUR SUPERVISION BY FLORENCIA L. PEZZUTTI ENTITLED, THE STEPS OF KINGS: TERRACED LANDSCAPES IN THE LAKE PÁTZCUARO BASIN, MICHOACÁN, MÉXICO, BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS.

Committee on Graduate Work

Mark T. Fiege

Mary L. Van Buren

Advisor: Christopher T. Fisher

Department Chair: Kathleen Ann Sherman

ABSTRACT OF THESIS

THE STEPS OF KINGS: TERRACED LANDSCAPES IN THE LAKE PÁTZCUARO BASIN, MICHOACÁN, MÉXICO

This thesis uses a landscape approach incorporating landesque capital as statecraft to relate agricultural intensification and state formation theories using data collected from the former island of Apúpato, in the Lake Pátzcuaro Basin, Michoacán, México. Apúpato is located in the geo-political core of the Purépecha Empire, south of Tzintzuntzan, the empire's capital. Apúpato was an important Purépecha island belonging to the Canzonci [Purépecha emperor] and was used as a ritual center, an imperial treasury, and for feasts and expeditions (RM 2008: page)

This thesis incorporates recent archaeological investigation, including full coverage settlement pattern survey, geoarchaeology, and remote sensing/ARCGIS, which documented patterns of settlements, confirmed the presence of terraces, and the general landscape development of the former island.

This thesis documents and analyzes, for the first time, agricultural terraces in the former island of Apúpato. The most common form of agricultural intensification is terrace agriculture (Donkin 1979) which is linked to the development of social complexity in middle range societies, and states and empires (Fisher et al. 2003). For

Mesoamerica, terraces are a fundamental characteristic of ancient social complexity, and continued to be used post-Conquest (A.D. 1520). In the Lake Pátzcuaro basin, agricultural intensification was an important component of state formation in the lake Pátzcuaro basin (Pollard 1993) exemplified by raised field systems and by the construction of terraces to repair Classic period land degradation (A.D 300-800) and to improve productivity of seed crops (Fisher et al 2003; Fisher 2005).

This thesis examines the implications of agricultural intensification and state formation in Mesoamerica, using terrace data collected from the former island of Apúpato. The terrace system documented on Apúpato represents a *refugia* for the Purépecha built environment in the Lake Pátzcuaro Basin, since the Apúpato island setting remained an island for hundreds of years, helping keep Apúpato protected and isolated from the consequences of the European conquest. The terraces documented in the former island of Apúpato are analyzed in terms of their form, function, and construction development for the first time in the Lake Pátzcuaro Basin.

Florencia Lorena Pezzutti
Department of Anthropology
Colorado State University
Fort Collins, CO 80523
Summer 2010

ACKNOWLEDGMENTS

This thesis would have not been possible without the support and belief in me from multiple people who have been influential and crucial towards my career. First of all I would like to thank my host family from Ohio, the Welkos, who had helped me in ways I could not explain. Many thanks to Linda, Jeff, Ashleigh, Nick, and David Welko for helping Eric and I move to Colorado and making the awesome road trip from Stow, Ohio to Fort Collins, Colorado worth it. I could not be more thankful to Dr. Fisher, or Chris, for introducing me to the Lake Pátzcuaro Basin area and giving me the research opportunity of a lifetime. His support and guidance has made me commit to Mesoamerican archaeology. Nonetheless, I could not forget to thank Dr. Fisher's family, Kiki and Della, for understanding the crazy Apúpató field season schedule during the Christmas holidays. Special thanks go to Victor Hugo Garduño and Isabel Alcántara for visiting our sites, helping us with the housing in Morelia, and for always giving us a warm welcome. Many thanks go to Dr. Elliot (CEMCA) and Dr. Hawks for helping survey Apúpató. A huge recognition goes to all my professors from the Department of Anthropology who have influenced and inspired my research interest during graduate school. And to my husband, Eric, who was been more than patient and supportive of my research and who has always believed in me. To my family in Buenos Aires, who always supported my crazy ideas of studying abroad, I would like to thank them for the visits and

the fun long phone conversations. A pesar de la distancia y los años, quiero agradecerle a mi familia y amigos de toda la vida, por el amor, apoyo, y por las amistades incondicionales.

TABLE OF CONTENT

SIGNATURE PAGE.....	ii
ABSTRACT OF THESIS.....	iii
ACKNOWLEDGMENTS.....	v
LIST OF TABLES.....	ix
LIST OF FIGURES.....	x
INTRODUCTION.....	1
CHAPTER 1: APUPATO AND STATE FORMATION THEORIES, ANCIENT STATES AND AGRICULTURAL INTENSIFICATION: THEORETICAL THEMES.....	13
CHAPTER 2: AN INTRODUCTION TO THE LAKE PÁTZCUARO BASIN.....	40
CHAPTER 3: LAKE PÁTZCUARO BASIN: CHARACTERISTICS AND DYNAMICS OVER TIME.....	61
CHAPTER 4: SOCIO-CULTURAL HISTORY OF APUPATO.....	72
CHAPTER 5: METHODOLOGIES.....	92
CHAPTER 6: SURVEY ANALYSIS OF APUPATO TERRACES AND RESULTS.....	103
CHAPTER 7: MAGUEY CULTIVATION AND PROCESSING: ARCHAEOLOGICAL IMPLICATIONS IN THE LAKE PÁTZCUARO BASIN.....	124

CHAPTER 8: CONCLUSIONS.....	157
REFERENCES CITED.....	164

LIST OF TABLES

1.1. Research objective, hypotheses, and evidence.....	8
2.1. Phases for the Lake Pátzcuaro Basin, Michoacán, México (Pollard from Fisher 2008).....	48
3.1. Summary of Major Trends during the Prehispanic period. Fisher (2000:121).....	66
3.2. Apúpató Strandlines.....	69
5.1. Demographic estimates (Fisher 2008).....	102
6.1. Apúpató terrace system summary by survey unit.....	122
7.1. Apúpató maguey productivity (table adapted from Parsons and Parsons 1994:338, table 25).....	143

LIST OF FIGURES

1.1 Map of Lake Pátzcuaro Basin in relationship to México.....	2
1.2 Map of Western México: Lake Pátzcuaro Basin.....	3
1.3 Map of Lake Pátzcuaro Basin: Apúpato.....	4
1a .1 A taxonomy of the major pathways of agricultural change.....	30
1a.2. Lake Pátzcuaro Basin: Terraced Areas.....	33
1a.3 Apúpato Terraces: Wet Season (July, 2006).....	34
1a.4 Apúpato Terraces: Dry Season (January, 2008).....	34
2.1. Extension of the Purépecha (Tarascan) Empire during the Late Postclassic (after Williams 2003:Fig.8, adapted from Pollards 2000:Fig.5.1 and 6.2).....	48
2.2 Ceramic Figurines from el Opeño, Michoacán (after Oliveros 2004 laminas 1,2).....	49
2.3. Anthropogenic clay figurines. Chupícuaro, Guanajuato (Williams 2004, FAMSI).....	51
Fig. 2.4. Anthropogenic clay figurine with geometric polychrome decoration. Chupícuaro, Guanajuato (Williams2004, FAMSI).....	51
2.5. Pottery Bowl with polychrome decoration. Loma Alta (Classic Period). Michoacán (Arnauld et al. 1993, Fig. 33).....	54
2.6. Twin Pyramids at Ihuatzio (Williams 2004, FAMSI).....	55
2.7. Ritual Incense burning used by Purépecha priests (Museo Michoacano, Williams 2004, FAMSI).....	56
Fig. 2.8. Tripod plate with negative Painting (Museo Michoacano, Williams 2004, FAMSI).....	56
2.9-3.0 Late Postclassic (Taríacuari phase) Negative painting examples (Museo Michoacano, Williams 2004, FAMSI).....	56
3.1 Beaumont Map (circa. 1540) Apúpato circled in red.	67
3.2. Paleoshore along settlement zone 108 in the NE of the former island.....	69
3.3. Apúpato strandlines and lake levels.....	70
4.1. Folio 46, Relación de Michoacán 2008. Probably a depiction of the Island of Apúpato looking north towards Tzintzuntzan. In the lower right a man is extracting aguamiel from a maguey plant (circled in red).....	76
4.2 Government Specialists (Relación de Michoacán 2008:173; folio 5).....	77
4.3. Apúpato Settlements.....	85
4.4. Apúpato Middle Classic to Epiclassic Settlements Zones.....	85
4.5. Late Postclassic settlement zones.....	86

4.6. Casa de Papas (Civic-Ceremonial Complex) Settlement zone 100.....	88
4.7. Structure 93 (top of pyramid).....	88
4.8. Folio 79.Relación de Michoacán 2008. Depiction of the island of Jarácuaro (A possible Casa de Papas (ritualistic house) associated with a Pyramid.....	89
4.9. Structure 88 (east platform wall).....	90
4.10. Structure 88 (west platform wall).....	90
4.11. Structure 89 (Room on structure88).....	90
4.12. Structure 89 (Room on structure 88).....	90
4.13. Colonial brick and roof tile.....	90
5.1. Apúpató satellite imagery (Google Earth Pro).....	96
5.2. Apúpató gridded satellite imagery (Google Earth Pro).....	96
5.3. TDS Recon rugged handheld data logger (GPS) (Trimble).....	9
5.4. Mapping at Apúpató with sub-meter accuracy DGPS running Tripod Data Systems(TDS) Solo Field software and real time correction (Omnistar).....	98
5.5. Surveying Apúpató with sub-meter accuracy DGPS running Tripod Data Systems(TDS) Solo Field software and real time correction (Omnistar)	98
6. 1. Erosion Systems at Apúpató.....	105
6 2. Settlement zone 103, exposed deposition sequence.....	106
6 3. Settlement zone 103, exposed deposition sequence.	107
6.4. Depositional sequence up-close (settlement zone 103).....	107
6.5. Erosion system III (looking south).....	108
6.5. Erosion system III (looking East).....	108
6.6. Profile of erosion System III (looking west).....	109
6.7. Digitized Terraces at Apúpató.....	110
6.8. Male captives from warfare used for agricultural fields (sementeras) (Folio 19, Relación de Michoacán 2008).....	113
6.9. Satellite imagery (Google Pro) showing terraces at Apúpató (from southeast, looking west).....	114
6.10. Satellite imagery (Google Pro) showing terraces at Apúpató (from west, looking northeast).....	114
6.11. Terrace Type A.....	117
6.12. Terraces Type A.....	118
6.13. Terrace Type A (From above) (looking north).....	118
6.14. Type B Terraces (steeper slope).....	119
6.15. Type B Terraces (steeper slope).....	119
6.16. Type C Terraces (retaining wall= structure 57).....	120
6.17. Type C Terraces (structure 11 incorporated into the terrace as retaining wall)	120
6.18 Apúpató terrace typology	121

6.19 Basic terrace typology of the Lake Pátzcuaro Basin (Designed by Fisher 2010)	121
6.20. Survey summary map.....	123
7.1 Sloping Terraces diagram (Wilken 1987:106, Fig. 6-3).....	126
7.2.Terraces on the south side of Apúpató. (with remains of wild maguey).....	127
7.3. Terraces with matured maguey plants (looking south).....	127
7.4 Terraces with matured maguey plants (looking south).....	127
7.5. Extensive Tablón Systems (Bench terraces), Totonicapán, Guatemala (beds are 0.5-1.5 m wide rising in tiers of 0.2-0.8 m high).....	127
7.6. Folio 105 v, Relación de Michoacán 2008. Folio depicting when Tariacuari (Canzonci) went searching for his son Curatame because he was getting drunk in Corínguaró.....	130
7.7. Folio 121, Relación de Michoacán 2008. Folio depicting when Tariacuari (Canzonci) sent his son, Curatame, to get killed because he was always getting drunk.....	130
Fig. 7.8. Planting a young Maguey plant (Parsons and Parsons 1994: 104, plate 13).....	134
Fig. 7.9. Uictli, or coa de hoja, wooden spade, being used for planting corn (Códice Florentino 4, f. 72 r) (Harvey and Prem 1984, Fig. 8.3).....	135
Fig. 7.10. Uictli, or coa de hoja, wooden spade, being used for planting corn (Códice Florentino 4, f. 72 r) (Harvey and Prem 1984, Fig. 8.3).....	135
Fig. 7.11. Maguey cavity partly filled with aguamiel (Parsons and Parsons 1994:120, Plate 36)	136
Fig. 7.12. Scraping interior of Maguey cavity (Parsons and Parsons 1994:120, Plate 37).	136
Fig. 7.13. Basalt scrapper from Apúpató (from Erosion system III).....	136
Fig. 7.14.Two Archaeological obsidian discoidal scrapers (Parsons and Parsons 1994:311, plate 163).....	136
7.15.Acocote (scale 50 cm) (hollow gourd to collect aguamiel (maguey sap)(Parsons and Parsons 1994:121, plate39).....	137
7.16. Sucking out aguamiel with an acocote (Parsons and Parsons 1994:122, plate 40).....	137
7.17. Folio 15.v, Relación de Michoacán 2008. Folio depicting a tlaquichero (aguamiel collector) sucking out aguamiel with an acocote from a sap producing maguey.....	137
7.18. Example of three-handled jar used for carrying water or aguamiel (Parsons and Parsons 1994:125, plate 45).....	137
7.19. Scraping maguey penca for fibers (Parsons and Parsons 1994:226, plate 90).	
7.19. Examples of coarse, fine, and medium maguey fabrics (Parsons and Parsons 1994:246, plate 122).....	140

7.20. Scraping maguey penca for fibers (Parsons and Parsons 1994:226, plate 90).....	141
7.21. Spinning maguey fiber in Orizabita, México (Parsons and Parsons 1994:248, plate 248).....	141
7.22. Prehispanic spinning, probably cotton (adapted from Dibble and Anderson 1957:Fig.75; right, adapted from Corona 1964: lámina LXIX in Parsons and Parsons 1994:287, figure 34B).....	142

INTRODUCTION

Agricultural intensification is a critical component of ancient statecraft (Fisher 2005) that has received relatively little archaeological attention when compared to other critical factors such as warfare and coercion, predation, expansionism, demographic change, and socio-economic change (Spencer and Redmond 2004:175). Typically agricultural intensification is considered either as an effect or outcome rather than a developmental process (Thurston and Fisher 2007). In Mesoamerica, agricultural intensification has been linked to the development of social stratification (Boserup 1965,1981; Steward 1955; Palerm 1955; Wittfogel 1957) demographic increase (Sanders et al. 1979), the reorganization of settlements (Blanton et al. 1981), climatic and environmental change (Redman 1999; 2000 2008), and even land degradation and collapse (see discussion in Fisher 2007).

The most common form of agricultural intensification is terrace agriculture (Donkin 1979) which is linked to the development of social complexity in middle range societies, and states and empires (Fisher et al. 2003). For Mesoamerica, terraces are a fundamental characteristic of ancient social complexity, and continued to be used post-Conquest (A.D. 1520), but have received very little archaeological attention, especially in terms of their form, function, and development (Whitmore and Turner II 2001,2002).

Apúpato was an important Purépecha island belonging to the Canzonci [Purépecha emperor] and was used as a ritual center, an imperial treasury, and for feasts

and expeditions (RM 2008: page). The terrace system documented on Apúpató represents a *refugia* for the engineered prehispanic landscape in the Lake Pátzcuaro Basin, since Apúpató remained an island for hundreds of years, this kept Apúpató protected and isolated from the consequences of the European conquest. In this thesis I will focus on the form, function, and development of this system of terraces to address construction timing, terrace function, and the role they served in the overall Lake Pátzcuaro Basin landscape.



Fig1. 1.Map of Lake Pátzcuaro Basin in relationship to México



Fig1.2 Map of Western México: Lake Pátzcuaro Basin

Terraces were the most common form of agricultural intensification in the Americas (Donkin 1979, Fisher 2000; 2003;2005) and have been documented throughout Mesoamerica including the Basin of México (Sanders 1979), Oaxaca (Feinman et al. 2002; Feinman and Nicholas 2004), the Maya region (Healy et al. 1983; Turner 1983; Dunning et al.1999; 2002), West México (Donkin 1979;Whitemore and Turner 2001; Foster 1948; West 1943), and the Lake Pátzcuaro Basin (Donkin 1979:56-57;Whitemore and Turner 2001:142, 147; Fisher 2001; 2005; 2007; Fisher et al. 2003; Foster 1948:West 1943).

One important Mesoamerican location is the Lake Pátzcuaro Basin, Michoacán, México, which was the geopolitical core of the Purépecha (Tarascan) Empire at the time of European Contact (A.D. 1520) with a dense population, centralized settlement system, socially stratified population, and an engineered environment (Fisher et al. 2003, Pollard

1993). Terraces have long been documented for the region (Donkin 1979:56-57; Whitemore and Turner 2001:142, 147; Fisher 2001; 2005; 2007; Fisher et al. 2003; Foster 1948; West 1943) but little is known about their form, function, and development, and little archaeological evidence exists for terraces in the Lake Pátzcuaro Basin. The terrace system documented at Apúpato represents a well preserved engineered prehispanic landscape. Apúpato has provided a small, but important piece of what the landscape looked like at the time of European contact. Agricultural intensification was an important component of state formation in the Lake Pátzcuaro Basin (Pollard 1993) and was exemplified by raised field systems and by the construction of terraces to repair Classic period land degradation (A.D 300-800) and to improve productivity of seed crops (Fisher et al 2003; Fisher 2005).

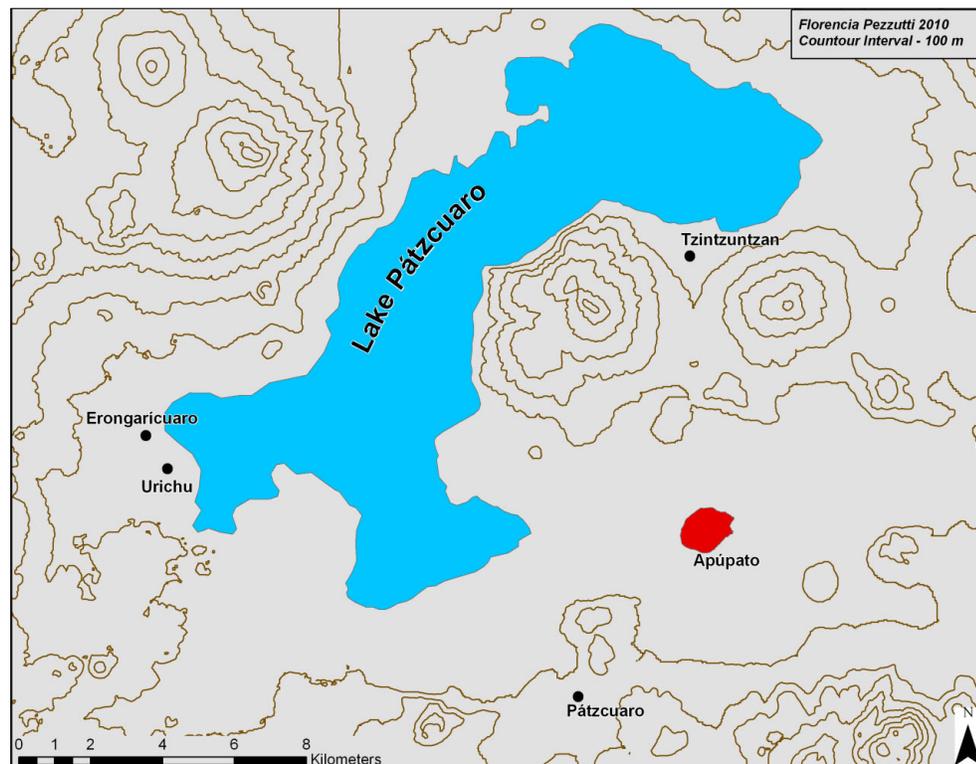


Fig. 1.3 Map of Lake Pátzcuaro Basin: Apúpato

The Apúpató terrace system was built and conditioned by a contingent landscape that underwent a wide variety of ecological conditions –lake level fluctuations, degradation episodes, human built environment episodes—making the island’s landscape a well preserved archaeological record of the long term dynamics between agricultural landscapes and socio-political complexity. Archaeological landscapes such as Apúpató can help answer questions like how certain systems of agricultural production develop in the context of different human-environmental conditions (lake levels fluctuations, degradation episodes, repair episodes, etc). In addition Apúpató offers an opportunity to explore complex relationships between agricultural landscapes and the role that technology and labor played in the evolution of different levels of social organization. This preserved anthropogenic landscape represents a *refugia* for the Prehispanic built environment and an ideal archaeological local to explore relationships between Prehispanic terraces and socio-political development in the lake basin. Apúpató also offers an opportunity for future comparative analysis of prehispanic agricultural intensification within Mesoamerica and other regions of the world.

This thesis documents for the first time extensive terraced areas on the former island of Apúpató within the Lake Pátzcuaro Basin near the Imperial Purépecha capital of Tzintzuntzan. Apúpató was an important Purépecha ritual center and the location of an Imperial treasury (Relación de Michoacán, 1541). Recent archaeological investigation, including full coverage settlement pattern survey, geoarchaeology, and satellite imagery interpretation/ARCGIS have documented patterns of settlements, confirmed the presence of terraces, and have documented the general landscape development of the former island.

This thesis addresses four key implications related to the development and function of the Apúpato terrace systems and the relationship of these features to complex polities in the region. Specifically:

1) Fisher et al. (2003) have suggested that much of the lake basin was covered with intensive terrace systems that were destroyed by subsequent Colonial land-use. As a former island, access to Apúpato remained difficult for much of this period serving to preserve the ancient built environment. Thus the Apúpato terrace systems serve as *refugia* of the pre-Hispanic built environment prior to European contact and an example of the built environment in the proto-contact period (prior to A.D. 1520).

2) The timing and function of the Pátzcuaro Lake Basin terrace systems remains unknown. Satellite imagery interpretation and analysis allowed me to discern patterns of construction related to terrace function and diachronic development. Additionally I am able to examine the role terraces may have played in larger systems of *landesque* capital in the region.

3) Ancient land degradation played a major role in the development of the Lake Pátzcuaro engineered landscape (Fisher et al. 2003). Apúpato terrace systems, including check dams, were designed to repair early erosion (Fisher et al. 2003), and as Fisher (2007) proposes, the need to repair a landscape affected by environmental damage, eventually led to a more predictable level of landscape production for the complex polities of the Lake Pátzcuaro Basin during the state formation period. Like the valley of Oaxaca, these terrace systems formed a Purépecha *‘piedmont strategy’*.

4) Finally, ancient maguey production (agave) was a critical Mesoamerican economic crop used for subsistence, fuel, and construction materials, associated with

specific forms of infrastructure (*metapantli*), and with key social and economic roles. Production and consumption of maguey during the prehispanic period is well documented for the region (*Relación de Michoacán*) mostly for pulque and maguey fibers, but has not been documented archaeologically for the lake basin. Here I present evidence that the Apúpato terrace systems were likely used for the production of maguey.

<p><i>Major Question</i></p>
<p>1) Researchers such as Fisher (Fisher 2005; Fisher et al. 2003) have argued that agricultural intensification was a key component of state formation by repairing existing land degradation through the construction of terraces and creating a Purépecha sort of piedmont strategy during the proto-contact period. I will focus on the form, function, and scale of development of these terraces as an attempt to answer what is the socio-political scale of construction and management, timing of construction, and function of this system of terraces?</p>
<p><i>Hypotheses</i></p> <p>H1: If the terrace system at Apúpato was built and managed at the state level then 1) residential settlements need not be present on the island with terraces constructed by state labor H°: If the terrace system at Apúpato was built and managed at the household level then 1) a greater density of residential settlement should be represented in the archaeological record of the island; and 2) a greater density of house mounds should be spread out and present on the island.</p> <p>H2: If the terrace system was built at the state level then 1) the configuration of the terraces should show that they were built in a limited number of construction episodes, showing a limited number of segments with coordination and planning at a large scale. H°: If the terrace system was built at the household level then 1) configuration of the terraces should provide evidence that the terraces were built in short, irregular segments with little indication of coordinating and planning.</p> <p>H3: If these terraces function for intense maguey cultivation then 1) narrow terraces should be present in the archaeological record; 2) evidence of wild maguey should be present in the archaeological record; 3) lithic tools and ceramic middens possibly related to maguey processing, collection, and storage of maguey should be present in the archaeological record (basalt or obsidian scrapers, obsidian blades, thick body sherds, ceramic handles, and spindle whorls, maguey ovens). H°: If these terraces function for intense maize cultivation then major sources of water and or irrigation canals should be present in the archaeological record.</p>

Evidence
1) Terrace system that covers roughly 90 % (109 he) (100%= 121.26 he) of Apúpató.
2) Extensive amounts of wild maguey that still grows on the slopes of Apúpató.
3) Ceramics (thick body sherds; handles) (n=267)
4) Lithics (Maguey basalt scraper, prismatic obsidian blades) (n=26)
5) Settlement(from Epiclassic to Postclassic) (structures n=120)
6) Geomorphology of the island (erosion systems) (n=5)
7) Strandlines: 2039 m a.s.l

Table 1.1. Research objective, hypotheses, and evidence.

This thesis is arranged into eight chapters with chapters 1 to 3 presenting key theoretical issues of ancient state formation and agricultural intensification, cultural background, methodologies and evidence supporting this thesis. Chapter 4 presents the history of climatic and lake level change for the region, chapter 5 presents the socio-cultural history for Apúpató, chapter 6 presents the analysis of Apúpató's terraces using satellite imagery interpretation and the settlement and lake level fluctuation data, chapter 7 presents the background and evidence of maguey production in Mesoamerica, and for Apúpató, and chapter 8 provides the summary and conclusions of this thesis.

Chapter one begins with an introduction to the theoretical relationship between ancient state formation and agricultural intensification that is used here as a way to articulate and elucidate the relationship of Apúpató's terrace system and Purépecha state formation under a coupled socio-ecological system framework. This chapter emphasizes the importance and relationships between ancient state formation and agricultural intensification. The organization of this chapter will be as follows: This first section will introduce the reader to critical concepts and terms surrounding agricultural intensification literature and complex societies. General theories of state formation will be introduced, and how the former island of Apúpató might be relevant towards state formation theory building. The second half of the chapter takes a historical view toward the development and influence of agricultural intensification studies. Within an intensification framework,

this thesis will introduce the concept of *landesque capital* and how it is operationalized in the landscape of Apúpató in the form of ancient terrace systems. This thesis will introduce land use intensification as a form of agricultural terraces in the new world; the different classification of agricultural terraces; and why these agricultural features—terraces and terrace-like features—that have been recorded in Apúpató can help improve our understanding of ancient Purépecha state formation under a coupled socio-ecological system.

Chapter two will provide the necessary background for the Lake Pátzcuaro Basin, including its physical, cultural, and environmental characteristics. This section will introduce the reader to the region archaeological record and explanations for the state formation in the Lake Pátzcuaro Basin. Overall, this chapter's goal is to introduce the reader to the environmental and cultural background of the Lake Pátzcuaro Basin. This region provides rich information regarding settlements dating to the early classic period, paleoenvironmental records which show the dynamic fluctuations of the lake levels, and in addition there are good ethnohistorical lines of evidence regarding the Purépecha state formation in the region. Furthermore, this thesis will present the characteristics of Lake Pátzcuaro at the time of European contact, as documented in the ethnohistorical account of the *Relación de Michoacán*.

Chapters 3 and 4 present the supporting evidence for lake level fluctuations in the Lake Pátzcuaro Basin and are meant to address the question of Apúpató's role as *refugia* of the landscape prior to European contact. Chapter 3 focuses on the physical evidence that provides the necessary background to better understand the nature of Lake Pátzcuaro level fluctuations and how this determines Apúpató's shoreline within the lake basin.

Chapter 4 expands on chapter three, and focuses on the ethno-historical evidence of Apúpató as an island. Two historical sources are presented in this chapter: the first source is the ethnohistorical account, *La Relación de Michoacán*, which discusses Apúpató as an island, the importance of islands, and the importance of maguey production in the lake basin. The second historical source (secondary source) provides historic accounts of land disputes which lasted over 100 years and presents many descriptions of Apúpató being an island and landscape descriptions of the southern portion of the lake basin surrounding Apúpató.

Chapter five presents the methodologies used to collect and analyze the data needed to answer the questions pursued in this thesis in terms of timing and function of this terrace system. Two different types of methodologies were implemented for this thesis: field methodologies and the laboratory analysis. Two lines of investigation were undertaken, a full landscape scale survey to record and map aspects of prehispanic settlements, agricultural features, and historic aspects of the landscape in Apúpató. The mapped and documented data was analyzed with Arc GIS, and the terraces were digitized over an updated geo-referenced satellite image. This allows for discernment of forms and patterns, characteristics and similarities, and to be able to eventually use them for comparative analysis. It also allowed discerning different elevations between terraces and paleo-shore elevations to better model lake level fluctuations. This is followed by a description and summary of dating technique use to confirm dates for these terrace systems through diagnostic ceramic sherds found in situ associated with the terraces and in eroded fan areas. Chapter six presents the analysis of the terrace system in relationship to patterns and distribution. This section is meant to answer the timing of construction

and the function they served in regards of ancient land degradation by overlapping them with the geomorphologic data documented and mapped in the field.

Chapter 7 addresses the issue of maguey as a potential crop being cultivated in Apúpató's terrace system. Most importantly, this chapter provides a background for the importance of maguey as a critical Mesoamerican crop in terms of the social and economic aspects it fulfilled in the lake basin. This chapter presents the material culture evidence in terms to Maguey cultivation and harvest that was documented in Apúpató and which supports the possibility that this crop was being cultivated on these terraces. Following this section, I will contrast this terrace system to terrace systems of El Palmillo, Oaxaca (Feinman et al 2007).

Finally, chapter 8 will summarize the results of this thesis by presenting in detail the outcome of the implications presented at the introduction and by presenting how Apúpató's ancient agricultural system helps to elucidate the process of state formation and its relationship to agricultural intensification in the lake basin. Most importantly, this connection between ancient agricultural intensification and state formation will be presented as a coupled socio-ecological system that built the environment and made it resilient enough to absorb external shocks and produce a resilient crop as maguey which was transform into a product (pulque) which was consumed by the Purépecha elites.

Thus, this thesis will link the Apúpató systems of *landesque capital* to broader theories of state formation in the LPB, and the role that agricultural intensification played in the lake basin at the local scale. Pollard (1993) and Fisher et al. (2003) and Fisher (2005) argue that agricultural intensification was a key component of state formation and landscape stabilization by repairing classic period land degradation through the

construction of terraces. This thesis will also demonstrate how this information could be interpolated to other regions and theories of state formation and agricultural intensification. Thus, Lake Pátzcuaro Basin can enter the broader intensification debate because it exemplifies a classic example of state formation that can be approached from a human-environmental theoretical framework.

**CHAPTER 1: APUPATO AND STATE FORMATION
THEORIES, ANCIENT STATES AND AGRICULTURAL
INTENSIFICATION: THEORETICAL THEMES**

This chapter introduces the reader to theoretical issues concerning the relationship between ancient state formation and agricultural intensification. Through this theoretical framework I will place Apúpató (a landscape shaped by human-environmental interaction) within the broader intensification literature.

Archaeological approaches to agricultural intensification developed during the middle to late twentieth century and have focused primarily on the relationship of population growth and social complexity (Boserup 1965; Steward 1955; Wittfogel 1957; Harris 1979 and see reviews in Rojas Rabiela and Sanders 1985;). These reductionist approaches to agricultural intensification and social complexity have been challenged and revised in the last few decades with new perspectives that view ancient agricultural intensification and social complexity from a more developmental approach. These new perspectives bring added nuance to explanations of ancient state formation and collapse.

Agricultural intensification has long been seen as the result of population growth that sparked the formation of many ancient state level societies. However, in the last few decades, archaeological approaches of state formation have integrated elements of the overall landscape by including paleo-climate, environmental fluctuations, population

growth, technology and knowledge. These new archaeological theoretical approaches of state formations have focused on themes such as socio-political organization (Earle 2002; Smith and Montiel 2001); economy (Bray 2003; D'Altroy and Hastorf 2001; Feinman and Nicholas 2004; Hirth 1996; Jacobs 2000; Sinopoli 2003; Smith 2004; Thurston and Fisher 2005), settlement patterns (Balkansky 2002; Billman and Feinman 1999; Nichols 1996; Sabloff and Ashmore 2001), and landscape development (Allen 1997; Ashmore 2002; Billman 2002; Denevan 2001; Dunning et al. 2002; Fisher et al. 2003; Fisher and Feinman 2005; Lentz 2000; McIntosh et al. 2000; Scarborough 2003; Sheets 2002; van Buren 2001; van der Leeuw and Redman 2002; Whitmore and Turner 2001; Wilkinson 2003). In spite of this theoretical shift, much of these approaches do not fully explain and present archaeological evidence capable of displaying processes of ancient states formation (Smith and Schreiber 2005; Ashmore 2002; Fisher and Feinman 2005; Fisher 2005; Smith 2006). As a result, these diverse theoretical approaches lack a well-integrated approach that could bring together many of these important themes into a unique theoretical framework meant to explain the development of ancient states across cultures.

For Mesoamerica these new approaches to state formation studies, suggest that during the Late Post Classic Period (1400-1519 A.D) as states and empires were consolidating in the Basin of México and the Lake Pátzcuaro Basin, the entire landscapes of central México were transformed by agricultural intensification in the form of irrigation, terracing, and raised fields (Smith 1996:69-84). Here I use the engineered Apúpato landscape as an environmental *refugia* yielding to explore agricultural intensification in the core of the Purépecha Empire, providing a well-preserved

archaeological sequence to demonstrate the human-environmental implications of state formation in the Lake Pátzcuaro Basin highlighting agricultural intensification, lake level fluctuations, population settlements, and social complexity exemplified by its intensive agricultural terrace system.

The organization of this chapter will be the following: The first part of this chapter is meant to introduce the main terms and concepts that are ultimately integrated in the main theoretical approach guiding this research: *landesque capital* exemplified in the Apúpató landscape as an extensive and intensive system of agricultural terraces. This first part will present the definitions and a brief historical view of the influences linked to the theoretical arguments, which validates the former island of Apúpató as an important and potential archaeological example for the improvement of Purépecha state formation models. The second part of this chapter will introduce land use intensification in the form of agricultural terraces in the new world. I will present the terrace typology for the new world, and how they compare to those present in the former island of Apúpató.

STATES AND EMPIRES: DEFINITIONS AND CONCEPTS

State definitions are often situational and are most often based on the material indicators that are typical manifestations of the emergence of the state (Stanish 2001: 44). States are civilizations that operate on larger scale than bands, tribes, and chiefdoms, and which have “centralized social and political organization, class classification, and intensive agriculture” (Scarre and Fagan 2003:27).

Currently, different theoretical approaches have produced a great diversity of definitions of ancient states in the archaeological literature. For the purposes of this

thesis, a state will be defined as a ‘society with a centralized and also internally specialized administrative organization’ (Wright 1977:383), social stratification, regulation of labor, manpower, defense, information, tribute (Flannery 1972, 1995; Marcus 1976, 1993; Sanders 1974; Wright 1978; Feinman and Marcus 1998), and ideological domination (van Buren and Richards 2000:3).

Older theoretical views of ancient states tended to approach them as evolutionary organisms rather than viewing them as political institutions (Smith 2004:80). In the Mesoamerican region, the archaeological literature regarding the processes and developmental stages of state formation is relatively weak (Thurston and Fisher 2007). For the most part state formation in Mesoamerica has been approached from theories that emphasized on simplistic motives concerning what could spark state formation. Among these simplistic explanatory motives justifying state formation and the evolution of socio-cultural complexity are classic theories of the emergence of state societies.

Gordon Childe’s ‘Urban Revolution’ theory of craft specialization was initially accepted as a cornerstone of state formation, even though craft specialization is more a characteristic than a cause of state formation (Childe 1950; Scarre and Fagan 2003:32). State formation theories based on intensification of agriculture and irrigation were rooted in Gordon Childe’s elements of the Urban Revolution, such as large food surpluses, diversified farming economies, and irrigation agriculture (Scarre and Fagan 2003:32). For example, large food surpluses state formation hypotheses were based on the agricultural surplus potential of river floodplains in regions where states-organized societies could flourish and be supported (Breasted 1906). State formation theories based on diversity of farming economies were based on the potential that the protection against famine and the

stimulation of trade and exchange of foods from diverse ecological zones could offer, by integrating and organizing those several ecological zones (e.g. Andean state) under a centralized authority (Scarre and Fagan 2003:33).

Irrigation based state formation theories present this technology as a way of supporting higher population densities and resulting in socially stratified societies (Steward 1955; Wittfogel 1956). This theory represents an oppressive internal coercion model of state formation, since an elite group takes control of a critical resource necessary for agricultural production (Scarre and Fagan 2003:38).

Exchange networks and trade formation theories are based on the shift from redistribution of goods and commodities to formal trade, leading to growth of political and social complexity; thus, to the development of the state (Scarre and Fagan 2003:35; Renfrew 1972; Rathje 1971). Theories emphasizing warfare argue that finite and limited amount of agricultural land could lead to war resulting in the consolidation of state level society (Carneiro 1970; Spencer and Redmond 2004:175). This theory represents a hostile external coercion model of state formation (Scarre and Fagan 2003:38).

Classic theories of state formation present linear explanatory models and have been rejected from the state formation studies. More complex and multi-casual state formation theories influence by systems models resulted in elaborate models of the origins of states (Scarre and Fagan 38-9; Adams 1960; Flannery 1972). The systems approach perceives the state as a system regulated by a centralized power and which has as main duties the management and regulation of the system's subsystems. These subsystems are under different levels of stress, and it is usually the duty of a centralized power to provide coping mechanisms that could result in both new institutions and

policies (Scarre and Fagan 2003:39). Ecological approaches of state formation theories, heavily rooted on systems approaches of state formation, argue that large scale agricultural systems supporting large populations were organized and managed by centralized state level societies (Sanders 1979).

Recently, state formation theories have shifted from systems-ecological approaches toward social models concerning power among individuals and groups. Power state formation theories include: economic power, social and ideological power, and political power. Economic power state formation theory is based on the ability to create a more specialized production and organize the surplus storage, distribution of food, and long distance trading of exotic commodities and goods resulting eventually in socio-economic relationships and leading to social stratification and a state level society (Scarre and Fagan 2003: 42). Social power state formation theory is based on ideological power by modifying or creating symbols of cultural and political commonality represented in private and public civic and ceremonial architecture (Scarre and Fagan 2003:42). The creation and management of this ideology result in social stratification leading to state formation based on ideological power (Scarre and Fagan 2003:42). Political power state formation theory is based on “the ruler’s ability to impose authority throughout society by both administrative and military means” (Scarre and Fagan 2003:43). For example, a leader with political power would be able to settle disputes between different factions. If these three powers are interplayed a new institutions would develop leading to the formation of state level societies (Yoffee 1993). This power theory of state formation requires a diverse and wide approach of social complexity, such as the

different obstacles that societies experienced, leading them to different evolutionary paths (Yoffee 1993; Scarre and Fagan 2003:43).

State level societies sometimes develop and expand into empires. A cross-cultural and standardized definition of such a complex socio-political and economic organization is one of the hardest archaeological tasks to be achieved among those focused on state and empire level societies. A simple cross cultural definition would characterize an empire as “an expansive polity incorporating multiple states” (Morrison 2001:3). Empires are more complex governmental entities and can be better characterized as,

—[...] states that expand, usually rapidly, and at least initially by conquest. Empires are subcontinental in size and have a population in the millions. Empires control diverse ecozones, and they are diverse culturally; they are organized to handle this diversity. Empires have central administrations; they support themselves through the extraction of tribute or the payment of taxes. Empires maintain standing armies. Empires maintain sovereignty over all people and territory in their realms (Schreiber 2001:71).

Detailed temporal sequences of events for the formation of an empire could be almost impossible in the archaeological record. The only visible evidence in the archaeological record is diachronic changes within the total period of an empire’s duration (Schreiber 2001:71). The size and diversity of an empire is measured in the archaeological record through spatial distribution of styles of material culture (ceramics, textiles, metal objects, architecture, etc) and imperial investments in infrastructure (roads, land reclamation, architecture, construction of extensive irrigation systems, terraces, etc) (Schreiber 2001:72-3). For example, the Aztec and Purépecha empires have notoriously been known to have sponsored infrastructure such as agricultural terrace systems (Smith 2001).

The centralization of an empire is expected to be located at the home territory from whatever polity expanded and developed into this level of socio-political organization. Archaeologically, the capital of an empire is expected to be the most diverse and complex geo-political core, reflected in socially diverse domestic, ritual, and political architecture (Schreiber 2001:73-4). This imperial capital is usually a large and complex urban center exhibiting imperial ideology (Smith 2001:130).

The domination of an imperial territory is mostly achieved through economic exchange and political control over polities (Smith 2001:130). Imperial control is usually achieved at the local level by reorganizing the local power infrastructure through the local leaders to provide tribute for the empire; or else imperial control is achieved by replacing the local administration with those more “favorable” to imperial rules. Another way of imposing imperial control is through the replacement of sacred beliefs with imperial ideologies (Schreiber 2001:74), or by projecting the dominant cultural influence beyond the borders of the geo-political core (Smith 2001:130).

Empires present a lot of heterogeneous characteristics and shifting frontiers (D’Altroy 2001:125). Empires are better understood as “intersecting networks of power that adapt and shape to conditions as they change” (Mann 1986). These contingent adaptations are present in the archaeological record of empires as daily dealings between ideological institutions and political institutions (D’Altroy 2001:125) take place and are exemplified by the Aztec and the Purépecha empires in Mesoamerica.

AGRICULTURAL INTENSIFICATION: DEFINITIONS AND CONCEPTS

Landscapes are spatial units that are the result of cumulative land use and management decisions of the resources it can provide through time (Blaikie and Brookfield 1987:71; Fisher and Feinman 2008). Thus, different types of land-use forever modify a landscape and it is an expression of the human-environmental interaction through time. Past land use behaviors are expressed in the archaeological record as the built environment or as destabilization of landscapes by deforestation and erosion (Fisher and Feinman 2008).

In the archaeological record, landscapes can be transformed as a built environment through agricultural intensification, which is defined as the ‘_addition of inputs up to, or beyond, the economic margin where application of further inputs will not increase total productivity’ (Blaikie and Brookfield 1987:31). Thus, intensification is more inputs of labor or skill into standard units of land (Thurston and Fisher 2007:11). Brookfield’s classic economic definition of agricultural intensification states that,

—[i]ntensification of production describes the addition of inputs up to the economic margin, and is logically linked to the concept of efficiency through consideration of marginal and average productivity obtained by such additional inputs... The primary purpose of intensification is the substitution of these inputs... [capital, labor and skills]... for land, so as to gain more production from a given area, use it more frequently, and hence make possible a greater concentration of production (Brookfield 1972:31).

The main principle of intensification is to gain more production from a given area of land, use that land more frequently, concentrate production, and secure production reducing risk for future uses (Brookfield 2001:182-183).

Social and organizational changes associated with agricultural intensification in prehistory are the product of the transformation of surplus into power by elites in most prehistoric societies (Thurston and Fisher 2007:10). Agricultural intensification consists

of dry and wet intensive agricultural systems. Dry intensive agriculture (shifting cultivation) consists of clearing fields through fire and then cropped in a discontinuous fashion (Conklin 1957:1). Shifting cultivation consists of five primary phases of activity: 1) site selection, 2) cutting, 3) firing, 4) cropping, and 5) fallowing (Conklin 1957:31) (Kirch 1994:5). This type of agricultural intensification is what Ester Boserup (1965) refers as “cropping cycle” intensification, which involves changing long to short fallow cropping systems and increasing labor input in different stages of agricultural production (Kirch 1994:19). Agricultural intensification studies have focused primarily on irrigated systems of agriculture. A bias toward wet systems (Wittfogel 1957) had left intensive dry land agricultural systems out of the theoretical equations (Kirch 1994:8-9).

Wet intensive agriculture is a type of agricultural practice represented by permanent modifications of agricultural landscapes and is expressed in the construction of irrigation features such as: terraces, raised fields, canals, pondfields, and check dams (Donkin 1979; Kirch 1994:129). This type of agricultural intensification is what Blaikie and Brookfield (1987) refer as “*landesque* capital intensification”. This type of agricultural intensification modifies the agricultural landscape by an initial labor input by building terraces, irrigation canals, etc. This built agricultural infrastructure may not require great amounts of regular labor for maintenance, since the greatest labor input was invested in the initial construction; thus saving labor and other inputs for future production (Blaikie and Brookfield 1987:9).

The agricultural built environment develops from land use management decisions and innovations. These are qualitative changes which modify the way things are produced and how knowledge is applied to production (Blaikie and Brookfield 1987:32).

It is a strategy that introduces qualitative changes to the production system and can increase the productivity of labor (Brookfield 1984), without increasing the inputs of labor by introducing new tools and technology that can substitute or improve labor productivity (Thurston and Fisher 2007:11). This increase in productivity without a reciprocal increase in labor inputs is achieved through the application of new agricultural tools, methodologies, as well as water and erosion control techniques, etc (Kirch 1994: 18)

Agricultural technologies could have similar labor inputs, but different social implications (Thurston and Fisher 2007:10). For example, Leach (1999; cited in Fisher and Thurston 2007:10) argue that for the Americas, the labor input for the construction of terraces and raised fields is almost equal; however, the agricultural outputs from both agricultural technologies are different, since wetland agriculture yields larger surpluses.

Permanent modifications to the landscape are defined as *landesque capital*, which refers to ‘any investment in land with an anticipated life well beyond that of the present crop, or crop cycle’ (Blaikie and Brookfield 1987:9). Thurston and Fisher (2007:11) described *landesque capital* as ‘labor that has been environmentally banked’ through the construction of agricultural infrastructure (stone walls, terraces, drainage systems, irrigation systems, raised fields, etc) (refer to discussion on section 3 of this chapter).

THEORETICAL AND HISTORICAL APPROACHES OF AGRICULTURAL INTENSIFICATION AND STATE FORMATION

EXPLANATORY MODELS OF STATE FORMATION AND AGRICULTURAL INTENSIFICATION:

Much anthropological research has been devoted to the rise and fall of states and empires, however not much research has been devoted to theories regarding the development and the processes of state and empire formation in the archeological literature (Fisher and Thurston 2007). Evidence of agricultural intensification in the archaeological record has always been seen as an indicator or as starter of cultural change leading to complex socio-political levels of organization. For example, agricultural intensification has been highly used as an explanatory model for the development of state level societies, population growth, climatic or environmental change, and centralization of power (Thurston and Fisher 2007:2). A lack of theoretical and case-specific approaches regarding processes and changes of agricultural intensification and social complexity are limited within the literature (Thurston and Fisher 2007:3).

Explanatory models of social complexity related to agricultural intensification are represented by two opposite theoretical approaches: —top down and —bottom up (Thurston and Fisher 2007:12). These models place emphasis on what type of people organized and managed different resources and the type of agricultural features and innovations they employed. The —top down” approach proposes that only the administration and decision making of a coercive ruler can manage and plan the amount and level of labor that agricultural intensification requires; thus, power is centralized in a state (Thurston and Fisher 2007:12). A classic example of this approach is the —hydraulic hypothesis” (Wittfogel 1957; Steward 1955). The —bottom up” approach, proposes that the planning, coordination, and labor management necessary for agricultural intensification is possible at the local group and household level (Thurston and Fisher 2007:13; Erickson 1993; Doolittle 1984; Scarborough 1991).

These explanatory models only indicate who and with what resources these changes happen, but they do not provide clarification as to what developmental processes could result in agricultural intensification and different levels of social complexity. For example, the Boserup (1965) explanatory model of agricultural intensification, proposes swidden agriculture practices as the initial stage of intensification. This approach has been deeply challenged under a contingent landscapes approach, which takes into account that land-use management decisions change based on the variations in fertility, soils, topography, and location at many scales (Fisher 2007:93). In addition, agricultural intensification expressed as *landesque capital* –terraces –is the result of a process that constructed the landscape piece by piece forming an accretionary landscape over many generations (Fisher 2007:14-15; 93; Fisher and Feinman 2008). The agricultural intensification process can be recognized by the changing patterns that convey increased labor investments on a certain landscape (Fisher 2007:95).

As the study of ancient state and empire formation continues to improve, and as more tangible examples like Apúpató can provide the sequence of state and empire formation process, the closer we are to reach a more unified and comprehensive theory of state and empire formation. Apúpató presents distinct archaeological evidence that allows us to distinguish between forms and process of agricultural intensification (Leach 1999). Apúpató provides the required evidence to identify the intensification process represented in the drastic increase of labor investment and landscape modification in the Lake Pátzcuaro Basin in the context of drastic Classic Period landscape degradation, lake level fluctuation, and consolidation of political power under a state by adopting a “*Purèpecha piedmont strategy*”. This intense agricultural strategy is similar to the Valley of Oaxaca.

In the Lake Pátzcuaro Basin, during the Late Postclassic period, the areas between 2050 and 2200m consisting of the lower slopes surrounding the lakeshore including islands, alluvial deltas and plains were modified through intensive agriculture in the form of terraces. In the Valley of Oaxaca, the “piedmont strategy” served to support local centers and Monte Alban. In the Lake Pátzcuaro Basin the exploitation of these new agricultural zones would have increased the agricultural potential of the lake basin and most likely supported the consumption of maguey products in the new cities of Tzintzuntzan, Ihuatzio, and Pátzcuaro. During the Late Postclassic period, the consumption of maguey pulque among the Purépecha elites has been documented in the ethnohistorical account called La Relación de Michoacán; however archaeological evidence from the Lake Basin remains weak and difficult to identify for this region.

BRIEF HISTORY OF THE DEVELOPMENT OF AGRICULTURAL INTENSIFICATION STUDIES:

Agricultural intensification studies have been rooted in early debates of demography and intensification originated by 18th century economist theoretical views of Thomas Malthus (1798). Malthus’ theory of population increase and the intensity of production resulted in an oversimplified view of demographic increase and unsustainable supply systems, where a society would reach a “carrying capacity” limit, being unable to supply resources to feed or support a society’s population. This view provided an evolutionary and simplistic view of intensification and demography.

During the 1960s, an ecological and anthropological attention revisited the subject of population and agricultural intensification. Among those theories that revived the subject are Wittfogel (1957) hydraulic hypothesis and Geertz (1963) agricultural

involution theory that presented population increase as correlated to agricultural intensification and as the driving force behind it. Another scholar in the social sciences who revisited this subject was Ester Boserup, who presented one of the most popular theoretical approaches on agricultural intensification. Her theoretical approach is an economic view of agricultural intensification, where population is not correlated to agricultural intensification, but it stimulates technological development to intensify agricultural practices (shortening fallow periods or building infrastructure such as terraces, canals, etc). Her model was presented as a historical model of population growth and how populations combat loss of production (Brookfield 2001:181). Boserup's model strongly influenced processual archaeology, but it also created intense debate and opposition to the idea that population was the main driver of subsistence technological changes. Currently, this model has been highly questioned and criticized for its deterministic and static approach toward human-environmental dynamics.

This critical view of Boserup's model, led to for the development of more contingent and dynamic views of agricultural intensification. This dynamic theoretical approach to agricultural intensification, proposes change as the normal condition, in which a constant adaptation occurs to the changing biophysical, social, demographic, economic, and political conditions (Brookfield 2001:182). However, her view of higher labor requirements to increase productivity would only be adopted when the agricultural production was under stress. Under her model, cultivators would return to previous amount of labor input when agricultural production normalizes, making cultivators reluctant to innovate.

During the 1970s, social scientists re-focused agricultural intensification studies towards the more tangible and measurable evidence from the archaeological record. Geographers such as Waddell (1972) incorporated new variables into the agricultural intensification studies, such as physical and biological variables. Wadell (1972) presented important variables to better understand agricultural intensification; however, Waddell (1972) left out all aspects of social changes and implications out of the formula. Sahlins (1972) presented a model of intensification based on scale. Sahlins (1972) argued that the household unit was the basic unit of production. Since it is based on a domestic mode of production it does not seek surplus. Sahlins (1972) argued that it was the intensification of labor, and that the social relations of production were the key in understanding the processes of intensification. In 1978, Swedlund presented an intensification model against demographics, presenting a model based on resource specific subsistence pressure. The land use management decisions affecting change in levels of subsistence production were made at various levels of kinship, political, gender, and class (Kirch 1994).

Another important influence on agricultural intensification theories was cultural ecologists Robert Netting. His model influenced and built upon Boserup's and was adopted as a model among processual archaeologists. His model associates population growth and social change, but it also incorporated and explained outdated views of intensification and degradation (Netting 1993), suggesting that degradation was a result of abandonment and/or lack of intense land use management (Fisher and Thurston 2007; van der Leeuw 2005). This new approach to degradation and intensive agriculture challenged outdated views rooted in the 19th century.

In 1972, Harold Brookfield clarified and redefined intensification. Highly influenced by Boserup's ideas and proposed models, he proposed viewing agricultural intensification by integrating all aspects of economic, caloric, and social inputs and returns. Brookfield defined social production as the production when inputs may be wildly uneconomic when measured against social returns (Brookfield 1972). In the 1980s, Brookfield distinguished and defined innovation versus intensification (Brookfield 1984). Brookfield's approach presents two critical points regarding agricultural intensification and the level of social change and implications. First, not all agricultural technologies requiring the same amount of labor input will result in the same level of productivity and social organization (e.g. wet vs. dry agriculture) (Thurston and Fisher 2007:10). Also, intensification may cause social and organizational changes that are not physically observable, like surplus resulting in the substance for supporting the elite culture and power. (Thurston and Fisher 2007:10). According to Brookfield, the main goal of intensification is to gain more production from a given area of land, thus creating the most surplus possible. In 1987, Blaikie and Brookfield presented the concept of *landesque capital* (see discussion below) which meant that a society could manipulate environmental constraints by the construction of a built environment that could improve agricultural production in the long term.

In 1994, Kirch argued that intensification was not determined by a single variable, but instead by multiple variables, such as demographic and social aspects. In addition, he added the ecological variable, changes in space and time. The incorporation of an environmental variable is crucial since most technological developments in agriculture are affected or stimulated by these environmental constraints. He defined two types of

agricultural changes: innovation and intensification. Agricultural change as innovation includes inventions, new methods, and devices, to fight environmental constraints (agronomic-technologic). Also, it includes the genetic innovation of crops, by manipulating traits and domesticating plants of value. Agricultural change as intensification includes construction of agricultural infrastructure such as terraces, canals, etc (*landesque capital*), or shortening the fallow cycles (cropping cycle) (Kirch 1994:18-9).

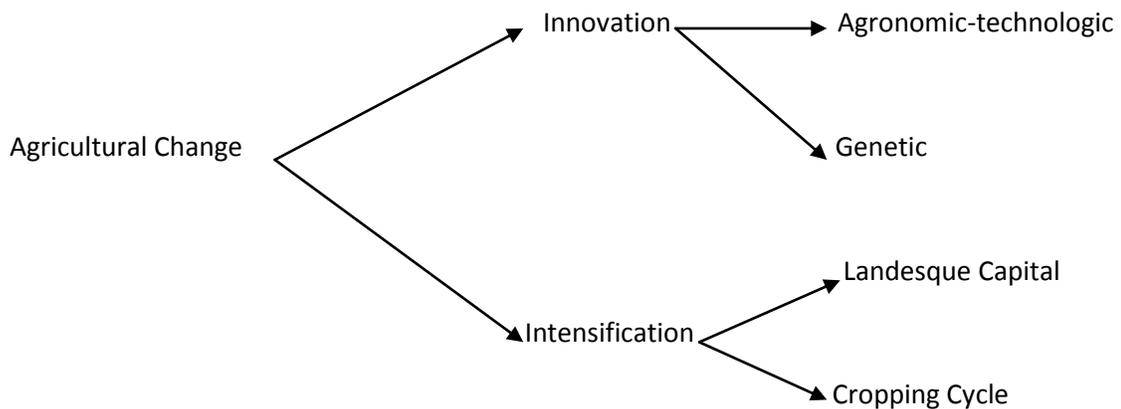


Fig. 1a .1 A taxonomy of the major pathways of agricultural change (Kirch 1994:19).

LANDESQUE CAPITAL: ARCHAEOLOGICAL IMPLICATIONS AT APUPATO

Socio-environmental implications regarding ancient state formation and agricultural intensification are expressed on the landscape as *landesque capital*, a physical expression of socio-environmental processes and dynamics. Agricultural features could be expressed in the landscapes as terraces, walls, and irrigation systems, providing evidence of the manipulation of environmental constraints by an ancient society. These agricultural features create capital to improve the future maintenance and landscape potential. They secure productivity and decrease future agricultural risks. This

capital—human labor and the natural potential of the landscape—is materialized and defined as *landesque* capital, which is ‘any investment in land with an anticipated life well beyond that of the present crop, or crop cycle’ (Blaikie and Brookfield 1987:9). The investment of this capital is a form of ‘saving’ labor and other inputs for future production (Blaikie and Brookfield 1987:9). Thus, *landesque capital* is a type of technology which does not require constant labor inputs, yet improving production returns (Thurston and Fisher 2007:7).

Associated with agricultural intensification are long and short-term benefits, which depend on the type of agricultural intensification and opted strategies. For example, *landesque capital* in the form of terraces requires a form of labor that is environmentally ‘banked’ (Thurston and Fisher 2007:11) for long-term benefits and sustainable agriculture. Thus, it becomes ‘built’ capital for the benefit of future generations as long as it is maintained (Whitmore and Turner 2001:134). The amount of labor necessary for the construction and maintenance of these agricultural systems is debatable. For example there are projections of high demands of population for such labor, but also projections with less demand for people and labor in the initial construction of *landesque capital*. Those projections with less demand for people and labor for the initial construction results in long-term productivity gains with reduced labor requirements (Fisher 2007:94), either for the construction of raised fields (Erickson 1993; 1999; 2000) and the construction of agricultural terraces (Denevan 2000:300; Whitmore and Turner 2001:133).

The construction of agricultural terraces is a long-term investment and could be observed as a form of state infrastructure. This form of *landesque capital* (Blaikie and

Brookfield 1987:9) makes sense in the geomorphologic context of the Central Mexican highlands. This landscape is rugged and fertile soils are threatened by topography and rainfall. The investment of labor, construction, and maintenance is justified, because terraces increment local production on slope, stabilizes agricultural production on slope in drought-prone and arid environments, and extends cropping surfaces to sloping niches that are otherwise too marginal to cultivate. In addition, terraces improve soil moisture, retard the loss of soil and soil nutrients down slope, and provide a more frequent use of the land in areas prone to frost, by reducing cold air and frost (Whitmore and Turner 2001:134-135).

Slope cultivation, in the shape of terraces, became a characteristic of Mesoamerican agricultural systems and a resilient agricultural strategy and investment in the context of the rugged highland terrain, which suffered from poorly drained and frost-prone conditions due to cold air drainage (Whitmore and Turner 2001:133). Evidence of changing intensification patterns based on the demand of agricultural labor and agricultural features is associated with the Purépecha Empire and form a key component of Purépecha state formation (Fisher 2007). These key components of the Purépecha State formation are represented in the form of engineered raised fields in the lakeshore lands in the Pátzcuaro Basin; and the construction of terraces to repair Classic period land degradation (A.D 300-800) and to increase agricultural productivity (Fisher et al. 2003; Fisher 2005; 2007). In previous archaeological research conducted by Fisher (2007:101) in the lake basin, agricultural terraces were identified at the site of Urichu. Fisher classifies these terraces as sloping-field or bench type terraces, and describes them as badly disturbed and eroded as a result of abandonment, modern land-use, and grazing.

The terraces documented at Apúpato during the 2007/2008 field season, cannot be classified as either sloping-field or bench type terraces. The terraces documented at Apúpato are perfectly preserved; with a few exceptions in specific areas presenting erosion patterns (see typology in chapter 6). During the 2009 LORE-LPB survey project, similar agricultural terrace systems were documented at Cerro Chapultepec and Cerro Buenavista located in the former lakebed in the vicinity of Lake Pátzcuaro.

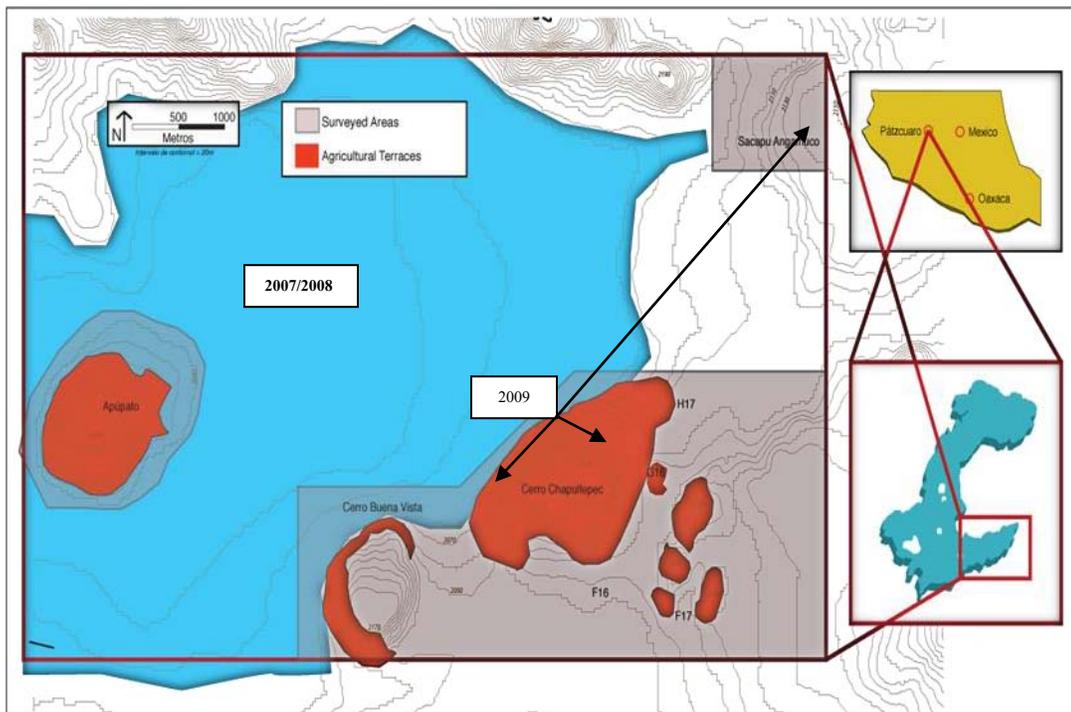


Fig. 1a.2 Lake Pátzcuaro Basin: Terraced Areas

Terraces vary in type and function, but basically, a terrace is an embankment constructed perpendicular to the slope so that it produces an area of land behind this embankment, which reduces or manages the degree of the slope (Whitmore and Turner 2001:133). Four types of terraces have been recognized in the Mesoamerican archaeological record; however, none of these descriptions match the type of terraces



Fig. 1a.3 Apúpató Terraces: Wet Season (July, 2006). Fig. 1a.4 Apúpató Terraces: Dry Season (January, 2008).

documented at Apúpató (see discussion in chapter 6). Expanding on Brookfield's (1972) concept of social production (see discussion above), some archaeologists have acknowledged that intensification often involves crops that are not uniquely food crops, and that they either represent luxury foods, or foods with social rather than economic meaning, or crops important for surplus production for trade (Hayden 2003; Leach 1999; Morrison 1994, 1996). The terraces documented at Apúpató present characteristics that suggest the intensification of maguey production for pulque or fibers, which has both a caloric, economic, and social return.

Sloping field terraces (also called semi-terraces, *bancales*, or *metapantli*) extend in gentle slopes and minimally alter the angle of the slope. They serve as a tool to collect deeper soils behind the terrace wall, retaining more moisture within the slope soils, and preventing the loss of soil nutrients through erosion (Whitmore and Turner 2001:134). Bench terraces are commonly irrigated, contour the slope, and form a leveled planting surface (Whitmore and Turner 2001:134). Cross-channel terraces form a barrier or check dam, or *lama y bordo* (silt and dam). These terraces are distributed along the landscape in

embankments, narrow valleys, or brief water courses, to capture sediments for cultivation. Finally, the valley floor terrace is not very common, but it is used to spread water and sediments across broad valleys (Whitmore and Turner 2001:134). The terraces found at Apúpató do not match any of the common terrace typologies known for Mesoamerica.

Prehispanic terraces are usually recognized in the archaeological record because in some cases terrace systems have been isolated and not disturbed by modern agriculture, and are visible when a full coverage archaeological survey is done in an area. Also, terraces have been found in archaeological excavations; and some terraces are still being in use at the present. However, much of the data on these types of agricultural features have been highly neglected and hardly mentioned in the ethnohistorical documents for Michoacán (*Relación de Michoacán*). Much of the terraced systems in Mesoamerica were under cultivation at the time of contact, however, descriptions of such systems do not appear in the ethnohistoric record (Whitmore and Turner 2001:134). These Prehispanic agricultural systems found in the Mesoamerican archaeological record, such as Apúpató, can serve fill in this lacuna, and can help focus on the importance of ancient agricultural intensification studies in the archaeological record.

These types of agricultural features –terraces, check dams – that significantly altered Apúpató, could have served to increase arable land and provide agricultural production security during lake transgressions (periods when arable lands were lost to the lake). This “Purépecha Piedmont strategy” at Apúpató served as an investment that secured production and reduced risk for future use by re-organizing agricultural production and exploiting new piedmont zones of the lake basin. The construction of

agricultural terraces allowed land managers to beat the 'diminishing returns' syndrome, of agricultural intensification by first investing labor in the construction of these types of intensification features and later reducing the labor cost to only maintenance (Fisher 2007:94).

In the last few decades an increasing body of fieldwork has addressed ancient agricultural systems in South America and Mesoamerica (Denevan 2001; Dunning and Beach 1994; Dunning et al. 1997, 2002; Fedick 1994, 1996; Fisher 2007). However, few of this data has been integrated into the context of theoretical ancient agricultural intensification (Smith and Schreiber 2005:195, 210), and the "built environment" theoretical approach. In this thesis, Apúpató's example of agricultural intensification will be integrated with both the general theoretical framework of ancient state formation and ancient agricultural intensification. Thus, the Apúpató example builds upon Fisher's (2007:91) argument that for Mesoamerica no substantial evidence of intensive agriculture and its processes has been properly articulated with the literature of state formation theory.

The former island of Apúpató is a model presenting evidence of agricultural intensification, and human constructed and managed landscapes by either consolidating and or repairing landscapes with erosional problems. Apúpató provides evidence that can help reinforce many of the arguments that have recently been presented by Fisher (2003; 2005; 2007) and has the potential to reformulate certain perspectives in regard to the agricultural potential in the Lake Pátzcuaro Basin in terms of caloric production per unit of land (Pollard 1983; see discussion in chapter 7). The main argument presented by Fisher (2005; 2007) and Fisher et al. (2003) is that agricultural intensification resulted

from the engineering of lakeshore landscapes into raised fields systems that were meant to mitigate lake levels fluctuations, and that the construction of terrace landscapes were meant both to repair Classic period land degradation (A.D 300-800) and at the same time increase productivity. These intensification features emerged in the context of increasing social complexity associated with low population density (Fisher 1999). Fisher (2005) has argued that the construction of these large-scale terrace landscapes was a crucial component of Purépecha statecraft. His approach argues for terraces as both a way to repair Classic period land degradation, but also as a way to increase the agrarian potential of the lake basin, by stabilizing landscapes. These strategies and labor investment in the landscape are excellent examples of past human resiliency, in the context of major disturbances or changes that were either absorbed or utilized as an opportunity to change and adopt a different type of agricultural technique.

Consequently, it is important to better understand the Lake Pátzcuaro Basin built environment (terraces, raised fields, etc) in relationship with social complexity to develop more sophisticated models for the Purépecha State formation. Not much attention has been placed to this type of research; thus, it is the goal of this thesis, to provide and fill in this lacuna. Research in the Pátzcuaro Basin started in the 1940s by geographers Foster (1948) and West (1948) who noticed systems of terrace cultivations in the region. However, it has been in the last two decades, mostly in the last ten years, that agricultural intensification studies and the built environment of the lake basin (Fisher 2005; Fisher et al. 1999; 2003) has grown due to the improvement of new field methodologies and post analysis geo-spatial analytical technologies. Currently, the discovery within the lake basin of new archaeological sites has yielded preserved ancient agricultural

intensification features (terraces, check dams) that have the potential to improve our understanding of Purépecha State and Empire formation.

The Apúpató landscape is almost an undisturbed example of agricultural intensification and the built environment (*landesque capital*) in the core of an empire. Apúpató provides excellent evidence for the improvement of the Purépecha State formation theories and human environmental interactions. Archaeological examples like Apúpató are candidates for comparative studies of states and agricultural intensification. Most of the archaeological evidence of agricultural intensification in central México has been lost to urban development, like the *chinampas* from the Basin of México, which are buried under modern México City. Other ancient agricultural intensification features have been lost to modern agricultural land-use, or are yet to be discovered as in the Mayan region. Thus, it is fair to say that much of the current anthropological theorizing has been somewhat speculative, and little connection between theory and real examples from the archaeological record has been done (Smith and Schreiber 2005:189). Apúpató is a unique and perfectly conserved example from the archaeological record that contains many agricultural features that are evidence of intensive agricultural practices, and could potentially signify a great analog for what the lake basin looked like at the time of European contact, before the landscape was managed in a drastically different way.

Apúpató's agricultural features built in the landscape are a tangible example of the levels of human adaptation and resilience as a response to a dynamic and changing environment. The Lake Pátzcuaro Basin presents a history of lake levels fluctuations. Adding this human-environmental dynamic to the explanation of the Purépecha State formation, will shift us away from the commonly repeated error of reducing state

formation and agricultural intensification to only population pressure (Smith and Schreiber 2005:194). This thesis will present for the first time well preserved prehispanic agricultural terraces and will analyze them in terms of their shape, function, and construction. This thesis will focus on the alterations to the physical and cultural landscape and its relationship to state formation, as a form of materialization of state ideology (DeMarrais et al. 1996). It will integrate the importance that both human agency and resilience plays in models of Purépecha State formation in the context of a dynamic environment (Smith and Schreiber 2006:26). Apúpato's terraces are evidence that can be used to reach a middle ground between polarizing views of human history, social change, and human-environmental changes, through the use of paleoenvironmental data (lake fluctuations), human agency and resilience (agricultural features built in the landscape).

CHAPTER 2: AN INTRODUCTION TO THE LAKE PÁTZCUARO BASIN

PHYSICAL CHARACTERISTICS:

The Lake Pátzcuaro Basin is located in the state of Michoacán, in west central México. It lies between 19°45' and 19°25' latitude, and 101°55' and 101°25' longitude and it has an elevation of 2035 m asl. Pátzcuaro is an active volcanic area with frequent seismic activity. The lake basin is 929 km², and has considerable internal variation in latitude, topography, rainfall, frost, soils, and vegetation (Gorenstein and Pollard 1983:4). The basin is within the axis of the Trans Mexican neovolcanic belt that runs from east to west. (Labat 1995:17). The Lake Pátzcuaro Basin is located within the central portion of this Trans Mexican volcanic belt, which has been created by both volcanic and tectonic activity (Israde 1995; Garduño 1997). It is a closed basin in the Michoacán-Guanajuato volcanic field, which dates to between 2.78 myr (Ban et al. 1992) to 40.000 k (Hasenaka and Carmichael 1985).

The lake basin elevations fluctuate from 3,200m and 2,035 meters above sea level (m a.s.l), however, the lake itself is roughly 130 km² and its depth varies from 12 meters being the deepest to less than 1 meter deep. These variations in lake levels have resulted in the past in the formation of islands, and, or in the connection of former islands to the mainland, like the case of the former island of Apúpato. This is a critical and important element of the topography of the area; since Lake Pátzcuaro is a closed lake basin, the lake level fluctuates depending on the amount of rain it receives during the rainy season.

The sixteenth century Lake Pátzcuaro perimeter was reconstructed through information of islands, shore-lines, canoe landing points, and shoreline settlements. Also, it was reconstructed based on sixteenth century sources such as colonial maps that were compared and contrasted to modern maps (Gorenstein and Pollard 1983:6).

These fluctuations of lake levels are critical to understanding land-use during the prehispanic and early Hispanic period, since they create environmental and socio-political circumstances that require a land-use management strategy. Thus, based on these estimates of lake level fluctuations we can estimate the agricultural potential at specific time periods and contrast it with the archaeological evidence such as surface evidence in the form of agricultural terrace systems in the piedmont region of the lake basin, as in the case of the former island of Apúpató.

ENVIRONMENT OF THE LAKE PÁTZCUARO BASIN:

Based on variations in hydrologic boundaries, vegetation, and soil distributions Pollard and Gorenstein (1987:4-5) proposed the presence of six distinctive environmental zones, which they argue had a considerable effect on the settlement system and on the formation and functioning of networks. Further, these environmental zones, or biotic zones, have been determined primarily on the basis of human utilization of the basin's resources during the colonial period, therefore the modern Lake Pátzcuaro environment is a product of prehistoric and historic activities and management strategies applied in the basin throughout time.

Six environmental areas have been observed and recognized. The first zone is the open water zone, which includes at least seven species of fish, and waterfowl that feeds

primarily on tule-reed marsh. This area includes the totality of the lake all the way to the shoreline or the marsh areas. During the prehispanic period, Lake Pátzcuaro was a rich and productive center for fishing, which was an important source of food. This ecosystem would have also included a large number of migratory birds (Pollard and Gorestein 1987; Fisher 2000). According to Foster's ethnographic work done in the late 1940s these birds were hunted with atlatls by fisherman in large, multi-communities drives. This activity was recorded all the way up to the 1950s and most likely has roots in prehistoric hunting practices (Foster 1948).

The second zone is the tule-reed marsh, which is found along shallow zones of the lakeshore, and it is no more than four to five meters in depth. The southern portion of the lake basin would have represented the largest proportion of these shallow zones (>1m to 5m). Since the lake Pátzcuaro has such dynamic level fluctuation behavior, it makes this zone very sensitive to such changes, transforming the extent of the marsh, and its location very often. This could be exemplified by the ever-changing marsh distribution that has been revealed with the on-going modern regression of the lake (Fisher 2000), and the connection of the former island of Apúpato to the mainland. During the prehispanic period this fluctuating area would have occurred between 2,032 m a.s.l going as high as 2,040 m a.s.l (Pollard 1993). The type of soils found in this area is lacustrine and alluvial, with vegetation such as tule-reed marsh, reed, cattails, water lilies, and with fauna such as shrimp, frogs and water snakes. Also, seasonal fluctuations create a transition zone of small marsh-grassland, which are seasonally flooded.

The third area, located between 2,034 m, and 2,035 is the lakeshore zone, which occupies the lower slopes of hills and the flat areas of the lake basin. The type of

topography of this area is the flattish floor of the basin, including lake islands, alluvial deltas and plains. All form of native forest and woodland has been removed for agricultural land gain; thus, making this type of landscape primarily a result of human manipulation and a built environment. As a consequence of intensive human use, most of this area contains predominantly agricultural flora including cash crops, alfalfa, peas, lentils, and in the case of Apúpato, it contains wild maguey (agave Americana). In the same way as the marsh and the tule-reed zone, this area's flora and fauna is sensitive to lake level fluctuations. During the prehispanic period, this area would have been found between the 2,035m a.s.l and 2,070 m a.s.l. In areas that have not been cleared for agriculture, the type of forest is oak and pine, and some grass, shrub, and cacti. The wildlife within this area consists of foxes, squirrels, skunks, chipmunks, gophers, rats, lizards, salamanders, leopard frogs, garter snakes, and rattle snakes. Birds found in this area are hawks, owls, ravens, hummingbirds, pigeons, doves, towhees, and blackbirds (Forster 1948; Pollard and Gorestein 1987; Pollard 1993; Fisher 2000).

The fourth area, located at 2,100 to 2,300 m of altitude, is the lower slopes of the Sierra zone, which represents the remains of stands of deciduous trees. This area is only slightly or not affected at all by the lake level fluctuations. The type of topography of this area is lower slopes of volcanic hills and mountains, and some lava flows (malpais) (Pollard and Gorenstein 1987). It contains two types of biotic communities depending on the elevation. At the lower elevations, the landscape is dominated by woodland forests of deciduous trees, with a diversity of up to more than twelve oak species, and several species of alder, and basswood. In the upper elevations, the landscape is dominated by a pine/oak mix (Fisher 2000).

The fifth area, located at 2300-2800 m of altitude, is the upper slope of the Sierra zone which is found in the upper slopes of most mountains in the lake basin. This is a conifer forest that consists of pine and pine/oak forest, woodland and cultivated fields. The topography consists of the upper slopes of volcanic hills and mountains, and also includes small alluvial basins (Pollard and Gorenstein 1987). This area is represented by at least seven different species of pines, in addition to forests of fir that occur at elevations higher than 2,800 m. This area is to some extent the habitat for abundant and diverse game, like white tailed deer, peccaries, wolves, jaquarundi, mountain lions, wild turkeys, and chachalacas, all which were common during the prehispanic period.

The sixth area is located at 2800 to 3200 m of altitude, and is the alpine zone which is restricted to those elevations above 2800 meters, where pine does poorly and fir does well. This represents a fairly small spatial portion of the lake basin. Its biota is predominantly represented by fir forest and some pine forest and cleared pine fields (Pollard and Gorenstein 1987).

In addition to these six environmental zones, Pollard and Gorenstein (1987) proposed three classes of agricultural land based on modern agricultural yields (as of 1987), land-use, and general characteristics that were supported with ethnohistorical data, forming a model of the proto-historic environmental productivity for the lake basin.

To better understand these three classes of land, it is important to first introduce the basic sources of soil formation and characteristics for the region. Since the area is an active volcanic and tectonic area, there are regions in the basin where parent material—regolith—has been exposed. There are two types of parent materials in the basin area: 1) *Uirás*, which is a thick deposit of diatomite and is extremely infertile (Gorenstein and

Pollard 1983:136). Diatomites are single-celled organisms that exist in all types of waters. They formed shells made out of silica. When they die, their shells accumulate on the floor of the body of water they lived, and they fossilize to form thick layers or beds of diatomite that are present in the geological record. The second type of sediment is composed of various volcanic sediments and rocks from which *Charanda* soil forms. This type of soil is a red earth high in clay content and it is highly erosive once plant cover is removed (Fisher 2000:23). The *Charanda* soil is located over the lower mountain slopes and floor of the basin. This soil developed from the weathering of volcanic rock, it does not readily retain moisture, and by the end of the dry season it creates large cracks, making it hard to plant crops before the rainy season, thus, planting can only be done after the rainy season has begun. As the rain hits this dried soil, its thick topsoil is easily eroded. This simple process of erosion results in deep gullies and exposed subsurface clay deposits.

The first type of land, Class I, includes irrigated plots, which can be located within the lakeshore topographic zone. This class of land is conformed by lacustrine parent materials with inputs of *Charanda* and Tupuri colluvium from the Sierra (Fisher 2000). Depending on the type of water management strategy and technique applied, this class of land can be further divided into two sub-classes of land. For example, if the type of irrigation applied is represented by a chinampa-like technique, pot-ditch, or canal style irrigation; fields that are irrigated in this fashion on a full-time basis are considered class Ia. For the modern (as of 1987) lake basin the annual agricultural yields obtained by applying this technique could be two or three in the basin without a fallow cycle. This class of land is very productive, and yet access has been, and still is, much contested

among neighboring communities whenever a lake regression exposes plots for potential cultivation. The second sub-class, Class Ib, is represented by *tierra de húmedad*, which is only irrigated on a part-time fashion, through floodwater and terraces techniques. This class of land is small in the modern lake basin, however, it was likely much larger during the prehispanic period, based on ethnohistorical data (Fisher 2000).

The second type of land, Class II land, is found between the lower slopes of the Sierra and the lakeshore zones. This land is formed from parent materials such as *Uirás* or volcanic overlaid with *Charanda* and *Tupurí* soils (Fisher 2000). The frequency of land-use is seasonal, and agricultural productivity is dependent on rain-fed moisture only. The fallow cycles varied from one to five years (Pollard and Gorenstein 1987). During the prehispanic period this class of land would have been terraced, thus increasing significantly the yields and productivity, as exemplified by Apúpató's well preserved terraced landscape. In addition, the archaeological survey data collected by the LORE-LPB archaeological project has obtained more spatial data regarding terrace systems within the Lake Pátzcuaro Basin (Apúpató, Cerro Chapultepec and Cerro Buena Vista).

The third type of land, Class III, is primarily located in the upper slopes of the Sierra zone. The soils are thin mountain soils of *Charanda*, *Tupurí*, or other type of high altitude variation. This land class is rain fed dependent for agriculture, and the fallow cycles are long (Pollard and Gorenstein 1987).

CULTURAL CHARACTERISTICS: PREHISTORY OF THE REGION

The prehistory of the Purépecha culture has received little research when compared to other Mesoamerican areas such as the Basin of México, Oaxaca, and the

Maya region. However, since the 1960s a great amount of archaeological research has been devoted to this area by Helen Pollard, Christopher T. Fisher, the *Centre Francais D'Etudes Mexicaines et Centramericaines* with the *Proyecto Zacapu* in the Zacapu Basin, and I.N.A.H Mexican salvage archaeological programs. The products of these recent studies have helped develop models of state formation for this region, and have improved understanding of the West Central Highlands prehistory. It is the goal of this thesis, to collaborate with models of state formation in the Lake Pátzcuaro Basin. The prehistory of the region will temporally be organized by the West Mexican cultural tradition from the Paleoindian period through the 16th century Colonial Period which has been synthesized by Pollard (1993) and Gorenstein and Pollard (1983). The prehispanic period will be divided by the standard and traditional Pre-classic through Post-classic time division used in Mesoamerican studies.

The territory controlled by the Purépecha civilization is based on ethnohistoric and linguistic evidence and delineates boundaries that extend beyond the Lerma River to the north and beyond the Balsas River to the south. It extends to the west including the Lake Chapala and the Coalcoman region of Jalisco. The eastern boundary is drawn by a line following Acámbaro in the north, passing through Zitácuaro and ending south in Balsas River again (Gorenstein and Pollard 1983). Basically, the territory they controlled was the modern state of Michoacán and adjacent parts of Guanajuato, Jalisco, and Guerrero (Pollard 1993).

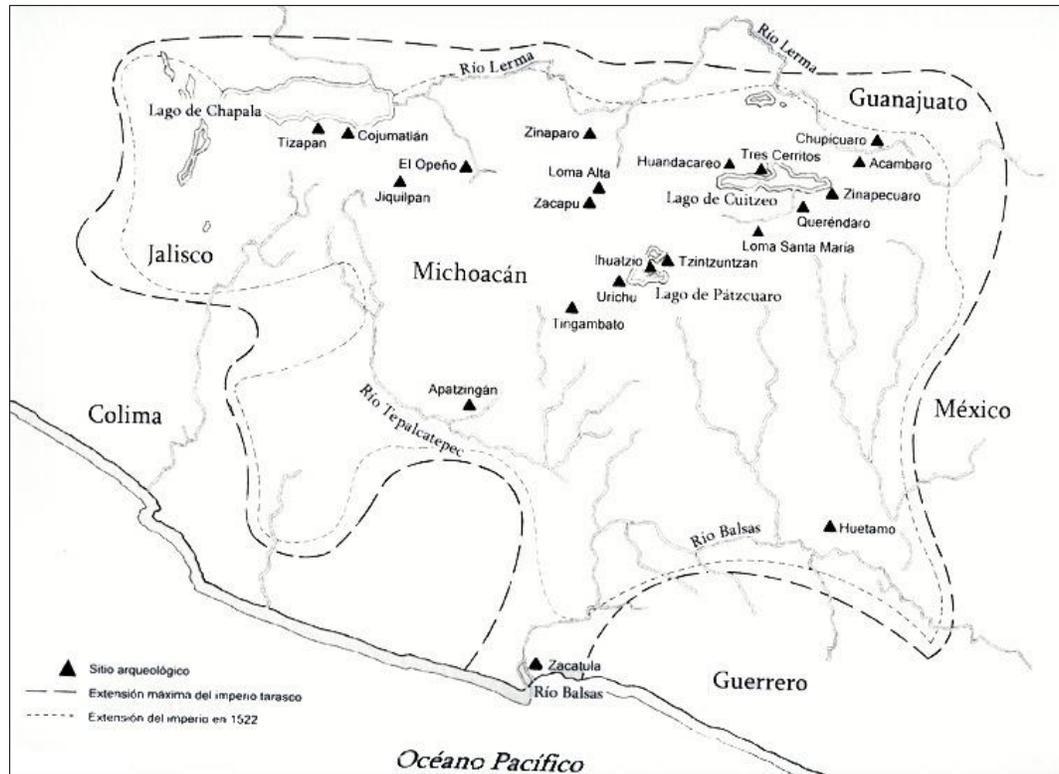


Fig.2.1. Extension of the Purépecha (Tarascan) Empire during the Late Postclassic (after Williams 2003:Fig.8, adapted from Pollards 2000:Fig.5.1 and 6.2)

Period	Pátzcuaro Phases	Dates
Early Hispanic		A.D 1520-1550
Late Postclassic	Uacuséchas	A.D 1350-1525
Early – Middle Postclassic	Angamucu	A.D 900/1000-1350
Epiclassic	Lupe-La Joya	A.D 600-900/1000
Classic	Loma Alta ³ /Jarácuaro	A.D 350-600
Pre Classic		A.D >350

Table 2.1. Phases for the Lake Pátzcuaro Basin, Michoacán, México (Pollard 1993 from Fisher 2008).



Fig. 2.2 Ceramic Figurines from el Opeño, Michoacán (after Oliveros 2004 laminas 1,2)

The cultural development of the Purépecha region dates back to the Paleoindian or Lithic period (before 2500 B.C) by small groups of hunter-gatherers who manufactured and utilized fluted projectile points and other stone tools. These tools have

been found in association with Pleistocene megafauna, like mammoths and bison (Pollard 1993:6). Deposit assemblages, conformed of basalt and obsidian debitage, a projectile point, and mano were identified from this archaic pre-ceramic period (dating to 2,500-2,200 BC) identified in Los Portales cave in the neighboring Zacapu Basin (CEMCA Project, Michelet et al. 1989), north of the Lake Pátzcuaro Basin.

During the Early Preclassic period (Archaic period) evidence of the earliest domesticated maize was recovered from pollen cores from the Lake Pátzcuaro Basin dating to approximately 1500 BC (Pollard 1993:6). Agriculture was implemented for much of western México during this time period. This agricultural life way is not only represented in the archaeological record by the presence of maize pollen, but also by abundant ceramic remains, large villages, and access to exotic goods (Fisher 2000). During this period the presence of agriculturally based villages and ceramic-producing societies is best exemplified in the archaeological record by the shaft tombs of El Opeño site, which is the best documented of formative societies (Pollard 1993:6) in western

Michoacán. The El Opeño site consisted of 11 excavated shaft tombs dating to 1500 to 800 B.C, and contained figurines, ceramic vessels, and objects which suggest a cultural interaction along the Santiago-Lerma River system with other cultures to the west of Jalisco and Nayarit, and also interactions to the east (Pollard 1996 and Fisher 2000). South of the Lake Pátzcuaro Basin, several small villages have been reported for the lower Balsas region associated with Capacha style ceramics (Fisher 2000).

During the Middle (~500-150 B.C) and Late Preclassic (150 B.C-A.D 350), three distinct cultural groups are consolidated in Michoacán: Chupícuaro, Balsas/Mezcala, and Chumbícuaro culture. The best known is the Chupícuaro culture known to have been adapted to lacustrine ecosystems. The Chupícuaro tradition is associated with distinctive polychrome ceramics and is seen most often in the context of burials. Their settlements have been described as small villages with no public or monumental architecture. Since they were known to have been adapted to lacustrine ecosystem, these settlements were located on islands within marshes or along lakeshores and rivers (Fisher 2000). The evidence of this cultural tradition is found in the highland lake basin of Zacapu and Cuitzeo and along the upper Lerma in the actual states of Michoacán and Guanajuato. Since Chupícuaro tradition ceramics have been, for the most part, found in association to burials, Pollard (1996) has suggested that social ranking may have existed during this time period. For the Lake Pátzcuaro Basin, there is no evidence in the archaeological record of this cultural tradition yet.



Fig. 2.3. Anthropogenic clay figurines. Chupícuaro, Guanajuato (Williams, FAMSI)

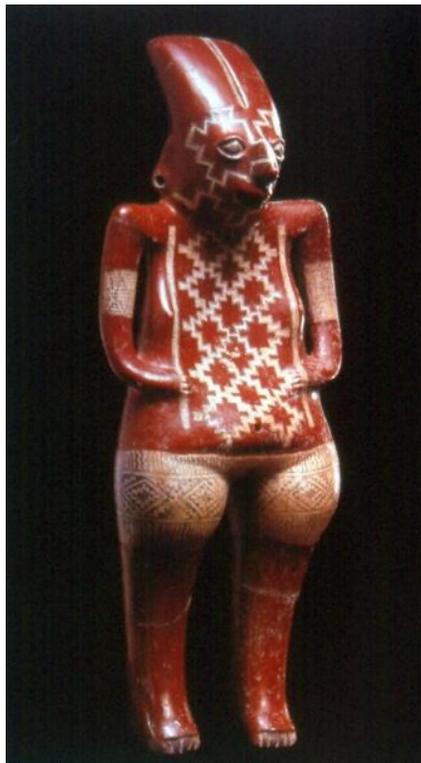


Figure 12. Anthropomorphic clay figurine with geometric, polychrome decoration. Chupícuaro, Guanajuato (private collection, photo by Eduardo Williams).

Fig. 2.4. Anthropogenic clay figurine with geometric polychrome decoration. Chupícuaro, Guanajuato (Williams, FAMSI)

During the Early Classic period (A.D 350-550) there is an increase in social and political complexity, reflected in the burial patterns and settlement sizes suggesting that social ranking was taking place in the Lake Pátzcuaro Basin. Also, there is an increase in urban development and intensification in craft specialization and trade networks. It is during this time period, that the great state of Teotihuacán is formed and reaches its highest peak of success. Thus, influencing ideologically, culturally, and stylistically many other centers of social organization, like El Otero (Jiquilpan), Tres Cerritos, Queréndaro, and Zinapécuaro for the Cuitzeo Lake Basin, and Tingambato, which all express talud-tablero architecture, plaza groups, ball courts, stucco painted murals, pseudo-*cloisonné* ceramics, large group tombs and Teotihuacán styled masks (Pollard 1993; Fisher 2000). Thus, it is during the Middle Classic period (A.D-550-600/700) that a major cultural change takes place, and it is represented with evidence of first ceremonial centers in the region, containing architectural style and artifact from Teotihuacán, demonstrating direct contact between the two regions. During the Late Classic period (A.D 600/700-900) the contact and influence of the Teotihuacán culture stimulated and increased the processes of social differentiation and the emergence of the territorially discrete and competing middle range societies or polities.

There are multiple hypotheses as to the reasons and in what ways Teotihuacán culture entered and influenced western México. Explanations varied in themes such as invasion, outposts, or post-collapse migrants settling the western frontier in search of obsidian, minerals, and other natural resources (Fisher 2000). It is important to point out that ceremonial centers and public architecture present in the archaeological record are not solely related to Teotihuacán's influence. For example, large centers like Urichu in

the Lake Pátzcuaro Basin are present. The site of Urichu, (which will be discussed later) is located in the north-eastern portion of the lake basin on the *Malpais* (badlands). This site, excavated by Helen Pollard in the early 1990's and later on surveyed, has provided (prior to Apúpató) some of the best preserved evidence of agricultural intensification for the basin in the form of terraces, and also, at least two public zones with associate plazas, pyramids, and remains of structures (Fisher 2000).

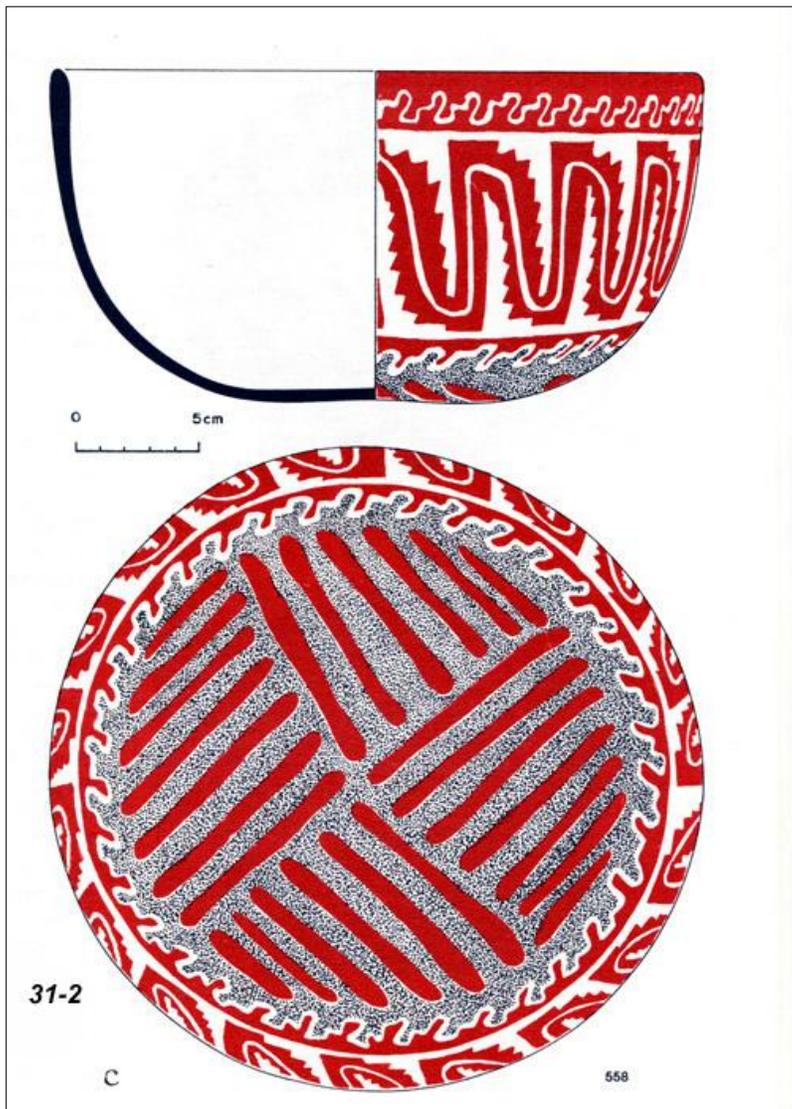


Fig. 2.5. Pottery Bowl with polychrome decoration. Loma Alta (Classic Period). Michoacán (Arnauld et al. 1993, Fig. 33).

In the context of the western central Mesoamerican highlands, the Epiclassic period (A.D. 600/700-900) marks the fall of Teotihuacán and the reorganization of much of the highlands. This reorganization is exemplified by the spark of new small centers like Tula in what is now the modern state of Hidalgo. Tula was a densely populated society with highly distinctive urban and non urban settlements, which when combined reached to a population of approximately 120,000 people. Tula was composed of three major ceremonial centers, elite palaces and residential apartments (Healan 1986 as cited in Fisher 2000). The relevance of Tula in relationship to western México, and specifically to northern Michoacán, is the presence at Tula of obsidian debitage from Michoacán sources. This is an important piece of evidence for the level of intensification in obsidian mining at the Zinapécuaro-Ucareo and Zináparo during the Epiclassic (Healan 1986 as cited in Fisher 2000).

In this socio-political and economic context, the rest of the Central Lakes Region experienced local processes of increasing social differentiation, settlement complexity, and centralization, while the connections with Central México diminished (Fisher 2000). The relevance of this time period for the formation of the Purépecha State relates to the many cultural traits that were outlined during this time period, and were later associated with the later Purépecha State (complex metallurgy, ceramic pipes, complex polychrome pottery with negative decoration, large-scale rubble filled mounds clustered into plazas and located on hillslopes or Malpais, and petroglyphs) (Pollard 1993).

During the early Postclassic period (AD 900-1000\1350) there is significant population growth resulting in major shifts in settlement patterns. During the middle Postclassic period (900 A.D- 1200 A.D) a major ideological shift is present in the region,

standardizing some of the shared traits, and beliefs that, later on, are characteristic of the Purépecha culture. These dramatic transformations of small city-state polities (señorios) were re-organized into large and diverse empires (Fisher 2000) in both the Lake Pátzcuaro Basin and the Basin of México. Therefore, it is during this period that two new ethnic groups appeared in the history of prehispanic Mesoamerica, both sharing a cultural and historical past. They emerged as polities, and in the case of the Purépechas, they are characterized as having a more complex metallurgy, abundant ceramic pipes, and occupation of sites that gained sacred significance to the Purépechas, large-scale rubble-filled mounds clustered into plazas and located on hill slopes or malpaís (badlands). Also, petroglyphs that depict the Purépecha sun-hunting deity Curicaueri are present as well (Pollard 1993:12).



Fig.2.6. Twin Pyramids at Ihuatzio (Williams 2004, FAMSI).



Fig. 2.7. Ritual Incense burning used by Purépecha priests (Museo Michoacano, Williams 2004, FAMSI)

Fig. 2.8. Tripod plate with negative Painting (Museo Michoacano, Williams 2004, FAMSI)

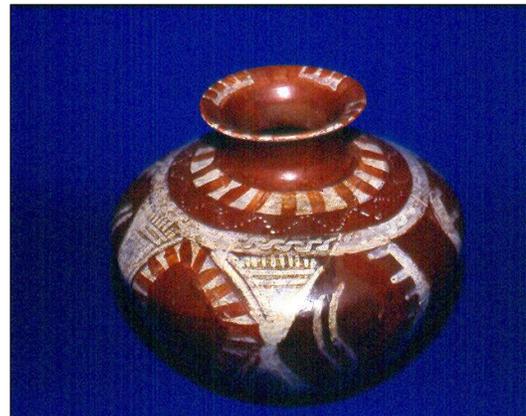
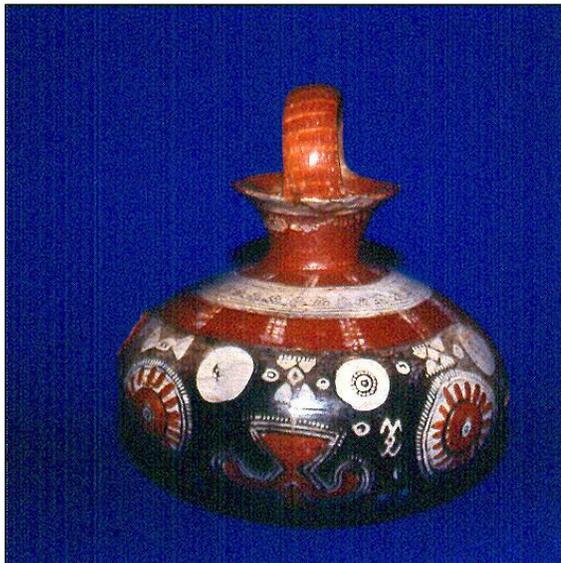


Fig. 2.9-3.0 Late Postclassic (Tariacuari phase) Negative painting examples (Museo Michoacano, Williams 2004, FAMSI)

There are multiple lines of evidence regarding the formation of the Purépecha State; however, there is an enormous lack of archaeological understanding regarding this subject for the Lake Pátzcuaro Basin. One of the most used and accepted lines of evidence is the ethnohistorical accounts of the *Relación de Michoacán* (RM). The *Relación de Michoacán* describes populations of Chichimecs, Nahuas, and Uacuséchas (which means ‘_eagles’ in the Purépecha language, and was the name given to the

Purépecha Royal dynasty) who entered the Michoacán area during the Postclassic period. The *Relación de Michoacán* narrates how these groups formed communities (polities or señoríos) among already existing groups within the Pátzcuaro Basin. For example, Yziparamucu, one of the eight señoríos (polities) located west of Tzintzuntzan, in the malpais area, is described as a Chichimec settlement. In 2009, the site of Sacapu Angamucu was recorded south of this señorío, in the malpais area.

The *Relación de Michoacán* describes how, a series of droughts sparked off a cascade of small scale wars over the basin's limited resources during the middle thirteenth century, and resulted in the legendary warrior king Tariacuari consolidating the basin into one state, with a defined center of political and economic power. Other lines of evidence other than the *Relación de Michoacán* consists of archaeological and paleoenvironmental data, which has been collected and analyzed in the last three decades into a more comprehensive approach. Based on these archaeological and paleoenvironmental data, Pollard (1993) based her proposed Purépecha State formation model. The model plays out with a scenario composed by several independent polities (señoríos), with their own agricultural lands, trades routes, and natural resources. However, lake level fluctuations caused by a significant climatic shift that occurred during A.D 750-1000 caused a lake transgression (Pollard 1993). This resulted in the loss of agricultural lands which were inundated, resulting in a food deficit, leading into competition and warfare between the polities, culminating with the integration of all these polities around the lake basin into one consolidated Proto-Purépecha State. Most lines of evidence and arguments have been, in some regards untested, or are in the process of being tested. For example, arguments regarding the fluctuations of lake levels, access to agricultural lands,

and agricultural land-use strategies within the region are in the process of being archaeologically tested.

At this moment the strongest state formation argument for the region is that the Purépecha State was formed by the warrior-leader Tariácuari, who united the several independent middle range centers of power or polities around the Lake Pátzcuaro Basin. It is later, during the Late Postclassic period (A.D 1350-1525), most specifically during the early 14th century that unified señoríos or polities of the Lake Pátzcuaro Basin initiated a series of conquest campaigns of much of Western México. Their most profitable ambitions were the obsidian mines of Zinapécuaro-Ucareo and Zináparo in the northern area and the copper mines in the southern area of the Balsas River. These campaigns shaped and helped consolidate the Purépecha Empire, which was orchestrated from the political, economic, and religious core in the Lake Pátzcuaro Basin, in the main capital Tzintzuntzan (Pollard 1993). Thus, around the fifteenth century the, Purépecha territory extended to the east and the Aztec territory to the west, putting their frontiers very close together, being only separated by a 50 kilometer buffer zone from each other (Gorenstein and Pollard 1983).

The Purépecha Empire expressed many of the characteristics of an archaic state (Pollard 1993). For example, the societal class division between the common people, the elite and Purépecha royal dynasty represented in a well defined expression of the landscape in terms of settlement distribution. Gorenstein and Pollard (1983) classified settlements based on size area and population, and importance variability within the Purépecha Empire at the time of European contact; thus, coming up with a five tiered classification.

As the most important center and representing Class one, was Tzintzuntzan, the capital of the empire, which was located in the northern section of the lake basin and was greater than 674 ha in size. This capital city was densely populated, and was one of the most important ceremonial centers in the basin. The importance of religion as a tool of dominance and power, helped legitimize elites in imposing their authority over diverse ethnic groups; this resulted in an ethnically heterogeneous society in the periphery and a homogenous ethnic composition in the core. Although the city was not planned at the large scale, it was planned in zones and functions associated with different types of architecture, resulting in Tzintzuntzan showing evidence of multi-purpose units. Tzintzuntzan's growth and development was supported by political factors and not economic ones (Gorenstein and Pollard 1983).

Class two settlements are exemplified by señoríos such as: Pátzcuaro, Erongarícuaro, and Ihuatzio, where political, economic and religious activities would take place, and constituted large elite residential areas. Class three to five were settlements made up of towns, villages, and hamlets, smaller than 50 ha in size and lower population densities. These settlement's economies were primarily based on agricultural or fishing activities.

This chapter has presented and outlined the environment and prehistory of the Lake Pátzcuaro Basin, and demonstrated the importance for more archaeological data and better integration into state formation models for this region. As presented in the chapter, this region presents rich information regarding settlements dating to the early Classic Period, paleoenvironmental records that show the dynamic fluctuations of the lake levels, and ethnohistorical line of evidence regarding the centralization and formation of the

Purépecha Empire and the characteristics of the lake basin at the time of European contact. However, a better and improved state formation model, which includes archaeological, ethnohistorical, and paleo-environmental data, has been under development for the last decade by Fisher with archaeological projects such as LORE-LPB taking place every year since 2006 in the Lake Pátzcuaro Basin.

CHAPTER 3: LAKE PÁTZCUARO BASIN: CHARACTERISTICS AND DYAMICS OVER TIME

Lake Pátzcuaro is a highland lake, and as such it is different from tropical lakes that are located at sea level. The long term record of information of this lake system coupled with long term human occupation shows severe anthropogenic pressures in the form of degradation of the basin and overexploitation of lake resources, which are responsible in part for the constant fluctuations of the lake (Chacon Torres 1993:1). Some of the most obvious reasons for the lake deterioration are indiscriminate logging, organic contamination, overexploitation of the fishery, introduction of exotic species, institutional programs of production that are incompatible with the social, cultural, and ecological reality of the lake basin, and lack of integration and coordination among lake management programs in the present (Chacon Torres 1993:2).

Lake Pátzcuaro has no tributary river or effluents into the ocean; thus, it is fed during the rainy season by temporary creeks and the infiltration of the rain water provided during the rainy season. This makes the lake levels fluctuate continuously from very low and high, with an overall average of 2035 meters above sea level (Chacon Torres 1993:4). Therefore, Lake Pátzcuaro, with its frequent lake level variations, does not have important tributaries, with the exemption of the Chapultepec channel (west of Apúpato), since the volume of water is regulated for agricultural uses. Lake Pátzcuaro suffers from a continual loss of depth (Chacon Torres 1993:5-6).

Little is known and agreed upon the geomorphometry or the geomorphological understanding of the lake. The oldest cartographic representation of Lake Pátzcuaro is from the Spanish contact and settlement period. There are two representation of the lake, probably drawn during the 1540s. One of these colonial maps is from Beaumont (published in 1932) and the other one is from Seler (1908). Regardless of the inaccuracy and scale of the maps, the relevance that these panoramic maps have for the understanding of the lake levels during the Spanish contact is invaluable (Chacon Torres 1993:13). In both maps, Apúpato (also spelled as Hapupato) is represented as an island, totally surrounded by the lake, and not connected to the mainland.

Based on barometric fieldwork and results, the deepest parts of the lake are in the northern part of the lake, and the shallowest parts are located in the southern portion of the lake (Chacon Torres 1993:15). Apúpato, as mentioned before, is located in this southern portion of the lake, supporting its susceptible position of transformation from being an island during high lake levels, to being connected to the mainland during low lake levels. This southern lake basin region is characteristic of marshlands and low slope contour lines between the lakebed and the mainland (Chacon Torres 1993:15). Thus, overtime, some of the islands have become part of the mainland, and new islands are starting to appear as the lake loses its depth. For example, Apúpato is not the only island affected by lake level changes, the former island of Jarácuaro, used to be the biggest island of the Lake Pátzcuaro Basin and is now connected to the mainland. The connection of Jarácuaro to the mainland has created an obstruction to the circulation of water, thereby allowing water to stagnate, making the water temperature rise, and consequently increasing water evaporation (Chacon Torres 1995:17). Also, close to Jarácuaro, is the

island of Pastora, which has recently connected to the island of Jarácuaro, creating a new insular cluster (Chacon Torres 1993:17).

The distribution of slope degree around the lake basin was put together by Chacon Torres (1993:17-18) in an illustrative map. The profile of the terrain is represented by slopes bigger than 5 % as 54.4% of the lake basin. The soft profiles of the terrain of 2-5% of slope degree are located in the southern region of the lake basin, particularly in the areas close to Pastora island. The sharp profile terrains (up to 33 %) are congregated particularly in the northwestern areas of the lake basin. However, the coastal area close to the modern town of Quiroga, presents a soft terrain profile (less 0.97% of slope).

Another important factor determining the lake level is climate. In Michoacán, the climatic distribution is determined by the elevation over sea level and the topographic characteristics of the region. For example, the latitude will determine the inclination, intensity, and duration of solar rays, thus, having significant influence on the climate in the Mexican plateau only during the change of seasons. Because Michoacán is located in the tropics, the sun's rays are homogenous year round. However, the interaction between atmospheric circulation and the topography is what defines the distribution of temperature and precipitation (Chacon Torres 1993:21). Seasonal variations are affected by the annual movements and latitude of the monsoonal season.

Thus, Lake Pátzcuaro levels will be significantly vulnerable and will vary depending on precipitation, evapotranspiration, superficial drainage, and infiltrated water coming from the catchment basin area (Chacon Torres 1993:22).

Many studies done in the basin suggest that the lake is decreasing in volume and that the annual precipitation is decreasing every year. Some of the evidences to make

such statements on lake level variations are associated with the transportation of soils from upper regions in the basin; this is exemplified by the disappearance of small islands in the southern area of the lake known as La Taza, China, San Pedrito, Corian y Cuyameo (Chacon Torres 1993:22). In the same way, Apúpató was identified by Brand (1943) y Hutchinson et al. (1956) as an island during the XVI century.

Some of the hypotheses as to why there is a trend of lake level regression are tectonic and volcanic events that have created temporary cracks and entrances to springs, and these cracks have affected the levels of the Lake Pátzcuaro. Other hypotheses are based on historical climatic records which have suggested that the regional rainfall variations are determined basically by atmospheric changes, but also by the mean annual temperature and the annual evaporation rate; both of which have been for the most part constant in the last century.

So far, lake level fluctuations during the late Postclassic and the early historical period are both documented in the earth science record as well as in colonial accounts and records. Research done by Sarah O'Hara (1993) over the last 600 years of lake level fluctuations using both climatic and historical data suggests a very dynamic scenario over a long period of time. Lake Pátzcuaro, whose lake levels fluctuate annually due to the rainy season and the dry season shifts, stands at an elevation of approximately 2036 meters a.s.l, rising during the raining season. Today the lake is regressing more and more each year due to climate change. Many of the paleolimnological studies done in Lake Pátzcuaro (Hutchinson et al. 1956; Deevey 1957; Watts and Bradbury 1982; De Buen and Zozaya 1942; Chacon Torres 1989; and O'Hara 1993 cited in Chacon 1993) all concluded that at on the millennia, century, and decadal scale, lake level fluctuations

have occurred with frequency (O'Hara 1993). One robust line of evidence comes from both the earth science record and the historical record, providing data that the lake stood at a higher elevation than today at the time of European conquest (O'Hara 1993). One of the most conservative estimates on the lake level at the time of European conquest comes from Gorenstein and Pollard (1983) suggesting that the lake was between 10 to 20 meters higher than at present –somewhere between 2045 to 2055 meters a.s.l).

Some of the historical accounts used to determine lake level fluctuations are the historical account titled “*Relación de las Ceremonias y Ritos y Población y Gobernación de Michoacán*”, which describes the protohistoric period and the formation of the Purépecha State and Empire. The *Relación de Michoacán* has plenty of protohistoric descriptions of landscape perceptions around the lake basin, thus islands that are now connected to the mainland are described in detail –as in the case of Apúpató—providing some clues for paleo-shore reconstructions and estimates of lake levels. For example, Apúpató is described in the *Relación de Michoacán* as an elite island where the Canzonci stored gold, silver and ornamental feathers.

Another source of historical accounts that document the lake level fluctuations are the *Archivo General de la Nación* (AGN) and the *Archivo General del Estado de Michoacán* (AGEM) (O'Hara 1993). These archives contained information regarding land disputes, which are excellent sources of data, since much of these claims will have very detailed and descriptive information regarding the landscape, its access to water, its fertility, and for the most part its relationship to the shore of Lake Pátzcuaro. Many of these disputes involved valuable islands like Apúpató and Copujo. According to O'Hara's (1993) research in the lake basin, Apúpató only forms an island when the lake

is above 2041.5 meters a.s.l. Therefore, if the water falls below this level, then Apúpató is connected to the mainland, as in its present situation.

Maps that were drawn at the time of conquest are a great source of lake level information. These maps, such as the Beaumont and Seler maps point to Apúpató as an island. According to estimates done by O'Hara (1993) based on historical accounts, the lake levels during the pre and post conquest period stood at approximately 2041.5 and 2045.5 meters a.s.l.

Period	Postclassic			Classic	
	Late	Middle	Early	Epiclassic	Middle
Pátzcuaro Phases	<i>Uacuséchas</i>	<i>Angamucu</i>	<i>Angamucu</i>	<i>Lupe/La Joya</i>	<i>Jarácuaro/Loma Alta 3</i>
Lake Level (meters asl)	<2033	<2033	>2035,>2033	>2035	>2035
Estimated Population	13,087-7155	7806-4087	1706-925	1018.8-581.3	393-543
Area Occupied (ha)	851-25	472.5	107.5	52.52	20
Persons/km ²	334-182	199-104	42-23	26-14	20
Sedimentation (Colluviation)	Low	Low	Low	Moderate	High

Table 3.1. Summary of Major Trends during the Prehispanic period. Fisher (2000:121).

According to two maps of México dating from 1579 and 1580 (O'Hara 1993) Apúpató remained an island during the colonial period. Also, sections of the island were purchased from Doña Beatriz de Castilleja three times: 1597, 1598 and 1600 (AGEM 1715 in O'Hara 1993). Another piece of information pointing to Apúpató being an island is provided by a land dispute between the Augustines, the Jesuits and the Purépechas people that claimed ownership of the land in 1674 (AGN 1730 in O'Hara 1993 and Enkerlin 1992). Most importantly, in the documents regarding this land dispute, Apúpató

is described as being surrounded by water and isolated from the mainland (AGN, Tierras in O'Hara 1993).



Fig.3.2 Beaumont Map (circa. 1540) Apúpató circled in red.

Historical documents in this area not only describe situations of high lake levels; they also provide us with information on low lake levels in which Apúpató stopped being considered an island. In late 16th century documents, Apúpató is referred as —Evado de Apúpató”. More specifically this refers to a 1715 document (AGEM 1715 in O'Hara 1993), meaning that Apúpató was accessible through the mainland in the form of a ford (vado in Spanish) or a causeway that would form if the lake dropped below 2041.5 meters a.s.l, allowing people to walk across from the towns of Sanabria to Tzurumútaró

(O'Hara 1993). As lake levels dropped more land disputes appear in the historical archives, due to the access to new lands that were not claimed or given to anyone by the colonial governments.

LAKE LEVEL FLUCTUATIONS EVIDENCE AT APUPATO:

Apúpato is known to be an important and central island to the prehistory of the lake basin. This former island is mentioned in the *Relación de Michoacán* (1541 A.D) as the place where the Canzonci (Purépecha emperor) and the royal elite held in reserve royal treasuries and headdresses, and also as the place where the Purépecha king met for the first time with the Spaniards as they were entering the lake basin. Furthermore, Apúpato was highly disputed between the natives, the San Franciscans, and the Augustinians. This conflict lasted for over a century.

The full coverage survey conducted during the 2007-2008 archaeological field season provided data of an occupation of great temporal span on the former island. The archaeological settlements were grouped into settlement zones and were further organized into temporal groups according to chronological phases known for the Pátzcuaro region. The settlement zones were dated using Pollard's (1993) chronology of the area based on the Prehispanic ceramics of the area.

The population density of Apúpato settlement zones was determined based on the size of the settlement zone and ceramic density. This methodology was developed earlier for central México (Parson 1982; Sanders 1965; Sanders et al. 1979; Blanton et al. 1982) and was applied with success to estimate ranges of population densities for archaeological sites. The estimated population in each temporal phase was calculated by applying Fisher's (2000) methodology which is based on those previously used in central

México and has been developed and applied with success in the Pátzcuaro region (Fisher 2000; Pollard 2001). The population density of each settlement zone was assigned following a model used in the Tzintzuntzan survey (Pollard 1993). This model consists of four levels of occupation density determining a range of population per hectare based on fragments of ceramic sherds per m².

The 2007-2008 archeological field season provided data on at least three periods of occupation on the island represented by 15 settlement zones. These settlement zones tend to be located along paleo-shores and in the medium and upper slopes of the former island. The temporal span of these occupations extends from the Middle Classic (550-600AD/700 AD) to the Early Colonial Period (1520A.D-1550).

Strandline	Elevation (m asl)	UTMs (zone14)	Temporal Diagnostics and Settlements at this elevations
1	2043.92	N 2164998/ E 230649	Late Classic-Epiclassic
2	2040.47	N 2164722/E 230616	Late Classic-Epiclassic
3	2043.97	N 2164510/E 230350	Late Classic-Epiclassic
4	2039.74	N 2164237/E 230084	Late Classic-Epiclassic
5	2040.20	N 2164268/ E230084	Late Classic-Epiclassic Late Post-classic

Table 3.2. Apúpató Strandlines.



Fig. 3.2. Paleoshore along settlement zone 108 in the NE of the former island.

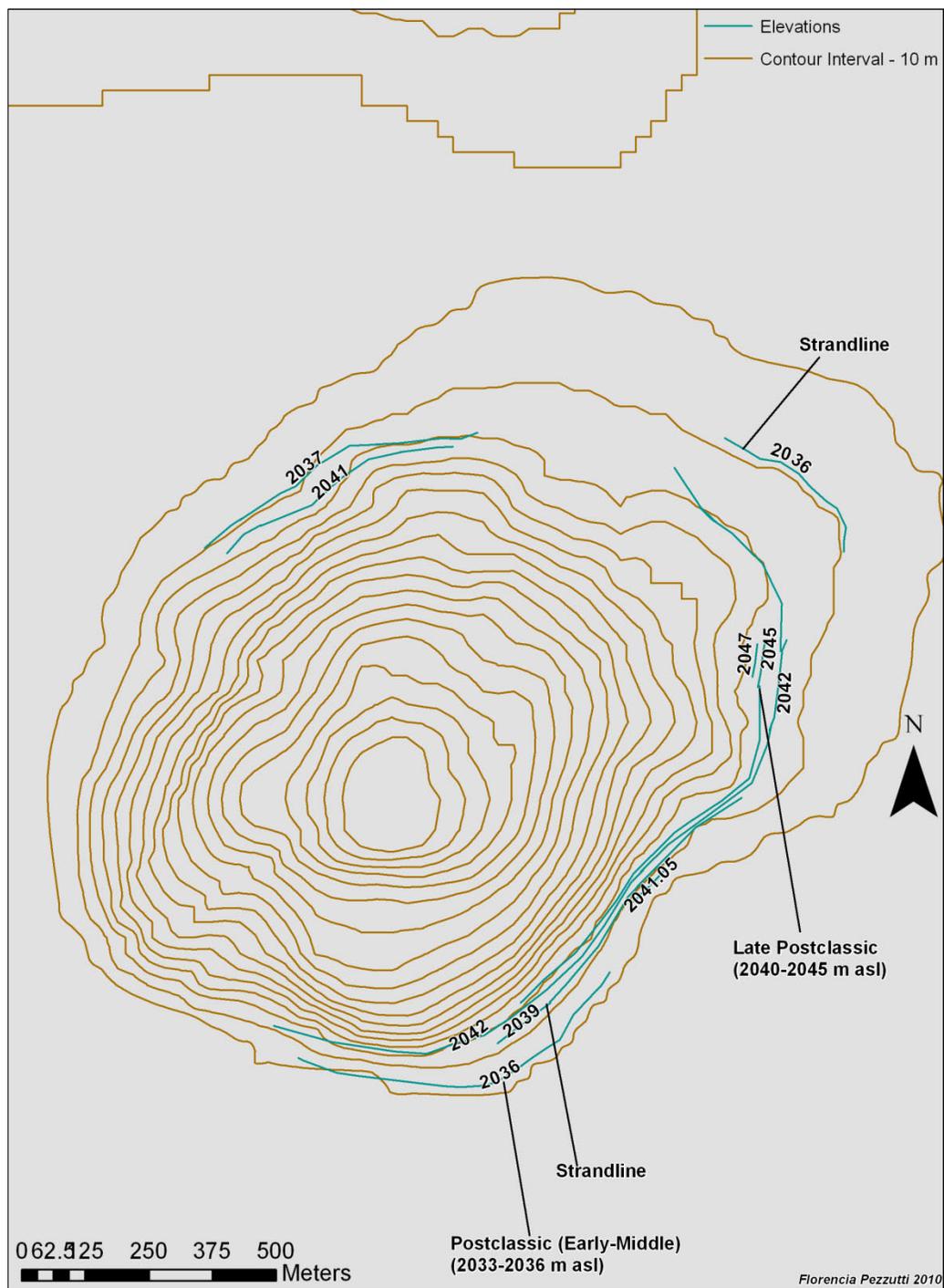


Fig. 3.3. Apúpató strandlines and lake levels.

Lake levels in Pátzcuaro have been very dynamic and have fluctuated quite a lot over time. According to O'Hara (1993) the overall trend of 1380 to 1522 was transgressing lake levels; 1521 to 1750 was regressing lake levels; by 1763 the lake rose slightly; and by the eighteenth and early nineteenth century saw regressing lake levels again. After the 1858 earthquake, there was a dramatic increase in lake levels that lasted from 1858 to 1882. Some of the estimates of recent lake levels are related to many factors such as decrease in rainfall percentages and increasing uses of the lake for domestic and agricultural uses. Thus, lake level fluctuations in Pátzcuaro are not only related to climate, but also are associated to tectonic events and human activities influencing the watershed catchment.

CHAPTER 4: SOCIO-CULTURAL HISTORY OF APUPATO

The most important ethnohistorical document for the Lake Pátzcuaro Basin is the *Relación de Michoacán*. In addition, historical documents dating to the post conquest period can be found at the colonial archives in México City called Archivo General de la Nación, *Tierras*, Archivo Parroquial de Pátzcuaro, and the Archivo Histórico Municipal de Pátzcuaro. Most of these historical archives constitute land disputes among different social actors during the colonial period.

The *Relación de Michoacán* is believed to have been written by a Spanish emissary sometime between 1539 and 1541 (Glass, 1975 in O'Hara 1993). The document was created to understand and explain the history, functioning, lifeways, customs, and religion of the Purépecha people, prior to and during the European conquest. The *Relación de Michoacán* makes mention of four important facts that can be tied to the island of Apúpato and are relevant to this research. First, the document describes the Canzonci's sementeras (agricultural field) which had economic, religious, and warfare importance in Purépecha society; second the document mentions the presence of a treasury on the island of Apúpato; and third the document describes and recognizes Apúpato as an island that belonged to the Canzonci; and finally, this document mentions the importance of maguey as a crop used either for blankets or for wine.

According to the *Relación de Michoacán*, Apúpato was an important Purépecha island belonging to the Canzonci [emperor] and was used as a ritual center and as the

location of storage of the imperial treasury for feasts and expeditions (Relación de Michoacán, 1541). The terraced landscape documented at Apúpató could possibly be the *sementeras* [agricultural fields] that were supervised and managed for the Canzonci (Relación de Michoacán, 1541). These lands belonging to the personal patrimony of the Canzonci and later became the focus of land dispute between Spaniards and the descendants of the Canzonci, who claimed ownership of these lands.

In the first section of the Relación of Michoacán, specifically in the section concerning the Tarascan government's divisions and specialists; the document describes a specialist, who was an official tavern keeper, called *Atari*. This specialist receives all the maguey wine that was made for the feast' (*__Había un tabernero mayor, diputado para rescibir todo el vino que hacían para sus fiestas, de maguey; éste se llamaba Atari'*) (RM 2008:178 f.7). The major tavern keeper, *Atari*, was in charge of receiving, storing, and administering the maguey wine (pulque). In addition, there was another specialist, *Atari*, who was only in charge of making the maguey wine (pulque) from maguey sap (*aguamiel*).

The *Relación de Michoacán* also mentions the existence of a chief treasurer who was responsible for all the silver and gold which they used during their feasts for their god, and he had under him assistants who kept accounts of the jewels' (RM 1970:13; RM 2008:178 f. 7). This type of treasury would consist of mitres, silver bracelets, gold wreaths, etc (RM 1970:13; RM 2008:178 f. 7). In addition, the Relación de Michoacán mentions it was a crime to abandon the *sementeras* [agricultural fields] belonging to the Canzonci and to abandon the maguey cultivation process, mostly the castration process of

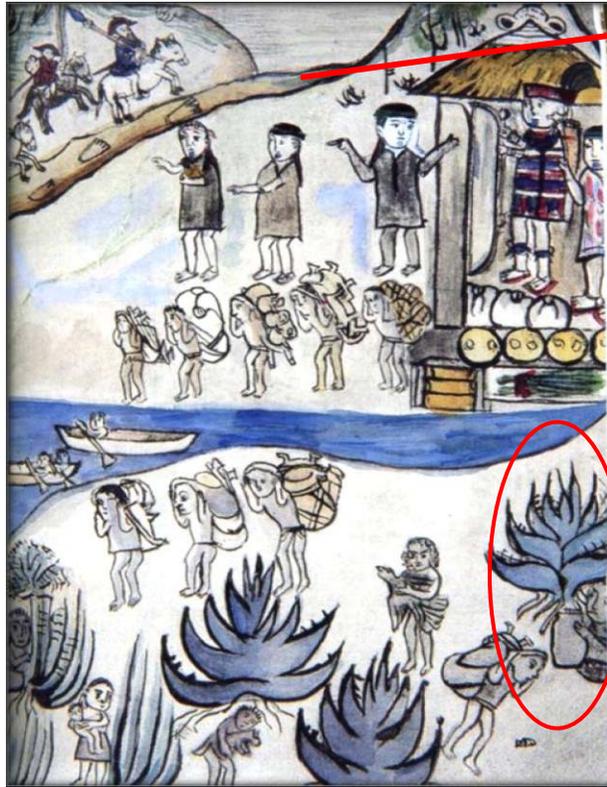
the maguey, essential for the production of sap and therefore of pulque (RM 2008: 14 f. 61).

Other important items that were very valuable and used for tribute and for payment of social reciprocal duties were blankets. In the *Relación de Michoacán*, blankets are mentioned in association with social and tributary responsibilities. Blankets can be made of cotton and or the fibers of maguey. However, the Lake Pátzcuaro Basin lacks the adequate climate and topography favorable for cotton cultivation. Cotton was imported to the lake basin from the Pacific coast regions of the Purépecha Empire, or probably was imported from Morelos and was likely exchanged for Zinapécuaro obsidian (Smith 1990). Morelos has a favorable climate and topography for cotton cultivation since it has warmer temperatures and longer growing seasons when compared to the Basin of México (Smith 1992:9) and the Lake Pátzcuaro Basin. During the Late Postclassic period, obsidian from Zinapécuaro (Purépecha territory) was documented in high quantities at Villa Morelos, in Morelos (Smith 1990:164-5). Even though, the Aztec and the Purépecha were hostile enemies, the border between these two empires seemed to have been opened for trade bringing obsidian from Zinapécuaro into Morelos in exchange for cotton.

Since cotton was only obtained from trade and it was an expensive crop likely used for the Purépecha nobility, it is assumed that the common Purépecha people in the basin of Pátzcuaro relied on maguey as the crop to obtain the fibers to make blankets. In the *Relación de Michoacán* blankets are mentioned in many aspects of their lifeways and customs (RM 1970: 12, 18, 18, 33, 34, 35, 36, 38, 41, 42, 45, 46, 52, 58, 60, 65; RM 2008: 176 f. 6, 60 f.84v) in which they are exchanged and offer to fulfill social and

tributary responsibilities. The type of fiber used to make blankets is not always described, however in few instances when referring to the nobility, cotton and “rich blankets” (RM1970:52, 65) are specified. The type of blanket material is not specified in other ordinary contexts. It is assumed that the blanket material comes from maguey fiber due to its abundance and acknowledgment that it has been used in other parts of the Mesoamerican world for purposes of spinning and weaving. Another important maguey product is pulque, or as mentioned in *the Relación de Michoacán*, “maguey wine” (RM 1970: 13, 55, 136, 203).

The *Relación de Michoacán* mentions the former island of Apúpato as the place where the Canzonci’s treasures were kept and protected. This wealth belonged to the Canzonci, and was inherited from his ancestors. These treasuries were used for his feasts and expeditions and consisted of great quantities of gold, silver, jewels, round shields, bracelets, halfmoons, liprings, and earrings, and were distributed all around the lake basin, in either islands or residential areas belonging to the Canzonci. Another island that is mentioned as a treasury keeper is the island of Xanecho (Janitzio) where silver dedicated to the moon had also been placed there by the Canzonci’s father (RM 1970:78-79). Also, there was a treasury on the island of Pacandan where silver and gold was kept. On this island there were also sementeras that were offered to that silver in the treasury and a designated person was in charge of the treasury and sementeras (RM 2008:259 f.49).



Probably the road to Tzintzuntzan.

Fig. 4.1. Folio 46, Relación de Michoacán 2008. Probably a depiction of the Island of Apúpato looking north towards Tzintzuntzan. In the lower right a man is extracting aguamiel from a maguey plant (circled in red)

The type of terrain and landscape of Apúpato means that these sementeras, had to exist on the slopes of islands (if the slope gradient was adequate,), and even though they are not described as such, were probably agricultural terraces. The most optimal and productive agricultural system applied by the Purépecha State and Empire were terraces, which help preserve the fertile soils, control erosion, and increase productivity. Evidence of agricultural terraces on islands or cerros with a certain slope degree is represented by: Apúpato, Cerro Chapultepec, and Cerro Buenavista. Evidence of agricultural terrace systems on more rugged terrain such as the malpais (badlands) of the lake basin is represented by sites like Urichu and Sacapu Angamucu (being surveyed since 2009 by the Legacies of Resilience: The Lake Pátzcuaro Basin Archaeological Project)

Canzonci's great-grandparents. Likewise, in another house there were ten chests of round shields, 200 in each chest, of not quite such fine silver placed there by the father of the deceased *Canzonci*, called *Zuangua*.(RM 1970: 78)'

Therefore, it is understood that this island most likely belonged to the *Canzonci* and or to the Purépecha nobility, and the terraced landscape could possibly be the *sementeras* that were supervised and managed for offerings to the gods and the silver.

It is important to understand that this thesis does not take literally all the descriptions and the history told in the ethnohistoric account of the *Relación de Michoacán*. This account was not written by the Purépecha people and was written through the cultural subjectivities in a specific historical context by an anonymous Spanish author at the time of the European conquest and colonial administration (Krippner-Martínez 1990; Stone 2004:4). For example, the *Relación de Michoacán* failed to mention and describe the terraced landscape, the cultivation and processing of maguey for pulque. These activities are present in the archaeological record today. The author of this historical account is unknown; however, it is known that it was most likely written by a Franciscan missionary, who did not, consider himself the author of this document, but an interpreter of the native Purépecha (Warren 1971:307; 309). This Franciscan missionary had spent quite some time with the Purépecha in the Lake Pátzcuaro Basin since 1539 and was proficient in the native Purépecha language and culture (Warren1971:309).

Other historical documents related to this area of the lake basin, mention the island of Apúpato and the surrounding exposed lands –in periods of regression of Lake Pátzcuaro –as a very important and highly contested area consisting of land disputes between the Catholic Church, the colonial power and the native Purépecha. All of these

colonial documents have been put together by Louis Margarete Enkerlin Pauwells in an edited volume of –Estudios Michoacáanos IV (1992). Enkerlin Pauwells used the colonial document such as the general national archives –Archivo General de la Nación, Ramos Ayuntamientos and Ramos Tierras – and the ethnohistorical accounts of the *Relación de Michoacán* to reconstruct the land disputes at the former island of Apúpato.

Enkerlin Pauwells (1992: 181) describes the Apúpato landscape after conquest, in which the ecological –“equilibrium” between its people and their landscape was interrupted by the Spaniards who imposed different life-ways, social organization, different cultivation techniques, and ownership of land. The Spaniards were known to prefer taking possession of the Canzonci’s and Purépecha nobility’s formal lands consisting of lakeshores and islands for the cultivation of crops like wheat, maize and cattle grazing. These preferences for land ownership conflicted with the interests of the native Purépecha. Also, exposed lake-bed lands product of the lake level fluctuations, during regressions of the lake, were highly disputed by native Purépecha and descendants of the Canzonci.

Under the administration of the Catholic Church by Don Vasco de Quiroga (first Bishop of Michoacán), the former island of Apúpato and its surrounding alluvial lands became the congregation of Tzurumútaró. This meant that these lands were under Spanish colonial laws and became the place where the process of creating a republic of Indigenous people (congregation) took place (Enkerlin Pauwells 1992: 186). Thus, the lands where Tzurumútaró is located today were lands belonging to the Purépecha nobility and donated by them to the Colegio de la Compañía de Jesus –Catholic Church –once they were established in Pátzcuaro (Enkerlin Pauwells 1992:187). As discussed in chapter

4, the lands of the southeast corner of the lake basin are alluvial lands which have been exposed during periods of lake regression and covered by the lake during periods of transgression of Lake Pátzcuaro, making these lands desirable by the Spaniards, since they are very fertile former lakebed lands and are optimal for agriculture (Enkerlin Pauwells 1992:187).

During the first years of the XVII century, four colonies were put under the jurisdiction of the Municipality of Pátzcuaro: San Francisco Echuen, San Juan Apúpato, San Joseph and San Pedro Cheranz. In these lands, the native Purépechas were congregated and practiced fishing, agriculture, and ranching (Enkerlin Pauwells 1992:187). Conflicts between the Catholic Church and the native Purépecha were initiated when the director of the Colegio de la Compañía de Jesus in Pátzcuaro, Don Francisco Ramirez broke the Congregation laws and took possession of these lands in February 26 1613. His justification for this action was that these lands belonging to the native Purépecha were more fertile than the tracts they received in exchange (Enkerlin Pauwells 1992:187, 188). The claim that these lands were more fertile has to do with the fact that the lands in the so called –San Juan de Apúpato” and Tzurumútaró area are located in the most extended alluvial area, belonging to the former lake bed and with access to irrigation by the Chapultepec canal. The exposure of former lakebed during lake regressions made these lands desirable for agriculture since they are fertile marsh soils at moments, or a swamp depending on rainfall levels. These exposed lands became the focus of land disputes to fulfill the European interests of fertile lands that were close to the lake and provided fresh grass all year long for cattle (Enkerlin Pauwells 1992:188).

The conflict between the native Purépecha and the Jesuits—Colegio de la Compañía de Jesus—continued for over 56 years when they complained that the native Purépecha continued cultivating the lands. The native Purépecha claimed that they owned these lands, but could not produce evidence of titles, because legal ownership evidence was in México City (Enkerlin Pauwells 1992: 188, 189).

According to testimonies found in the Archivo General de la Nación, Tierras, the native Purépecha were crossing wood fences and stone fences, constructed by the Jesuits to protect the lands from being accessed by the native Purépecha. According to one complaint documented in the AGN Tierras, the native Purépecha were opening new roads and removing bridges. The mayor decided to remove the native Purépecha from the lands (AGN Tierras, Vol 445, Exp.1, f.11 in Enkerlin Pauwells 1992:189, 190). By making this decision, many important congregation laws were broken by the Jesuits. The native Purépecha, with no space to negotiate, challenged the colonial power, by stealing cattle, opening roads to damage crops, and reporting them to the colonial authorities (Enkerlin Pauwells 1992:201).

The most interesting points presented by Enkerlin Pauwells (1992) is the use of primary sources detailing conflicts of land ownership, which also serve as a great source of detail descriptions of what the landscape looked like after the European conquest. In addition, these documents can be used to identify what different social actor's interests were and what power strategies were being used to negotiate interests, and how intense these conflicts were. For example, the description of the lands surrounding Apúpató as being inundated and the need to build bridges to access them (AGN, Tierras, Vol.445,

Exp.1, f.27 in Enkerlin Pauwells 1992:190) give an excellent description of the nature of lake level fluctuations and how it modified Apúpato's landscape.

These types of historical descriptions are great sources to identify shifting characteristics the Lake Pátzcuaro Basin landscape at moment when the lake levels were low, and the lands in the southern basin were swamps or marshes, and also moments when the lake was not high enough to make Apúpato into an island. Also, it provides us with descriptive information on what type of lands were desirable to the Spaniards. The documents mention that the Spaniards were interested in flat and fertile lands to cultivate and ranch, therefore, the former island of Apúpato was out of the question, leaving its terraced slopes almost forgotten, out of the conflict, and unwanted. However, the marshy lands surrounding the island have been highly contested as the historical documents have shown. The Spanish undesirability of slope agriculture had the effect of leaving a piece of the landscape as a refugia or sample of what the landscape looked like prior to the European conquest and the colonial administration.

PREHISPANIC OCCUPATION OF APUPATO:

The ethnohistorical and historical documents have provided information regarding Apúpato settlement, focusing on the ritual use of the island and the land disputes during the colonial period. However, these documents have only provided information regarding Apúpato as an important and central island to the prehistory of the lake basin. The *Relación de Michoacán* (1541 A.D) mentions Apúpato as the place where the Canzonci (Purépecha emperor) and the royal elite held in reserve royal treasuries and headdresses, and also as the place where the Purépecha king met for the first time with the Spaniards

as they were entering the lake basin. Furthermore, the historical documents have provided information about how Apúpato was highly disputed between the natives, the San Franciscans, and the Augustinians. This conflict lasted for over a century. Both the ethnohistorical accounts and the historical documents, give testimony to the history of occupation and uses of this island, and how many native Purépechas claimed and participated in land disputes over Apúpato during the colonial period. However, little is known of the prehispanic occupations of Apúpato. The full coverage archaeological survey conducted in 2007-2008 for this thesis research has been able to document a long temporal span of prehispanic settlements.

The full coverage archaeological survey conducted during the 2007-2008 archaeological field season provided data of prehispanic occupations on the former island over a great temporal span. The archaeological settlements were grouped into settlement zones and were further organized into temporal groups according to chronological phases known for the Pátzcuaro region. The settlement zones were dated using Pollard's (1993) chronology of the area based on the Prehispanic ceramics for the area. The estimated population in each temporal phase was calculated by applying Fisher's (2000) methodology which is based on those previously used in central México and has been developed and applied with success in the Pátzcuaro region as well (Fisher 2000; Pollard 2001). The population density of each settlement zone was assigned following a model used in the Tzintzuntzan survey (Pollard 1993). This model consists of four levels of occupation densities determining a range of population per hectare based on fragments of ceramic sherds per m². The following settlement pattern data is a summary of the

Apúpató partial technical *informe* submitted to I.N.A.H (*Instituto de Antropología e Historia*) by Dr. Fisher in 2009.

The Prehispanic occupation at Apúpató has always been a lakeshore-focused occupation with most sites located on the paleo-shore or located on the lower slopes of the island. The 2007-2008 archaeological survey defined three main periods of occupation represented by 15 sites from the Classic Period through the Colonial period. Initial settlement focuses on the south side of the island, composed of a small commoner occupation, which continues until the Middle Postclassic. An abrupt change occurs during the Late Postclassic when settlements are moved to the north (facing Tzintzuntzan) side of the island. The Late Postclassic Period settlement is associated with an occupation and ceremonial architecture type indicative of Tarascan elite. This observation is consistent with the *Relación de Michoacán*, which describes the island as a ceremonial center, where the Canzonci held a treasury at the time of European contact. The occupation of the early Colonial Period includes scattered features that can be defined as structures related to rural work, foundations of a small building, possibly belonging to the 16th century chapel which can be seen in historic maps.

A total of two settlement zones are associated with the Classic and Epiclassic (800 AD/100AD) periods. These settlements are located in the southeastern lower and middle portion of the island. The ceramics collected from these settlement zones are associated with Loma Alta, Lupe and Angamucu phases and indicate a commoner settlement and have population ranges of 88 to 127 people. A total of 3 settlement zones are associated with Early and Middle Postclassic period (1000-1350 AD). These zones

are located in the south, west and north of the island and are associated with the Angamucu phase. The collected ceramics consist of jars, bottle vessels, and bowls with little polychrome decoration, associated to commoners as well. This settlement zone is estimated to have had a population ranging from 216 to 305 individuals.

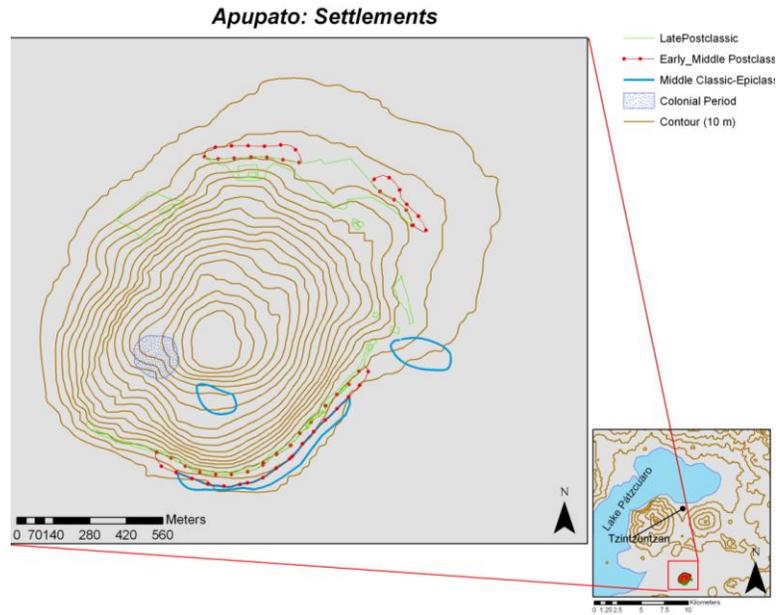


Fig. 4.3. Apúpató Settlements

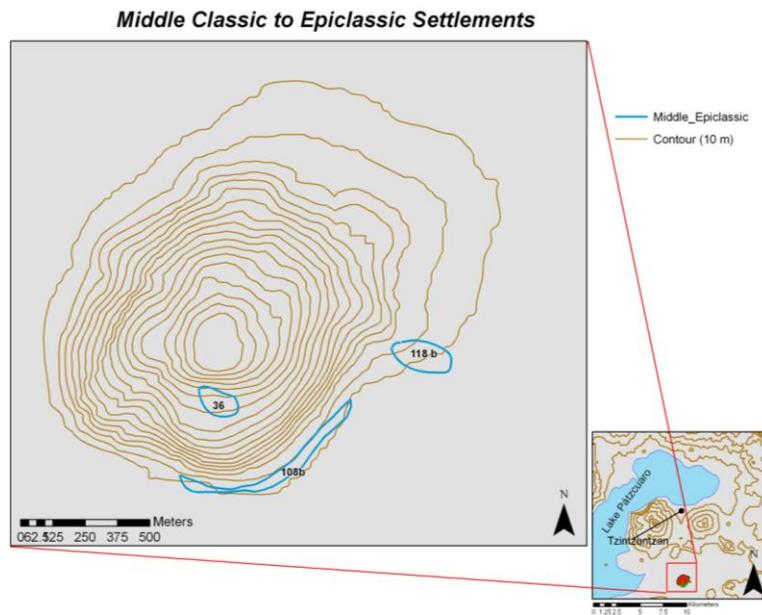


Fig. 4.4. Apúpató Middle Classic to Epiclassic Settlements Zones

A total of 10 settlement zones are associated with the Late Postclassic Period (1350-1520 AD) (Uacuséchas phase). A dramatic shift of settlement zones towards the northern portion of the island occurs during the Late Postclassic period. The settlement zones are located in the lower slope areas and on the paleo-shores of the former island. The occupations are represented by Purépecha elite and commoners residential structures. The architectural typology observed is represented by ritual Purépecha houses (*casa de papas*), residential terraces, and platforms. The population range estimated for this phase is between 298-419 individuals (Fisher 2008).

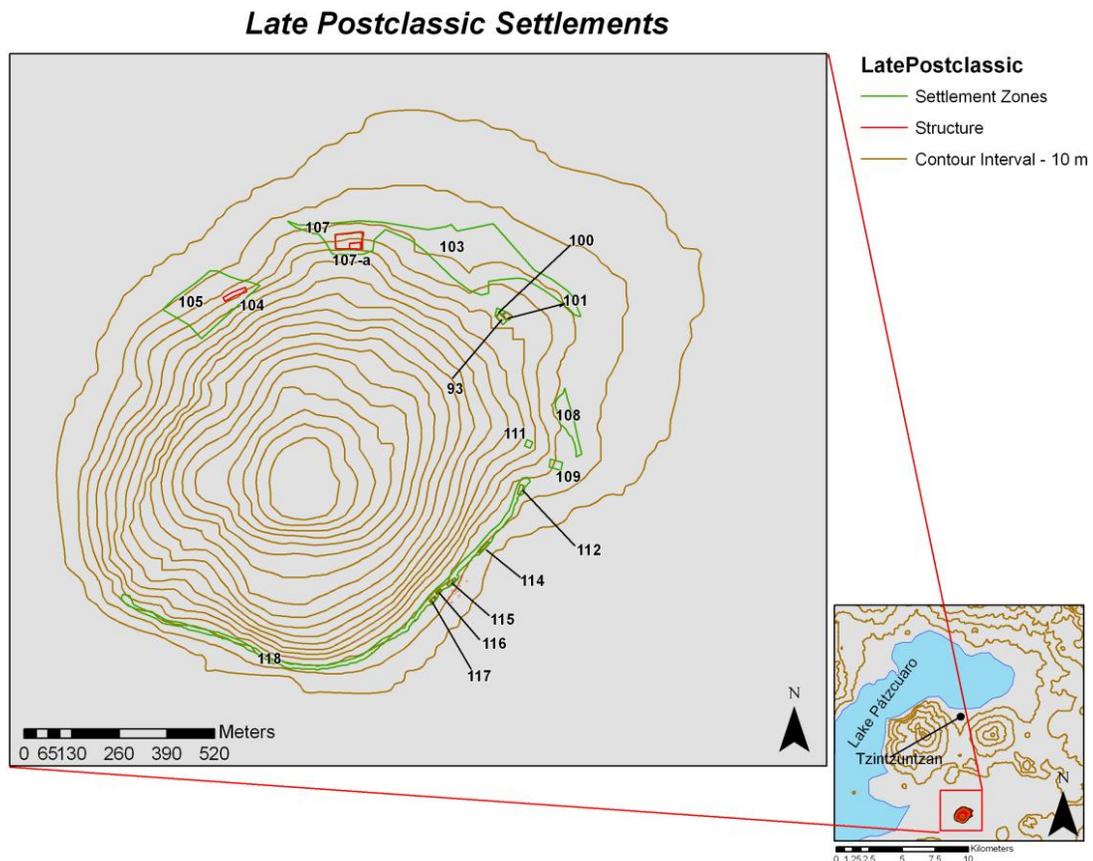


Fig. 4.5. Late Postclassic settlement zones

A Purépecha ritualistic complex (*casa de papas*) consisting of a small scale pyramid, buildings, and stone piles was documented in the northern portion of the island (looking towards Tzintzuntzan). This complex building is located on a large flat platform (Structure 100) that contains the foundations of a rectangular building (Structure 101) with an entrance to the south. The pyramid (Structure 93) is located on the southwest portion of the platform and on top it presents four small square room divisions formalized by stone walls (*muros*). Stone piles were placed surrounding the big building (structure 101) and the pyramid (structure 93). This type of ritualistic complex is very common during the Post-Classic period, during which the Purépecha State promoted urban and architectural projects. In this case, a flattened platform (structure 100) and complex building composed of a rectangular, building (structure 101) and a pyramid (structure 93) were built for ritualistic activities. This civic-ceremonial architectural complex was composed of a rectangular pyramid (93) filled with earth and rubble. According to Migeon (1998) each pyramid is associated with at least one *casa grande* (101) (rectangular building). The activities that take place in this rectangular building (*casa grande or casa de papas*) are reunions, all night gatherings, or it could have served as an elite residence, and or it could have served as the location of various altars (Migeon 1998). At Apúpato, this rectangular building (structure 101) is represented only by the foundations of a thick and robust wall. The foundation opens up in the west of the building into a narrow entrance. The internal walls are arranged in steps or benches. These types of architecture are similar to those described and portrayed in the folios of the *Relación de Michoacán* as a ritual Purépecha house, depicted as a house with only one entrance and with a roof maintained by a wood post. This type of architecture was

used by the Tarascan priests and elites. The pyramid (structure 93), almost a square shaped building, was surrounded by smaller circular rock piles, which could be remains of a larger foundation within the pyramid (structure 93). On top of the pyramid, four rooms were still visible and were identified even though they were badly eroded.

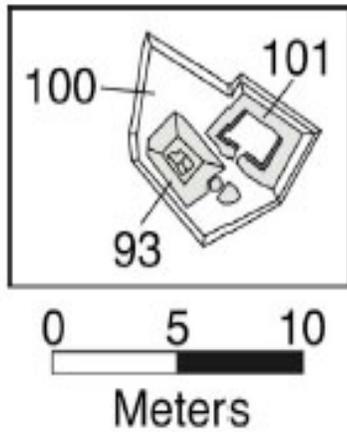


Fig. 4.6. Casa de Papas (Civic-Ceremonial Complex) Settlement zone 100.



Fig. 4.7. Structure 93 (top of pyramid)



Fig. 4.8. Folio 79. Relación de Michoacán 2008. Depiction of the island of Jarácuaro (A possible Casa de Papas (ritualistic house) associated with a Pyramid.

During the Early Colonial Period (1520-1555) settlements are associated with the ruins of the XVI Chapel located on the center-west of the island, and with almost 40 stone structures, that seem to be the remains of *Jacales* or *Casa de Campo* (country houses) mentioned in the ethnohistorical documents of the XVI and XVII. In addition, a well defined colonial wall which divides Apúpato in an eastern and western portion was documented during the survey. This colonial wall could well be associated with the XVII Jesuit and native Purépecha land disputes. The remains of the XVI Chapel, depicted in Beaumont map of the Lake Pátzcuaro Basin, is probably represented by the foundations of a big platform, a room, and steps. Also, the Cuevas map version of the lake basin (see Pollard 1993) shows that a chapel exists at Apúpato. The chapel is located on a big platform in the same place and orientation where it was re-located during the 2007-2008 full coverage archaeological survey.



A. Fig. 4.9. Structure 88 (east platform wall)
B. Fig.4.10. Structure 88 (west platform wall)
C. Fig 4.11. Structure 89 (Room on structure88)
D. Fig.4.12. Structure 89 (Room on structure 88).
E. Fig.4.13. Colonial brick and roof tile.

The Modern period does not present any type of residential settlement zone; however, it presents the construction of a modern gravel road that wraps around the island from the bottom to the top and cuts across (postpones) the agricultural terraces. This road is associated with a government run program of observation centers throughout the lake basin, meant to benefit local communities and to improve tourism in the area.

This road leads all the way to the remains of what seemed to be the construction foundations of such observation center located on the western portion of the island.

Overall, the ethnohistorical, historical, and archaeological data provides evidence of a long occupation history at Apúpato. The landscape descriptions from local historical documents are great sources to identify characteristics and changes of the Lake Pátzcuaro Basin landscape. They provide great descriptions regarding lake level fluctuations when the landscape of the Lake Pátzcuaro Basin was low, and the lands in the southern basin were swamps or marshes, and the lake was not high enough to make Apúpato into an island. Also, it provides us with descriptive information on what type of lands were desirable to the Spaniards. The documents mention the Spaniard interest in flat and fertile lands to cultivate and ranch, therefore, the former island of Apúpato was out of the question, leaving its terraced slopes almost forgotten, out of the conflict, and unwanted. This meant leaving a piece of the landscape as a refugia or sample of what the landscape looked like prior to the European conquest and the colonial administration.

CHAPTER 5: METHODOLOGY

This thesis incorporates full coverage archaeological survey methodologies, theoretical implications of agricultural intensification such as *landesque capital* in relationship to state formation, and mapping technologies, which were used to guide and create a cohesive full coverage survey design. The survey design consisted of ~~full~~ coverage archaeological survey' intended to collect and document every aspect of the total landscape of Apúpato. These survey techniques are unlike the conventional sampling survey designs where survey units are selected in an arbitrary and objective fashion (Taylor 1977:74).

The archaeological full coverage survey (part of the Legacies of Resilience Project: the Lake Pátzcuaro Basin Archaeological Project) was conducted between December 15th 2007 and January 22nd, 2008 at Apúpato, a former island of the Lake Pátzcuaro Basin, considered an important Prehispanic royal center where, according to the *Relación of Michoacán*, the Purépecha Canzonci [emperor] stored Purépecha treasuries. According to the *Relación de Michoacán*, the treasuries stored in this former island were given to Cristobal de Olid, conqueror of Michoacán, to satisfy the Spaniards demands of gold and silver. This treasury consisted of a total of 60 loads (60 *cargas*) from Apúpato, which were given to Olid to be sent to Cortéz in the Basin of México. Apúpato (today called Cerro El Vado) has been recognized in ethnohistorical, geographical, and archaeological literature, but no archaeological work had ever been performed.

Fieldwork was designed to collect archaeological and paleo-environmental data to evaluate the relationship between Purépecha State formation, human-environmental interaction, Prehistoric and Historic land-use, and lake level fluctuation. Apúpató is located in an area of the Lake Pátzcuaro Basin that is characterized by a large expanse of shallow lake lands sensitive to subtle changes in lake levels (Gorenstein and Pollard 1983; O'Hara 1993). This gave Apúpató dynamic characteristics of sometimes being an island, and sometimes being connected to the main-land, creating a rich and diverse access to different land types for different crop types.

The excellent preservation of the archaeological and environmental sequences at Apúpató provided data that allow us to ask and answer questions crucial to our understanding of the Purépecha State formation theories. For example, what was the timing, function and means of construction of Apúpató's terrace system? What role did the lake level and environmental fluctuations play in the settlement patterns and built environment at Apúpató? The Lake Pátzcuaro Basin has experienced a dramatic 10 m regression over the last decade connecting Apúpató to the main land, and allowing the documentation of paleo-shores, and document former lake level elevations from the exposed lake bed. The Lake Pátzcuaro Basin has experienced a dramatic 15m or more lake regression over the last decade connecting Apúpató to the main land, and allowing the documentation of paleo-shores, which have allowed the identification of former lake level elevations from the exposed lake bed.

SURVEY DESIGN:

Our fieldwork was designed to focus on agricultural features by documenting agricultural terraces. In addition, we collected residential zones, architecture, ritual complexes of the

alleged treasury mentioned in the *Relación de Michoacán*, and geomorphological features of the former island. We used satellite imagery provided by Google Earth Pro in both digital and paper format.

Overall, the project was designed to collect archaeological and paleo-environmental data and to evaluate the relationship between the Purépecha State formation, the human-environmental interactions and land-use in the lake basin landscape and the lake level fluctuations. Fieldwork consisted on surveying and mapping geomorphological features, agricultural features, settlement patterns, vegetation, and locating prehispanic lake level fluctuation evidence at Apúpató. The overall goals of the 2007/2008 Fieldwork season were: 1) perform a full coverage survey of Apúpató to document archaeological features; 2) perform a full coverage survey of Apúpató to document Prehispanic agricultural features; and 3) document geomorphological features to model lake level fluctuations, prehispanic settlements, and land use.

The study area consists of the entire former island of Apúpató (195 ha, 1.95 km²) which has never been surveyed and documented before. Apúpató is located in the southeast portion of the Lake Pátzcuaro Basin, in an area between three Prehispanic settlements (Tzintzuntzan, Ihuatzio, and Pátzcuaro). These settlements are known to be elite señoríos, traditionally seen as significant role players in the Purépecha State formation (Pollard 1982, 2003).

The fieldwork methodologies consisted on the full coverage landscape survey. A total of four sampling procedures were implemented to be able to identify, document, and map agricultural features on the landscape, settlement features, and surface collection of diagnostic pottery and lithic. The following four archaeological survey procedures were

used: 1) Surface observations of agricultural features such as: terraces check dams, and vegetation. Diagnostic pottery or lithic associated with agricultural features, such as terraces, were collected for assigning chronology. These observations aid in determining and locating the boundaries of these agricultural terraces. These boundaries were marked by a GPS point labeled "end of terrace". These GPS points collected in the field helped digitize during the laboratory work the terraces using ArcGIS 9.3. 2) The survey region was gridded into units of equal size (1 ha) (N=195). We divided Apúpató into an upper, middle and lower area. These areas were surveyed by three individuals separated at least 10 to 15 m apart. Each area was walked following the terrace's ditches; thus following the contour of Apúpató's slopes. This systematic surveying technique allowed us to "wrap" around each area. Each area (upper, middle, and lower) of Apúpató was further divided in a 1 ha area. The grid was composed of 15 columns and 13 rows, totaling 195 survey block units of 1 ha (10,000 m²) each. These 195 (1.95 km²) survey blocks were completely surveyed by the end of the 2007/2008 field season. 3) Spatial observations of possible agricultural features or architecture were possible through the satellite imagery, and were identified and later field checked for corroboration during the survey season. 4) Geo-archaeological observations were done when exposed eroded profiles or construction trenches were available within the survey area.



Fig. 5.1. Apúpató satellite imagery (Google Earth Pro).

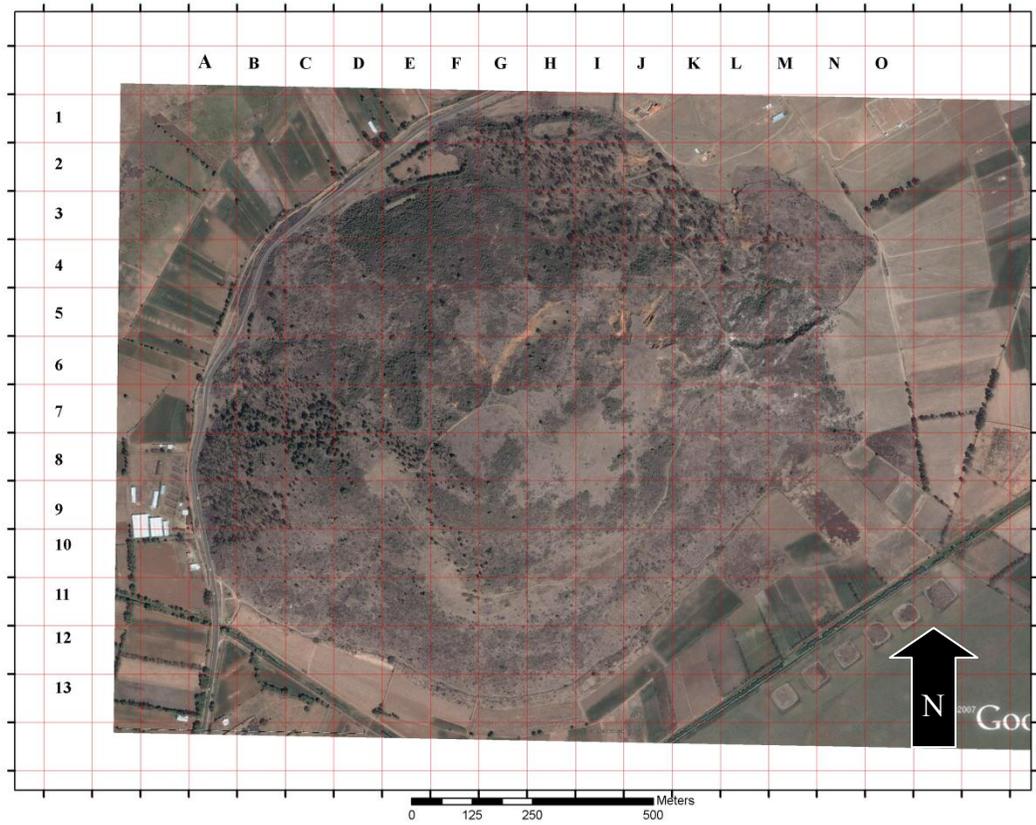


Fig. 5.2. Apúpató gridded satellite imagery (Google Earth Pro).

The full coverage landscape survey was performed in a systematic way. The Google Earth Pro imagery provided us with a general landscape scale view of Apúpató that allowed us to discern larger features (terraces, walls, platforms), which we might not have been physically observed in the field due to heavy vegetation cover in certain areas. The survey documented ancient architecture, clusters of ceramics, terraces (residential and agricultural), erosional control features, and early colonial features.

Mapping Technology:

The mapping and location of archaeological feature was recorded with digitally corrected Global Positioning System (GPS) equipment with sub-meter horizontal accuracy and > 2 meter vertical accuracy running Tripod Data Systems (TDS) Solo Field software. The GPS error was reduced by a process called Differential GPS (DGPS), which reduced most of the error produced by vegetation, location, and atmospheric conditions. This correction signal was broadcast from a subscribed communication satellite (OmniStar) service which offers GPS correction service in real time, improving the GPS receiver accuracy by more than 100 times. This service removed the location error and calculated a more accurate position in real time.

Diagnostic artifacts, such as ceramics and lithics, were collected (see catalogue in chapter 6) from settlement areas, terraces, and other landscape features to help characterize the function, age, and socio-political association, and general characteristics of land use and occupation. The diagnostic artifacts collected from Apúpató were given a general provenience, catalogued, and placed into chronological phases.



Fig. 5.3. TDS Recon rugged handheld data logger (GPS) (Trimble)

Fig. 5.4. Mapping at Apúpató with sub-meter accuracy DGPS running Tripod Data Systems(TDS) Solo Field software and real time correction (Omnistar)



Fig. 5.6. Surveying Apúpató with sub-meter accuracy DGPS running Tripod Data Systems(TDS) Solo Field software and real time correction (Omnistar)

The documentation of archaeological features and artifacts were mapped as points, lines, and areas (polygons). Points consisted of coordinates and elevations, and were used for rock piles, artifacts, and specific elevations. Lines consisted of two or more

points defining a linear type of feature such as a terrace, structure, rock alignment, check dam, terrace wall, etc. Areas (polygons) consisted of several points that defined a two dimensional object, such as structure, a platform, a rock enclosure, etc. All points were logged by averaging the position prior to storing the point in the data file to improve the location accuracy. Usually, the HDOP (Horizontal Dilution of Precision) of 4 or a PDOP (Positional Dilution of Precision) of 6 was required to log a point. The DOP is the level of accuracy of a position based on the number of satellites and the geometry of satellite positions. The final and completed Solo Field data file was exported into two ESRI shapefile (one consisting of points, and another consisting of polygons and polylines) in order to continue the geo-spatial analysis on Arc GIS version 9.3.

The survey procedure No.1 provided agricultural feature observations and surface collections to provide a distinct chronology (see Chapter 6). These observations provided the boundaries of systems of agricultural terraces which aided in the final digitizing of the terraces. Following this digitizing technique allow discerning the landscape extent, form, development, and function of these terraces, but it does not allow quantifying them at the terrace level. However, the extension, form, construction development, and function of these intensive agricultural systems (terraces) were the original goals of this thesis and were applied to the survey design.

In addition, the survey provided evidence of pre-Hispanic and early historic occupation at Apúpató. The full coverage landscape survey at Apúpató resulted in the discovery of a considerable Prehispanic settlement (at least 30 hectares), agricultural terraces, platforms, and at the summit of Apúpató we documented architectural structures with room divisions. This architectural structure (Structure 93) is believed to be the

treasury mentioned in the *Relación de Michoacán*. In addition, the survey provided crucial evidence of paleo shorelines, which were documented and mapped. Apúpató presents diverse topographic characteristics in the Lake Pátzcuaro Basin area, which has been an ideal candidate to better understand lake level fluctuations.

POST-ANALYSIS METHODOLOGIES:

The laboratory methodologies consisted of the geo-spatial analysis of Apúpató through the use of ESRI ArcGIS 9.3 to analyze the terrace system and model the lake level fluctuations, settlement, and land-use. The archaeological full coverage survey at Apúpató presented an extensive system of agricultural terraces, and other intense agricultural features, such as check dams and retaining walls. It also presented erosion features in areas where water controlled features (check dams, retaining walls) and eroded terraces were recorded. Due to time limitations and due to the extent of Apúpató agricultural terrace system, the mapping of these terraces was not done in the field. The terraces were digitized from a geo-referenced satellite imagery. Other agricultural features, such as check dams, were mapped in the field.

The digitized terraces were analyzed by dividing the former island into 195 survey units of 1 ha grid each. Each 1 ha grid surveying block was analyzed in terms of form and function, in the context of other landscape features documented during the surveying. The observation and analysis of each, or groups of 1 ha surveying blocks aided in determining if a certain pattern of construction, timing, and functioning was visible for the terrace system in Apúpató in the context of other agricultural and landscape features.

First, the terrace's morphology was grouped and described by survey blocks (1 ha each) or individual survey blocks depending on pattern of similarities. They were described in terms of how morphology relates to areas of erosion, other erosion control features (check dams), and slope contour. Second, the terrace system was described in terms of morphological patterns to discern episodes of construction and function. Third, Apúpató terrace system was analyzed in terms of the relationship of erosion, settlement patterns, and lake level fluctuations.

Lake level, settlement pattern, and land use, were modeled by the settlement pattern and paleo shoreline evidence collected during the full coverage survey. In addition, ethnohistoric accounts providing historical information regarding lake level fluctuation in the lake basin were used. These historic accounts provided the necessary information and lake level data to determine the conditions when Apúpató became an island and when it was connected to the mainland. During the survey elevation points were taken in diverse parts of the former lake bed (today modern agricultural fields) in search of specific elevations mentioned in historical documents. We used a sophisticated corrected GPS unit, with a level of error of < 2 m.

The diagnostic artifacts were used for function, age, and socio-political association within the settlement areas of Apúpató. The ceramics were catalogue and assigned in a chronological phase. The settlement areas were assigned a demographic estimate using methodology developed by Fisher (2000), previously used with success in the Lake Pátzcuaro Basin (Gorenstein and Pollard 1983; Pollard 2001). The demographic estimate method developed by Fisher, uses site size and density of ceramic material (Blanton et al. 1982) resulting in a range of potential population estimates.

Category	Notes	People/ha (minimum)	People/ha (maximum)
Low	1-5 sherds/m ²	>5	
Medium Low	5-10 sherds/m ²	5	10
Medium	10-15 sherds/m ²	10	25
Medium High (moderate)	15-25 sherds/m ²	25	35
High (Maximum)	>25 sherds/m ²	35	50

Table 5.1. Demographic estimates (Fisher 2008).

All this data was further analyzed to determine Apúpató's terrace system in relationship to patterns (construction), landscape location (function and shape) to further answer the timing of construction and the function they served in regards of ancient land degradation and socio-political complexity in the Lake Pátzcuaro Basin.

Apúpató has proved to be a particularly important site for the study of *landesque capital* as statecraft during the Postclassic period in the Lake Pátzcuaro Basin. The archaeological full coverage survey conducted in this site has shown that Apúpató is one of the very few Late Postclassic sites in Lake Pátzcuaro where extensive systems of intensified agriculture in the form of terraces are preserved in great condition.

CHAPTER 6: SURVEY ANALYSIS OF APUPATO TERRACES AND RESULTS

Apúpató presents one of the most extensive and well preserved prehispanic agricultural systems in the Lake Pátzcuaro Basin. The archaeological data collected from Apúpató was analyzed to address questions of construction timing, shape and function of these agricultural terraces. Fisher (et al. 2003) argues that extensive landscapes of agricultural terraces in the Lake Pátzcuaro Basin were key components of the Purépecha state-craft, and that terraces were built to repair soil degradation that the landscape suffered during the Classic period after extensive construction of ceremonial and residential compounds. He argues that the construction of these terraces help increase the agricultural potential and stabilize the landscape in the lake basin (Fisher et al. 2003).

At least three types of data were collected and were analyzed from the Apúpató full coverage survey: 1) prehispanic settlement zones represented by prehispanic residential and ceremonial compounds and high artifact density clusters (summary in Chapter 4); 2) lake level fluctuation evidence represented by paleo-shore mapping and elevation data acquisition in the former lake bed (summary in chapter 3); and 3) agricultural and geomorphologic data represented by pre-Hispanic intensive agricultural features. All three types of collected data were analyzed and summarized in chapter 3 and 4; however, this thesis will intensively focus on the Prehispanic agricultural features documented at Apúpató.

Apúpató's intensive agricultural features (terraces) were organized and digitized by survey units (labeled numbers 1 through 13 in a North-South orientation and A through O in an East –West orientation) and were further analyzed in terms of function, shape, and timing of construction to address the socio-political scale of construction and management, timing of construction, and function of this system of terraces. The terraces were not mapped during the survey due to their quantity and extent. Instead, the terraces were digitized based on: a) terrace boundary GPS waypoints; b) field observations; and c) digitized from a high-quality geo-referenced satellite imagery with discernable terrace's ditches which were expressed in darker vegetation coloration due to moisture retention. The terrace bed was expressed as a lighter color in the geo-referenced satellite imagery. This mapping technique provided spatial data regarding form, function, and construction development at the landscape scale; however, it did not provide a way to quantify the terraces individually. Instead, terraces were quantified by site coverage and by presence or absence of terraces by survey unit.

Here I am presenting Apúpató's terraces as concrete examples for Fisher's (Fisher 2005; Fisher et al. 2003) argument that agricultural intensification was a key component of state formation implemented to repair existing land degradation through the construction of terraces that, in effect, created a Purépecha 'piedmont strategy' that was not similar to the piedmont strategy at the Valley of Oaxaca, México.

PREHISPANIC INTENSIVE AGRICULTURAL FEATURES AND GEOMORPHOLOGICAL DATA:

During the full coverage survey, we were able to identify at least six barranca erosion systems and five physical erosion zones. As previously stated, Apúpató is a tertiary ash

cone, which geologically could never have supported springs or any other sources of permanent fresh water, making the agriculture dependant on seasonal rains. Soil moisture was retained and intensified by the use of terraces, which not only control soil erosion, but also form deep deposits of moisture, increasing moisture retention. In Apúpató, the erosion zones are associated with natural seasonal drainages, which have all exceeded their natural and original catchment area.

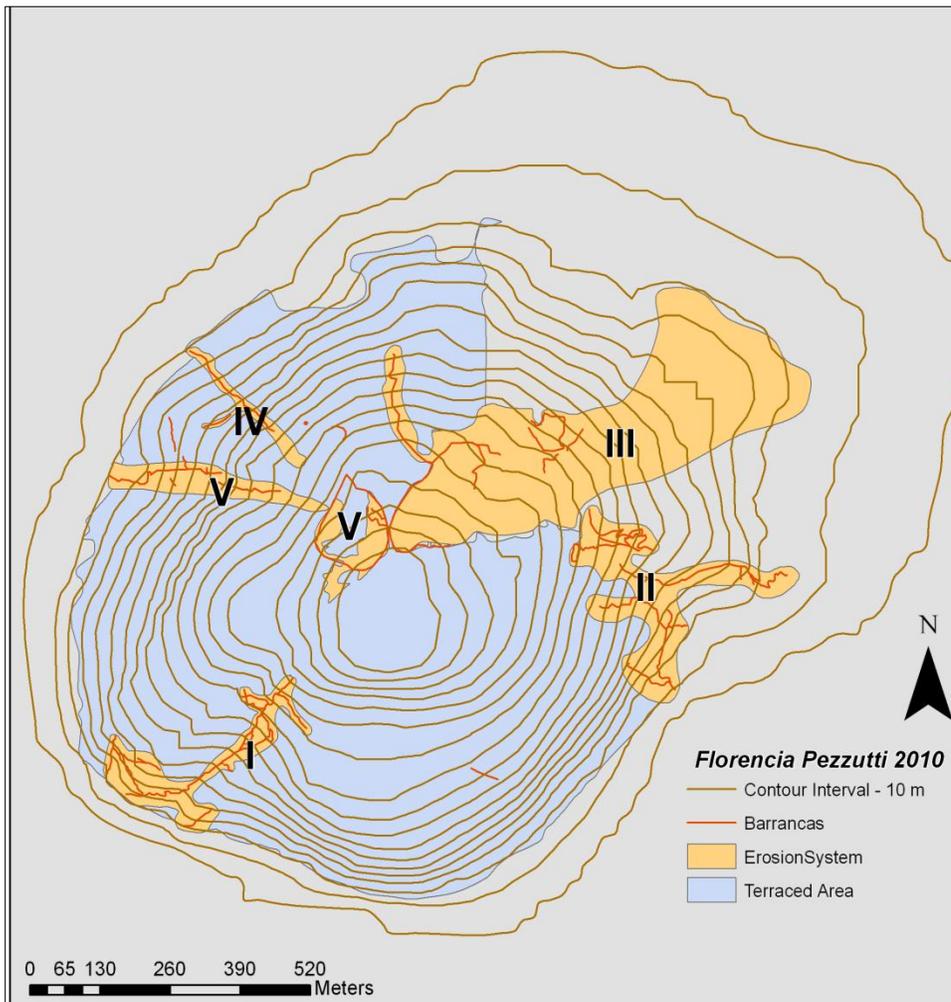


Fig. 6.1. Erosion Systems at Apúpató.

The northeast and the northwest of Apúpato had suffered a great deal of erosion, which has resulted in exposed bedrock and massive barrancas located in the north and center of the island. This severe erosion has destroyed and altered some in-situ evidence for Late Postclassic occupation, represented by Late Postclassic period cultural material being re-deposited at the bottom of the lake bed (settlement zone 103, Late Postclassic). This material re-deposition was observed in the northern portion of the lake bed, where local residents shaved some of this material away to construct a soccer field allowing us to observe the sequence of deposition. This cut shows a cultural horizon of Late Postclassic Period cultural material buried by a thick (40 to 50 cm) layer of unstable colluvial deposits.



Fig.6 2. Settlement zone 103, exposed deposition sequence.



Fig.6.3. Settlement zone 103, exposed deposition sequence.

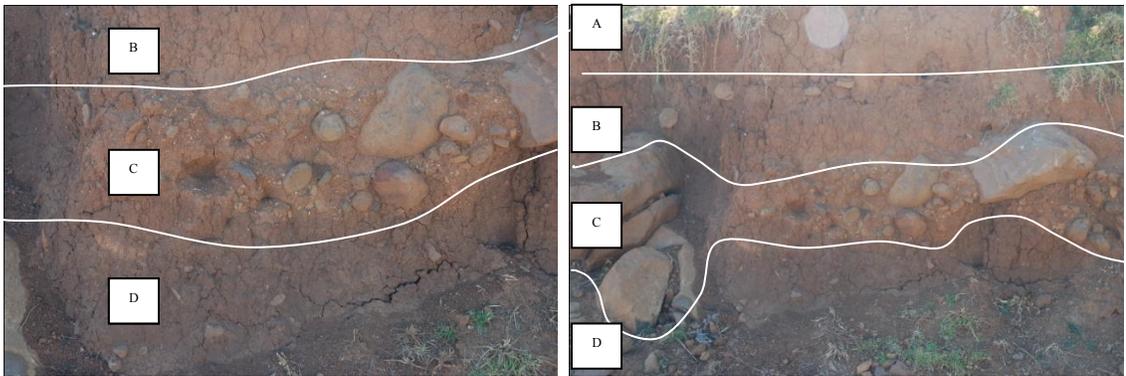


Fig.6.4. Depositional sequence up-close (settlement zone 103)

- A: Modern erosion
- B: Colonial erosion
- C: episode of abrupt colluvial deposits unconsolidated material (Early Colonial erosion)
- D: Late Postclassic occupation.

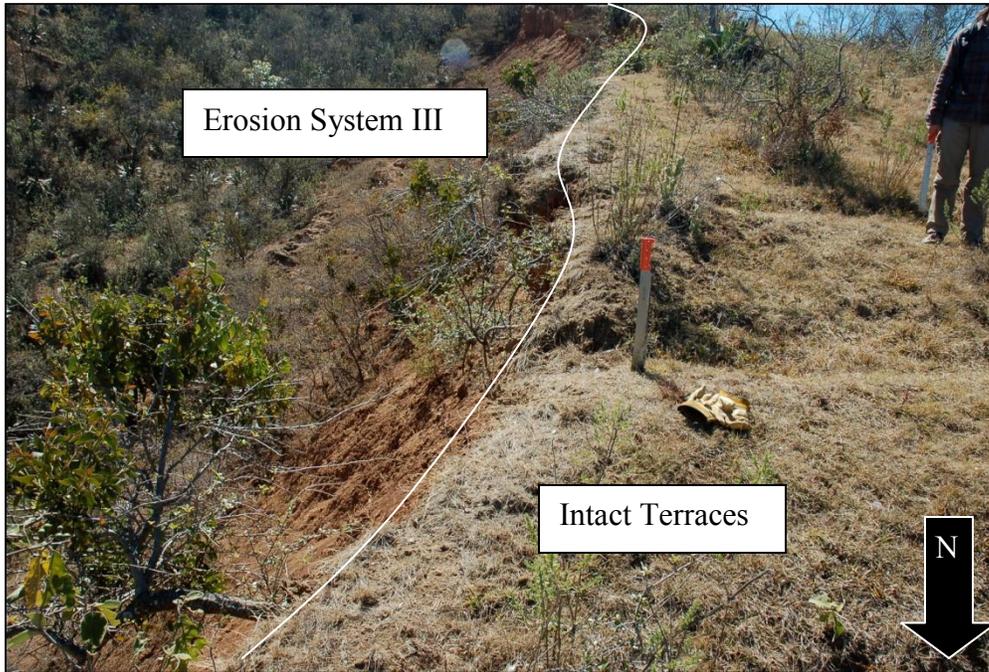


Fig. 6.5. Erosion system III (looking south)



Fig. 6.6. Erosion system III (looking East)



Fig. 6.7. Profile of erosion System III (looking west).

Full coverage survey revealed intensive Prehispanic use of the landscape in the form of agricultural terraces. The former island is covered in hundreds of narrow terraces, commonly categorized as contour terraces, bench terraces, or cross-channel terraces (Whitmore and Turner 2001:134). These agricultural terraces are in excellent condition with few exceptions where these agricultural features have suffered erosion due to abandonment and by modern use of the land by the local farmers who utilize these lands for grazing and logging.

To better understand the function, shape, and construction of this terrace system, all terraces were digitized to place their spatial configuration in the context of their physical environment and settlement

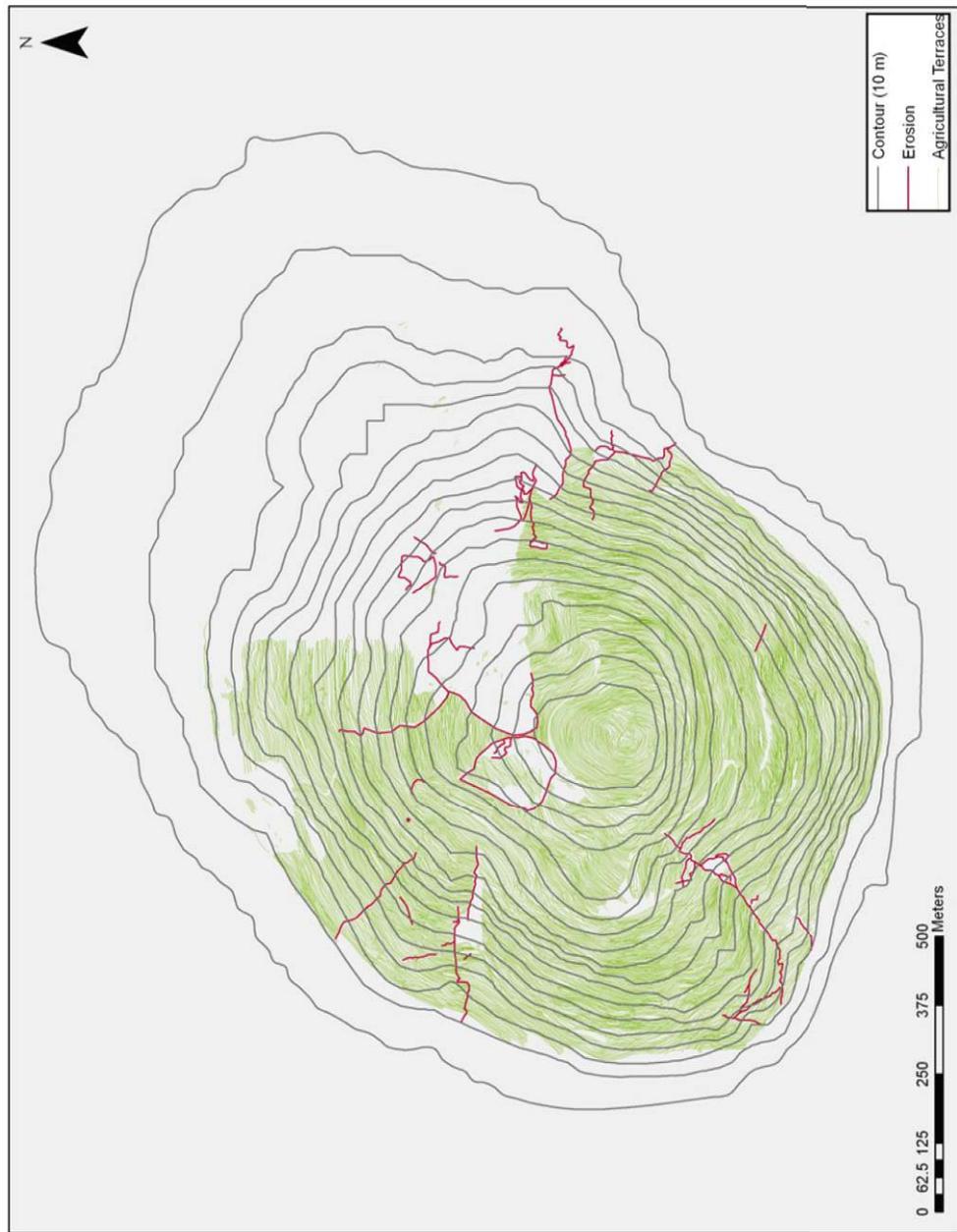


Fig. 6.8. Digitized Terraces at Apúpató

CONSTRUCTION:

Examining construction patterns of prehispanic intensive agro-ecosystem is a great way of understanding the scale of involvement and amount of organized labor needed for their construction and maintenance. Terrace systems have been presented as intensive agrosystems that require less planning and coordination of labor, and once built they require small but continuous maintenance (Smith and Price 1994:176). As a result, they have been associated with centralized political institutions (Rojas Rabiela 1985; Sanders, Parsons, Stanley 1979; Wilkens 1987). Wilkens (1987:100) has called this household approach to construction and maintenance of terrace systems “the process rather than the project approach of so many traditional management activities”. Wilkens (1987) based this approach on modern Mesoamerican agricultural terrace systems that are built by small groups of people, often individual families. Netting (1989; 1990) argues that that terrace agriculture systems are close to the farmer’s settlements because of the continuous need of labor requirements and maintenance.

A more accepted scale of agricultural intensification in the archaeological community is the household approach of construction and maintenance of terraces, seen as less labor intensive when compared to more demanding intensive agrosystems such as canal irrigation, which require large scale involvement and organized labor for their construction and maintenance (Smith and Price 1994). Smith and Price (1994) presented spatial configuration evidence that it is not necessary to have an elite or state power control to explain the extensive distribution of terraces in Morelos during the Postclassic period. The Postclassic Morelos Archaeological Project (1994) provided evidence of contour terraces and settlement patterns, which were interpreted by their spatial

configuration. The terraces' spatial configuration pattern provided evidence that the terraces were built in short, irregular segments with little indication of coordinated planning. In addition, house foundations were spread throughout the terraces, indicating and supporting Netting's (1989; 1990) argument for terrace systems co-existing in proximity to a farmer's settlement.

The spatial configuration interpretation of the Apúpató terrace system does not support a household approach and scale of construction, organization, and labor organization for the construction of the terraces. After intensively digitizing each terrace and later analyzing the terraces' pattern, orientation, and continuity, the geospatial data results suggest that the Apúpató terrace system was built in different phases of short and intensive periods of construction, since it presents no clear divisions, separations, or abrupt changes in terrace pattern and orientation. Apúpató terrace systems seem to have been constructed under well planned and coordinated labor that not only serve to intensify agriculture, but also solve for existing erosion. Today, areas with robust retention walls or check dams are the ones presenting the most erosion and landscape instability problems from the lack of continuous maintenance that agricultural terraces require. The labor required for this scale of construction is certainly more intense than what could be expected from a specialized settlement. During the Purépecha imperial expansion, many of the conquered areas were used for slave recruitment. The *Relación de Michoacán* talks about how these captives were brought to the lake basin to be used for either sacrifice or for labor, such as domestic and agricultural labor. The *Relación de Michoacán* states that,

Tanto las guerras de conquista como las entradas tenían el fin primordial de capturar gente en los pueblos enemigos. Las mujeres, los viejos, los heridos y los niños eran sacrificados en los pueblos conquistados pero a los hombres se les llevaba a la ciudad de Michoacán, y quizás a otros lugares, para ser sacrificados en los templos, excepto los más jóvenes que se ocupaban de las labores domésticas o agrícolas, muchos de los cuales deben haber sido también cautivos de guerra, aquellos que no habían sido sacrificados y que se ocupaban de los servicios domésticos y agrícolas (los llamados teruparaquebaecha). (RM 2008 199).



Fig. 6.8. Male captives from warfare used for agricultural fields (sementeras) (Folio 19, Relación de Michoacán 2008).

Most of the evidence recovered from Apúpato and the spatial configuration data suggest that this large scale terrace system seems to constitute an entire system wrapping the entire island from bottom to top, and that it presents evidence that it was constructed by organized labor at the state level of social organization. This evidence supports arguments regarding changing intensification patterns processes based on the demand of agricultural labor and agricultural features in the lake basin. These changes into intensified agricultural features are mostly associated with the Prehispanic Purépecha Empire and form a key component of the statecraft (Pollard 1993; Fisher 2007). These key components of the Purépecha State formation are represented in the form of engineered raised fields in the lakeshore lands in the lake basin; and the construction of terraces to repair Classic period land degradation (A.D 300-800) and to increase agricultural productivity (Fisher et al. 2003; Fisher 2005; 2007).



Fig. 6.9. Satellite imagery (Google Pro) showing terraces at Apúpató (from southeast, looking west)



Fig. 6.10. Satellite imagery (Google Pro) showing terraces at Apúpató (from west, looking northeast)

FUNCTION:

Apúpató's geomorphology, location in relation to Lake Pátzcuaro, and the already known benefits of its terraced landscapes, suggest at least three important functions can be identified for Apúpató terraces system. First, the Apúpató terrace system consists of agricultural terraces lacking evidence of domestic activities such as residential foundations associated with these terraces, small amounts of ceramic material, and the narrow proportions characterizing Apúpató terraces. One of the most important functions and benefits of Apúpató terraced landscape was moisture retention. As previously stated, Apúpató has no springs or sources of permanent fresh water that could support an agricultural landscape. Therefore, agriculture on Apúpató was dependant on rainfall, which occurs more often during the wet monsoon season. The terraces' ditches form deep deposits of moisture, conserving and retaining moisture more efficiently for agriculture.

In addition, Apúpató's terraces created a leveled planting surface functioning to improve and increase the agricultural land which during the Late Postclassic period was lost due to the transgression of Lake Pátzcuaro which reached between 2040-2045 m a.s.l. The transgression of Lake Pátzcuaro during the Late Postclassic Period was confirmed with previous paleo-environmental and archaeological research (Fisher 2000) which provided the general sequence of lake level fluctuation. During the Apúpató full coverage survey, cultural material dating to the Late Classic-Epiclassic period was collected at elevations between 2033-2044 m a.s.l., and cultural material dating to the Late Postclassic was collected at elevations between 2040-2045 m a.s.l.

A third terrace function was erosion control and landscape stability. At least five major unstable areas with heavy levels of erosion were recognized during the survey. At

least half of these erosion areas are located in the southeastern portion of Apúpató. The soil profile documented in the lower and southern portion was dug by a local farmer and helped understand episodes of erosion at the site. The profile clearly demonstrates an episode of abrupt colluvial deposits of unconsolidated material, burying a cultural horizon of stable soils and Late Postclassic Period sherds and pipes associated with the Purépecha elites. The northern parts of Apúpató presents the most robust and well preserve contour terraces with and without retention walls. The western portion of Apúpató presents some big erosional systems due to the deterioration of well preserved terraces that are in need of maintenance and repair. These portions of Apúpató which present erosional problems in areas with visibly preserved terraces also present other types of erosion control features such as check dams.

Apúpató's terrace system presents a full picture of a complete terrace system that dates to the Late Postclassic Period and presents archaeological evidence for Fisher's (2005; 2007; Fisher et al. 2003) argument stating that the construction of terraces helped repair Classic Period land degradation (A.D 300-800) and increase agricultural productivity in the lake basin at the moment of state formation and are a key component of the Purépecha statecraft (Pollard 1993; Fisher 2007).

There is one potential and strong, yet not tested, function hypothesis which leads to consider that Apúpató terraces served as maguey cultivation fields (*sementeras*) (*metapantli*). This is a more favorable and strong function for these terraces based on some lithic and ceramic evidence that we recovered from the survey which indicate some type of Maguey production and consumption was common on the island. Among the lithics recovered that could be associated with maguey production are scrapers and

obsidian prismatic blades. Ceramic evidence of maguey production, such as thick and big ollas for the collection of Aguamiel used for the production and consumption of its final product: Pulque. No spindle whorls were found during the survey, which are a great diagnostic and indicator of household or workshop areas for spinning and weaving fabric and clothing manufactured from maguey fibers, a very common and successful economic specialization.

SHAPE:

At least three terrace types were recognized at Apúpató. The first type (type A) consisted of a unique terrace that presented characteristics of sloping field terraces, also called semi-terraces, bancales, or metapantli. This type of terrace was identified in certain areas in Apúpató where the terraces extend in gentle slopes and minimally alter the angle of the slope, following the contour of the slope. This terrace type clearly served the function of collecting deeper soils behind the terrace wall, retaining more moisture within the slope soils, and prevents the colluvial loss of soil nutrients (Whitmore and Turner 2001:134)



Fig. 6.11. Terrace Type A.



Fig. 6.12. Terraces Type A



Fig. 6.13. Terrace Type A (From above) (looking north).

The second terrace type (type B) consisted of what is commonly known as a bench terrace, which contours the slope and forms a leveled planting surface (Whitmore and Turner 2001:134). This type of terrace is commonly irrigated; however, no irrigation

canal was identified in relationship to this terrace type in Apúpató. Type A and B are the most common types of terraces in the Apúpató landscape.



Fig. 6.14. Type B Terraces (steeper slope)



Fig. 6.15. Type B Terraces (steeper slope)

A third type, though less common, was recognized (type C) at Apúpató. This type is similar to cross-channel terrace, which forms a barrier or check dam, or *lama y bordo* (silt and dam). These type of terraces were observed in the context of barranca systems and the areas with erosion problems, presenting low levels of integrity due to

abandonment, lack of maintenance, and modern use of the land for grazing, all of which have caused some of the retention walls to collapse.

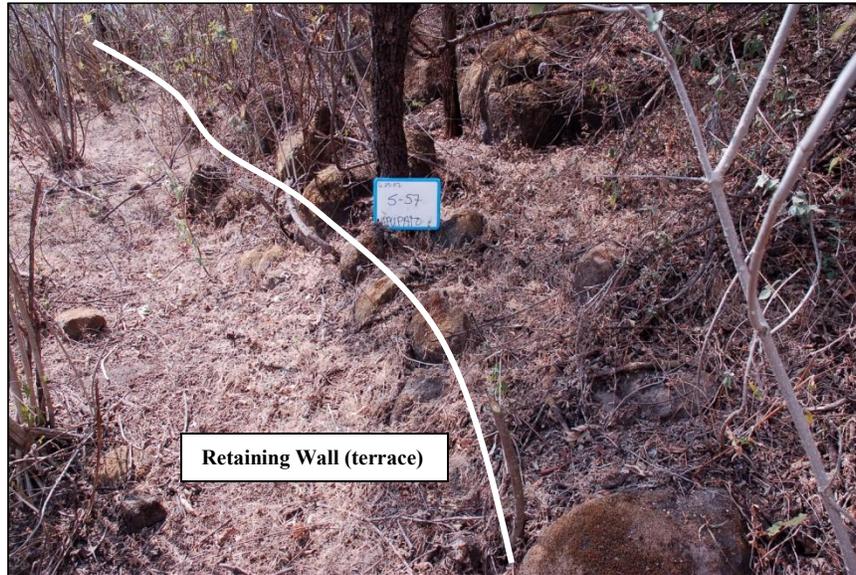


Fig. 6.16. Type C Terraces (retaining wall= structure 57)



Fig. 6.17. Type C Terraces (structure 11 incorporated into the terrace as retaining wall)

Slope Modification at Apúpató

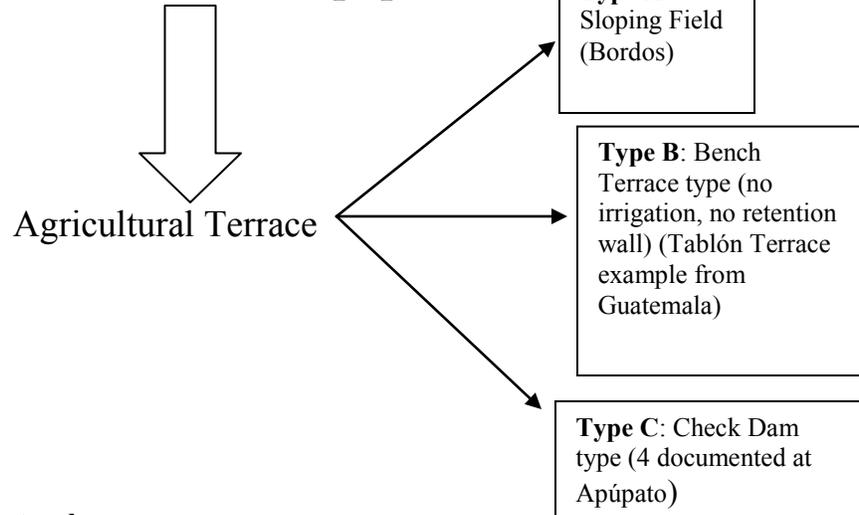


Fig. 6.18. Apúpató terrace typology

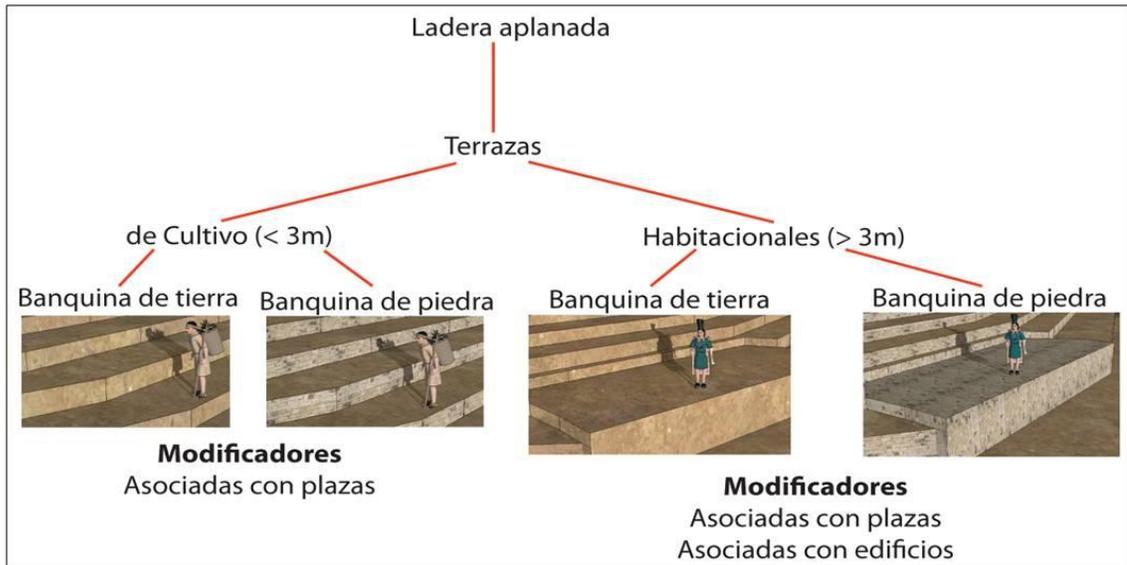


Fig. 6.19. Basic terrace typology of the Lake Pátzcuaro Basin (Designed by Fisher 2010)

AGRICULTURAL TERRACES: SURVEY SUMMARY:

The terraces were analyzed by survey unit (1 ha) (10,000 m²). These survey units (N=195) were used as the measuring unit and were analyzed and organized in terms of presence or absence of terraces and erosion. Therefore, the terraces were not individually quantified, but instead they were quantified by presence or absence of terraces at the

survey unit scale since the terraces were not mapped individually in the field. The count of individual digitized terraces cannot provide an actual count. On the other hand, the count of presence or absence of terraces by survey unit is accurate. A total of 109 survey units (1 ha; 109 ha) (N=195) produced evidence of agricultural terraces; a total of 86 survey units (86 ha) produced no evidence of agricultural terraces. A total of 64 (64 ha) (N=195) survey units presented erosion in the form of barranca.

Survey Units (1 ha)	Hectares	Survey Units (terraces)	Survey Units (Erosion)
195	195	109	64

Table 6.1. Apúpató terrace system summary by survey unit.

At the biggest scale, the shapes of these terraces demonstrate a well planned and organized project with more than one intention. First, the well planned shape and pattern of these terraces illustrate the intention of a full coverage and slope tracing of Apúpató. In addition, the shapes of these terraces clearly state the intention of increasing the agricultural potential by intensively and extensively modifying the island from the bottom to the top in a continuous approach. Lastly, at the smaller scale, the shape of the terraces changed with the degree of the slope they were meant to modify. In the deepest slopes, terraces were built to be very narrow (Type A) and in some cases presented check dams and supporting walls. In the more leveled slopes of Apúpató, terraces were wider and provided a more leveled planting surface (type B).

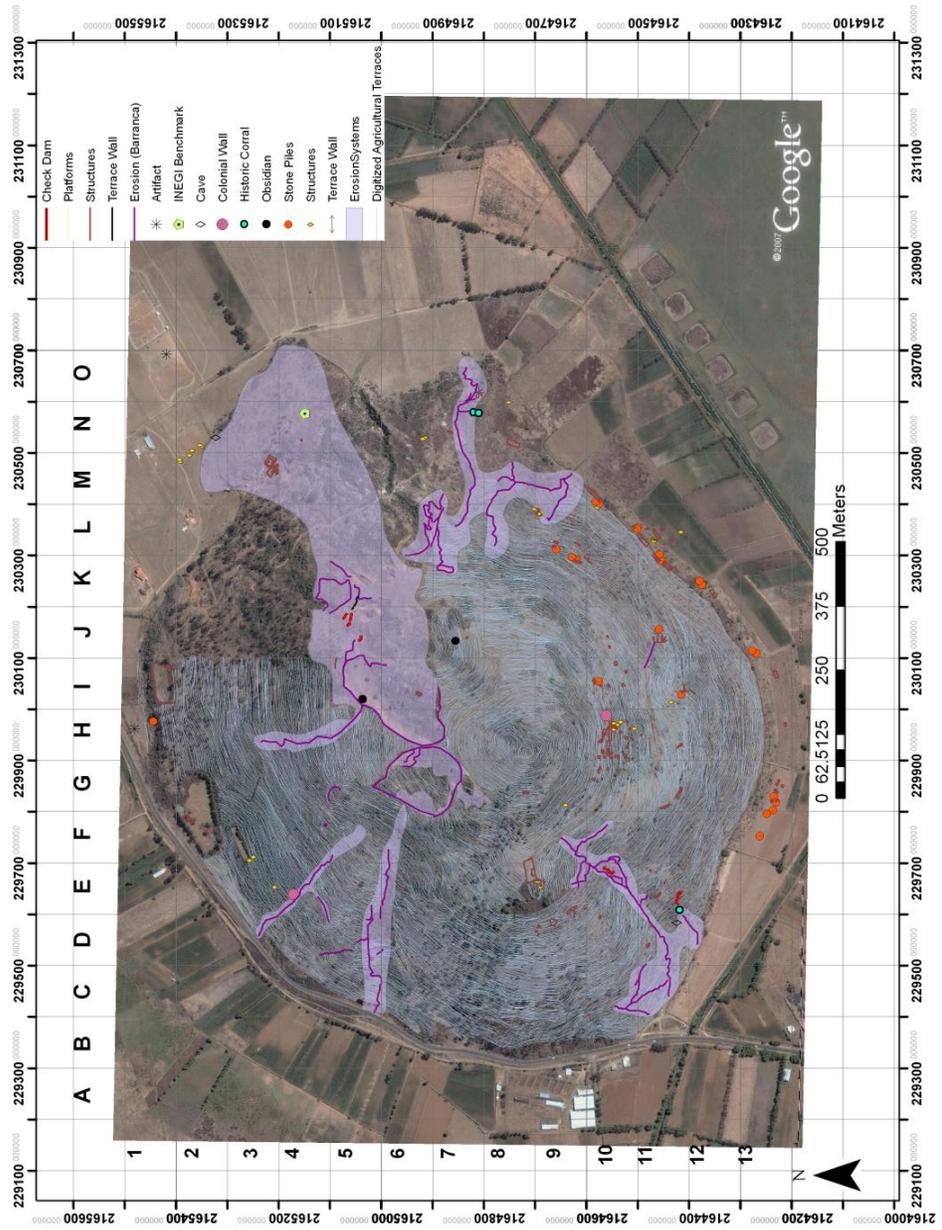


Fig. 6.20. Survey summary map.

CHAPTER 7: MAGUEY CULTIVATION AND PROCESSING: ARCHAEOLOGICAL IMPLICATIONS IN THE LAKE PÁTZCUARO BASIN

The maguey plant (*Agave Americana*) is an important Mesoamerican crop that was an alternative dietary pathway in Mesoamerica (Parsons and Parsons 1990:1; Feinman and Nichols 2004). Archaeologically, there is limited knowledge of the importance and utilization of maguey as an agricultural crop in Mesoamerica, and there is poor preservation of maguey plants in the archaeological record (Parson and Parson 1990:4). We know that maguey was used during the Prehispanic period for food, fuel, pulque, fiber, tools, and construction materials (Parsons). Most of the archaeological knowledge regarding Maguey utilization comes from ethnohistoric research correlating activities associated with maguey cultivation or processing, ethnohistoric documents, and modern ethnographies (Parson and Parson 1990). Most of the maguey cultivation techniques, sap extraction and fermentation, the roasting of the plants in pits, and the spinning of the fibers to produce clothing are still poorly understood in the archaeological record (Parsons and Parsons 1990). Very little archaeological work has been done on the actual techniques of cultivation and processing of this crop, especially in terms of the built environment (with exceptions of Evans 1990; Nichols 1987; Nichols et al. 2000) associated with the intensification of this crop, and the socio-political implications of food transformation of maguey's aguamiel into pulque in the Lake Pátzcuaro Basin.

The archaeological record indicates that the maguey plant was commonly exploited for its fiber and food value from cooked flesh. Given the broad knowledge of maguey as a Mesoamerican crop, specific archaeological evidence is relatively poor. Parsons and Parsons (1990:5) noticed that the lack of a more in depth knowledge of maguey cultivation and processing results in not recognizing cultural material associated with activities of cultivation and processing of maguey. Among these activities, only two are well known and documented in the archaeological record: roasting maguey pencas (leaves) in pits and spinning fibers for clothing (Parsons and Parsons 1990:5).

Some archaeological knowledge about maguey cultivation and processing has been documented in certain regions of Mesoamerica, mostly in the Basin of México (Evans 1992; Parsons and Parsons 1990) and Oaxaca (Feinman et al. 2002). In the Lake Pátzcuaro Basin no evidence of maguey cultivation and or production has ever been documented archaeologically. Archaeological studies regarding agricultural intensification in the Mexican Central Highlands support scenarios where Prehispanic cultivators would have preferred to invest human energy and technology intensifying agricultural production of seed crops and not maguey cultivation (Parsons and Parsons 1990:340). However, the intensification of maguey production is exemplified by increasing the size of maguey plants and the amount of aguamiel (sap) production, or by even shortening the maturation period. As a result, the intensification of maguey could be possible by cultivating this crop in more humid and fertile soil (Parsons and Parsons 1990:340) provided for example by agricultural terraces. The socio-political implications of the transformation of maguey from a utilitarian food to a more complex food symbol such as pulque remain to be studied in the Lake Pátzcuaro Basin. Pulque is known as an

elite food choice; thus, the transformation of this new food item could be indicative of political changes in the Lake Pátzcuaro Basin.

In the context of agricultural societies known to have intensified agricultural production of *maíz*, it is expected that maguey cultivation would have been assigned to lands lacking access to irrigation and of low organic content. The terrace system built on the slopes of Apúpató represents a “Purépecha Piedmont Strategy” that took advantage of this type of land for agricultural intensification of certain crops, such as maguey. Even though it remains to be further tested, the surface evidence of maguey cultivation on this terrace system consists of hundreds of wild maguey plants that continue to grow on the former island, basalt maguey scrapers, obsidian blades, thick body sherds, and very narrow (<3 m) agricultural terraces, that according to Parsons and Parsons (1990:21) are characteristic of maguey cultivation.

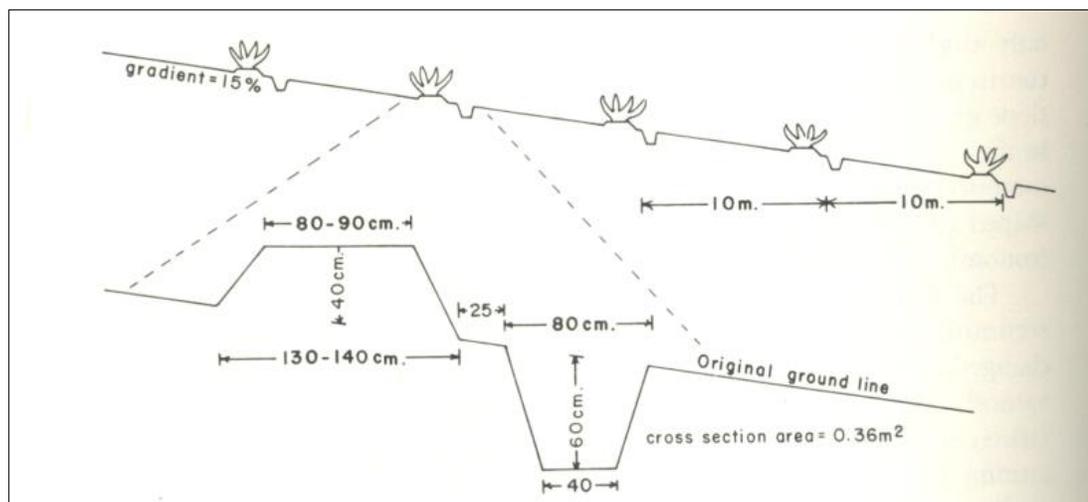


Fig. 7.1. Sloping Terraces diagram (Wilken 1987:106, Fig. 6-3)



Fig. 7.2. Terraces on the south side of Apúpató. (with remains of wild maguey)



Fig. 7.3.-4 Terraces with mature maguey plants (looking south)

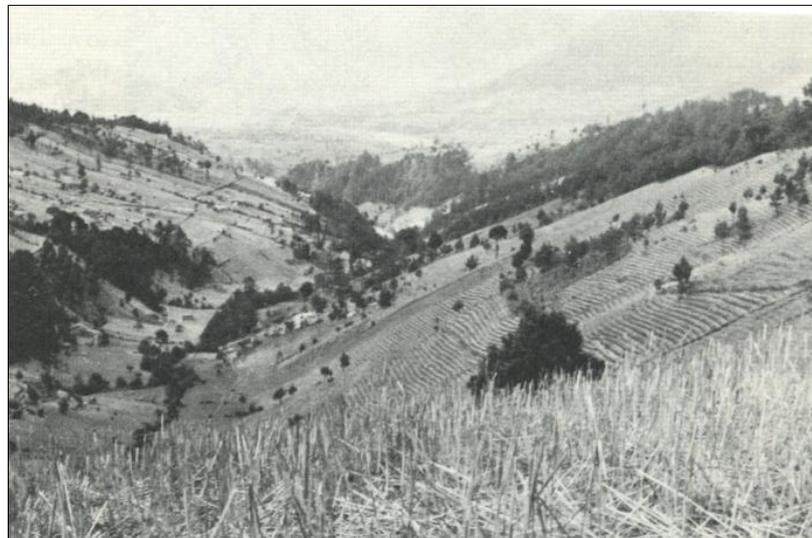


Fig. 7.5. Extensive Tablón Systems (Bench terraces), Tonicapán, Guatemala (beds are 0.5-1.5 m wide rising in tiers of 0.2-0.8 m high).

In the Lake Pátzcuaro Basin marginal lands are areas of higher elevation or steeper slopes that are characteristic of thin soils, low temperatures, and limited moisture, and where labor intensification and technological investment for seed crops would have most likely been a low return without intensification (Class II and III lands, Gorenstein and Pollard, 1983) (Parsons and Parsons 1990:341) in comparison with richer and more fertile lands in the lake basin.

Another common agricultural intensification practice from Highland Central México cultivators is the inter-planting of maguey and maize or other seed crops. This intensification technique improved soil conservation, especially in terraced areas, and provided a barrier to soil erosion and sheet wash (Parsons and Parsons 1990:342). Terracing and/or inter-planting agricultural practices are examples of prehispanic long-term resilient agricultural strategies that not only conserve and improve the soil fertility and soil humidity, but also provided a resilient long-term strategy that produced a reliable and frost resilient crop during the dry season.

Maguey is a resilient crop to drought, frost and hail; thus it provides security for agriculturally based subsistence in the *tierra fría* region (Parsons and Parsons 1990:342). For example, cooked maguey flesh provides 347 calories and 4.5 grams of protein (Fish et al. 1986). Caloric estimates suggest that maguey inter-planted with seed crops can probably double the annual caloric output of a typical non-irrigated agricultural plot in *tierra fría*; and it can significantly increase the caloric output of irrigated land as well (Parsons and Parsons 1990:345). Thus, maguey cultivation provided a way to improve and intensify agriculture in the *tierra fría* context beyond a single season of land growth and harvest, giving this region year round agricultural productivity (Parsons and Parsons

1990:344). Maguey provided year round productivity, and maize provided long-term storability, since maguey's products do not preserve very long, and surpluses of this crop were never able to be stored for long periods of time (Parsons and Parsons 1990:346).

APUPATO TERRACES: MAGUEY CULTIVATION HYPOTHESIS

The strongest hypothesis regarding the function of the agricultural terrace system found at Apúpato is Maguey cultivation or *metaplanti*. Diagnostic sherds and lithic tools collected from the survey included thick handles and thick ceramics sherds, most likely from jars or ollas, or three handled jars. In addition basalt scrapers were present on Apúpato along with a *laja* mine. Scrapers like these, although smaller, have been associated with intensive maguey cultivation in Mesoamerica (although the Apúpato examples are larger) (Feinman, 2000). Terraces at Apúpato presented maguey cultivation features: their layouts were very narrow and thus the terraces were very close. We observed terraces at Apúpato built between 1.5 to 3 meters apart. Parsons and Parsons (1990:21) observed that maguey fields (*milpas*) where maguey grows alone, or even with *nopal*, the terrace rows are spaced much more closely, sometimes no more than 3.5 meters apart.

Almost no archaeological evidence of Maguey production or cultivation exists for the Lake Pátzcuaro Basin, yet maguey and its products are often mentioned in the *Relación de Michoacán*. The *Relación de Michoacán* mentions a maguey specialist called “*Atari*” who was in charge of receiving and managing the fermented maguey (Pulque) for parties (RM 178). Another social category related to Pulque was a female also called

Atari, in charge of serving the Canzonci (Purépecha emperor) pulque and water (RM 185). The *Relación de Michoacán* mentions the social and economic importance of blankets for tribute and offering to *Curicaueri* (Purépecha god). Blankets were made by women as tribute or as an offering to the Gods. The *Relación de Michoacán* does not mention the material used for these blankets, however, it makes a distinction between “big blankets” (*mantas grandes*) and “thin blankets” (*mantas delgadas*) (RM 184; 187; 251).

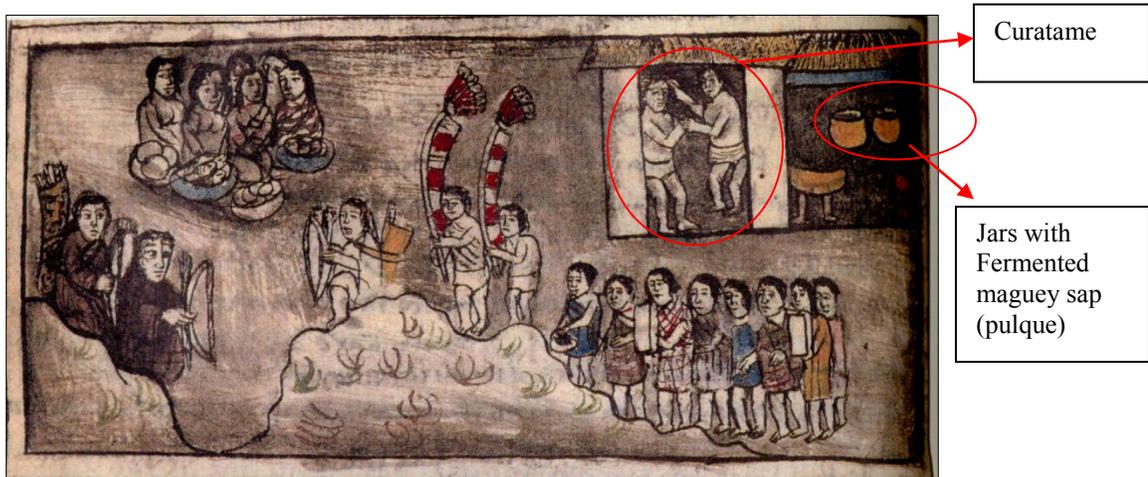


Fig. 7.6. Folio 105 v, *Relación de Michoacán* 2008. Folio depicting when Tariacuari (Canzonci) went searching for his son Curatame because he was getting drunk in Coringaro.

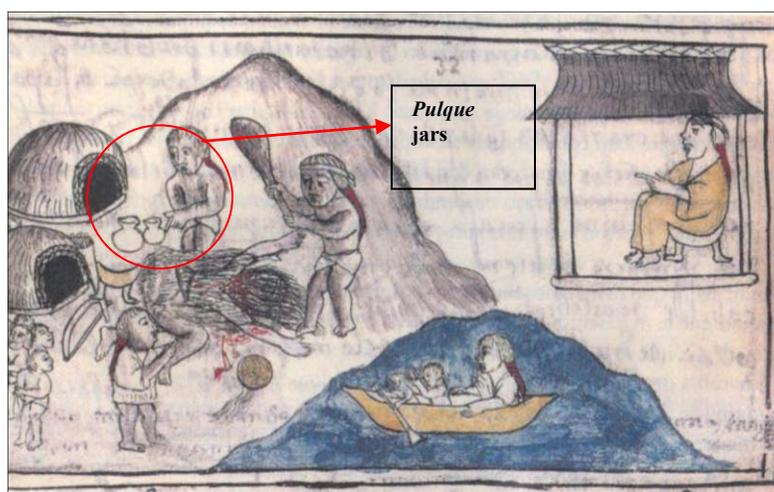


Fig. 7.7. Folio 121, *Relación de Michoacán* 2008. Folio depicting when Tariacuari (Canzonci) sent his son, Curatame, to get killed because he was always getting drunk.

THE MAGUEY PLANT IN MESOAMERICA

The maguey plant belongs to the *Agave* genus with at least 136 species distributed from Utah to Costa Rica (Parsons and Parsons 1990). Different maguey species and varieties produce better sap for pulque manufacturing and others produce better fiber for clothing manufacturing. The agave plants are a resilient type of crop that flourishes in elevations below sea level and up to 3000 m asl, and in extreme environments from dry to humid, and in between (Parsons and Parsons 1990) Therefore, cultivating and exploiting maguey is a reliable choice since maguey is such a resilient crop that is successful in any type of environment, and it provides a great range of products in return. According to Flannery (1968:83), the cultivation of Maguey in the Oaxaca Valley in the Mitla region was as important as maize, and in some years it was the only crop that did not fail due to low rainfall patterns. The *fría* maguey is a crop that can resist cool, dry highland zone, drought, hail, frost, and thin impoverished soils (Parsons and Parsons 1990:3). In the Oaxaca region in Mesoamerica, where cotton cannot be grown, maguey has served as a great source of cordage and clothing, and in the treeless or deforested areas, maguey served as a source of fuel and construction material (Parsons and Parsons 1990:4; Feinman et al. 2006:27. In the last few decades, studies of intensified maguey cultivation have begun to question the importance given to maize as a staple in Mesoamerica. New archaeological studies have suggested that in drier parts of Central México (Oaxaca) populations have adapted to xerophytic plants, such as maguey, which is a resilient plant and provides not only food but economic products (fibers, construction materials, syrups, sugars, etc). (Feinman et al. 2006:27).

In the central Mexican region of *Tierra Fria*, maguey only grows at elevations higher than 1800 m asl. This region presents a cool, semi-arid environment. The maguey products extracted from this crop are pulque, syrup and sugars, fibers, construction materials, household utensil, paper, fuel, and it has also served as a staple component of subsistence agriculture in Highland Central México (Parson and Parson 1990:2,3).

The massive and robust maguey plants can be used as retaining walls to conserve top-soil and create an embankment. In deforested or treeless areas, maguey served as a source of construction material (Parsons and Parsons 1990:4), syrups, sugars and the flesh are known to have been use as a source of reliable food. In most of Mesoamerican maguey terrace systems, inter-planted maguey with seed crops to expand the overall productivity over an entire annual cycle. This inter-planting strategy reduced sheet erosion and conserved soil nutrients by stabilizing the landscape with the size of most maguey plants and extensive root system (Parsons and Parsons 1990:4). There are ethnographic and historic records indicating the inter-planting of maguey and maize in Highland Central México (Parsons and Parsons 1990:341-2).

MAGUEY PULQUE:

One of the most important products of maguey is *pulque*. Pulque is the fermented maguey sap (*aguamiel*). This alcoholic beverage was consumed by the Aztecs (*octli*) and the Purépecha and is better known as *Pulque* (*pulque* is thought to be a word of Antillean origin) (Arduini 2007:46), and it is produced by fermenting the aguamiel of the maguey plant. Parsons and Parsons (1990:17) argue that because the fermentation process happens quickly, the *pulque* producers and maguey cultivators need to be part of the

same productive unit. Furthermore, because the maguey sap ferments and spoils so fast, it is important that the processing (fermentation) is close by the place of origin (cultivation).

The maguey plant provides a great variety of products; however, its cultivation and supervision depends on intensive and complex human management to obtain all of its byproducts efficiently. Domestic maguey plants rarely propagate naturally by seeds; maguey plants would produce seeds if the plants were allowed to reach full maturity (Parsons and Parsons 1990:18). They are propagated from offshoots (*mecuates*) from the base of a parent plant (Parsons and Parsons 1990:19). The maguey plant reaches maturity and full productive capacity after between seven and twenty-five years, depending on soil fertility, moisture, and temperature (Parsons and Parsons 1990:18). The maguey plant's maturity is prevented by castrating the plant. This process secures the most amount of maguey sap production for human use and it also prevents the death of the maguey plant, which fails within a few months of reaching maturity. Dead maguey plants must be replaced by a new plant to keep productive the space formerly occupied by the plant (Parsons and Parsons 1990:18).

The excessive extraction of aguamiel (sap) results in a completely dried-out plant, unfit for fiber and flesh production, and only usable as a source of fuel (Parsons and Parsons 1990:18). Thus, to successfully exploit the maguey for sap and fibers, it is important to care for the nonproducing plants in all their stages of immaturity, as well as close attention while they are between seven to twenty-five years of age. The maguey plant should be carefully managed while reaching maturity for the extraction of sap and

fibers to avoid excessive extraction, and replacing the exhausted plants with new ones (Parsons and Parsons 1990:18).

A maguey plant reaches maturity when a central woody stalk (*quiote*) is formed, and in five to six weeks this stalks grows to a height of 4 to 8 meters. This growth is fueled by a great flow of sap from the maguey plant. A few months later, the maguey plant dies. It is this tremendous sap use required for the growth of the *quiote* that is usually stopped by a castration process that secures the plant's rich store of sap for human use (Parsons and Parsons 1990:29). This process involves removing the growing stalk before it begins to form in the maguey plant (Parsons and Parsons 1990:29). It is during this process that a cavity is prepared by picking (*picazón*) inside the plant's trunk and through this process a cavity is prepared to collect the sap that would flow into the stalk of an un-castrated maguey plant, and make it available for human use (Parsons and Parsons 1990:29)



Fig. 7.8. Planting a young Maguey plant (Parsons and Parsons 1994: 104, Plate 13)

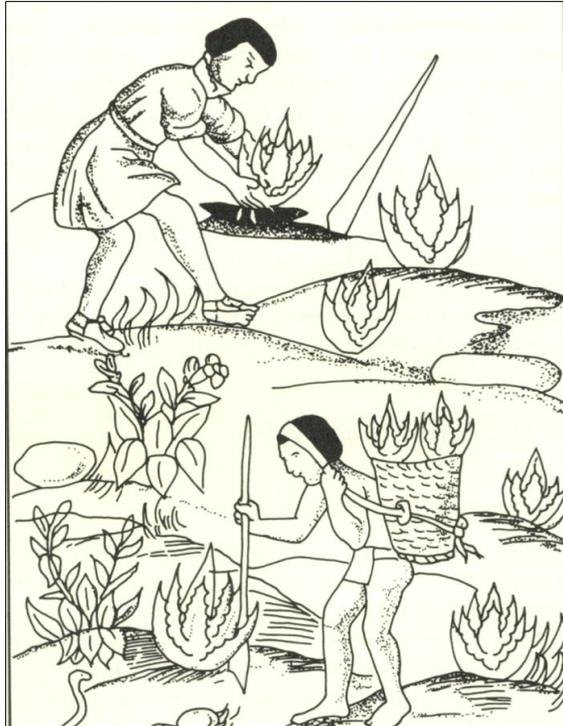


Fig. 7.9. Sixteenth century maguery cultivation (adapted from Dibble and Anderson 1963:Fig. 750 in Parsons and Parsons 1994: 290, Figure 35).



Fig. 7.10. Uictli, or coa de hoja, wooden spade, being used for planting corn (Codice Florentino 4, f. 72 r) (Harvey and Prem 1984, Fig. 8.3).

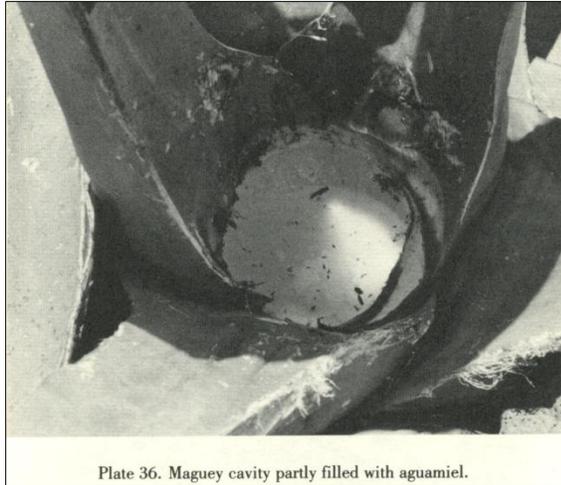


Fig. 7.11. Maguey cavity partly filled with aguamiel (Parsons and Parsons 1994:120, Plate 36)



Fig. 7.12. Scraping interior of Maguey cavity (Parsons and Parsons 1994:120, Plate 37).



Fig. 7.13. Basalt scrapper from Apúpato (from Erosion system III)

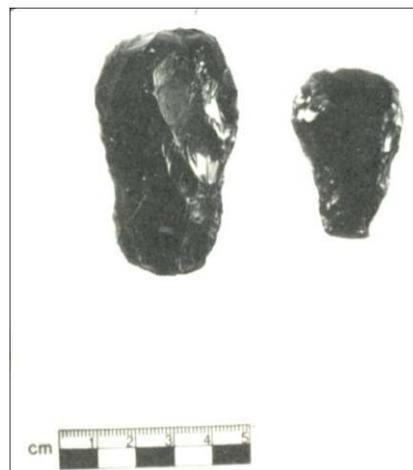


Fig. 7.14 .Two Archaeological obsidian discoidal scrapers (Parsons and Parsons 1994:311, plate 163).

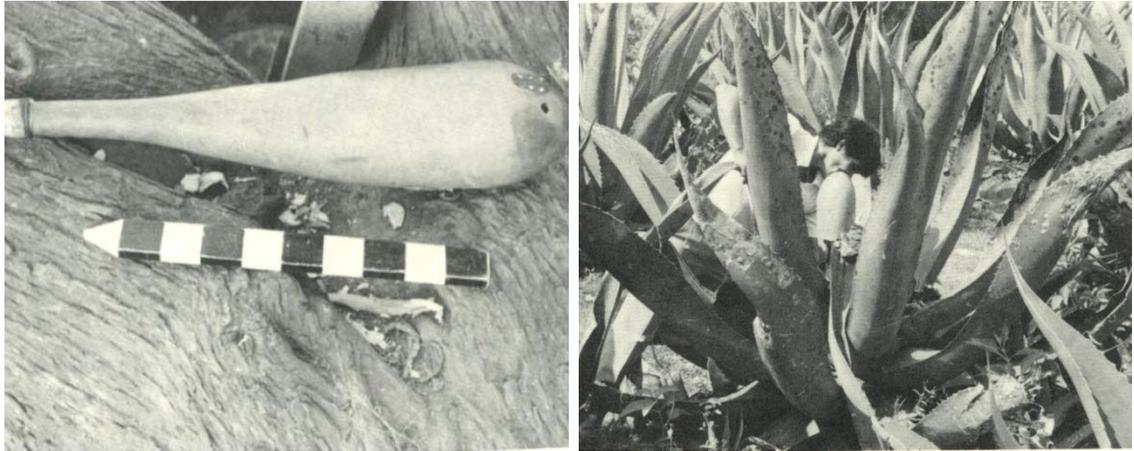


Fig. 7.15. Acocote (scale 50 cm) (hollow gourd to collect aguamiel (maguey sap))(Parsons and Parsons 1994:121, plate39).

Fig. 7.16. Sucking out aguamiel with an acocote (Parsons and Parsons 1994:122, plate 40).



Fig. 7.17. Folio 15.v, Relación de Michoacán 2008. Folio depicting a tlaquichero (aguamiel collector) sucking out aguamiel with an acocote from a sap producing maguey.

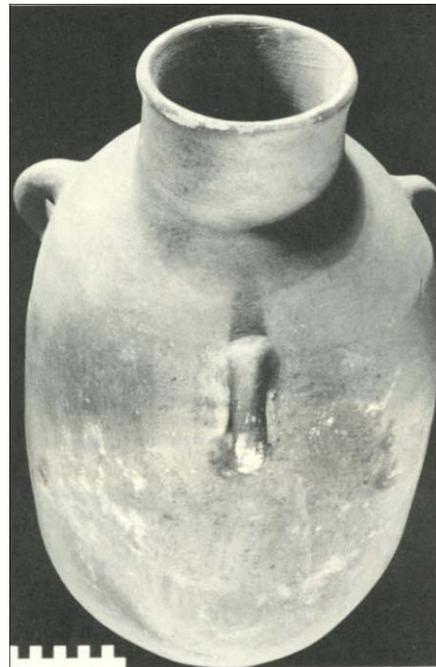


Fig. 7.18. Example of three-handled jar used for carrying water or aguamiel (Parsons and Parsons 1994:125, plate 45)

MAGUEY FIBERS:

Other products from maguey include fibers for making cordage and clothing. The use of maguey fibers for clothing was mostly found in the *Tierra Fria* (highlands) region, which is too cold for cotton production (the other known source of fiber for clothing in Mesoamerica) (Parsons and Parsons 1990:4). The archaeological implications of maguey fiber processing could be linked to either households or as a basic important fundamental aspect of the regional economy visible in the archaeological record. A variety of techniques and activities to process the fiber depend on the methods of fiber extraction (cooked vs. raw leaf of *penca*) visible today in the archaeological record.

Similar to maguey sap fermentation, maguey cultivation had to be in the vicinity of the maguey fiber extraction workshops (Parsons and Parsons 1990:297-8). Once the maguey fiber was obtained, it was most likely transported to workshops for spinning and weaving. The maguey fiber could have been stored and transported, since the fiber is light and durable once extracted and dried out (Parsons and Parsons 1990:312). Therefore, there should be no expectations in the archaeological record of documenting spinning and weaving activities with maguey cultivation and processing in the same archaeological context.

For example, Parsons and Parsons (1990:313) observed that in contexts of hierarchically organized systems with effective large-scale redistribution networks it is expected to have the maguey cultivation and fiber processing activity areas at a considerable distance from the spinning and weaving workshops. Evidence of this spatial disassociation comes from the Postclassic urban centers in the Valley of México (Brumfiel 1976) and Tula (Healan 1977) presenting high concentrations of maguey spindle whorls, suggesting a considerable distance between cultivation and processing, and the final spinning and

weaving workshops. Similarly, Classic period evidence of household scale economic activities at El Palmillo, Oaxaca (Feinman et al. 2002) provides archaeological evidence of maguey fiber processing (maguey ovens and scrapers) and spinning for cordage and clothing (spindle whorls), but little evidence of maguey cultivation. Excavations at El Palmillo terraces suggest mostly a residential function, with little spaces reserved for gardens or cultivation. Maguey plants were planted in the rock retaining walls of the residential terraces for wall reinforcement, erosion control, and maguey products (fibers, flesh, sap) (Feinman et al. 2002:269). The excavations of the Classic period site of El Palmillo, Oaxaca, provided evidence that the residents were highly invested in specialized economic activities such as spinning and lithic production. Thus, it is likely they were cultivating maguey for fiber, but mostly acquiring maguey fiber for spinning from other areas; since almost no space was assigned for maguey cultivation at the scale they committed their households economy.

Postclassic sites in central México associated with spindle whorls suggest a pattern of rural household production. A complementary seasonal division of labor hypothesis has been suggested in which commoner women participate in spinning and weaving activities during the long winter agricultural off-season for seed crops in the *Tierra Fría*, especially for tribute duties in Highland Central México. Also, historic documents such as the *Relación de Michoacán* (RM 2008:175, f.6) make mention of specialized production of high quality cloth by women who worked at the Canzonci's palace (RM 2008:185, f. 12). One important aspect that is difficult to distinguish is between cotton and maguey fiber cloth production, since it is not well differentiated in the historical documents. For example, In the Valley of México, maguey spindle whorls

are totally absent in the archaeological record prior to Postclassic period, and become very common during the Postclassic period Highland Central México possibly due to the demand of maguey fibers at the market and for tribute payments (Parsons and Parsons 1990:362).

It is likely that in the Prehispanic period the maguey fibers were extracted from *penca asada* (cooked leaf), visible in the archaeological record in the context of the cooking hearth, the rotting pit, and the large pounding stone (Parsons and Parsons 1990:298). Also, because maguey fiber processing is such a labor-intensive activity which needs more than one individual to be efficiently processed, it is expected to observe supra-household workshop operations in the archaeological record (Parsons and Parsons 1990:299).

The scraping tool use for maguey fiber extraction must have a smooth dull working edge to avoid cutting or damaging the fiber during the scraping process (Parsons and Parsons 1990:301). Another important archaeological implication for maguey fiber processing is access to fresh water. Large quantities of water are needed for the rotting pit, washing the cooked and rotted leaves, and for scraping the leaves by periodically pouring water over the fibers on the scraping board (Parsons and Parsons 1990:302).

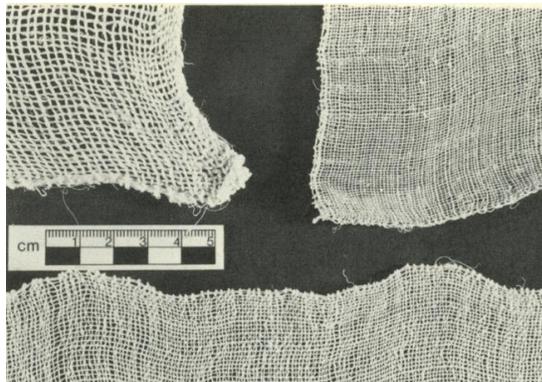


Fig. 7.19. Examples of coarse, fine, and medium maguey fabrics (Parsons and Parsons 1994:246, plate 122)



Fig. 7.20. Scraping magüey penca for fibers (Parsons and Parsons 1994:226, plate 90).



Fig.7.21. Spinning magüey fiber in Orizabita, México (Parsons and Parsons 1994:248, plate 248)

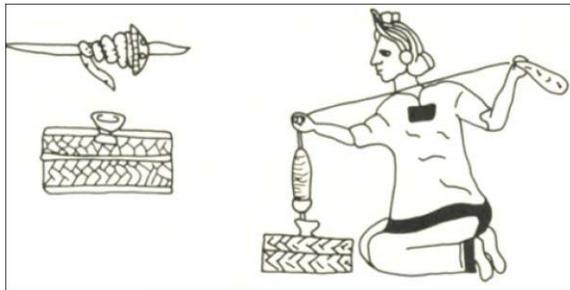


Fig. 7.22. Prehispanic spinning, probably cotton (adapted from Dibble and Anderson 1957:Fig.75; right, adapted from Corona 1964:lamina LXIX in Parsons and Parsons 1994:287, figure 34-B)

MAGUEY: INVESTMENT AND RETURNS

Cultivating maguey plants requires a set of long-term management skills and strategies. It requires a steady and continuous expenditure of adult labor to maintain aguamiel production annually. Aguamiel collection is a physically demanding job that requires transporting or carrying a heavy amount of liquid (sap) over considerable distances. Also, the cultivation process requires to keep nonproductive maguey plants at different stages of maturation in the context of sap productive plants, so they can be ready to start producing aguamiel as soon as they are castrated (Parsons and Parsons 1990:335).

According to Parsons and Parsons (1990:335) for every productive plant on an individual holding, there are likely thirty to fifty unproductive plants being cared for. Loyola (1956:26) calculates that for every productive maguey plant there are fifteen unproductive plants at different stages of maturation. Lomeli et al. (1976) presented data where approximately an average of 27 plants per hectare is exploited for sap in a year from an overall average of 586 plants per hectare (4.6 percent). The overall average pulque productivity is 9000 liters/year.

Loyola (1956) has argued that the density of Maguey plants can reach 800 per hectare, with an expectable average of 500 plants per hectare.

			Annual Caloric Output	
Source	% of Plants in Production	Aguamiel output per hectare	Aguamiel	Cooked flesh
<i>Parsons and Parsons (1994)</i>	<i>2-5 % at any time</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
<i>Humboldt (1811)</i>	<i>7.1-8.3 % annually</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
<i>Loyola (1956)</i>	<i>6.7% at any time</i> <i>500 plants/ha</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
Apúpató (compared to Loyola 1956) (88 ha)	109 ha = 54,500 total maguery plants 6.7%: 3651.5 producing maguery plants	N/A	N/A	N/A
<i>Lomeli et al. (1976)</i>	<i>4.6% annually</i> <i>586 plants/ha</i> <i>27/ha/year= pulque production</i>	<i>9000 liters/ha/yr</i>	<i>5,000,000 calories/ha/yr</i>	
Apúpató (compared to Lomeli et al. 1976) (88 h)	109 ha= 63874 maguery plants Pulque=2943 productive maguery plants	981000 liters/ha/year (pulque)	545000000 calories/ha/year	

Table 7.1. Apúpató maguery productivity (table adapted from Parsons and Parsons 1994:338, table 25)

For Apúpató, the total archaeological survey units (N=195) (195 ha; 1.95 Km²) include the former island of Apúpató and the surrounding lakebed. A total of 109 survey units (109 ha) (1.09 Km²) were positive for terraces. However, the former island of Apúpató alone consists of 1.2146 km² (121.46 he) and terrace system covers (1.09Km²) (109 he) (approximately 90 % of the total island) with an expected average of approximately 54,500 maguey plants [109 ha x 500 (500 plants by hectare) = 54,500] (Loyola 1956). Parsons and Parsons (1990:336) argue that the data on productivity per hectare suggest that at any given time somewhere between 2 to 7 percent of all the cultivated maguey plants in a region are likely to be producing aguamiel. In Apúpató (109 ha), 2 to 7 % would be somewhere between 1090 plants to 3815 productive plants. Therefore, a lot of land is necessary for long-term maguey cultivation and to grow the unproductive plants on their way to become productive for sap collection.

MAGUEY CULTIVATION: APUPATO ARCHAEOLOGICAL IMPLICATIONS

The archaeological implications of maguey cultivation and or production at Apúpató are dependent on cultural material evidence inferred from modern maguey cultivation. However, modern maguey cultivation and processing most likely does not fully represent the ways in which this crop was cultivated and exploited during the prehispanic period. The technological and economic changes that occurred from the introduction of iron tools and domesticated pack and draft animals (Parsons and Parsons 1990:269) and from the imposed cash economy have significantly changed from prehispanic methods of cultivation, processing, storage, and transportation. Parsons and Parsons (1990:270-271) argue that modern maguey production today might help the archaeologist understand that past Prehispanic cultivation and processing of this crop was

actually a product of complex economic, political and technological forces resembling almost nothing of the practices of maguey exploitation in the present.

Regardless of what the main products were, maguey had to be cultivated and aguamiel had to be collected. In the archaeological record it is expected that all the maguey sap processing (pulque fermentation, syrup making, or sugar making) would be located in the vicinity of the maguey production zones (Parsons and Parsons 1990:294). The transportation of either the aguamiel or the mature pulque was dependant on human carrying fragile ceramic shipping containers, or baskets making it difficult for the maguey products to be carried far from the maguey cultivation plots or the pulque consumer's settlements. Thus production zones (fermentation and *tinacales* operations) needed access to multiple containers and access to plenty of fresh water to keep the fermentation vessels clean to avoid spoiled or contaminated pulque (Parsons and Parsons 1990:294).

The lines of archaeological evidence regarding maguey cultivation and processing in Mesoamerica (pulque, fibers, syrups, vinegar) show an intensive and extensive cultivation of this product. Therefore, in the context of Apúpato, the agricultural terraces present a specialized commitment to the production of its products and the participation in a redistribution network ending at specialized settlements for processing and distribution (markets, elite households, ceremonial-civic festivities, etc) (Parsons and Parsons 1990:304-5). Pulque producers and consumers need to have a well-defined and organized shipping and delivery system to avoid wasting their products. For example, the maximum time that mature pulque can be kept fresh and from developing a bad unacceptable flavor is a week. Aguamiel needs to go under fermentation no more than a

few days after being collected from the maguey plant to avoid spoilage (Parsons and Parsons 1990:347). Parsons and Parsons (1990:348) suggest that a way to store aguamiel surpluses was to convert it into either syrup or sugar, since they were able to be stored over longer periods of time. Unfortunately, almost no archaeological information exists regarding the production and consumption of these byproducts in Mesoamerica. Parsons and Parsons (1990:348) have suggested that maguey syrup and sugar would have been a more important product than pulque in Highland Central México during the prehispanic period.

MATERIAL CULTURE

Maguey cultivation and processing requires a set of digging, cutting, and scraping tools used to transplant the young maguey offshoots (*mecuates*), pruning and weeding the maguey plants, and for scraping the mature plants for the production of aguamiel (sap). The most likely prehispanic tools for these activities would have probably been: wooden sticks (*uitzoctli*), and flared digging sticks (*uictli*) used for the digging and levering, and for transplanting and weeding (Parsons and Parsons 1990:289; Rojas 1985:221). A variety of knives manufactured out of obsidian, chert, and or basalt, were used for heavy cutting tasks, trimming maguey leaves, breaking roots, and scraping out the plant's interior cavity prior to aguamiel production. For small cutting jobs, small knives and blades manufactured out of obsidian were used for trimming off spines, cutting thin leaves, and castrating the maguey plant (Parsons and Parsons 1990:289).

In most contexts, some of the lithic material collected from the archaeological record cannot be directly associated with maguey cultivation and processing since most

of these tools could be associated with any type of agricultural practices. Parsons and Parsons (1990:291) have recognized this issue and have suggested wear pattern and plant residue analysis on stone tools as means to sort out if tools were associated with maguey related activities. The most visible tools are those related to aguamiel collection and processing. For example tools and containers carried by humans or by canoes in lacustrine areas such in the context of Apúpató.

Some of the prehispanic stone tools used in the aguamiel collection are the handle discoidal (plano-convex) scraper, which is similar to the contemporary iron scrapers used in the valley of México for aguamiel production (Parsons and Parsons 1990:291-2) (see figure 7.10). The sixteenth century Florentine Codex (Arduini 2007) depicts the use of these scrapers to extract aguamiel at the time of European contact.

These scrapers are visible in the archeological record (Brumfield 1976:105; Michelet 1984:401; Tolstoy 1971:Fig.4d; Spence 1971:36). The author of the Florentine Codex, Sahagun describes similar examples and assigns these scrapers to the modern scrapers used for aguamiel production. Evidence of these scrapers comes from the seventeenth century interpretation of Ruiz de Alarcon (1984:122-3) who observed “a copper spoon with a cutting edge” which was used to scrape the surface of the maguey plant’s interior to stimulate sap production. This distinctive handled, discoidal stone scrapers are typically found in the *Tierra Fría* region. Parsons and Parsons (1990:361) argue that these discoidal scraper tools probably functioned as scrapers for inducing the flow of maguey sap after the castration when the internal cavity of the maguey plant is created. The increase in size of these scrapers over time could be a sign of more intensive and efficient aguamiel collection, by replacing the less efficient method of pressing out

the sap from mashed maguey leaves (*pencas*). Thus, the size increase of these scrapers could provide a good indicator of aguamiel (sap) collection specialization (Parsons and Parsons 1990:362).

Collection and transportation of aguamiel and pulque was carried out with three handled ceramic jars that are strapped to the *tlachiquero*'s back with a shoulder harness or tumpline (Parsons and Parsons 1990:292). This collection and transportation system is still carried out in some regions of México that continues to exploit maguey. Even though three handled jars are fairly common in the Mesoamerican archaeological record, Parsons and Parsons (1990:292-3) argue that this type of vessels are much less common in the archaeological record of highland central México, therefore, they have the potential of being good indicators of aguamiel collection and transportation in the region. In a lacustrine area like Apúpató, waterborne transportation in canoes was available to distribute pulque to either Tzintzuntzan or other important civic centers in the lake basin.

No historic information exists regarding how sap was actually removed in prehispanic times. Parsons and Parsons (1990:293) consider this was done in the same manner as in the present time with hollow gourds or reed tubes, which unfortunately will not be preserved in the archaeological record. The gourds in use today are not grown in the *Tierra Fria*, which means that in prehispanic times these gourds were imported from other regions (Parsons and Parsons 1990:293). The pumpkin species use for bottle gourds (*lagenaria siceraria*) need to grow in frost free environments obtained maybe through some sort of interregional exchange network (Parsons and Parsons 1990:293). Bailey (1937) and Heiser (1979) suggest that perhaps prehispanic cultivators selected over long

periods of time for the extremely elongated trait of bottle gourd (*lagenaria siceraria*) to satisfy the demands of ancient *tlaquicheros* aguamiel extraction in the *Tierra Fría*.

Some of the possible maguey tools found at Apúpató are a variety of obsidian, chert, or basalt knives, and a variety of small obsidian prismatic blades. The discoidal scraper found in the northern lower part of Apúpató made out of basalt, was most likely associated with scraping activities for maguey fiber extraction (Parsons and Parsons 1990:311 plate 163).

Prismatic obsidian blades found in Apúpató were most likely for trimming activities (cutting off spines and thorns; cutting off slices of charred butts or pieces of charred fibers) during the scraping process at the penca asada workshop (Parsons and Parsons 1990:302). The basalt discoidal scraper and the prismatic blades collected from Apúpató could potentially be tested for residue analysis in the future to further test the hypothesis of maguey production and processing at Apúpató. Agave and maguey plants contain distinctive calcium carbonate or calcium oxalate crystals which adhere to stone tools used for cutting and scraping maguey plants. Through microscopic examination it is possible to detect such crystals, but only in a preserved archaeological context (Parsons and Parsons 1990:302).

The ceramic evidence collected from Apúpató consists of the potential presence of handled ceramic jars, which are most likely a partial presence of the common three-handled ceramic jars for transportation of aguamiel and or Pulque. The absence of archaeological maguey roasting pits at Apúpató does not necessarily mean that maguey flesh and leaves (pencas) were not prepared and consumed. Maguey pencas and leaves are known to have been cooked in above-ground mounds built atop heated stones and

earth lying on the surface (Parsons and Parsons 1990:339). These maguey ovens could possibly be represented by rock pile features identified at Apúpató. Future excavations of these rock piles at Apúpató will test for the potential hypothesis that maguey pencas were being cooked for fiber, flesh or syrups on the island.

MAGUEY SCALE PRODUCTION:

In Mesoamerica, most of the archaeological evidence of maguey cultivation and processing comes from the Valley of México suggesting a household level spinning and weaving of maguey fiber, and a large household scale collection and fermentation of maguey sap for pulque and other byproducts (Parsons and Parsons 1990:335). However, there is no logical reason explaining why large scale maguey fiber processing could not have been successful in prehispanic times. It has never been archaeologically recorded at that scale, but it could potentially exist in the archaeological record.

Maguey has proven to be one of the most resilient and daily valuable Mesoamerican crops; yet it has not received the archaeological significance it deserves. Maguey has proven to be the least demanding and most flexible cultigen from the Central Mesoamerican highlands. This crop is a non-seasonal source of food and fiber adaptable to any type of landscape. By opting for such a resilient crop as maguey, the landscape is used effectively extending into higher, drier, colder and less fertile and marginal terrains. It can also be inter-planted with other crops to improve the fertility and soil retention of agricultural landscapes.

For the valley of México, maguey cultivation chronological development suggests different production scales in Highland Central México. Parsons and Parsons (1990:349)

predict that during the Late Formative period (500-250 B.C) maguey specialization and exchange was likely at the household level, but due to their perishable characteristics, aguamiel and pulque were managed at the intra-community level. However, maguey fibers, syrups and sugar are expected to have been exchanged at the intercommunity level for other specialized goods.

Urbanization and state formation changed the logistics of maguey cultivation and production because direct access to agricultural lands and transportation was limited due to the increase in residential settlements. In earlier settlements, almost every household had access to their own agricultural land and maguey plants in the Tierra Fría region (Parsons and Parsons 1990:350). Some technological and organizational changes of maguey cultivation and production were most likely necessary to supply the rapid urbanization and to maximize soil fertility and humidity. At this level of socio-political organization (state-empire) we expect: 1) specialization of either maguey production or seed crops; 2) state administrators knowledge of maguey complementary features of year round food and textile production in the Tierra Fría (Parsons and Parsons 1990:351). For example, in the context of lakeshore urbanization during the early Postclassic period (A.D 950) in the Valley of México, Parsons and Parsons (1990:351-2) argue that,

—The potential for rapid transport of bulky materials between producers and consumers would have been possible; thus, intensifying and expanding specialized maguey production since it would have been possible to transport heavy, fragile ceramic containers of liquid, heavy packages of solid sugar, masses of processed fiber, or dried out maguey stumps for use as fuel across considerable distances by canoes and get them quickly to urban consumers and specialized artisans in lakeshore centers.”

A similar scenario is expected for Apúpató during the late Postclassic period when the lake levels were at 2041.5 m above sea level (O'Hara 1993:53) providing access to fresh water for maguey processing and water transportation of the final products to Tzintzuntzan and the rest of the urban centers in the Lake Basin. Following the maguey production model from the Valley of México, it is expected that the largest and most specialized production of maguey products (mostly aguamiel and pulque) would have been placed around the edges of the lake or on islands with easy access to waterborne transportation during the Middle and Late Postclassic; and that the most marginal lands further away from the lakeshore and urban concentrations would have opted for specialized maguey production of easier transportable products over long distances like sugar and fiber.

The lack of residential structures associated with the terraces at Apúpató and the level of large scale plan of construction and organization of the agricultural terraces suggests that it is likely that maguey production at Apúpató was being organized at the supra-household level (Parsons and Parsons 1990:352). The supra-household level of maguey production is a large-scale organized system of cultivation, aguamiel collection, fermentation, and possibly fiber processing detached from each other and from the ordinary household residence (Parsons and Parsons 1990:352). In the context of this scale of production, the archaeological record would lack the specialized tools and utensils used for maguey production and cultivation activities due to overlapping of multiple functions. However, the archaeological record would present handled and discoidal scrapers for scrapping the maguey interior cavities; large ceramic basins used for boiling

and fermenting the maguey, and large smooth edge trapezoidal scrapers for fiber extraction (Parsons and Parsons 1990:353).

SOCIO-POLITICAL IMPLICATIONS OF MAGUEY CONSUMPTION:

The intensification of maguey production during state level socio-political organization in the lake basin, involved human selection for specific traits such as higher aguamiel production, higher fiber production, greater resistance to drought or cold, more rapid fermentation of aguamiel, more rapid growth and maturation, greater mass or density to improved fuel efficiency, or more effective medicinal qualities (Parsons and Parsons 1990:358). Apúpató's terraces are not only the evidence of a built environment and landscape, but likely evidence of human selection of maguey plants and transformation of this food for social and political identity among the Purépecha elites. In the context of landscape stabilization and management in the Lake Pátzcuaro Basin during the Postclassic period, not only did the intensification of maguey serve to supply the lakeshore Purépecha elites with maguey sap for pulque consumption, but it also provided other social actors with maguey fibers, fuel from dried maguey pencas, which were of particular importance for ceremonial, ceramic production, and residential needs in the lake basin.

Generally, transformation in food preparation, distribution, and consumption reflect political changes (Harstorf and Johannessen 1993). People's choices of food selection, processing, and ritualization are driven by politics and culture, and can help observe different power relationships within a society (Harstorf and Johannessen 1993). Food consumption can be the arena where social relations, cultural values, action and

social negotiations are expressed within a society. The transformation of maguey in Mesoamerica from a utilitarian food to a more complex symbolic food presents similarities to the transformation of maize into *chicha* in the Andes, which had a social, political, ceremonial, and religious role. In the Inka imperial system fermented maize (*chichi*) was used for exchange of alliance (Harstorf and Johannessen 1993). *Chicha* was used as a social contract to maintain power and status in the Inka Empire. Maguey for pulque in the Lake Pátzcuaro Basin compares to the transformation and use of maize for Chicha in the Andes as an expression of a new political dynamic and identity (Harstorf and Johannessen 1993)

In similar way, the transformation of maguey aguamiel into pulque reflects a political process of food use and consumption which drives and reflects a group's culture and social status within a society. The use and consumption of pulque in the Lake Pátzcuaro Basin during the Purépecha State and Empire consolidation validated power and status, demarcating socio-political positions and establishing social relations within the lake basin. These values are maintained through political action or public consumption through public display of foodway choices (Harstorf and Johannessen 1993). The manufacturing and consumption of pulque would have expressed and reinforced cultural structures and social relations (Harstorf and Johannessen 1993) among the Purépechas.

The intensification and transformation of maguey aguamiel into pulque represented a new meaning, value, and status for those consuming pulque, expressing a cultural and political change in the archaeological record. Apúpato could exemplify an archaeological example of production, and possibly processing of this crop associated

with the consumption of the product by specific social actors of the Purépecha State and Empire. The consumption of pulque among the Purépecha elites is well known from ethnohistorical documents, such as the *Relación de Michoacán*. The consumption of pulque by the Purépecha elite could have helped aggrandize these social actors during the Postclassic period. Apúpató has the potential to represent a link between food and the creation of political identities within the Purépechas. The link of food and politics usually reflect changes in cultural principles underlying political changes expressed in floodway changes.

CONCLUSIONS:

The role of maguey as an important Mesoamerican crop that provided important economic, religious, dietary, social, political, and medicinal products has been highly underrepresented in archaeological studies. The difficulty of recognizing maguey cultivation and processing in the archaeological record has improved as more archaeological sites have been associated with maguey activities. I expect that the terrace system of Apúpató can serve as evidence of maguey agricultural intensification under a large scale of organization (state/empire) as opposed to the most common household level of cultivation (Smith and Price 1994).

The terraces at Apúpató provide an illustration of maguey agricultural intensification, obtained by cultivating this crop in terraces that provide the more humid and fertile soil needed for an increase of maguey size. In addition, the terraces increase the area for cultivation; therefore, increasing the amount of maguey plants and sap productive plants producing *pulque* and other products. The labor investment of building

these terraces and cultivating these plants would have had a long-term return of continuous producing maguey plants.

Similar to the Valley of Oaxaca, during the Late Postclassic period, the areas between 2050 and 2200m consisting of the lower slopes surrounding the lakeshore including islands, alluvial deltas and plains were modified through intensive agriculture in the form of terraces. In the Valley of Oaxaca, the “piedmont strategy” served to support local centers and Monte Alban. In the Lake Pátzcuaro Basin the exploitation of these new agricultural zones would have increased the agricultural potential of the lake basin and supported the pulque consumption of the Purépecha elite from the new cities of Tzintzuntzan, Ihuatzio, and Pátzcuaro

Chapter 8: Conclusions

The fieldwork and analysis for this thesis, including full coverage settlement pattern survey, geoarchaeology, remote sensing/ARCGIS, and analysis of ethnohistoric documents, has documented patterns of settlements, confirmed the presence of terraces, and outlined the general landscape development of the former island of Apúpato. This thesis has presented for the first time in the Lake Pátzcuaro Basin a well-preserved example of *landesque capital* as statecraft in the form of hundreds of agricultural terraces. It has analyzed their episodes of construction, function, and form to further investigate socio-political implications of state and empire formation and agricultural intensification, the prehispanic built environment, lake level fluctuation, settlement history, and possible social identity and political implications of consumption of maguey pulque.

The terrace system documented at Apúpato has provided a well preserved agriculturally engineered prehispanic landscape and it has added to the growing research of agricultural intensification in the Lake Pátzcuaro Basin, Michoacán during the Postclassic period. Agricultural intensification was an important component of state formation in the Lake Pátzcuaro Basin (Fisher et al. 2003) exemplified by raised field systems and by the construction of terraces to repair Classic Period land degradation (A.D 300-800) and to improve productivity of seed crops (Fisher et al 2003; Fisher 2005).

The agricultural features documented on Apúpató suggest, in terms of construction development, form, and function, that the terraces were built in different phases of short and intensive periods of construction with no clear divisions, separations, or abrupt changes in orientation and terrace pattern. The system seems to have been constructed under a well-planned and coordinated agricultural infrastructure project that presents evidence of organized labor at the state level of socio-political organization. This level of labor organization materialized as *landesque capital* at Apúpató provides evidence that supports arguments regarding changing intensification patterns processes based on socio-environmental dynamics with socio-political implications in the Lake Pátzcuaro Basin. This resulted in a new land-use management strategy, addressed here as the “Purépecha piedmont strategy” that provides evidence of the state formation process by re-organizing and focusing agricultural production in the piedmont zones of the lake basin. The agricultural intensification process can be recognized by the changing patterns that convey increased labor investments on a certain landscape (Fisher 2007:95). Similar to the Valley of Oaxaca, during the Late Postclassic period, the areas between 2050 and 2200m consisting of the lower slopes surrounding the lakeshore including islands, alluvial deltas and plains were modified through intensive agriculture in the form of terraces. In the Valley of Oaxaca, the “piedmont strategy” served to support local centers and Monte Alban. In the Lake Pátzcuaro Basin the exploitation of these new agricultural zones would have increased the agricultural potential of the lake basin and supported the new cities of Tzintzuntzan, Ihuatzio, and Pátzcuaro

RESEARCH IMPLICATIONS:

In addition, this thesis has tested four research implications regarding the development of, construction, and morphology of the terraces documented in Apúpató in the Lake Pátzcuaro Basin. First, it has provided a preserved archaeological example of agricultural terraces for Fisher et al.'s (2003) argument that suggested much of the Pátzcuaro Lake Basin was covered with intensive terrace systems that were destroyed by subsequent Colonial land-use. Fisher's (2000; 2005) work presented earth science evidence of sustainable land use during the late Postclassic period by assuming a stabilization of Prehispanic erosion, achieved by investing in the construction of terraces at the landscape scale. His work also presents earth science evidence for colonial land use and the causes of land degradation due to the lack of sustainable knowledge of land management in the region. This thesis was able to present a Postclassic period terrace system and evidence of erosion systems due to abandonment and lack of maintenance of the terrace system at Apúpató.

Second, the well preserved terraced landscape, with aid of satellite imagery, allowed me to reconstruct the timing and development of the terraces by discerning single or multiple patterns of construction. The terraces' pattern, orientation, and continuity, the geospatial data results suggest that the Apúpató terrace system was built in different phases of short and intensive periods of construction, since it presents no clear divisions, separations, or abrupt changes in terrace pattern and orientation. The Apúpató terrace system seems to have been constructed under a well planned and coordinated management that not only served to intensify agriculture, but it also seems to have meant to tackle areas with erosion problems and known drainages. Most of the evidence

recovered from Apúpato and the spatial configuration data suggest that this large scale terrace system seems to constitute an entire system wrapping the entire island from top to bottom, and that it presents evidence that it was constructed by organized labor at the state level of social organization. This evidence supports arguments regarding changing intensification patterns and processes based on the demand of agricultural labor and agricultural features in the lake basin.

Third, as a former island, accessibility to Apúpato remained difficult during periods of lake transgression (for example during the Late Postclassic) serving to preserve the ancient built environment from modern development and agricultural practices. Thus the Apúpato terrace systems served as a refugia of the prehispanic built environment prior to European contact and an example of the built environment in the proto-contact period (prior to A.D. 1520). Apúpato becomes an island when lake levels are at 2041.5 m asl (O'Hara 1993:53). At the time of European contact, lake levels were at least at 2041.5 m asl as depicted in the colonial maps and the *Relación de Michoacán*. The fluctuating nature of Lake Pátzcuaro could have isolated the island of Apúpato as a result of transgressions during the early and middle Postclassic period (900-1300 A.D) and during the Colonial period (1750-1860 A.D). This thesis has documented the dynamic lake level fluctuations documented by five paleoshores (strandlines) at 2043.92 m asl, 2040.47 m asl, 2043.97 m asl, 2039.74 m asl, and 2040, 20 m asl. Diagnostic sherds dating to the Late Classic to Epiclassic period were found in an area at an elevation of between 2033 and 2044 m asl, and diagnostic sherds dating to the Postclassic period were found in an area between 2040 and 2045 m asl. In addition, settlements located at 2035 m asl in the former lake bed that could indicate earlier occupations.

Fourth, the terraces at Apúpató have provided potential evidence for maguey cultivation for pulque. The production of maguey during the prehispanic period is well documented for the region (*Relación de Michoacán*) but has not been documented archaeologically. This thesis presents potential evidence, yet to be tested further, that the Apúpató terrace systems were likely used for the production of maguey. Parsons and Parsons (1994: 21) work in Orizabita, México, documented modern maguey cultivation in narrow terraces (>3.5 m) which suggests possible maguey cultivation at Apúpató. Evidence of a basalt maguey scrapper, thick body sherds, handles, and obsidian blades suggest that maguey cultivation was occurring on Apúpató's terraces. The lack of archaeological tools and cultural material associated with other maguey processing activities might support the argument that these terraces were not maintained and utilized at the household level, but were used and managed at the state level through maguey specialized agricultural labor. In addition, some of the agricultural tools utilized for the cultivation and processing (digging and transplanting) of this crop, were likely made out of wood, as in the case of the *uitzoctli*, *uictli* or *coa de hoja*, wooden spade. Also the lithic material collected from the archaeological record cannot be directly associated with maguey cultivation and processing since most of these tools could be associated with any type of agricultural practices. The production of maguey for pulque introduces new social and political implications regarding social identity and political power in the Lake Pátzcuaro Basin that resembles the food transformation of maize into *chicha* for political alliances during the imperial Inka expansion in South America. The food transformation of maguey from a more utilitarian food to a more complex symbolic food consumed by the Purépecha elites can provide new information regarding social relations, cultural

values, actions and socio-political negotiations in the Lake Pátzcuaro Basin and beyond the Purépecha Empire. Therefore, future research projects at Apúpato include excavation and phylolith analysis to further test this hypothesis of maguey cultivation and processing.

Thus, this thesis has now provided archaeological evidence of *landesque capital* associated with state formation arguments for the Lake Pátzcuaro Basin by documenting and analyzing a terrace system in terms of their function, shape, and construction development. First, the Apúpato systems of *landesque capital* have provided archaeological evidence of agricultural intensification to broader theories of state formation in the Lake Pátzcuaro Basin. Apúpato is a *refugia* of the proto-historic landscape with evidence of the socio-environmental dynamics of the Lake Pátzcuaro Basin yielding evidence of: 1) prehispanic through colonial settlement occupations (Middle Classic period to Early Hispanic period), lake level fluctuations, *landesque capital* (terraces), and potentially cultivation of maguey for pulque production. Apúpato is presented here as a great example of agricultural intensification and as a key component of state formation and landscape stabilization in the Lake Pátzcuaro Basin, and could be used as an example for comparative studies with other regions for the improvement of more comprehensive theories of state formation and agricultural intensification. Thus, Apúpato has the potential to enter the broader intensification debate because it exemplifies a classic example of agricultural intensification tied to socio-political complexity from a human-environmental framework.

Reference Cited

- Adams, Robert Mc Cormick
1960 City Invincible: A Symposium of Urbanization and Cultural Development in the Ancient Near East (coedited with C. H. Kraehling). University of Chicago Press. Chicago
- Álcala, Jerónimo de
2008 Relación de Michoacán. El Colegio de Michoacán. Zamora, México.
- Allen R.
1997 Agriculture and the origins of the state in Ancient Egypt. *Expl. Econ. Hist.* 34:134–54
- Arduini, F.
2007 The world of the Aztecs in the Florentine codex. Mandragora, Florence.
- Arnauld, Charlotte, P. Carot and M.F. Fauvet-Berthelot
1993 Arqueología de Las Lomas en la cuenca lacustre de Zacapu, Michoacán, México. Cuadernos de Estudios Michoacanos 5, Cemca, México.
- Ashmore, Wendy
2002 Classic Mayan Landscape and Settlement. In *Mesoamerican Archaeology*, edited by Hendon Julia and Rosemary Joyce, Blackwell Publishing, Malden, MA.
- Bailey, L. H.
1937 *The garden of gourds*. The Macmillan company, New York,.
- Balkansky, A. K.
2002 *The Sola Valley and the Monte Albán State: A Study of Zapotec Imperial Expansion*, Memoirs No. 36, Museum of Anthropology, University of Michigan, Ann Arbor.
- Ban, N., Hasenaka, T., Delgado, H,
1992 K-Ar Ages of lavas from Shield Volcanoes in Michoacán-Guanajuato, Mexico. *Geofísica Internacional* 31:467-463.
- Bailey, L

- 1937 The Garden of Gouds. New York: The Macmillan Co.
- Beaumont, Pablo
 1932 Crónica de Michocán (1776-1780). Archivo General de la Nación: 17-19, México.
- Billman, B. R. and G. M. Feinman, Eds.
 1999 Settlement Pattern Studies in the Americas—Fifty years since Virú. Smithsonian Series in Archaeological Inquiry. Washington, Smithsonian Institution Press.
- Billman BR.
 2002 Irrigation and the origins of the Southern Moche State on the north coast of Peru. *Lat. Am. Antiq.* 13:371–400
- Blanton, Richard E. et al.
 1981 Ancient Mesoamerica: A Comparison of Change in Three Regions. Cambridge University Press, Cambridge.
 1982 Monte Alban's Hinterland, part I: The Prehispanic Settlement Patterns of the Central and Southern Parts of the Valley of Oaxaca, Mexico. Memoirs No. 15, Museum of Anthropology, University of Michigan, Ann Arbor.
- Blaikie, Piers and Harold Brookfield
 1987 Land Degradation and Society. Methuen & Co, New York.
- Boserup, E.
 1965 The conditions of Agricultural Growth. Aldine, Chicago.
 1981 *Population and technological change : a study of long-term trends.* University of Chicago Press, Chicago.
- Brand, Donald
 1943 An Historical Sketch of Geography and Anthropology in the Tarascan Region. *New Mexico Anthropologist* 6-7 (2):37-108.
- Bray, Tamara L.
 2003 Inka Pottery as Culinary Equipment: Food, Feasting, and Gender in Imperial State Design. *Latin American Antiquity* 14 (1):3-28.
- Breasted, James Henry
 1906 Ancient Records of Egypt: Historical Documents from the earliest times to the Persian Conquest. Chicago.
- Brookfield, Harold
 1972 Intensification and Disintensification in Pacific Agriculture. *Pacific Viewpoint* 13:30-38.
 1984 Intensification Revisited. *Pacific Viewpoint* 25(1):15-44.

- 2001 Intensification, and alternative approaches to agricultural change. *Asia Pacific Viewpoint*, 42(2/3):181-192).
- Brumfield, Elizabeth
 1976 Specialization and Exchange at the Late Postclassic (Aztec) community of Huexotla, Mexico. PhD dissertation, University of Michigan. Ann Arbor: University Microfilms.
- Carneiro, Robert L.
 1970 A Theory of the Origin of the State. *Science* 169: 733–738
- Chacón Torres, A.
 1989 A limnological Study of Lake Pátzcuaro, Michoacán, Mexico. Ph.D Thesis, University of Stirling.
 1993 El Lago de Pátzcuaro, Michoacán, Mexico. Bosque Limnológico de un Lago Amenazado. Universidad Michoacana, Morelia.
- Childe, Gordon
 1950 ‘The Urban Revolution’, *Town Planning Review*, 21, 3–17.
- Conklin, Harold
 1957 *The Relation of Hanunoo Agriculture*
- D'Altroy TN, Hastorf CA, eds.
 2001 *Empire and Domestic Economy*. New York: Plenum
- Deevey, E.S. Jr.
 1957 Limnologic Studies in Middle America, with a chapter on Aztec limnology. *Transaction of the Connecticut Academy Arts Sciences* 39:213-328.
- DeMarrais et al.
 1996 Ideology, materialization, and power ideologies. *Current Anthropology* 34:15-31.
- Denevan WM.
 2000 *Cultivated Landscapes of Native Amazonia and the Andes: Triumph Over the Soil*. New York: Oxford Univ. Press
- Dokin, R.A
 1979 Agricultural Terracing in the Aboriginal New World. University of Arizona Press, Tucson.
- Doolittle, W. E
 1984 Agricultural Change as Incremental Process. *Annals of the Association of American Geographers* 74:124-137.

- Dunning, Nicholas, et al.
 1999 Temple Mountains, Sacred Lakes, and Fertile Fields: Ancient Maya Landscapes in Northwestern Belize. *Antiquity* 73(281)
 2002 Arising from the Bajos: The Evolution of a Neotropical Landscape and the Rise of Maya Civilization. *Annals of the Association of American Geographers* (92)2: 267-283.
- Earle, Timothy K.
 2002 Bronze Age Economics: The beginnings of Political Economies. Westview, Boulder.
- Endfield, Georgina, H. and Sarah O'Hara
 1999 Degradation, Drought, and Dissent: An Environmental History of Colonial Michoacán, West Central Mexico. *Annals of the Association of American Geographers*, 82(3):402-419.
- Erickson, C.L
 1999 Neo-Environmental Determinism and Agrarian 'Collapse' in Andean Prehistory. *Antiquity* 73(281):634-641.
 1993 The Social Organization of Prehispanic Raised Field Agriculture in the Lake Titicaca Basin. In *Economic Aspects of Water Management in the New World*. V. Scarborough and B. Isaac (eds.) pp. 367-427 JAI Press, Greenwich, Connecticut.
- Evans, S. T.
 2001 Aztec Period Political Organization in the Teotihuacan Valley. *Ancient Mesoamerica* 12(01):89-100.
- Evans, S. T. and A. Freter
 1996 Teotihuacan Valley, Mexico, Postclassic Chronology. *Ancient Mesoamerica* 7(02):267-280.
- Fedick, S. L.
 1994 Ancient Maya Agricultural Terracing in the Upper Belize River Area. *Ancient Mesoamerica* 5(01):107-127.
- Feinman, G. M. and J. Marcus
 1998 *Archaic states*. 1st ed. School of American Research advanced seminar series. School of American Research Press, Santa Fe, N.M.
- Feinman, G. M., L. M. Nicholas and H. R. Haines
 2002 Houses on a Hill: Classic Period Life at El Palmillo, Oaxaca, Mexico. *Latin American Antiquity* 13(3):251-277.
 2007 Classic Period Agricultural Intensification and Domestic Life at El Palmillo, Valley of Oaxaca, Mexico. In *Seeking a Richer Harvest: The*

Archaeology of Subsistence Intensification, Innovation, and Change. Tina L. Thurston and Christopher T. Fisher (eds.) Springer, New York.

Feinman, G. M and Nicholas, L.M

2004 Archaeological perspectives on political economies. University of Utah Press, Salt Lake City.

Feinman, G. M., L. M. Nicholas and E. F. Maher

2008 Domestic offering at El Palmillo. *Ancient Mesoamerica* 19(02):175-194.

Fisher, CT and GM Feinman

2005 'Introduction to "Landscapes over time" ', *American Anthropologist* 107 (1): 62-9

Fisher, Christopher T. et al

1999 Intensive Agriculture and Socio-Political Development in the Lake Pátzcuaro Basin, Michoacán, Mexico. In C. Fisher and T. Thurston (Eds), *The Topography of Anthropogenic Environments in Global Perspective*. Special Section in *Antiquity* 73:642-649.

2003 A Reexamination of Human-Induced Environmental Change within the Lake Pátzcuaro Basin, Michoacán, Mexico. *Proceedings of the National Academy of Sciences of the United States of America*, 100(8):4957-4962.

Fisher, Christopher T.

2000 Landscapes of the Lake Pátzcuaro Basin. Thesis (Ph. D.) University of Wisconsin, Madison

2005 Demographic and Landscape Change in the Lake Pátzcuaro Basin, Mexico: Abandoning the Garden. *American Anthropologist*, 107(1):87-95.

2009. *Interim Report: Un Reconocimiento de Campo de la Isla Apúpato, Michoacán, México. Informe Técnico Parcial, Temporada 2007/2008*. Instituto Nacional de Antropología e Historia, Mexico. 43 pp.

Flannery, K. V.

1968 Archeological systems theory and early Mesoamerica. In *Anthropological Archaeological in Americas*, Edited by Betty J. Meggers. Washington, Washington DC: Anthropological Society of Washington. Pp. 67-87.

1972 The Cultural Evolution of Civilizations. *Annual Review of Ecology and Systematics* 3:339-426.

1995 Prehistoric Social Evolution. In *Research Frontiers in Anthropology* edited by C. E. a. M. Ember, pp. 1-26. Prentice-Hall, Englewood Cliffs.

Foster, George C

1948 Empire's Children: The People of Tzintzuntzan. Nuevo Mundo Press, Mexico.

Fowler, W. R.

2000 Introduction. *Ancient Mesoamerica* 11(02):245-245.

- Garduño-Monroy, V.H., Israde, I., Francalanci, L., Carranza, O., Chiesa, S., Corona, P., Arreygue, E.,
 1997 Sedimentology, volcanism and tectonics of the southern margin of the lacustrine basins of Maravatio and Cuitzeo, Mich., Mexico, en International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI). General Assembly, Puerto Vallarta, Mexico, Fieldtrip guidebook: Guadalajara, Jal., México, Gobierno del Estado de Jalisco, Unidad Editorial, 15p.
- Geertz, Clifford
 1963 *Agricultural Involution: The Process of Ecological Change in Indonesia*. University of California Press, Berkeley.
- Google Earth Pro
 2010 www.google.com
- Gorenstein, Shirley, and H. Perlstein Pollard
 1983 The Tarascan Civilization: A Late Prehispanic Cultural System. Vandervilt University Publications in Anthropology 28. Nashville.
- Haines, H. R., G. M. Feinman and L. M. Nicholas
 2004 HOUSEHOLD ECONOMIC SPECIALIZATION AND SOCIAL DIFFERENTIATION: The stone-tool assemblage at El Palmillo, Oaxaca. *Ancient Mesoamerica* 15(02):251-266.
- Haller, M. J., G. M. Feinman and L. M. Nicholas
 2006 SOCIOECONOMIC INEQUALITY AND DIFFERENTIAL ACCESS TO FAUNAL RESOURCES AT EL PALMILLO, OAXACA, MEXICO. *Ancient Mesoamerica* 17(01):39-55.
- Hasenaka, T., Carmichael, I.
 1985 The Cinder Cones of Michoacán-Guanajuato, Central Mexico. Their Age, Volume, Distribution, and Magma Discharge Rate. *Journal of Volcanology and Geothermal Research* 35:105-124.
- Hastorf, Christine A. and Sissel Johannessen
 1993 Pre-Hispanic Political Change and the Role of Maize in the Central Andes of Peru. *American Anthropologist* 95 (1):115-138.
- Harris, Marvin
 1979 *Cultural Materialism: The struggle for a Science of Culture*. Random House, New York.
- Hayden, B
 2003 Were luxury foods the first domesticates? Ethnoarchaeological perspectives from Southeast Asia *World Archeology* 34(3)458-469.

- Healan, D
 1977 Archaeological Implications of daily life in ancient Tollan, Hidalgo, Mexico. *World Archaeology*, 9:2:140-56.
- Healy, Paul F. et al.
 1983 Caracol, Belize: Evidence of Ancient Maya Agricultural Terraces. *Journal of Field Archaeology* (10) 4: 397-410.
- Heiser, C. B.
 1979 *The gourd book*. 1st ed. University of Oklahoma Press, Norman.
- Hirth KG.
 1996 Political economy and archaeology: perspectives on exchange and production. *J. Archaeol. Res.* 4:203-40
- Hutchinson, G.E., R. Patrick, and E. Deevey
 1956 Sediments of Lake Pátzcuaro Michoacán, Mexico. *Bulletin of the Geological Society of America* 67:1491-1504.
- Israde, Isabel
 1995 Bacini Lacustri del Settore Centrale Dell'Arco Vulcanico Messicano: Stratigrafia ed Evoluzioni Sedimentaria Basata Sulle Diatomitee. PhD. Thesis, Univesita Degli Studi de Milano, Italia.
- Jacobs J.
 2000 *The Nature of Economies*. New York: Mod. Libr.
- Kirch, P. V.
 1994 *The wet and the dry : irrigation and agricultural intensification in Polynesia*. University of Chicago Press, Chicago.
- Klein, C. F.
 2000 THE DEVIL AND THE SKIRT. *Ancient Mesoamerica* 11(01):1-26.
- Krippner-Martínez
 1990 *The Politics of Conquest: An Interpretation of the Relación de Michoacán*, " *The Americas* XLVII:2 177-198.
- Labat, Par Jean-Noël
 1995 Végétation du Nord-Ouest du Michoacán, Mexique. In *Flora del Bajío y de Regiones Adyacentes*. Instituto de Ecología. Centro Regional del Bajío Pátzcuaro, Michoacán, Mexico. Fasciculo Complementario VIII.
- Leach, H.M
 1999 Intensification in the Pacific A Critique of the Archaeological Criteria and their Applications. *Current Anthropology* 40(3):311-339.

- Lentz, David L
 2000 *Imperfect Imbalance: Landscape Transformations in the Precolombian Americas*. Columbia University Press, New York.
- Lomeli, S., M.A., et al.
 1976 *Pulque Enlatado. Su Comercialization y Operación Financiera*. Mexico, D.F: Universidad Nacional Autonoma de Mexico, Seminario de Investigacion Administrativa.
- Loyola Montemayor, E.
 1956 *La industria del Pulque*. Mexico. D.F: Banco de Mexico, S.A.
- Malthus, Thomas
 1970 (1798), *An Essay on the Principle of Population, as It Affects the Future Improvements of Society*. Penguin Books, London.
- Mann, M
 1986 *The sources of Social Power, 1 A History of Power to A.D 1760*. Cambridge University Press, Cambridge.
- Marcus, J.
 1976 *Emblem and state in the classic Maya Lowlands : an epigraphic approach to territorial organization*. Dumbarton Oaks, Trustees for Harvard University, Washington.
 1993 *Ancient Maya Political Organization*. In *Lowland Maya Civilization in the Eight Century A.D*, edited by J. A. S. a. J. S. Henderson, pp. 111-183. Dumbarton Oaks, Washington D.C.
- McCafferty, S. D. and G. G. McCafferty
 2000 *TEXTILE PRODUCTION IN POSTCLASSIC CHOLULA, MEXICO*. *Ancient Mesoamerica* 11(01):39-54.
- McIntosh RJ, Tainter JA, and McIntosh SK.
 2000 *Climate, history, and human action*. In: McIntosh RJ, Tainter JA, and McIntosh SK (Eds). *The way the wind blows: climate, history, and human action*. New York, NY: Columbia University Press.
- Michellet, Dominique et al.
 1984 *Rio Verde, San Luis Potosi (Mexico)*. *Etudes Mesoamericaines*. Vol. IX, Centre Etudes Mexicaines et Centroamericaines. Mexico, D.F.
 1989 *El Proyecto del CEMCA en Michoacan. Etapa I: Un Balance*. *Trace* 16:70-87.
- Migeon, G.

1998 El doblamiento del Malpaís de Zacapu y de sus alrededores, del Clásico al Posclásico. In Darras, V. (ed.), *Génesis, culturas y espacios en Michoacán*, Centre d'Etudes Mexicaines et Centraméricaines, México, pp. 35–46.

Morrison, Kathleen

1994 The Intensification of Production: Archaeological Approaches. *Journal of Archaeological Method and Theory* 1(2):111-159.

1996 Typological Schemes and Agricultural Change. Beyond Boserup in Precolonial South India. *Current Anthropology* 37(4):538-608.

2001 Coercion, resistance, and hierarchy: local processes and imperial strategies in the Vijayanagara Empire. In: Alcock, S., D'Altroy, T., Morrison, K., Sinopoli, C. (Eds.), *Empires: Perspectives from Archaeology and History*. Cambridge University Press, Cambridge, pp. 253–78.

Netting, R. M.

1989 Smallholders, Householders, Freeholders: Why the Family Farm Works Well Worldwide In *The Household Economy: Reconsidering the Domestic Mode of Production*, edited by R. R. Wilk, pp. 221-224. Westview Press, Boulder

1990 Population, Permanent Agriculture, and Politics: Unpacking the Evolutionary Portmanteau. In *The Evolution of Political Systems: Sociopolitics in Small-Scale Societies* edited by S. Upham, pp. 21-61. Cambridge University Press, New York.

1993 Smallholders, Householders: Farm Families and the Ecology of Intensive, Sustainable Agriculture. Stanford University Press, Stanford, CA.

Nichols, D. L.

1996 An overview of regional settlement pattern survey in Mesoamerica: 1960–1995. In Mastache, A. G., Parsons, J. R., Santley, R. S., and Serra Puche, M. C. (eds.), *Arqueología Mesoamericana: Homenaje a William T. Sanders*, Vol. 1, Instituto Nacional de Antropología e Historia, Mexico City, pp. 59–95.

Nichols, D. L., M. J. McLaughlin and M. Benton

2000 PRODUCTION INTENSIFICATION AND REGIONAL SPECIALIZATION. *Ancient Mesoamerica* 11(02):267-291.

O'Hara Sarah

1993 Historical Evidence of Fluctuations in the Level of Lake Pátzcuaro, Michoacán, Mexico over the Last 600 Years. *The Geographical Journal*, 159(1):51-62.

Oliveros, Arturo

2004 Hacedores de tumbas en El Opeño, Jacona, Michoacán. El Colegio de Michoacán, Zamora.

Palerm, A. and E. R. Wolf

1957 Ecological Potential and Cultural Development in Mesoamerica. In Studies in Human Ecology, Monograph No. 3. pp. 1-37. Anthropological Society of Washington and Pan American Union of Social Sciences.

Parsons, Jeffrey R. and Mary H. Parsons.

1994 Maguey Utilization in Highland Central Mexico: An Archaeological Ethnography. Anthropological Papers Museum of Anthropology, University of Michigan N°82, Ann Arbor.

Parsons, Jeffrey R., Elizabeth M. Brumfiel, Mary H. Parsons, and David J. Wilson

1982 Pre-Hispanic Settlement Patterns in the Southern Valley of Mexico: The Chalco-Xochimilco Region. Museum of Anthropology Memoir 14. Ann Arbor: University of Michigan

Pauwells, Enkerlin

1992 La conformación de las haciendas en la ribera sur del lago de Pátzcuaro”, *Estudios michoacanos*, vol. 9, Zamora, El Colegio de Michoacán – Instituto Michoacano de Cultura, p. 17-50

Pollard, Helen P. and Shirley Gorenstein

1980 Agrarian Potential, Population, and the Tarascan State. *Science, New Series*, 209(4453):274-277.

Pollard, Helen P

1980 Central Places and Cities: A Consideration of the Protohistoric Tarascan State. *American Antiquity*, 45(4):677-696.

1983 La Cuenca del Lago de Pátzcuaro: Población y recursos durante el período prehispánico y comienzas del hispánico 1500-1550. *Revista de la Universidad* 2:22-23.

Universidad Michoacana, Morelia, Mexico.

1987 The Political Economy of Prehispanic Tarascan Metallurgy. *American Antiquity* 52 (4): 741-752.

1993 Tarícuari's Legacy: The Prehispanic Tarascan State. University of Oklahoma Press, Norman..

1996 La transformación de élites regionales en Michoacán central. In Williams, E., and Weigand, P. C. (eds.), *Las cuencas del occidente de México: época prehispánica*, Colegio de Michoacán, Zamora, pp. 131–156.

2001 Informe Final al Consejo de Arqueología, INAH. Proyecto Desarrollo del Estado Tarasco: Los Señoríos Urichu, Xaracuaro, y Pareo (1990-1998). Tomo 3. La Cerámica. Archivo Técnico, Coordinación Nacional de Arqueología, INAH, Mexico

Redman, Charles

1999 Human Impact on Ancient Environments. University of Arizona Press, Tucson.

- 2004 Effects of agriculture and urban society. In *The archaeology of global change: the impact of humans on their environment*, edited by Charles Redman et al. Smithsonian Books, Washington.
- 2004 Environmental degradation and early Mesopotamian civilization. In *The archaeology of global change: the impact of humans on their environment*, edited by Charles Redman et al. Smithsonian Books, Washington.

Redman, Charles et al.

- 2004 Introduction: human impacts on past, environments, In *The archaeology of global change: the impact of humans on their environment*, edited by Charles Redman et al. Smithsonian Books, Washington.
- 2008 *Agrarian landscapes in transition :comparisons of long-term ecological and cultural change*. Oxford University Press, Oxford.

Rojas Rabiela, Teresa

- 1984 Agricultural Implements in Mesoamerica. In *Explorations in Ethnohistory. Indians of Central Mexico in the Sixteenth Century*. pp.175-204. Harvey, H. R. and Hanns J. Prem eds, University of New Mexico Press, Albuquerque.

Rojas Rabiela, Teresa

- 1990 La Agricultura en una Región Indígena: La Cuenca del Lago Pátzcuaro. In *Agricultura Indígena: Pasado y Presente*. pp.275-341. Ediciones de la Casa Chata, CIESAS, Mexico.

Rojas Rabiela, T.

- 1985 La Tecnología Agrícola Mesoamericana en el Siglo XVI. In *Historia de la Agricultura: Epoca Prehispanica-Siglo XVI, Vol. 1*, edited by T. R. R. a. W. T. Sanders. vol. 1. Instituto Nacional de Antropología e Historia, Mexico City.

Rojas Rabiela, T. and W. T. Sanders

- 1985 *Historia de la agricultura : época prehispánica-siglo XVI*. 1a ed. Colección Biblioteca del INAH. 2 vols. Instituto Nacional de Antropología e Historia, México, D.F.

Ruiz de Alarcón, H., J. R. Andrews and R. Hassig

- 1984 *Treatise on the heathen superstitions that today live among the Indians native to this New Spain, 1629*. 1st ed. The civilization of the American Indian series [v. 164]. University of Oklahoma Press, Norman

Sabloff, J. A., and Ashmore, W.

- 2001 An aspect of archaeology's recent past and its relevance in the new millennium. In Feinman, G. M., and Price, T. D. (eds.), *Archaeology at the Millennium: A Sourcebook*, Plenum, New York, pp. 11–32.

Sahlins M.

1972 Stone-Age Economics. Chicago: Aldine

Sanders, W., T.

1974 Chieftdom to State: Political Evolution at Kaminaljuyu, Guatemala. In *Reconstructing Complex Societies: An Archaeological Colloquium* edited by C. B. Moore, pp. 97-116. vol. 20. Supplement to the Bulletin of the American Schools of Oriental Research, Cambridge.

Sanders, W.T.

1965 The Cultural Ecology of the Teotihuacan Valley. Department of Anthropology, Pennsylvania State University, Ms on file.

Sanders, W. T., Jeffrey R. Parsons, Robert S. Stanley

1979 *The Basin of Mexico: Ecological Processes in the Evolution of a Civilization* Academic Press, New York

Scarre, Christopher and Brian Fagan

2003 Ancient Civilizations. Prentice Hall Publisher.

Scarborough VL.

1991 Water Management Adaptations in Nonindustrial Complex Societies: an Archaeological Perspective. In *Archaeological method and Theory*, M. Schiffer (ed.), pp. 101-154. Vol.3. University of Arizona Press, Tucson, AZ.

2003 The Flow of Power: Ancient Water Systems and Landscapes. Santa Fe, NM: Sch. Am. Res.

Schreiber, Katherina

2001 The Wari Empire of Middle Empire Peru: the epistemological challenge of documenting an empire without documentary evidence. In: Alcock, S.D., Altroy, T., Morrison, K., Sinopoli, C. (Eds.), *Empires: Perspectives from Archaeology and History*. Cambridge University Press, Cambridge

Seler, Eduard

1908 *Gesammelte Abhandlungen zur Amerikanischen Sprach und Alterthumskunde*. Vol. 3. Behrend, Berlin.

Sheets, Payson

2002 *Before the Volcano Erupted*. Payson Sheets, Ed. University of Texas Press.

Sinopoli CM.

2003 *The Political Economy of Craft Production: Crafting Empire in South India, c. 1350–1650*. New York: Cambridge Univ. Press

- Smith, M. E. and T. J. Price
 1994 Aztec-Period Agricultural Terraces in Morelos, Mexico: Evidence for Household-Level Agricultural Intensification. *Journal of Field Archaeology* 21(2):169-179.
- Smith, Michael E.
 1990 Long-Distance Trade Under the Aztec Empire: The Archaeological Evidence. *Ancient Mesoamerica* 1: 153-169.
 1996 *The Aztecs*. Blackwell Publishers, Malden, MA.
 2004 The Archaeology of Ancient States Economies. *Annu.Rev.Anthropol.* 33:73-102.
 2006 How Do Archaeologists Compare Early States? Reviews in *Anthropology*, 35:5-35.
- Smith, Michael and Frances F. Berdan
 1992 Archaeology and the Aztec Empire. *World Archaeology* 23: 353-367.
- Smith, Michael and Katharina J. Schreiber
 2005 New World States and Empires: Economic and Social Organization. *Journal of Archaeological Research*, 13(3):189-229.
 2006 New World States and Empires: Politics, Religion, and Urbanism. *Journal of Archaeological Research*, 14(1):1-52.
- Smith, Michael E. and Lisa Montiel
 2001 The Archaeological Study of Empires and Imperialism in Pre-Hispanic Central Mexico. *Journal of Anthropological Archaeology*, 20:245-248.
- Spence, M
 1971 Some Lithic Assemblages of Western Zacatecas and Durango. *Mesoamerican Studies* 8, Carbondale: University Museum, Southern Illinois University.
- Spencer, Charles S. and Elsa M. Redmond
 2004 Primary State Formation in Mesoamerica. *Annu.Rev.Anthropol.* 33:173-99.
- Stanish, Charles
 2001 The Origin of State Societies in South America. *Annu. Rev. Anthropol.* 30:41-64.
- Steward, J. H
 1955 *The Theory of Culture Change*. University of Illinois Press, Urbana, IL.
- Stone, Cynthia

- 2004 In Place of Gods and Kings: Authorship and Identity in the 'Relación de Michoacán'. Norman: University of Oklahoma Press.
- Street-Perrott, F. A et al.
1989 Anthropogenic Soil Erosion around Lake Pátzcuaro, Michoacán, Mexico, during the Preclassic and Late Postclassic-Hispanic Periods. *American Antiquity*, 54(4):759-765.
- Taube, K. A.
1993 The Bilimek Pulque Vessel. *Ancient Mesoamerica* 4(01):1-15.
- Taylor, P.J.
1977 Quantitative methods in geography. Boston: Houghton-Mifflin.
- The Chronicles of Michoacán
1970 Translated and edited by Eugene R. Craine and Reginald C. Reindorp. University of Oklahoma Press, Norman.
- Thurston, Tina L. and Christopher T. Fisher
2007 Seeking a Richer Harvest: An Introduction to the Archaeology of Subsistence Intensification, Innovation, and Change. In *Seeking a Richer Harvest: The Archaeology of Subsistence Intensification, Innovation, and Change*. Tina L. Thurston and Christopher T. Fisher (eds.) Springer, New York.
- Tolstoy, P.
1971 Utilitarian artifacts of central Mexico. In: G.Ekholm and I.Bernal (eds.), *Archaeology of Northern Mesoamerica, Pt. 1*, pp.270-96. *Handbook of Middle American Indians*, Vol. 10. Austin: University of Texas Press.
- Turner, B. L II
1983 Once Beneath the Forest: Prehistoric Terracing in the Rio Bec region of the Maya Lowlands. *Dellplain Latin American Series 13*, Westview Press, Boulder, Colorado.
- van der Leeuw, Sander
2005 Climate, hydrology, land use, and environmental degradation in lower Rhone Valley during the Roman period *Comptes rendus. Géoscience* 337(1-2):9-27.
- Van Buren, M.
2001 The archaeology of El Niño events and other “natural” disasters. *Journal of Archaeological Method and Theory* 8: 129–149.
- Van Buren, M and Janet Richards
2003 Order, Legitimacy, and Wealth in Ancient States, edited by Janet Richards and Mary Van Buren. Cambridge University Press, Cambridge.

- Waddell,
1972 The Mound Builders: Agricultural Practices, Environment, and Society in the Central Highlands of New Guinea. Seattle: University of Washington Press.
- Warren, J. Benedict
1971 –Fray Jerónimo de Alcalá: Author of the Relación de Michoacán? *The Americas* 27(3):307-26.
- Watts, W. and K. Platt Bradbury
1982 Paleocological Studies at Lake Pátzcuaro on the West-Central Mexican Plateau and at Chalco in the Basin of Mexico. *Quaternary Research* 17:56-70.
- West, Robert C
1948 Cultural Geography of the Modern Tarascan Area. U.S Government Print, Washington D.C.
- Whitmore, T. M. and B. J. Williams
1998 Famine Vulnerability in the Contact-Era Basin of Mexico. *Ancient Mesoamerica* 9(01):83-98.
- Whitmore, Thomas M. and B.L Turner II
2001 Cultivated Landscapes of Middle America on the Eve of the Conquest. Oxford University Press, Oxford.
- Williams, Eduardo
2003 La sal de la tierra: etnoarqueología de la producción salinera en el occidente de México. El Colegio de Michoacán/Secretaría de Cultura de Jalisco, Zamora and Guadalajara.
2004 Prehispanic West Mexico: a Mesoamerican culture area. Foundation for the Advancement of Mesoamerican Studies, Inc (FAMSI) (www.famsi.org/research/williams).
- Wilken, G. C.
1987 Good Farmers: Traditional Agricultural Resource Management in Mexico and Central America. University of California Press, Berkeley.
- Wittfogel, K.
1957 Oriental Despotism. Yale University Press, New Haven.
- Wright, H. T.
1977 Recent Research on Origin of State. *Annual Review of Anthropology* 6:379-397.

1978 Toward an Explanation of the Origin of the State In *Origins of the State: The Anthropology of Political Evolution* edited by R. C. a. E. R. Service, pp. 49-68. Institute for the Study of Human Issues, Philadelphia.

Yoffee, Norman

1993 Too Many Chiefs? (or, Safe Texts for the '90s). In *Archaeological Theory: Who Sets the Agenda?* edited by N. Yoffee and S. Sherratt, p p. 60-78. Cambridge University Press, Cambridge.