UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

ASPECTS OF LAND TENURE IN AN ANCIENT SOUTHWESTERN FARMING SOCIETY IN THE MIMBRES VALLEY, NEW MEXICO

A Dissertation

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

Doctor of Philosophy

By

ROBERT JAMES STOKES
Norman, Oklahoma
2003

Downloaded from SHAREOK. Persistent Handle URL: https://hdl.handle.net/11244/644

UMI Number: 3107284

INFORMATION TO USERS

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleed-through, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

UMI®

UMI Microform 3107284

Copyright 2004 by ProQuest Information and Learning Company.

All rights reserved. This microform edition is protected against unauthorized copying under Title 17, United States Code.

ProQuest Information and Learning Company
300 North Zeeb Road
P.O. Box 1346
Ann Arbor, MI 48106-1346

© Copyright by Robert James Stokes 2003
All Rights Reserved

ASPECTS OF LAND TENURE IN AN ANCIENT SOUTHWESTERN FARMING SOCIETY IN THE MIMBRES VALLEY, NEW MEXICO

A Dissertation APPROVED FOR THE
DEPARTMENT OF ANTHROPOLOGY

BY

Patricia A. Gilman, Chairperson

Paul E. Minnis

Robert L. Brooks

Lesley Rankin-Hill

Robert Rundstrom

ACKNOWLEDGMENTS

The completion of this dissertation could have not happened without the support of numerous people over the many long years it took to reach this point. My committee members were instrumental in providing their time, insight, instruction, and critical evaluation of my research. Dr. Patricia Gilman served as my chairperson and was generous with her support, guidance, and encouragement, in addition to always being ready to engage in discussions regarding the Mimbres people, pottery, mobility and sedentism, and Southwestern archaeology in general. Whenever my progress flagged, Dr. Gilman was always ready to offer her encouragement, which has finally paid off. Dr. Paul Minnis was never shy about providing his informed opinion regarding a variety of topics, nor about stepping on toes when necessary. Dr. Minnis' own dissertation work in the Mimbres Valley provided much of baseline data used in this dissertation, and for that all researchers who study the Mimbres and social responses to food stress are indebted. Dr. Robert Brooks served in many ways as my mentor and biggest supporter during my many years working for him at the Oklahoma Archaeological Survey. Through Dr. Brooks and the Survey I learned much about Plains Archaeology and aspects of cultural ecology, conflict, and patterns of interaction across much broader areas than I was accustomed to. Much of what I learned helped to reshape many of my views of Southwestern archaeology. Dr. Lesley Rankin-Hill graciously accepted the role of committee member during my final semester at OU, and I am grateful for her patience, instruction, support, and friendship over the years. Finally, Dr. Robert Rundstrom of the Geography Department served as an excellent outside committee member. Anthropology and Geography ought to be more closely entwined academic disciplines.

At the University of Oklahoma, numerous non-committee members were also vital to the completion of my research and dissertation, either for their knowledge and insights of archaeology, or for their friendship and support. These include my friends and instructors at the Oklahoma Archaeological Survey, Dr. Marjorie Duncan, Dr. Richard Drass, Dr. Lee Bement, Dr. Valli Marti (Powell), Charles Wallis, Larry Neal, and Lisa Whitman. I learned much at the Survey that I am now using in my cultural resource management work in Phoenix. I am also indebted to Dr. Susan Vehik for her superb ability to stimulate critical thinking; much of what I learned from her regarding cultural ecology, optimization strategies, and decision-making went into my dissertation research.

My "cohort" of fellow graduate students was always supportive of me and each other, and without them I may not have succeeded. They include Jennifer Nisengard, Kari Schmidt, Steve Swanson, Scott Brosowske, Kris Dobschuetz, Jen Gordon, Karin Rebneggar, and Beau Schriever, among many others. We managed to have fun amid the hectic life of a student, especially at the Anthro house on the corner of Chautauqua and Lindsey.

Outside of the OU community, fellow Mimbres researchers generously gave of their time, knowledge, and friendship over the years, including Dr. Barbara Roth, Dr. Cynthia Bettison, Dr. Darrell Creel, Dr. Harry Shafer, Dr. Peggy Nelson, Dr. Michelle Hegmon, and Jennifer Brady, among many others. Dr. Barbara Roth was especially significant; her support of my work and her friendship never faltered from the time of my first Mimbres field school at the Lake Roberts Vista site in 1992 to the completion of this dissertation. I can't thank her enough! Robert Schiowitz at the Gila National Forest was

always generous of his time and friendship and was always an enthusiastic supporter of my research efforts on the Forest.

Of the people I have worked with on various Mimbres projects over the years, and who helped me with my survey and excavation work there, I must single out Carol McCanless, Marilyn Markel, Harold and Shari Chandler, Dave and Joan Jordan, Jeff Shuford, and Kris Kunkle, all of whom provided good company and friendship. Carol has been an especially great friend over the past 15 years and was with me at my very first archaeological field school when I was still a geology major at the University of Pittsburgh. In many ways, she kept me going over the years, from my B.A. at Pitt and M.A. at Eastern New Mexico University, through my Ph.D. work; it couldn't have been an easy task for her. I have worked with many others over the years, and they are too numerous to name individually, but I thank you all. My research on McDermott Ranch could not have happened without the permission and support of the owner, Tom McDermott, a most unique man. Likewise, my research on Cooney Ranch was graciously permitted by the Stewart family (especially Henry Stewart, Jr.). I think we were all united in our belief that the Mimbres are a fascinating prehistoric society and that southwestern New Mexico is one of the most beautiful places in the Southwest.

My formative archaeology years were shaped by many professors and friends at the University of Pittsburgh and Eastern New Mexico University. From both, I learned to appreciate the value of a scientific approach to archaeology and the necessity of studying society, culture, and environment as an intertwined set of systems. I must especially thank Drs. James Adovasio, Richard Drennan, and Ron Carlisle from my years at Pitt as

an undergraduate, and Drs. Phil Shelley, Steve Durand, and John Montgomery at Eastern New Mexico University for guiding me through my M.A. work.

Lastly, I cannot thank enough several people at my current place of employment, Archaeological Consulting Services, Ltd., in Tempe, Arizona. Dr. Margerie Green, owner, has been always extremely supportive and generous, and provided me the opportunity to take a month off of work to "get over the hump" with my first dissertation draft. It is not hyperbole when I say that this dissertation would never have been completed without her support; I was literally dead in the water at the time. Also at ACS, Dr. Shirley Powell provided constant support and friendship, as did Teresa Pinter, my immediate supervisor for the State Route 88 project in the Tonto Basin. I learned much about the intricacies of contract work, report writing, budgets, and Section 106 compliance from Teresa, and her friendship is greatly valued by me. Many others at ACS have also been supportive, especially Melanie Ryan, Michael Droz, and Linda Schilling, who with myself formed a support group to encourage each other to finish our dissertations and theses while working full-time in the world of contract archaeology, not an easy task.

Lastly, I wish to thank my family, who have been supportive of my academic career over the years. I think many of them finally understand what archaeology is all about, after dragging them from ruin after ruin over the years.

TABLE OF CONTENTS

		Page
ACKNOWLEDGMENTS		iv
LIST OF TABLES		xii
LIST OF FIGURES		xiv
CHAPTER		
I.	INTRODUCTION	1
	Outline of the Dissertation	8
II.	THEORY AND MODEL BUILDING FOR UNDERSTANDING LAND TENURE AND THE DEVELOPMENT OF AGRICULTURALLY PERIPHERAL COMMUNITIES	14
	Overview of Cultural Ecology	16
	Studies of Evolutionary Selection, Adaptation, and Systems Theory	21
	The Concept of Adaptation	22
	The Scale of Adaptation	25
	Optimization Strategies: Territoriality and Land Tenure	26
	Theoretical Background	27
	Models of Territoriality and Resource Ownership	29
	The Tragedy of the Commons	31
	The Evolutionary Ecological Approach	32
	Social Change, Settlement Patterns, and Symbolic/de Facto Land Tenure	34
	Broader-Scale Applications of these Models	37
	Central Place Theory	38
	Operationalizing Central Place Theory	39
	Humans and Central Place Theory	41
	Economics, Geography, and Central Place Theory	42
	Catchment Analysis, Land Use Issues, and the Southwest	44
	Ethnographic Case Examples of Land Tenure and Agriculturally Peripheral Land Colonization	48
	The Nahua (Aztec) of Amatlán Village, Veracruz, Mexico	51
	The Hopi and Tewa of the American Southwest	57
	The Egyptian Fellahin	63
	Discussion of Ethnographic Examples	67

A Model for Studying and Understanding Population Movement into Peripheral Areas 69
The Model 70
Archaeological Measures 73

III ENVIRONMENTAL BACKGROUND FOR SOUTHWESTERN NEW MEXICO 78

IV ARCHAEOLOGICAL BACKGROUND FOR SOUTHWESTERN NEW MEXICO 86
Paleoindian Period (9800–7200 B.C.) 87
Archaic Period (7200 B.C. –A.D. 200) 89
The Mimbres-Mogollon Sequence (A.D. 200–1150/1200) 93
The Mimbres-Mogollon Tradition 93
Subsistence 98
Settlement Patterns 99
The "Demise" of the Mimbres 100

V SURVEY DATA FOR THE GREATER MIMBRES RIVER VALLEY AREA OF SOUTHWESTERN NEW MEXICO 104
The Upper Mimbres Archaeological Project 108
Reanalysis of Graybill's Pueblo Period Data 113
Summary of Graybill's Survey Data 119
The Mimbres Foundation Survey of the Middle and Lower Mimbres Valley 124
Reanalysis of the Mimbres Foundation Survey Data 129
Summary of the Mimbres Foundation Survey Data Reanalysis 141
The Sapillo Valley Survey Project Data 143
Summary of the Sapillo Valley Survey Project Data 152
Summary of the Three Survey Data Sets 154

VI EXCAVATION DATA FOR TWO PERIPHERAL AREA COMMUNITIES 156
Excavations at the Upper Noonday Canyon Community (The McDermott Ranch Project) 165
General Background 165
Test Excavation Results 167
McDermott Site Number One 168
Surface Collections 168
McDermott Site Number Two 168
Surface Collections 170
McDermott Site Number Four 172
Surface Collections 173
Analytic Results for the Noonday Canyon Community Sites 173

Architectural Analysis 175
Ceramic Analysis 179
Microseriation of Mimbres Painted Wares 183
Discussion of the Dating of the Three Sites 186
Site Function based on Ceramic Analysis 187
Lithic Analysis 190
Local versus Exotic Raw Material Types 195
Flake Size and Grain Texture of Lithic Materials 199
Flake Use-Wear Patterns 202
Marginal and Facial Retouch (Prepared/ Formal Tool Use) 204
Other Lithic Items: Crystals, Chrysacolla, and Ochre/Hematite 206
Summary of Lithic Analysis 206
Ground Stone Analysis 207
Faunal Analysis 212
Flotation Analysis 214
Brief Summary of the McDermott Ranch Test Excavation Data 214
The Mimbres Periphery Study in the Upper Middle Fork of the Mimbres River 216
Site Descriptions 217
Feature and Architectural Summary 218
Artifact Analyses 222
Ceramic Analysis 222
Brief Observations on Trade Wares 228
Ceramic Cross-Dating of LA 5841 and Its Architectural Units 230
Radiocarbon Dating Correlation 234
Ceramic Artifacts and Worked Sherds 235
Adobe Analysis 235
Lithic Analysis 237
Projectile Points 237
Lithic Tools 239
Reduction Stages and Raw Materials 242
General Observations on Lithic Trends at LA 5841 244
Ground Stone Analysis 246
Ornamental Artifacts 248
Minerals 249
Faunal Analysis 251
Number of Identified Specimens (NISP) 252
Results of the Analysis 253
Burning Patterns 253
Worked Bone 255

Faunal Remains from Flotation Samples 255
Burning Patterns 255
Discussion of the Faunal Assemblage 257
Summary and Evaluation of Research Goals and Excavation Results for the Noonday Canyon and Middle Fork Communities 258

VII PERIPHERAL LAND USE, SITE CATCHMENT, AND LAND TENURE: EVALUATION OF THE MODEL 264
The Model of Peripheral Land Use 267
What Was the Population Growth Trajectory of the Mimbres through Time? 273
Was the Classic Period Mimbres Population under Social and Subsistence Stresses? 275
Were Peripheral Areas Permanently Occupied Locations or Not? 277
Do Peripheral Community Locations Represent Optimum Placement with Regard to a Wide Range of Available Resources and Other Considerations? 282
Width of Potentially Arable Bottomland and Terraces 285
Available Water Sources 291
Ease of Access into the Community and to Nearby Resources 293
Types of Resources that Occur within a 4-km Radius 295
Strategic Value of Site Placement 299
Summary of Site Catchment Analysis 301
Do The Mimbres Settlement Patterns in Primary and Peripheral Areas Suggest Land Tenure? Can a "Landless" Subgroup be Detected in Mimbres Society? 301

VIII CONCLUSIONS 306
The Results of the Research 308
Implications for the Study of Southwestern Archaeology 312

REFERENCES CITED 315

LIST OF TABLES

Table		Page
4.1	Mimbres-Mogollon cultural periods and major attributes	95
5.1	Site types and frequencies recorded by Graybill (1975) for the upper Mimbres River Valley	111
5.2	Site size, frequency of occurrence, and estimated number of Classic period rooms generated from Graybill's (1975) survey data	115
5.3	Classic period communities in the upper Mimbres Valley	123
5.4	Survey results from the Mimbres Foundation's work in the Mimbres Valley (adapted from Blake et al. 1986)	127
5.5	Site size, frequency of occurrence, and estimated number of Classic period rooms generated from Mimbres Foundation and Laboratory of Anthropology survey data	131
5.6	Side drainages of the Mimbres River with and without community systems	140
5.7	Site type frequencies from the Sapillo Valley Survey Project (Stokes 1995)	146
5.8	Site size, frequency of occurrence, and estimated number of Classic period rooms generated from the Sapillo Valley Survey Data (Stokes 1995)	148
5.9	Potential community clusters in the Sapillo Valley	149
5.10	Comparison of site size categories expressed by number of rooms for the three survey areas	154
6.1	Pueblo size and room dimensions at McDermott Ranch	176
6.2	Mimbres Black-on-white pottery microseriation attributes (adapted from Shafer and Brewington 1995)	180
6.3	All ceramic types and frequencies, including microseriated ceramic type frequencies for McD #1	181
6.4	All ceramic types and frequencies, including microseriated ceramic type frequencies for McD #2	181
6.5	All ceramic types and frequencies, including microseriated ceramic type frequencies for McD #4	182
6.6	Ceramic microseriation and functional type percentages per site	188
6.7	Lithic raw material types and reduction stages at McD #1	196
6.8	Lithic raw material types and reduction stages at McD #2	197
6.9	Lithic raw material types and reduction stages at McD #4	198
6.10	Percentage of local versus exotic lithic raw materials	198
6.11	Percentages of flake size correlated with lithic raw material grain texture	200
6.12	Correlation of expedient flake tools, flake size, and lithic grain texture	203
6.13	Distribution of formal lithic tool types per site	205
6.14	Ground stone analysis and metric measurements per site	208
6.15	Faunal analysis and frequency of mammal bone size per site	213
6.16	Ceramic analysis results for LA 5841 (Cooney Ranch #1), all units combined for site total	224

6.17	Microseriation results for LA 5841 (Cooney Ranch #1), all units combined for aggregate site total	231
6.18	Mimbres Black-on-white pottery microstyles and their suggested date ranges (from Shafer and Brewington 1995)	231
6.19	Ceramic artifacts and worked sherds from LA 5841 (Cooney Ranch #1)	236
6.20	Projectile point analysis for LA 5841 (Cooney Ranch #1)	238
6.21	Lithic tools recovered from LA 5841 (Cooney Ranch #1)	240
6.22	Frequency of lithic raw material type by reduction stage and tool type, all units and levels combined, LA 5841 (Cooney Ranch #1)	243
6.23	Ground stone analysis results for LA 5841 (Cooney Ranch #1)	247
6.24	Ornamental artifacts from LA 5841 (Cooney Ranch #1), all proveniences	249
6.25	Minerals recovered from LA 5841 (Cooney Ranch #1)	250
6.26	Taxon counts of faunal remains collected during excavation (one-quarter inch screening method)	254
6.27	Faunal totals by provenience (one-quarter inch screening method)	254
6.28	Taxon counts of faunal remains recovered from heavy fraction (one-sixteenth screening method)	256
6.29	Totals of heavy fraction fauna by provenience (one-sixteenth inch screening method)	256

LIST OF FIGURES

Figure		Page
3.1	General overview of Southwestern New Mexico in the North American Southwest	79
4.1	The Mimbres-Mogollon region in southwestern New Mexico	94
5.1	Location of Graybill's (1975) survey areas in the upper Mimbres and Sapillo valleys	114
5.2	Stem and Leaf histogram of site sizes (m^2) using Graybill's (1975:161–165) survey data	116
5.3	Map of the community clusters found in the upper Mimbres River	122
5.4	Stem and leaf histogram of site sizes (m^2) in the main Mimbres Valley and tributaries	130
5.5	Map of the Mimbres Valley showing the locations of site clusters	133
5.6	Map of the Allie Canyon community cluster	136
5.7	Map of the Shingle Canyon community cluster	137
5.8	Map of the Noonday Canyon community cluster	138
5.9	Map of the Gallinas Canyon and Cold Springs Canyon community clusters	139
5.10	Stem and leaf histogram of site sizes (m^2) in the Sapillo Valley survey area	147
5.11	Map of potential community clusters in the Sapillo Valley	150
6.1	Location of the Noonday Canyon and Cooney Ranch communities in the Mimbres Valley area, southwestern New Mexico	158
6.2	The sites on McDermott Ranch and Gila National Forest that comprise the upper Noonday Canyon community	159
6.3	The sites on Cooney Ranch and Gila National Forest that comprise the upper Middle Fork of the Mimbres River (Cooney Ranch) community	160
6.4	Photo of the McDermott Ranch area in upper Noonday Canyon, facing South. Note McD #2 rubble mound at edge of terrace	161
6.5	Photo of the Cooney Ranch area in the upper Middle Fork of the Mimbres River, facing north	161
6.6	Plan of McD #1 showing the location of the two test units and east midden area	169
6.7	Excavation areas at McD #2, including the test unit, shovel probe tests, wall scrapes, and surface collection areas	171
6.8	Plan map of McD #4, including excavation units and exposed walls	174
6.9	Plan map of Cooney Ranch #1 (LA 5841) showing the locations of architectural areas and test units	219
6.10	Plan map of Unit 1 (LA 5841) showing Rooms 1 and 2, dividing wall, Pithouse 1, and features	220
6.11	Photograph of Rooms 1 and 2 in Unit 1 (LA 5841), facing northwest. Note the two-course wide cobble wall, doorway, and in situ door slab	221
6.12	Close up photograph of two-course wide cobble wall between Room 1 (left) and Room 2 (right), facing south. Note in situ door slab and threshold stones. Dark area between wall and right side of photo is a portion	

of Pithouse 1 221
7.1 Boundaries of biotic provinces in southwestern New Mexico (adapted From Diehl and LeBlanc 2001:11, Figure 2.2). The locations of McD #2 (LA 119341) and Cooney Ranch #1 (LA 5841) serve as the central points for the catchment areas 296

CHAPTER I

INTRODUCTION

This dissertation examines the relationship between primary and peripheral agricultural and habitation zones used by subsistence level farming societies, and the roles that overcrowding and land tenure play in settlement decisions. Thus, it is a study of human behavior and decision making with regard to subsistence and settlement patterns in the course of adapting to less certain environmental zones under certain kinds of social and environmental stresses. Although part of this research is a broad overview of how subsistence level farming societies come to use peripheral areas, it focuses on the development and role of land-tenure systems in framing the choices available to those without access to good farmland, or those who simply want more farmland, good or not, and in determining when more intensive use and colonization of peripheral areas might occur and under what conditions. The model developed here for study of the development of tenure systems and landless groups within a society is based on a review of several ethnographic sources. This research focuses on the primary/peripheral "dichotomy" of land use in the ethnohistoric examples and searches for commonalities in environmental, social, and historical variables that serve as the foundation for model building to examine land-tenure systems in ancient agrarian societies.

I argue in this dissertation that, based on the ethnographic research in conjunction with cultural ecological theory, environmental locations most favorable to farmers will be used first to the point of near-saturation of people and potential food production. When the society approaches the point of potential land shortages, land tenure systems invariably develop that restrict who has legal access to pieces of "owned" land. Land

tenure rules cover not only who has immediate access to the fruits of labor on owned land, but how and to whom the land passes after the head of the family dies. The development of land tenure systems helps to mitigate social and community stresses that arise as a result, especially when families become too large to efficiently subdivide the land amongst all, or when an influx of immigrants threatens to overwhelm the capacity of the land and water. In effect, when all of the best land is claimed and options become limited for growing populations, steps must be taken to ensure that those who have the longest established "claims" to parcels of land retain possession of it.

As will be shown later in this research, several new problems arise in the course of dealing with land/population imbalances through land tenure and private ownership. First, if there ever truly was a "commons" among small-scale societies, it is lost when private ownership develops; true egalitarianism is no longer viable. When disparities in wealth arise in societies, especially when possible starvation looms for some, conflict becomes more common. As will be shown in the ethnographic examples, although conflict is present, or at least the threat of conflict, the society still takes the steps necessary to avoid it. Primarily, this entails some people leaving the primary villages and establishing their own new residences along the margins of claimed land. Another problem that arises with land tenure is that at some point, the land can no longer be subdivided among family descendants without falling below a minimum number of hectares necessary to sustain life. What invariably happens is that a landless group develops within the society; these are people who have little or no chance of inheriting, owning, or marrying into land. They, and the newcomers to the area, form a dangerous element to the larger society, as they have nothing to lose. However, the ethnographic

data will show that the society again resorts to steps to ensure their survival by permitting the landless to settle along the margins of claimed land. They, in effect, secure access and use rights to that land by "developing it" (i.e., cultivating it and building upon it); if successful, other family members and villagers follow, establishing new villages, land claims, and land tenure systems. Thus, the use of agriculturally peripheral areas is seen to change through time under these conditions, from occasional, supplemental, or seasonal to long-term and permanent.

This outward expansion into peripheral areas begins to occur on a regular basis, if environmental conditions remain generally favorable. The process is similar to earlier models offered by Adler (1996) and Kohler (1992) for the northern Ancestral Puebloans of the North American Southwest. They, however, focus on the primary villages with a view of how distant areas are used, similar to the way Minnis (1985a) approaches his study of the Mimbres people in southwestern New Mexico. And although hinting at land tenure, it is not viewed as a primary cause of peripheral area use, as Adler and Kohler focus on the role of population expansion and the generally limited agricultural potential of the Colorado Plateau (Minnis studied the more fertile, but geographically limited Mimbres Valley). In effect, distant areas are colonized as a growing population steadily pushes outward to increase their resource base under conditions of population and/or food stresses. This dissertation focuses on the role of land tenure itself for creating the conditions necessary to induce the high costs of colonizing poorer agricultural areas away from former homes and kin.

The ethnographic evidence shows that peripheral area colonization occurs in a predictable manner as an outcome of land tenure systems and produces important

material culture, architectural, settlement pattern, and land-use evidence that are suitable measures for studying ancient small-scale farming societies. If the ethnographic record and the patterns elucidated from them are truly broad-scale and recognizable, and can be used as a basis for predicting human behavior, then comparable patterns may be found in the prehistoric record. If they are found, then it can be argued that land tenure systems may have played a role in the archaeological record left behind by ancient peoples. The research contained in this dissertation follows this basic line of reasoning for the purposes of building middle-range theory aimed at enhancing our understanding of some of the processes and forces that guide decision-making with regard to subsistence, settlement, and land use.

For the ethnographic background research, I concentrate on subsistence and settlement adaptations by agriculturalists in regions that generally have sharply demarcated divisions of potentially arable land (from good to poor), because primary and peripheral environmental zones are easier to differentiate in these cases. For example, in arid and semi-arid regions of the world where agrarian societies persist, a clear understanding exists among the people in these societies on what constitutes the best land (areas of lowest cost-energy expenditure and highest returns, in terms of successful harvests) and water sources, and where the less profitable areas are to be found. The less profitable areas are usually peripheral to prime agricultural zones, where higher labor and investment costs are necessary to produce a sustainable crop while extracting the wild resources necessary to supplement the smaller harvests. Low or unpredictable returns are commonplace in peripheral areas because of the harshness of the environment (in many cases), poorer soils (in most cases), and lack of available water (critical in some areas).

As a case in point, permanent rivers and streams flowing through arid lands form linear oases, and the differences between these lush river valleys and the drier highlands surrounding them can be striking. This is probably nowhere more striking than the Nile River valley flowing northward through the desolate Sahara Desert in northeastern Africa (Said and Issawy 1964; Shaw 2000). The oldest extended families with intact claims on farm plots closest to the river and along existing canals retain access to the best farmland. They often expend less energy producing crops than do newcomers who must build and maintain lateral irrigation canals (and who may not receive any water for their troubles in low water volume years) or physically transport water to the margins of the valley/desert (Ayrout 1963). It is acknowledged that most subsistence level or small-scale farmers labor intensely in order to make a living no matter where they are on the landscape, but the marginal areas would be quickly reclaimed by the harsher environment surrounding them if the life-sustaining water were to cease. The social, economic, and political relationships and boundaries between established, landed families, poorer families with land, and newcomers along the margins of the fertile land are clear-cut and deeply embedded within the fabric of society and law (Ayrout 1963; Hassan 1994). Years of low river volume would strike first and hardest at those farthest from the river, who are often the disenfranchised members of society. Clearly, subsistence-level farming and the various strategies used to produce crops in these two environmental settings are vastly different, as are potential and reliable returns. In most cases, no matter how much effort is expended in peripheral areas, crop returns generally remain lower than those from prime farmlands.

What makes these additional costs acceptable (or even unavoidable) for the

peripheral area farmers? In a word: land-tenure. In a world where true egalitarianism and equal access to all resources is largely a myth, most societies resort to highly complex regulations to govern land-tenure and property rights, whether through codified law or through sociocultural traditions (Adler 1996). At a more basic level, why study human use of peripheral areas when the study of primary occupation areas has resulted in a tremendous wealth of knowledge regarding human subsistence, settlement, and adaptation? One answer is that often what we think we know about human adaptation to peripheral areas changes once problem-oriented research is focused on them. Early anthropologists understood that in order to study the evolution of modern humans and "civilization," one had to go back as far as the Neolithic (Childe 1936), but to go no further than the oases that nurtured humankind's transition from hunting and gathering to farming. However, Braidwood (1960; Braidwood and Braidwood 1983) and others (Flannery 1965; Hole et al. 1969) demonstrated that the origins of agriculture, and perhaps the origins of farming lifestyles as well, occurred not in the river valley oases of the Near East, but in the drier grasslands covering the hilly flanks surrounding them. This breakthrough in early agriculture research demonstrated the value of investigations of "apparently" agriculturally peripheral areas. However, even in the ancient Near East, river valleys became the foci of ancient civilization development and, subsequently, the focus of large-scale research. The interplay between primary and peripheral agricultural areas has certainly been studied, but much remains to be investigated.

The previous discussion still begs the question of what is to be gained by studying peripheral area use by agriculturalists. This perhaps can be answered at several levels of concept and focus. First, at a very basic level, human adaptation to prime habitation and

resource/environmental zones has been the focus of anthropological research for a long time, while human use of harsher environments has received less interest, as noted above. One of the purposes of academic research is to fill gaps of knowledge, no matter how large or small. We know a lot about people who settle and farm river valleys, but we know far less about their country cousins out in the hinterlands. Are they segments of the same society or separate groups? Are mobility and/or seasonal land use patterns being exhibited in peripheral areas, or is sedentism and land ownership in evidence? What are the economic, cultural, and social bonds between the homeland and the hinterland? These are the kinds of questions that can be addressed only by studying both primary and peripheral areas.

Second, some of the social mechanisms that drive human colonization of harsher environmental zones may be determined by studying why groups choose (or are forced) to leave more favorable locales. A number of causes may come into play depending upon the circumstances of each case, but with such studies commonalities may be delineated that are indicative of cross-cultural human behavioral patterns. Some of these commonalities include conflict and privatization of property and resources. The utility of ethnographic research becomes most apparent in such a case, where potential motives can be directly studied. Ethnographic research in a sense sets the stage for archaeological research in that it can provide for model-building which then leads to explicit research questions and goals for academic research. This is especially true for prehistoric groups who did not leave written accounts of their world-view and decision-making rationale.

Thus, it is critical for this study to first define broad behavioral patterns for subsistence-level agriculturalists and their use of primary and peripheral areas, and then

to develop research questions and expectations for the archaeological record. As will be seen in this dissertation, the two (analogy and archaeology) rarely form an exact match, and many questions are left unanswered or only partially answered, but in a sense, this is the nature of scientific and archaeological process. The models, expectations, and conclusions offered in this dissertation will help us to understand some of the behaviors teased from the archaeological record but will also point the way towards a myriad of additional research questions for future studies, especially with reference to the development of private property and land tenure in ancient societies.

Outline of the Dissertation

This dissertation is divided into several major sections that incorporate similar elements. Chapter I (Introduction) and Chapter II (Theoretical Background and Model Building) serve to introduce the research and its goals in a theoretical and methodological construct. It then proceeds to review the ethnographic record on land use and settlement patterns of subsistence level agriculturalists using adjacent, but generally distinct, environmental zones. The rationale behind land use and land tenure for each case is examined for similarities and dissimilarities. The theoretical underpinnings of the research serve to guide the subsequent research, and unite its many aspects into a unified and coherent whole. Without the aid of observable and measurable patterns found in the ethnographic record, no truly meaningful investigation of the prehistoric past can take place as it becomes difficult to answer the question "do people really behave this way?" Analogy serves as a guide for understanding some of the patterns and possibilities of the archaeological record, but no direct links between the past and the present are being made

or suggested in this dissertation, only possible explanations based on observed behavior.

Chapters III and IV introduce the prehistoric study area with both a broad overview and a specific case study. The study area is the prehistoric North American Southwest, a generally well-known and well-researched geographic area that fits the parameters set forth for investigating the use of prime/peripheral agricultural area use and colonization. Because the environment plays such a decisive role in this research, it is necessary to fully explore the Southwest as an environmental and cultural entity (Chapter III). The important point of these chapters is that the Southwest is not viewed as a homogenous environmental province, but as a richly varied and oftentimes highly demarcated hodgepodge of environmental and biotic zones. This is the setting upon which the occupants of the region acted and left their marks on the historical trajectory of the Southwest.

Chapter IV focuses more closely upon a specific case study: the Mimbres of southwestern New Mexico. The Mimbres area is a fairly well-defined geographic and culture area of the overarching Mogollon culture, which is a catchall designation for groups living primarily in the highlands of the southern Southwest. However, the Mogollon also made extensive use of a multitude of environmental zones and are probably better thought of as occupants of the vast Chihuahuan Desert of southern New Mexico, west Texas, and southeastern Arizona in the United States and northern Chihuahua in Mexico. This description of the Mogollon homeland contains dry deserts; mid-elevation grasslands; rolling hills covered with shrubs, piñon, and juniper; forested mountains; and most importantly, perennial rivers and streams that flow through all of these diverse environments.

The Mimbres people have been the focus of scientific investigation since the 1920s, and this corpus of information has demonstrated the complexity of this early sedentary, subsistence-level farming society (Anyon and LeBlanc 1984; Anyon et al. 1981; Bradfield 1929; Cosgrove and Cosgrove 1932; Creel 1999; Gilman 1980; Haury 1936; LeBlanc 1983; Lekson 1992a; Minnis 1985a; Shafer 1999a). In general, the Mimbres primarily occupied several riverine oases in southwestern New Mexico (Lekson 1986; Nelson and Anyon 1996) but clearly also used the deserts, foothills, and mountains that surrounded the relatively lush river valleys (see Blake et al. 1986; Minnis 1985a). However, in large measure, their use of peripheral areas has received scant attention from archaeologists in comparison (see Minnis and Wormser 1984; M. Nelson 1999; Schriever 2002; Stokes and Roth 1999 for exceptions). In addition, the available evidence shows that, at least in most of the peripheral areas and the northern portion of the Mimbres homeland, no other prehistoric group moved in after the Mimbres disappeared from the archaeological record, leaving a relatively pure Mimbres occupational record behind. The post-Mimbres Animas and Salado groups appear to have concentrated themselves in the main valley of the middle and lower Mimbres River and Bootheel of New Mexico, and none of the peripheral area communities are the result of these later occupations. Thus, the ancient Mimbres people serve as an exceptional case study for investigating the interplay between primary and peripheral areas.

Chapters V and VI discuss past archaeological projects in the Mimbres area and bring their findings to bear on the research questions outlined in Chapter II. Chapter V discusses the results of three important research projects of the 1970s and 1990s. The first was a large-scale survey of the mountainous and heavily forested upper Mimbres Valley

and nearby areas (e.g., upper Sapillo Valley) conducted by Donald Graybill (1975) as part of his dissertation research. The goals of that research were modest, but importantly for this research, site types, sizes, ages, and distributions were recorded for a number of important side (peripheral) drainages of the Mimbres River.

The second major body of data is the much broader and comprehensive survey of the well-watered middle and lower Mimbres valley and many of its tributaries, directed by Steven LeBlanc of the Mimbres Foundation during the 1970s (Blake et al. 1986; LeBlanc 1983). This research program also focused on both test and large-scale excavations at a variety of site types, including artifact scatters, field houses, and Pithouse and Pueblo period habitation sites (LeBlanc 1975, 1976, 1977, 1983; LeBlanc and Whalen 1980). Although sites in the main river valley were the focus of research, important survey data were obtained for sites in peripheral areas. Most importantly, Mimbres chronology and phase taxonomy systematics were refined (Anyon et al. 1981) and demographic/settlement patterns through time delineated (Blake et al. 1986). Human ecology-themed research led to the definition of patterns of land use and subsistence that forms the core of our understanding of Mimbres adaptation and use of many of the local environments (Minnis 1985a). From this research came a model of limited peripheral land use and settlement that has endured. However, a general lack of interest by other researchers on studying in depth the implications of peripheral area land use and settlement also endures.

The third major body of survey data covers the forested Sapillo Valley on the west side of the Continental Divide, which separates this valley from the west fork of the Mimbres River. Stokes (1995) conducted a 20 percent random sample survey of the

valley and documented changing settlement patterns and demographics for the Mimbres occupation (Stokes and Roth 1999). Although the Sapillo Valley is larger than the other peripheral areas noted in this dissertation, it is none-the-less a high elevation location that would present certain difficulties for agriculturalists. The survey coverage is not as thorough as seen with the Graybill and Mimbres Foundation surveys of the Mimbres Valley, but does provide important data for this dissertation.

Chapter VI builds on what we do know of peripheral land use. This chapter discusses the results of two important survey and test excavation research projects undertaken specifically for this research. The first is a survey and test excavation project in a tributary valley of the middle Mimbres valley that sought to understand the nature and timing of Mimbres land use and occupation of Noonday Canyon (Stokes 1997). The findings from this project produced several interesting preliminary observations, leading to the development and undertaking of another similar study deep in the mountainous middle fork of the Mimbres River (Stokes 2000a). The results of these projects demonstrate the presence of hierarchically arranged site clusters that appear to be very similar to settlement patterns found in the heavily occupied lower Mimbres valley (Stokes 1999). In both cases, the development of these peripheral community systems did not begin until after the lower Mimbres Valley was already heavily settled and farmed and was fast approaching population/resource imbalances (see Minnis 1985a; Shafer 1999a). This observation and others, plus their ramifications for Mimbres research, are examined in Chapter VI.

Chapter VII synthesizes the survey and excavation data, and then evaluates the model presented in Chapter II for goodness of fit with the data, which includes a site

catchment analysis presented in Chapter VII. These results are used to detail and understand the role of land tenure and landless groups of people in colonizing peripheral areas. This colonization also functions to alleviate social stresses while maintaining the integrity of the overall society; in other words, by colonizing peripheral areas, the society is preserved instead of being torn apart by violence between the haves and have-nots. Chapter VIII summarizes the results of this research and explores its impacts to the study of southwestern archaeology, social systems, and the development of private property. Similarities and deviations among the ethnographic examples and the archaeological record are discussed in these two chapters, while the final chapter examines the ramifications of this research for our understanding of modern and ancient agricultural groups and pinpoints areas of future research.

CHAPTER II

THEORY AND MODEL BUILDING FOR UNDERSTANDING LAND TENURE AND THE DEVELOPMENT OF AGRICULTURALLY PERIPHERAL COMMUNITIES

This chapter discusses the theoretical and methodological framework that serves as a guide for orienting this research and interpreting the results in a meaningful way. It consists of three parts: 1) theoretical orientation, 2) ethnographic cases that serve to illustrate aspects of land tenure, and 3) development of a model to study land tenure in ancient societies. As a result, this chapter sets the stage for examining archaeological evidence in the search for patterns of land tenure in otherwise "egalitarian" societies.

The overarching theoretical orientation of this dissertation is cultural ecology (Binford 1977; Netting 1977; Orlove 1980; Ortner 1984; Plog et al. 1988; Steward 1955). Nested within cultural ecology are several subareas of middle-range theory and analytic techniques that are necessary to use in order to detect the presence of land tenure systems in ancient societies. These include settlement pattern theory and analysis (e.g., Chang 1968; Flannery 1972; Trigger 1968), optimization/ decision making theory, specifically catchment analysis (e.g., Dennell and Webley 1975; Hastorf 1980; Higgs and Vita-Finzi 1972; Vita-Finzi and Higgs 1970), and to a lesser extent, central place theory (Cristaller 1933; Hodder and Orton 1976; King 1984).

Cultural ecology is a way to understand the complex relationships between people and their environment, which subsumes many kinds of studies familiar to archaeologists, including settlement patterns, demographics, subsistence, material culture, trade and

resource procurement, and human osteology (Binford 1977; Clarke 1968; Doyel and Hoffman 2003; Green 1980; Harris 1968; Orlove 1980; Ortner 1984). Traditional cultural ecology of 1960s and 1970s focused primarily on cultural adaptation to varying sets of environmental circumstances, but since then, aspects of social behavior and decision making within cultural ecology, including studies of conflict and warfare, alliance building, population movements, and differential access to food, have become more prominent in American archaeology (e.g., Adler 1996; Brooks 2000; Cameron and Tomka 1993; Kohler 1992; Minnis 1985a; M. Nelson 1999; Tainter and Tainter 1996; Varien 1999; Welch and Scarry 1995). This dissertation also examines the role society plays in shaping the conditions under which people live and the choices for survival that become available as a result, but within an overarching ecological framework. An important component in studying and modeling cultural ecology is derived from ethnographic research, which also forms an important part of this dissertation. It is critical to view cultural ecological decision making in the "real world" in order to better approximate potential conditions, the range of potential decisions, and the range of potential outcomes for ancient societies who, we hope, were living roughly similar lifestyles to the people in the ethnographic examples.

Within the broader study of cultural ecology, specialized subdisciplines have developed that examine specific variables in the search for explanations of broader patterns, often based on theory originating from outside anthropology. These include economics and mathematics, e.g., central place theory and game theory (Barth 1956; Cristaller 1933; King 1984); vertebrate and insect studies, e.g., behavioral studies, foraging patterns, and inheritance and population dynamics (Boughey 1968; Orians and

Pearson 1979; Stephens and Krebs 1986); ecology and geography, e.g., catchment analysis, systems theory, evolution and adaptation, and resource distributions and human geography (Binford 1977; Plog 1975; Hudson 1969; Viti Finzi and Higgs 1970); and physics and hard sciences, e.g., energy intake and expenditures (Lee 1968; Smith 1988; Smith and Winterhalder 1992). Because many groups are intimately tied to their environment, which is especially true for hunter-gatherers, pastoral groups, subsistence-level agricultural societies, and pre-industrial societies (Binford 1990; Netting 1977; Plog 1983; Steward 1955), research within a cultural ecological framework has been shown to be extremely useful for understanding human behavior and patterning.

Overview of Cultural Ecology

Much of cultural ecology relies on data and models derived from ethnographic studies of "primitive," marginalized, and/or small-scale hunting and gathering, pastoral, and agricultural societies. Archaeologists think that most people in modern industrial societies no longer behave in ways that can be used in the process of understanding the distant past, and that modern industrialism, capitalism, and colonization have irrevocably altered even the most remote of subsistence-level societies (Wolf 1982:ix–x; Wylie 1985). However valid this assessment is regarding most of the modern world, the use of ethnographic data, whether from a "pristine" group that has been barely touched by the modern world to studies of marginalized people today, has proven to be extremely useful for model building and test studies. The primary use of ethnography in archaeology has been for scientifically recording how people react to, manipulate, and change each other and their environment, and how this is portrayed in any number of behaviors that can

then be used to build sets of expectations (models) for ancient societies (Binford 1962, 1967). This approach is often referred to as "analogy," and although it has its share of theoretical, methodological, and teleological problems (Wylie 1985), including imposing modern behavior onto ancient groups, it nonetheless serves to form a baseline of behavior from which predictions can be built and then tested in the field. Perfect matches between ethnographic and prehistoric groups are generally no longer expected in the modern use of analogy (see Kroeber 1939 and Kidder 1924 for early uses of analogy). However, similarities and differences in behavior and their correlates can be illuminating for understanding the past.

Because cultural ecology is a "catch-all" term for a diverse group of subdisciplines, it in and of itself lacks the ability to be completely explanatory; it relies on its various middle-range theories and models for articulating ranges of human behavior in relation to the natural environment. This was the problem encountered by earlier practitioners of cultural ecology, including Kroeber (1939) and Steward (1938, 1955), who provided ways to link culture, evolution, and the environment, and advocated cross-cultural studies, but their results were often "just-so" stories that were often environmentally deterministic (Harris 1968:663–669). White (1959) attempted a more scientific and explanatory approach with his study of the linkages between evolution and the ability of a particular to group to extract energy from the environment, and thus to move along the ladder of increasingly complex sociopolitical organizational stages. But his studies tended to feed back into solidifying existing cultural and evolutionary typologies; that is, he "explained" certain levels of socio-cultural-political development as the inability of the group to devise ways to extract more energy from their

environment to better their position. Thus, they were stuck and were at the mercy of their technology.

The New Archaeology of the 1960s and 1970s developed middle-range theory that set out to create testable hypotheses based on systemic relationships between various cultural and environmental attributes, and thus build bridges between "meta-theory" and human behavior (Binford 1962, 1977; Watson et al. 1971). Those who incorporated this new epistemology into their research often focused on the choices made by groups to enhance their adaptability (fitness) to remain in equilibrium with their environment following a perturbation in one or more of its subsystems. The uses of early middle-range theory developed into the myriad of cultural ecological forms and studies noted earlier, which went by various names, including human ecology, evolutionary ecology, historical ecology, systems theory, game theory, and optimization-decision making studies. Although each approach had its strengths and weaknesses, all were successful at modeling different aspects of diachronic human interaction and intervention with the environment that served to explain how choices were made that led to sociocultural adaptation and evolution. By themselves, each approach leaves unanswered a host of other questions about the human condition, but together, under the general rubric of cultural ecology, a more complete understanding of why human groups do (or did) what they do is emerging.

The previous discussion also demonstrates the utility of not relying solely on one subarea of study. Systems theory is useful for modeling the complex relationships between various human and natural subsystems (e.g., subsistence, economics, religious, biotic environment, climate), but it leaves the impression that the people themselves are

more or less passive as the various subsystems strive for equilibrium. Decision making strategies were developed in response to the potential of environmental determinism, which then led into new ways to use evolution and selection theories in modeling human behavior (e.g., Dunnell 1982; O'Brien and Lyman 2000). Unfortunately, it has proven to be extremely difficult to model all of the potential choices available to an ancient group, thus leading to difficulties in explaining why a particular choice was made without the study becoming teleological. Analogy has helped to bridge this gap and avoid the circular reasoning pitfall to a degree (Wylie 1985), despite its inherent weaknesses (mentioned previously).

A better way of doing research using cultural ecology is a multi-study approach that takes into account several variables either at once or in succession. I argue that it more accurately models the complexities of "real life" and the interplay of variables that crosscut systems, decision-making, optimization, adaptation, and political economy. In other words, people did not rely on "one way" of doing things or approaching their socio-cultural-environmental interfaces. This is the approach taken in this dissertation and the reason why it is necessary to briefly examine some of the interconnected subareas of cultural ecological research.

As Minnis (1985a) and others (O'Brien and Lyman 2000; Plog et al. 1988) have demonstrated, people (singly or as a group) make choices that lead to adaptive responses to various actual or perceived stimuli. The process often begins with the easiest, least-costly solutions that are also easily reversible and are limited to the immediate family group. If the solution does not prove satisfactory, real or perceived, people will then move toward increasingly more costly (and often complex) choices that become less

reversible and include greater numbers of people, thus becoming more risky for larger groups of people in the face of particular environmental and social stimuli. These stimuli can include population pressure, food provisioning stress, and natural environment imbalances or shortages. The most common choices available, from least to most costly, include hoarding food, intensifying food production, relying on others for assistance (reciprocity), intensifying use of marginal areas, and turning to starvation foods, to partial or total social collapse and dissolution in the face of (potential) starvation and/or warfare and conflict.

These studies demonstrate what subsistence level farming societies may do when faced with varying stresses in a generally predictable way, with a focus on the choices made by those living in optimal areas who wish to remain in optimal areas. This dissertation builds on previous studies of the choices people make in optimal areas, but it focuses on the choices made by those who have selected colonization of new or underutilized marginal areas that have the potential for a wider variety of subsistence pursuits, including agriculture and natural resource extraction. What actually happens in primary habitation and agricultural areas in a social sense that leads to certain people making the choice to leave? Why do these people choose the peripheral areas that they do and not others? And, Why do certain settlement patterns and configurations then arise in peripheral areas that seem to mimic those seen in primary areas? I argue that one of the primary factors that came into play as a preferred choice by both prime and peripheral groups is land tenure, and that many of the subsequent patterns we see in the archaeological record is a result of the "loss of the commons" (Kohler 1992). What is unclear is how, or even if, "commons" were used in the past, but this dissertation

proceeds under the assumption that property was truly communal at some point in the past and was transformed into private property.

By focusing on both primary and secondary areas, I expect to see an adaptive strategy emerge that attempts to reestablish system stability across a much wider area that affects different sub-groups in an unequal way. This strategy forces a particular subset of the society to bear the riskiest adaptive strategies in order for the society as a whole to better survive. In order to accomplish a wider study of adaptation as described here, it is then necessary to move beyond broadly drawn cultural ecology or systems theory by engaging in other subareas of study, including maximization strategies and risk management, with a focus on land tenure strategies, catchment analysis of peripheral areas, and central place theories of settlement behavior. Although it is not necessary to fully immerse this dissertation in the totality of each analytic method, aspects of each will be used to create a "successionary" model of movement into agriculturally peripheral areas. It will be shown that these areas of investigation are interrelated and are a fruitful way of studying the "larger picture" of human decision-making and adaptation to their social and natural environments by focusing on land tenure systems.

Studies of Evolutionary Selection, Adaptation, and Systems Theory

Evolution has been an important theory used (and abused) by anthropologists since the late 1800s (e.g., Morgan 1877). However, investigations focused on selection and adaptation did not begin until the 1930s with the work of Julian Steward and Leslie White. Modern anthropologists continue to refine, and in many cases to redefine, these concepts and processes and their implications for the study of people, ancient and modern

(Dunnell 1982; Larson et al. 1996; O'Brien and Lyman 2000). The fact that such effort is expended on evolutionary theory and its subdisciplines demonstrates its overall utility for understanding the complex interactions between humans and their social and natural environments.

The Concept of Adaptation

The concept of adaptation is generally viewed as the end result of an organism's development of traits that will enhance its survival and procreation; in other words, an organism creates for itself abilities to successfully cope with particular situations and events by selecting for appropriate responses (Bennett 1976; Price 1996). Trait selection is critical for biological adaptation as the process of change, for selecting a "wrong" response to stimuli can result in non-advantageous adaptation and possibly extinction. Most scholars tend to agree that traits can be selected for from a wide variety of available choices, although argument arises over how the multitude of possible selections is created. Some of these processes include mutation and natural variation resulting from recombination of genes (Boughey 1968:65–68; Price 1996) and through cultural systems and information flow for nonbiological evolution (Buckley 1968; Butzer 1982:281–285; Rappaport 1971a). Part of the information flow cycle that enhances variation is anticipation of events, a situation that allows for a conscious and deliberate course of action towards a specific solution or goal selected from many possible choices (Bennett 1976). The important components of adaptation, then, are survival, selection, variation, information flow, and procreation/replication.

The medium of adaptation is viewed as either biological or cultural, although the

two have been combined at times (Vayda and Rappaport 1968:478). Survival takes place in the environment in the forms of sustenance extraction, avoidance of predators, and sexual attractiveness and reproduction (Boughey 1968; Price 1996). A successful survival selection can be either conscious or unconscious, or in other words, planned or unplanned. Successful selection and reproduction can then lead to, for example, population evolution and niche adaptation. However, not all adaptation is so directional, that is, a progression towards a specific goal (e.g., a niche or a symbiotic relationship with another organism) (Rindos 1980, 1989).

Rindos (1989) identifies two types of adaptation that various scholars have used: undirected and directed. With this division, he identifies variation in both adaptation and in general paradigmatic frameworks. Directed adaptation is described as functionalist, which reflects synchronic perspectives and a view that all organisms strive for homeostasis, or stability, within their ecosystem. Examples include Steward's (1938, 1955:Chapter VI) ethnographic work in the Great Basin, where he clearly characterized the Shoshonean groups as having reached a stable and persisting interrelationship with their environment. Another is Lee's (1968) work with the !Kung of the Kalahari Desert, and while Lee's approach is more sophisticated than Steward's, it remains a study of homeostasis within an ecosystem approach, where selection and adaptation are directed towards negating disturbances in the environment through subsistence activities.

Rindos (1989) acknowledges the importance of these kinds of studies but suggests that groups often select for traits that do not achieve homeostasis and that the impetus for selection can be more than economics and survival. Change can occur through ritualistic and self-aggrandizement situations in which the goals are personal empowerment and

which may be destructive to the group or larger population (e.g., Rappaport 1971b, 1978). This approach (undirected) necessitates a group or region specific study, with an historical perspective, coupled with a more thorough investigation of possible sources of selectable variation, much of which arises out of human culture.

For scholars interested in human ecology, the process of selection and adaptation moves beyond genes, zygotes, and phenotypes to culture, energy, and information flow; thus, the concept of adaptation and the theory of evolution become "humanized" to a degree. It was generally acknowledged that groups had adapted to their particular environment or niche, but the process was often not investigated (e.g., Steward 1938). Concern was placed on the final result, termed "cultural stages," a construct for explaining and defining levels of socio-political complexity and organization (Sahlins and Service 1960; Steward 1955; White 1959).

Although in later years other scholars backed away from these "ladder-like" stages of cultural adaptation, emphasis continued on ethnographic (synchronic or limited historical) studies of particular human/environment adaptations (Lee 1968). However, more effort was directed towards explicating interrelatedness and adaptive possibilities of symbiosis, niche exploitation, and systemic interaction with other variables, often subsumed under the "ecosystem" approach (Moran 1984). A change in one portion of the system often created a ripple effect, allowing for, or necessitating, adaptation among many of the other components. Although related concepts, such as stability/instability and homeostasis, have been viewed differently through the years, the systems approach is still in use; it is recognized that a change in one subsystem (environmental, social, or cultural) can have effects upon other subsystems (e.g., see Minnis 1985a).

The Scale of Adaptation

The scale at which scholars choose to study adaptation varies depending on the subject or goals of the research, a situation that is present in both biology and anthropology. In anthropology, the use of scale varies depending upon the subject matter. The scale of the large group or population appears to have been the most widely used through time. Within the large-scale framework are more specific studies of ecosystems (Moran 1984), optimization strategies (Kelly 1995; Lee 1968), stability versus instability as prime movers (Rindos 1980, 1989), and risk management studies, usually in the forms of subsistence, social, and economic adaptive strategies (Minnis 1985a; Tainter and Tainter 1996; Winterhalder 1994). The use of a larger scale in anthropology allows scholars to understand general processes of human adaptation that may be cross-culturally applicable. Although it is recognized that variation exists among adaptive strategies, the basic framework is general enough to allow for and to accommodate particular and specific circumstances and instances.

Often, the use of the group or population scale leads to regional studies of group-to-group interaction, symbiosis, and mutually beneficial adaptation (Barth 1956; Lee 1968). Earlier uses of the regional concept led to linkages between environmental zones and particular types of human societies (Kroeber 1939), and although an important step in understanding human adaptation, these studies were left as "just so" stories. Causal links, explanatory frameworks, and historical developments had to wait (Crumley 1994; Steward 1955; Vayda and Rappaport 1968; White 1959).

Many other anthropologists use a finer-grained scale to study what individuals do, and how they manipulate social, cultural, and environmental factors to achieve self-

satisfaction and in many cases, perpetuation of their condition (e.g., the rise and empowerment of elites) (Rappaport 1971b). Others also study the individual, but in terms of the constraints and latitudes allowed for individual expression and action by the society and its cultural structures (Bennett 1976). These scholars recognize that the actual process of selection and ultimate adaptation occurs within and among individuals, and that change is not always system-wide or monolithic. An individual may adapt to a particular situation, while his/her society or culture does not. However, these scholars understand that group and population adaptation does occur, but they argue that the process begins and ends with the individual.

Optimization Strategies: Territoriality and Land Tenure

The study of territoriality and resource ownership in the North American Southwest is moving toward creative interpretations and sophisticated models of how and why this social process operates (Kohler 1992) and on what levels of social organization (Adler 1996). Much of the foundation for these studies is derived from larger and more generalized theories and models of evolutionary ecology (Dyson-Hudson and Smith 1978), neo-Darwinian selectionism (Larson et al. 1996; O'Brien and Lyman 2000), and microeconomics (Cashdan 1990; Sahlins 1963).

While an evolutionary ecological approach is satisfactory for particular questions, such as what is the optimal solution (selection and adaptation) to a situation where critical resources are dwindling and/or restricted, it leaves unanswered other questions involving social change that may co-evolve with changing subsistence practices (Dupré 1987). Increasing territoriality as a result of the "loss of the commons" and subsistence risk management as a social process have been addressed in the early work of Hardin (1968)

and more recently by others (Adler 1996; Brandt 1994; Feeny et al. 1990; Kohler 1992; McCay and Acheson 1987; Richardson 1982). This section will focus on territoriality as a social process against a backdrop of changing resource availability, differential resource stress, population pressure, and optimization strategies.

Theoretical Background

The study of resource control has been a primary focus of research in anthropology (McCay and Acheson 1987), whether in the form of territorial defense at the group level (Dyson-Hudson and Smith 1978), defense of seasonally occurring critical resources (Richardson 1982), or appropriation and manipulation of resource surplus (Johnson and Earle 1987; Sahlins 1963). In fact, some of the earliest studies of sociopolitical organization focused on elite formation and maintenance through control of resources and/or surplus (Peebles and Kus 1977; Wittfogel 1957). Many studies emphasized resource control and manipulation as critical components in cultural evolution (Steward 1955:30–41) and sociopolitical developmental stages (Sahlins and Service 1960:12–44). An example would be Sahlins' (1963) typological description of "the Big Man" form of temporary and situational leadership, where a person may achieve a disproportionate level of influence over others in the community by gaining control over some of the resources produced by others (e.g., by assisting others who are facing hard times and then later calling in debts, multiple marriages that come with dowries, or manipulation of sacred and/or curing knowledge). Of course, other factors also may be present that empower certain individuals, including manipulation of trading relationships, conflict and warfare, and alliance building.

Despite the large amount of literature on this subject, little attention was paid to how and why a group of people became territorial and invested energy into land tenure practices; most studies focused on the manipulation of resources and surplus after the process of territoriality had already begun. In the mid-1960s, a revolution in ecological thinking occurred with the publication of Hardin's (1968) essay on the "tragedy of the commons." This was one of the first studies to specify the process of changing social attitudes towards land tenure and ownership of resources. Additionally, it defined many aspects of how this process might work and the variables that may play important roles. Despite criticisms of this approach (Kohler 1992; McCay and Acheson 1987), it remains an important starting point for studying optimization strategies and territorial behavior in human societies.

Following Hardin's seminal publication, and in conjunction with the increasing popularity of ecological anthropology (Netting 1977; Orlove 1980), a new sub-discipline arose that investigated the interplay between evolutionary theory and ecology, variously termed evolutionary ecology or optimal foraging theory (Lee 1969; Smith and Winterhalder 1992). While this methodological framework covered a range of topics including optimal foraging strategies, variation and selection, and ecological constraints, other research foci also became important, including territoriality and resource control as evolutionarily stable strategies (Dyson-Hudson and Smith 1978; Richardson 1982; Smith 1988). This body of literature provided important insights for elucidating the role of ecological/human interaction and understanding how and why adaptive selections are made, which includes the process of territoriality and decisions to defend and control resources. Attention to certain group dynamics, such as how and when resource sharing

should occur, who is involved, group composition and size, and group-to-group interactions, have also benefited the study of optimization strategies (Smith 1987). Selection, optimization of fitness, and reproductive maximization in terms of neo-Darwinian evolution are the driving mechanisms for alterations in subsistence economies and social interactions.

Evolutionary ecological studies primarily focused on environmental constraints and energy cost/benefit ratios as the critical variables in human adaptation. As a result, social and cultural aspects of human intentionality and self-determination were lost (Dupré 1987). This is a situation that seems to have limited the usefulness of evolutionary ecology, as pointed out in numerous critiques of the approach (Dupré 1987; Emlen 1987; Pierce and Ollason 1987). However, some archaeologists have begun to merge social and cultural variables back into evolutionary ecological studies to produce a more satisfying result (e.g., Adler 1996; Kohler 1992; Larson et al. 1996). Human intentionality and agency are again important components of many models, as first suggested by Hardin.

Models of Territoriality and Resource Ownership

It is important to outline the models offered by Hardin (1968), Dyson-Hudson and Smith (1978), Kohler (1992), and Adler (1996) and discuss the ways they understand and apply the concept of territoriality, land tenure, and resource ownership. Each has a different emphasis on territoriality, although all share certain attributes, including the roles of population pressure, variation in the environment, and changing social structures in altering human perceptions of how to manage the world around them. Together, they suggest that research geared in this direction can provide a way of investigating aspects

of social change that may have been unapproachable in the past.

Several important terms and concepts appear regularly in most of these studies. *Corporate group* refers to a social group united through various structural mechanisms but acting in a relatively unified manner when dealing with socioeconomic issues (Basehart 1967; Murdock 1960). The corporate group controls access to its ranks and possessions, including subsistence resources that it owns or manages. The corporate group can exist at many levels, ranging from kin and clan-based configurations to larger segments of a population. Alternative terms for the corporate group include "primary resource access group" (Adler 1996:85) and "extended family-collectivity" (Sahlins 1969:401).

Open commons describes an economic and social strategy where access to resources is unrestricted to all potential users within the group, however the group is defined (Hardin 1968). The success of the open commons depends on the cooperation of the individuals involved. It is expected that no one will take advantage of the situation in terms of differential resource extraction (using more than their share), while expecting others to share and accept the burden and hardships of reduced and/or degraded resource availability. Differential extraction of resources without acceptable resource regeneration, and the absence of controlling social mechanisms, will eventually lead to the "tragedy [loss] of the commons."

Resources is an expansive category and can include such things as food items, wood and timber, lithic raw material, water, land, information, ritual knowledge, medicine, children, and mating partners (Dyson-Hudson and Smith 1978). *Ownership of resources* is a form of direct resource control where access can be denied to others who

are not part of the corporate group (Adler 1996; Dyson-Hudson and Smith 1978; Sahlins 1969:401–403). Additionally, various levels of resource production can be owned by different people, as described by Sahlins (1963) and others (e.g., Johnson and Earle 1987; Kelly 1991). For example, hierarchical social structuring permits the elite, or those who have administrative, ritual, and economic power, to control access to resources and surpluses produced by others (Johnson and Earle 1987; Kelly 1991).

Territory refers to a circumscribed region containing resources, habitat, and habitation areas recognized as explicitly or implicitly belonging to a particular group. Recognition of ownership or control of a territory may or may not require force or active defense (Dyson-Hudson and Smith 1978:22–23). Territories can be maintained through various mechanisms including boundary markers, common or negotiated agreement, witchcraft, threat, and aggression (Carneiro 1994; Dyson-Hudson and Smith 1978; Orcutt et al. 1990). *Land tenure* is a form of ownership where access to parcels of land and the resources they contain is restricted to a particular subset of the group and is passed down to members of the subset through the generations (Sahlins 1969; Smith 1988). Tenure also describes the terms and conditions of the property being held as commonly and legally understood by the participants.

The Tragedy of the Commons

Hardin (1968) has offered a model that outlines group transformation from communal to landowning, which he termed the "tragedy of the commons." This model suggests that a communal type of subsistence strategy (open and free access) is workable when population is low and resource availability is adequate, but when resource depletion

becomes increasingly problematic when coupled with population growth, conflict will eventually arise over control and access to the resource(s). Social mechanisms may then come into play that regulate or defuse the situation. One such mechanism is individual ownership of property and resources that results in restricted access to formerly common property (Hardin 1968:1247).

This process is not instantaneous, however; it builds and feeds upon itself over time, intensifying as population continues to increase and resources become more stressed. In an agro-pastoral society, resources that can become critical are both pasturage and good farmland (Hardin 1968; McCay and Acheson 1987). For societies that rely heavily on agriculture, the availability of good farmland and water may become critical factors that induce a change in social rules. Interpersonal and group-level relationships may be altered to prevent certain people or groups access to particular areas and resources (Hardin 1968; Kohler 1992; Kohler and Van West 1996).

The Evolutionary Ecological Approach

Since the late 1960s, numerous studies regarding human interaction with the environment based on adaptive selection and cost/benefit ratios of resource extractive strategies have documented the utility of the evolutionary ecological approach (Smith 1987). Under this paradigm, humans select a subsistence strategy that optimizes their chances for survival and procreation. Costs of a strategy are measured against expected returns or benefits within a set of assumptions and constraints; measurements are generally in the form of energy input/output (calories) (Smith 1987). Practitioners of this approach do not claim to model reality fully, or that humans will always act in their own

best interest, and yet their generalizations about the choices humans make are often similar to ethnographic observations (Richardson 1982; Smith 1987).

Dyson-Hudson and Smith (1978) have offered a model that outlines the possible trajectories of resource sharing, mobility, sedentism, and territoriality within an evolutionary ecological approach. They suggest that key variables include resource density and resource predictability; both play important parts in cost/benefit ratios, or "economic defendability of resources" (Dyson-Hudson and Smith 1978:22). Within this model, four generalized strategies are possible (although the authors acknowledge that continuous variation better reflects reality). These are:

1) Dispersion and mobility of people when both resource density and predictability is low;
2) High mobility, generalized sharing, and temporary territories when resource density is high, but predictability is low;
3) Home-range systems (seasonal movement) when predictability is high, but density is low; and
4) Stable territorial systems when both predictability and density are high.

The authors note several exceptions and extraneous situations that affect cost/benefit ratios and adaptations. These include superabundance of resources where it is not economically beneficial to control that resource and differential levels of territoriality. The latter refers to situations where a group may actively defend highly ranked resources but permit open access to other, less important resources (Dyson-Hudson and Smith 1978:33–36). Other critical variables include population densities, outside group interaction, patchiness of the environment, and social constraints.

With this model, predictions can be generated as to what type of subsistence and settlement strategies can be expected within a particular environment. Additionally, the model can be used diachronically, in that modification of one variable to account for change can produce a new set of expectations. For example, if it can be demonstrated that climatic deterioration occurred during a certain time frame, changes in subsistence, settlement, and social patterns can be predicted. The expectations generated can be tested on the archaeological and ethnographic records, thus giving an independent measure or evaluation of the model. Although the model does not necessarily focus on specific social ramifications of the predictions, it sets up a framework that allows such studies to be done.

Social Change, Settlement Patterns, and Symbolic/de Facto Land Tenure

Kohler (1992) has offered a model that begins with Hardin's tragedy of the commons but attempts to detail the mechanisms responsible for changes in resource ownership strategies. In Kohler's model, two key variables interact to induce change: population increase and resource depletion. Population increase may account for several processes co-occurring simultaneously, including aggregation, restriction of movement across the landscape, and resource depletion. Aggregation may result in response to intensification of subsistence practices where increased demands for labor offset the costs associated with population packing (greater potential for intra-group conflict, sanitation problems, and greater subsistence risk as fewer resources are used) (Kohler 1992).

Freedom of movement, as a subsistence strategy, can become restricted or greatly curtailed as a result of increased population density within a region (Kohler 1992). In

other words, people no longer have the ability to pick up and move somewhere else to make a living if unclaimed territories no longer exist (Fish and Fish 1994). Resource depletion occurs if extraction rates exceed resource renewal; one way to offset this is to intensify production of fewer resources, a strategy that often adequately supplies nutritional needs but can be very risky in terms of periodic to catastrophic resource failure (Kohler and Van West 1996; Minnis 1985a).

Kohler (1992) suggests that the conditions outlined above occurred in the Mesa Verde region during the Pueblo I and Pueblo II periods (about A.D. 800–1150). As regional population levels increased, a series of climatic fluctuations occurred that tended to limit productivity, density, and predictability of resources. The Ancestral Pueblo of the Mesa Verde region responded by aggregating into fewer villages located near prime agricultural land. The best parcels of agricultural land were claimed by the inhabitants of the villages (most likely by some form of corporate group) and were symbolically and physically marked on the ground by the construction of field houses.

Field houses are generally conceived to be seasonal or short-term structures associated with agricultural systems and result as part of the aggregation process (Ellis 1978; Haury 1956b). They are primarily occupied during the agricultural season and are viewed as "distance" or "inconvenience" shelters; that is, they function as temporary shelters for farmers who need to travel longer distances to get to their fields (Haury 1956b; Moore 1978). Kohler (1992) suggests that the earliest field structures appear very close to the main villages and that distance was not likely a concern; their main function may have been to demarcate privatized property.

Kohler's model suggests several important considerations that go beyond simpler

ecological approaches. These include the practice of attempting to increase depressed levels of resource density and predictability (intensification of resource production and extraction) and variation of social responses to subsistence stresses and risk (Kohler and Van West 1996). The latter may include reorganizing land tenure policies and social relationships (moving from family groups to larger resource controlling corporate groups).

Adler (1996) has also provided a model for viewing the operation of land tenure in the Ancestral Pueblo region. Again, the critical variables are population densities and resource fluctuations and scarcity. In his model, small groups of people lived in semi-isolated hamlets and controlled the resources nearest to them. As population levels increased and resources became scarcer, people chose to leave their hamlets and aggregate into larger villages. As part of this process, they formed larger corporate groups, or "primary resource access groups" within the larger community (Adler 1996:85). Rights of access and control of land and resources formerly owned by the smaller units were now merged and administered by the corporate group. The benefits of this strategy include a greater labor pool for intensifying resource production (e.g., building water control systems, clearing land) and a better ability to exercise direct control over land holdings. This scenario appears to be built on the observed pattern of ethnographic Puebloan land tenure strategies, where in many cases a clan, or even a whole village, nominally "owns" a resource territory. Whether this is completely true will be discussed later in this chapter.

Adler suggests that evidence for this scenario is found in settlement pattern shifts. During the Pueblo I period (A.D. 800–950), settlements primarily consisted of regionally

scattered small sites, often referred to as Prudden unit pueblos (Prudden 1903). During the Pueblo I-Pueblo II transition, many of these smaller sites were abandoned in favor of residence at fewer, but much larger villages. This pattern is strengthened during the Pueblo II period, but it does not last much beyond this period, at least in this area. Village layout suggests discrete blocks of habitation and communal rooms, which are interpreted as inter-dependent and semi-autonomous corporate groups. Evidence that suggests these groups controlled land resources comes primarily from the Pueblo ethnographic record and observed village layout and clan responsibilities and holdings. Although Adler does not argue for a direct relationship between prehistoric and historic Puebloan social structures, he does suggest that this form of resource control is a strong possibility.

Adler's model goes beyond Kohler's in defining ways of examining changes in social structure in more detail, both in the ethnographic and archaeological venues. Both remain convinced of the critical nature of population dynamics and ecological constraints (resource fluctuations, unpredictability, and availability limitations) and the social choices made to alleviate these stresses. They focus on adaptive changes in subsistence and social structures to deal with population and resource stress in a manner that is more detailed than Hardin's original "commons" model. However, many elements of evolutionary ecology are present in both models, although neither Kohler nor Adler directly suggests that the scenarios they outline are the "optimal" solutions to environmental conditions.

Broader-Scale Applications of these Models

The models outlined above, while focused on discrete regions and during

particular time frames, offer a methodology for studying social responses to subsistence risks and environmental change. The parameters involved can be changed to allow for examination of known social change during a variety of time periods and places, including the transition from hunting and gathering to agriculture, and for investigating aspects of the transition from one form of domestic structure to another as part of the mobility to sedentism continuum. Territoriality comes in many forms and guises, and occurs at many levels of social-economic-political organization. This flexibility can allow for broader-scale applications.

Central Place Theory

The study of subsistence strategies in evolutionary ecology has modeled (among many) a particular optimal strategy: central place foraging based on central place theory (Bettinger 1991; Kaplan and Hill 1992; Orians and Pearson 1979; Stephens and Krebs 1986). Briefly, central place theory suggests that an optimal foraging strategy for a situation where resource ranges and territories are limited, or when foragers are tethered to their main habitation site, is to locate a base of operations near as many resource areas as possible. This strategy may be optimal in terms of cost/benefit ratios, where the "benefits" outweigh the "costs" of resource procurement in terms of distances traveled and time spent away from "home." In other words, central place foraging allows "predators" to maintain long-term residences if internal and external conditions limit mobile foraging patterns. These aspects suggest a useful linkage between central place theory and catchment area analysis (discussed later in this chapter).

While central place theory in evolutionary ecology generally focuses on hunters

and gatherers, I suggest that this strategy is also beneficial for studying sedentary, subsistence level agricultural societies when considering their overall food provisioning strategy. In fact, central place theory may be more applicable to agriculturalists, in that their mobility may be severely constrained by their ties to their fields and in some cases, the environment in which they live. In certain cases, sedentary agriculturalists should establish centrally located habitation sites that maximize their ability to exploit a wide range of resources, or at least good agricultural land and water, yet still minimize distances traveled to resource areas, all else being equal. To determine if main habitation sites are located in "ideal" central locations with regard to varied resources, it is important to study settlement pattern data and resource distribution (Hastorf 1980; Kintigh 1985). The type of settlement pattern observed can then be used to determine if territorial behavior and land tenure is evident. This aspect will be explained in more detail later in this chapter.

Operationalizing Central Place Theory

Briefly, classic optimal foraging theory suggests that predators will attempt to maximize net energy returns in relation to costs incurred while pursuing, capturing, and processing prey (Smith 1987; Stephens and Krebs 1986). The strategies chosen are thought to reflect selection, decision making, and adaptation that enhance survival, fitness, and procreation, all of which are critical variables of general evolutionary theory (Kelly 1995; Krebs and Davies 1993). Optimization of net energy returns can be accomplished through various formulations (Bettinger 1991), including:

1) Optimal diet breadth (ranking of food items according to cost/benefit ratios);

2) Patch exploitation (moving from one circumscribed zone of resources to another in a linear fashion); and
3) Establishing centrally located places that tend to reduce distance and energy costs.

Agricultural societies, by their very nature, are more tethered to particular resource zones (e.g., flood plains, arable land, and good water sources). By choosing agriculture as the primary means of subsistence, an aspect of the first strategy has been chosen, almost by default. Cultivated food is determined to be the preferred food choice, and the costs associated with farming are viewed as acceptable. For these societies, mobility is often restricted to varying degrees (but see Graham 1994), limiting the usefulness of choosing strategy two. However, strategy three would prove to be beneficial for agricultural societies and is the focus of this discussion.

In classic central place theory, Orians and Pearson (1979:156) model animal foraging behavior in terms of differing strategies of central place foraging tactics and constraints. They describe the basic unit in central place foraging as the "round trip," which includes distance and time costs (an outbound trip, foraging time, and return trip). A major constraint associated with central place foraging is that other prey items cannot be pursued, even if they are highly ranked, while the predator is carrying resources back to its home base (Kaplan and Hill 1992). However, connected with this constraint is distance. For example, it may become economically feasible to abandon captured prey on the return trip if the expenses associated with its procurement were low and the expected returns of exploiting a higher ranked resource are greater.

The predator may find that expending greater energy in acquiring more prey items

at one time, and then returning them to the central place (making fewer round trips), offsets energy expenses associated with making many long distance trips carrying fewer food items. Whichever strategy is ultimately chosen is the result of trial and error, in that a forager probably does not innately know which strategy will work initially in any given situation. Additionally, a forager may flip-flop between strategies as conditions change and new variables are encountered; this basic premise is true of any foraging strategy type (Orians and Pearson 1979; Winterhalder 1981:33).

Humans and Central Place Theory

Kaplan and Hill (1992) and others (Hastorf 1980; Richardson 1982) have modeled optimal foraging strategies for humans based on theory, expectations (models), and observation (testing). Results vary, but the utility of optimal foraging theory as a tool for modeling human behavior is demonstrated rather consistently (Hughes 1993). What these studies have revealed is that the range of human responses to food acquisition and survival strategies often interact with one and another, producing a scenario where one optimization strategy gives good results but is further strengthened when another strategy type is used as well. Richardson's (1982) study of Northwest Coast Native American resource optimization strategies includes considerations of prey ranking, environmental constraints, resource sharing and hoarding, and conditions of territoriality (restricting access of resources to others) as part of the overall set of subsistence and social behaviors. However, all studies share in an approach that emphasizes one optimization strategy over the others.

Distances to resources, and how the resources are ranked, often condition where central places will be located. Other costs and constraints taken into consideration include

processing, or partial processing, of food items at the source before transporting them back to the central place (Metcalf and Barlow 1992). Another cost incurred by central place foraging is establishing and maintaining several bases for situations where it is more economical to return to a different place than to where the forager originated (Kaplan and Hill 1992). This aspect can be correlated with the variety of field houses used by many agricultural societies.

Economics, Geography, and Central Place Theory

An important component to central place theory when dealing with human groups is economics (Hodder and Orton 1976; King 1984). This factor takes into consideration economic variables that influence human decision-making in terms of site location, resource exploitation, and inter-group relations. In fact, behaviors tied to economics may override purely ecological and subsistence factors, negating decision making solely on cost/benefit ratios and energy maximization. Trading networks and alliances may provide extra incentives and motivations to exploit certain resources that may not be highly ranked based solely on energy cost/benefit ratios. The important point is that economic factors may significantly alter cost/benefit ratios for any number of resources.

Models of idealized central place configurations across the landscape have been devised that maximize optimal placement of primary and secondary settlements, resources available and their distributions, and the types of services provided by each settlement (Cristaller 1933 in King 1984; King 1984, Hodder and Orton 1976). The hexagonal pattern is the most efficient form of site placement, but in reality this ideal pattern rarely develops. In short, the largest settlement (the central place) is surrounded by smaller settlements in a hexagonal fashion, which in turn has embedded hexagonal

distributions of still smaller sites surrounding the mid-level settlements. Each level of central place provides certain services to outlying nodes, in addition to acting as receiving stations for incoming goods. The size of the catchment area or tributary systems depends on the level reached by the central places (King 1984).

The important point is that settlement patterns should show some regularity in site size hierarchies and placement, and with variable site functions, including a centrally located main village that serves as the focal point for commerce, religion, government, and large-scale social interactions, and smaller sites surrounding it that lack one or more of these functions (Hodder and Orton 1976). The fact that the ideal pattern does not fully develop indicates that other factors influencing site distributions are at work and may include such variables as geographical constraints; differing levels of trade; interaction and inter-dependence among trading groups; and varying scales of trading networks. For example, when the local environment is basically linear, as in coastal zones or river valleys, a more linear geometrical site arrangement may form (Stark and Young 1981). Additionally, a region that suffers from chronic low-level warfare and conflict may never fully develop trading networks or optimum site placements (Carneiro 1994), and settlements may show a pattern of defense instead (Haas and Creamer 1993; LeBlanc 1999).

As with optimal foraging theory, the main goal of site placement analysis is to model an idealized scenario that may explain a good deal of the patterns observed, but which also allows for the identification and study of variation. The economic version of central place theory is such a situation. The idealized hexagonal pattern of site hierarchy and distribution may never be realized in the real world, but it does provide a baseline

from which deviations can be explored and potential explanations offered for site size distributions.

Catchment Analysis, Land Use Issues, and the Southwest

Site catchment analysis was first formulated and introduced in the early 1970s by Higgs and Vita-Finzi in several articles that combined aspects of cultural ecology, optimization strategy, and ethnoarchaeology (Higgs and Vita-Finzi 1972; Vita-Finzi and Higgs 1970). Their basic argument was that, all else being equal, a group will locate a base camp (hunters and gatherers) or a village (agriculturalists) in a central spot in the environment in order to maximize exploitation of various resources while minimizing costs (e.g., travel, harvesting, processing, and transportation). Site location correlated with the primary subsistence strategy should show that resource zones and settlements are linked for these reasons. Calculating costs associated with the exploitation of various resources are accomplished by examining catchment areas surrounding the site at varying radii from its center. The radii are based on ethnographic data that document the various distances people will travel for certain resources, assuming that all travel is done by foot. They argue that this method can also be used to determine the possible function of a habitation site. For example, if a site is located in close proximity to good, arable land and reasonably close to pasture land, but far from forests (hunting areas), then the occupants of the site should be primarily agro-pastoralists who rely little on hunting. Any number of configurations with relation to resource zones can be envisioned.

Radii from the central place were determined by calculating the average distances farmers traveled to reach their fields, and the average that hunters and gatherers traveled in pursuit of various plant and animal resources. The costs of procuring different

resources vary in response to real or perceived needs, making a high cost resource (perhaps in travel time) acceptable in certain situations, and thus the result is varying radii. The distances used for hunters and gatherers were based on data derived from studies of the !Kung people of southwestern Africa (Lee 1968), who typically traveled more than 5 km daily in search of food. For sedentary, agricultural groups, distances traveled were derived from groups living in rural England, who generally did not travel more than 3–4 km to their most distant fields (Chisholm 1968). The difference in distances traveled based on subsistence and mobility patterns is used to draw catchment circles around the primary habitation site in order to see if changes in expected resource type occur as modeled. This approach may demonstrate that other factors are also involved that influenced catchment area chosen, including engaging in multiple resource tasks (farmers who also travel longer distances to hunt) or in response to trade patterns (hunters and gatherers traveling long distances to reach a preferred trading partner; Lee 1968). The goal of catchment analysis is to determine why a particular habitation site is located where it is, and documenting the decisions made to choose that spot to achieve a measure of optimality in terms of actual and, on the part of archaeologists, suspected subsistence activities (Kintigh 1985).

Dennel (1980) has offered a critique of site catchment analysis that brings to light several flaws of analysis and assumptions. First, he suggests that subsistence patterns at the site should be investigated first or in conjunction with site catchment analysis before assigning a specific subsistence strategy for its inhabitants. This sort of site interpretation is made more difficult when no excavations are undertaken. A subsistence strategy cannot be fully determined by strictly looking at the types and distributions of resources

in the area without other lines of evidence, particularly excavated faunal and macrobotanical data. He argues that this approach can only suggest possible subsistence strategies without the benefit of excavated data. In addition, a site may be located at a particular place on the landscape for non-subsistence reasons, perhaps for trade, convenience when traveling from point A to point B, or ritual reasons.

He also questions the validity of the distances used for the radii by stating that even Chisholm noted that some farmers traveled up to 10 or more km to their fields (Dennell 1980). However, this situation appears to be rare and is likely influenced by the automobile (Chisholm 1968). Dennell also argues that the use of the !Kung San as a hunter-gatherer example is misplaced because they are better characterized as a fairly sedentary collector/agricultural society, if one considers harvesting the ubiquitious mongongo nuts a form of cultivation and occupation of base villages lasting longer than several months as sedentary behavior. Lastly, Dennell questions the use of the modern landscape and current biotic distributions to map out ancient (or even more recent) distributions of resources. Modern activities have severely altered the landscape in many areas, and the way it is used and occupied today may not accurately portray its ancient characteristics. Resource maps would be better built from soil types, topographic features, and paleoenvironmental studies (e.g., Dennell and Webley 1975; Webley 1972).

Despite these problems, catchment analysis still provides a useful framework for understanding subsistence variables, and settlement and social patterns for ancient people (Kintigh 1985). For example, Watanabe (1977) investigates both resource distributions and human settlement and social patterns for the Ainu of northern Japan. Although this study is not explicitly site catchment, it could have been easily designed that way. He

notes that the Ainu settled along rivers, not because of farming, but because of their dependence of fishing, but only during part of the year. The sites were also strategically located to take advantage of nearby winter hunting grounds, during which time the group breaks up into special task or labor units, some of whom remain at the site (sedentary), while the others temporarily become more mobile. He notes that these "human-resource systems" take advantage of centrally locating their sites with regard to primary resources, but with secondary pursuits in mind.

Others have used site catchment analysis in Spain (Francis and Clark 1980), in pre- and post-Roman England (Green 1980), in the bootheel of southern New Mexico (Findlow 1978), and in the Zuni area (Kintigh 1985) to better understand ancient land use and settlement patterns, and in China to study the relationship between site catchment and endogamy (Adams and Kasakoff 1976). These researchers focused on soil type distributions and topography, in addition to modern biotic resource distributions, to map site location and potential resource distribution, including arable land and optimum farming techniques. Their findings that many sites were optimally placed for specific resource extraction or activities (e.g., farming, herding, or coastal) have more robustness than other research that only mapped modern biotic zones. However, either approach can be made stronger when used with excavation data. Because site catchment analysis can be a useful tool for archaeologists wishing to examine resource distribution (including agricultural land) and settlement location, its utility for research in the Southwest may be particularly suitable because this region contains a diversity of topographic, resource, and environmental zones (Hastorf 1980).

The use of site catchment analysis for elucidating potential subsistence patterns is

a common approach, but I argue that it can also be used as one of many tools for determining if territoriality and possible land tenure is also exhibited in settlement location. For example, if land tenure was present in an agricultural society, and a marginalized segment of the society was excluded from land holdings, it would be expected that one option for these people would be to move into underutilized or unclaimed territory. If the new habitation site is located in a prime spot in relation to nearby available resources, including arable land, then the most basic use of site catchment is applicable. However, if the site itself is surrounded by variously sized satellite sites that are shown to be optimally located themselves, it then stands to reason that the settlement pattern is exhibiting signs of resource/territory control. For example, ethnographic data has shown that one common form of demonstrating land tenure in subsistence level societies is to build on all land holdings followed by permanent or periodic occupation ("use it or lose it"). The presence of built structures in peripheral areas demonstrates use and possibly land ownership, but the presence of community systems more clearly demonstrates the intent to permanently occupy an area by a specific group of people. In this case, catchment analysis can be used for both modeling the relationship between resources, subsistence strategies, and settlement and for elucidating potential social patterns as well.

Ethnographic Case Examples of Land Tenure and Agriculturally Peripheral Land Colonization

This section discusses in detail several ethnographic examples showing how subsistence and/or low-level market farming societies come to settle and use peripheral

areas, with a focus on population density stress and land tenure practices. These examples demonstrate how sub-segments of a population are more or less "forced" into marginal areas if they choose to remain part of the larger social group. This commonly arises as a result of limited amounts of arable land in prime agricultural areas, the development of land tenure systems in these areas to control land through inheritance, and decisions made by the peripheral area colonists on the best way to make a living in the face of limited choices. As we will see, in some instances, these decisions are potentially detrimental to the lives of the colonists, but if successful, can result in the establishment of new villages and land claims. These examples demonstrate some of the expectations generated from cultural ecological theory but also demonstrate some of the social aspects of peripheral land colonization and use. The observations made from the ethnographic examples, in conjunction with the preceding discussions of various theoretical and methodological approaches, will be used to formulate a model for understanding how and why peripheral areas come to be permanently colonized, and how land tenure practices are exhibited in settlement pattern and architectural data. This model is then tested in later chapters using a well-studied subsistence level farming society in the prehistoric Southwest.

As discussed previously, under conditions of increasing population pressure coupled with limited arable land and water, several potential responses are available from which to choose. Minnis (1985a) outlined several potential responses to increase food production and relieve social stresses in order of risk, reversibility, and levels of group inclusiveness (discussed more fully below). To these, I have added several additional potential responses, including violence and land tenure. These two social processes have been underutilized as potential responses in past research efforts in favor of cooperation,

hoarding, and mobility as responses for dealing with population and food imbalances (e.g., Minnis 1985a; Tainter and Tainter 1996). However, warfare and land tenure have gained renewed interest in anthropology, especially for the archaeology of the North American Southwest (e.g., Adler 1996; Haas and Creamer 1993; Kohler 1992; LeBlanc 1999). In fact, after less risky attempts are made to increase food production but fail (*sensu* Minnis 1985a), optimization theory suggests that attempts should be made to control access to critical, preferred, and valuable resources, whether on a family/kin or larger corporate group level. In a sense, this is cooperative behavior, but not necessarily on a community-wide level of integration and participation, as it may exclude various members of society. This is a common response in the ethnographic literature; in fact, peripheral areas were often settled by migrant farmers after the process of land tenure and exclusion from prime resources had begun in prime settlement areas.

Minnis (1985a) indicates use of marginal areas for supplemental agricultural production is one potential choice to deal with food stress, but clearly in an egalitarian, communal way (for the benefit of society). When this strategy fails, then more drastic social measures may ensue, but again, Minnis indicates that the more drastic step likely chosen is the dissolution of the entire social group. Again, this seems a reasonable assumption when the society is viewed as egalitarian and communal, and the idea of private ownership and "classes" within a society is abhorrent. This dissertation asks, What if these ancient groups were less egalitarian and less cooperative than generally thought? If they were, then more seemingly unpleasant social responses might be chosen, including land tenure and exclusion, and/or violence and warfare. The ethnographic examples presented below illustrate these responses and discuss the social and

demographic factors that fostered land ownership and the creation of marginalized, landless groups within the larger society.

The Nahua (Aztec) of Amatlán Village, Veracruz, Mexico

Sandstrom (1991) conducted a detailed, multiyear ethnographic study of a Nahua group in Veracruz, Mexico, undertaken in the 1970s (with several later visits), and was published in 1991. The focus of that study was Nahua ethnic identity and cultural survival in the face of 500 years of conquest and assimilation attempts by the Aztec empire, the Spanish, and the Mexicans. As a result, Sandstrom's study focused not only on subsistence, settlement, and material culture patterns, but on social relations within the village, with neighboring *Mestizos* (persons of Hispanic-Indian mixed blood), and with the encompassing state and federal governments. This study also includes descriptions of land tenure practices and the process of marginalization. It is interesting to note that several layers of marginalization and peripheral area colonization are evident: one involves relations between the large ranch-owning *Mestizos* and the Nahua villages, while another is within Nahua society that continually threatens to split the villages (and society) apart. These intriguing patterns are discussed below.

The study village of Amatlán is located in the low elevation, humid, and hilly flanks of the Sierra Madre Oriental and is roughly between this mountain chain and the Gulf of Mexico in the Mexican state of Veracruz. The environment is generally lush, with several small rivers and streams draining the mountains (Sandstrom 1991:55–59). However, distinct variation in yearly rainfall patterns, vegetation cover, and soil conditions has lead to three quality gradations of arable land identified by the Nahua:

1) *atlali* ("flat earth" or "muddy place"): found along the banks of rivers and streams, excellent for farming;
2) *cuatlali* ("hilly earth" or "forest earth"): the major soil type in the village area and generally good for slash and burn cultivation but not for large-scale agriculture; and
3) *tepetlatl* ("stone mat"): rocky soil found on some hillsides that is very poor for cultivation (Sandstrom 1991:57–58).

Perhaps not surprisingly, the *Mestizos* own the best land along the rivers, and these areas are no longer available to the Nahua, who have retreated to the hilly areas between the rivers and the mountains (Sandstrom 1991:62).

The Nahua can be considered intensive horticulturalists, which given their current homeland is likely the best approach to farming the easily damaged subtropical forest soils. They practice swidden (slash and burn) agriculture, but within a carefully demarcated area per household. Many fields are often left fallow to regenerate, but the Nahua must be careful not to leave these fields out of production for long as they may be usurped by others or taken away by the federal government and given to someone else (Sandstrom 1991:90). Maize is their primary staple crop, but they also plant beans, squash, melons, onions, tomatoes, chilis, and peanuts (Sandstrom 1991:132–134). They supplement their diet with occasional fish, fowl, chicken, pork, eggs, and other food items either directly procured (e.g., amaranth) or obtained from outside markets. The Nahua also participate to a degree in the local and national economy, often producing excess maize to sell or trade; they pay close attention to cycles of market crop prices. Many villagers also engage in wage labor outside of their homeland for a variety of

reasons, including poor harvests, lack of available land for farming, and as supplemental income (Sandstrom 1991). Basic public and utility services are almost non-existent, with few having direct access to phones, electricity, and indoor plumbing and sanitation in the village.

The history of conflict and colonization in the area containing the Nahua villages, including Amatlán, has shaped the observed social, economic, and subsistence patterns. The constant struggles for land and livelihood over the centuries often erupts into violence in Nahua society, usually over land. Although they once farmed along the main rivers (the atlali), the *encomienda* (working ranch) system instituted by the Spanish for Hispanic conquistadors and patrons removed the Nahua from their previous homelands and effectively turned them into slaves of the ranch owner. Reforms enacted after the Mexican revolution in 1832 released the Nahua from near-slavery status. However, the *Mestizos*, the descendants of the Spanish conquerors and colonizers, retained the *encomienda* system. Without the ability to take back their riverine homelands, the Nahua retreated to the more agriculturally peripheral areas, the hilly flanks of the Sierra Madre Oriental (the *cuatlali*). In time, a number of villages were established, but these became surrounded by additional *Mestizo* ranches and land holdings, further limiting where the Nahua could farm and hunt and gather natural resources (Sandstrom 1991:62).

As a result of this historical process, a complex form of land tenure and social relations developed within Nahua society that grew out of the land ownership and tenure practices of the larger Mexican society. The reformed land laws and patterns of inheritance attempted to regulate access to farmland and control its distribution among the villagers. Later land reforms by the Mexican government guaranteed certain numbers

of hectares (7 to 8) per head of household per recognized village, provided the land was kept in use (Sandstrom 1991:89).

The total amount of land available to a village developed into the *ejido* (land allotment) land tenure system still in practice today. If a Nahua village is recognized by the federal government, a census is taken of the male heads of households, and the number of hectares allotted to the village is calculated. The village of Amatlán was eventually given 400 ha of *cuatlali* to be divided among the recognized male heads of households taken during a previous census. However, as this process often takes years to finalize, the number of households can change, leading to imbalances between available land and the number of households.

Additional imbalances arise when family land is inherited, which in Nahua society has evolved into a system of primogeniture (inheritance of the property by the eldest son) by necessity given the limited land available to each established family (Sandstrom 1991:174). This situation leaves many other sons without land, with little prospect of acquiring land through acceptable social and legal measures (Sandstrom 1991:173–178). In essence, a landless and marginalized class of villagers (the *vecinos*) formed as a result of population growth in a situation of limited land that has already been claimed. In order for a *vecino* to stay in the village, he can attempt to become the "eldest son" through violence or can marry a widow who has no children but does have a land claim (Sandstrom 1991:174–176). Alternatively, he can attempt to colonize a remote and unused area of land, either singly or in conjunction with other *vecinos* (Sandstrom 1991:89). Areas beyond the margins of existing Nahua villages, usually on the margins of *Mestizo* ranches, are cleared and planted. If the ranchers do not object, houses are built

and other *vecinos* and their families move to the new "village." If after several years the ranchers still have not objected, the new villagers petition the federal government for the creation of a new *ejido*, which is either granted (thereby the rancher loses some of his property), or they are forcefully and often violently ejected (Sandstrom 1991:77).

Because the original village may be implicated and lose valuable hectares of land as a result, daughter villages that have budded off are often at odds with the mother village, which often escalates into violence. As a result, empty zones ("no man's land") often develop between communities (Sandstrom 1991:77). In addition, if the Mestizo rancher objects to the encroachment prior to petitioning, he can also forcefully evict the settlers through the use of hired mercenaries. Bloodshed is often a common outcome of the attempts by the Nahua *vecinos* to colonize new territory along the peripheries of the riverine ranches and existing Nahua villages, but this has become an acceptable risk in the face of untenable conditions of village overpopulation and lack of untenured, potentially arable land.

This study demonstrates the social, economic, and demographic conditions that can lead to the development of land tenure and fracturing of established villages into daughter villages, sometimes peacefully but often not. The overarching physical constraints leading to this development include limited arable land, rising population densities in villages, and the boundedness of the social group (inability to resort to a more mobile settlement and subsistence pattern). In the face of these perceived and actual intolerable conditions, the landless poor (the *vecinos*) are faced with many difficult decisions if they want to remain a part of the society. Intensification of resource extraction and seeking the goodwill of others do not seem to be available choices in this

situation at this stage, perhaps due to existing social conditions. The choices available to the *vecinos* include migration out of their homeland to engage in wage labor for the Mestizos and/or larger Mexican society, thus abandoning much of their cultural identity and sense of place. Or, they can attempt to settle new lands along the margins of existing land holdings in the face of often hostile opposition from various sources. The latter is a choice often made in order to remain within the society and keep in place established family and social ties.

It is important to note that if the colonists are not immediately evicted, they quickly begin to build new villages and petition for legal land rights. That is, they begin the process of replicating the land tenure process in new areas to protect themselves and for building a work force large enough to cope with establishing virgin farm plots. Because of existing land claims, these new villages are often in marginal zones not currently in use by either the established home village or the *Mestizo* ranchers.

A secondary point is that the desire to continue as a working social group appears to be tenacious, and that subsets of the social group will endure hardships and resort to often extreme measures to ensure the continuance of their way of life, or some measure of it. In order for a society to completely disintegrate as an option, it must be under a tremendous amount of unmanageable stress. Some of the scenarios developed for the complete disappearance of "cultural" groups under conditions of moderate drought or population stress observed in the archaeological record appear to be somewhat simplistic in this light. The fact, however, that many groups did "disappear" from the archaeological suggests that other factors not currently described or understood beyond environmental and population variables also contributed to the break up of these groups. As an example

of the tenacity to remain an identifiable cultural group in the face of hardships, I now turn to the next ethnographic example from the American Southwest.

The Hopi and Tewa of the North American Southwest

This case study focuses on the Hopi reservation in northeastern Arizona, but supporting statements and examples are also taken from Cochiti Pueblo along the Rio Grande in northern New Mexico. The Hopi pueblos (villages) are primarily located along the southern extremes of three projecting finger ridges of a huge land mass known as Black Mesa (Brew 1979; Connelly 1979). Currently, there are 10 principal Hopi pueblos spread out over First, Second, and Third Mesas, with small subsidiary settlements in the lowlands below the mesas and along ephemeral streams, including Jeddito and Keams Canyon washes. An eleventh village, Hano, is a Tewa-speaking community of migrants from the Rio Grande Valley and is located on First Mesa (Dozier 1966).

The Hopi homeland is situated along the western edge of the uplifted Colorado Plateau and is characterized by high, rocky mesas and deeply incised canyons (Thornberry 1965:405–441). Forested regions are restricted to the northern portion of Black Mesa and the mountain ranges on the larger Navajo Reservation that surrounds the Hopi (e.g., San Francisco peaks to the west, Chuska Mountains to the east, and the Mogollon Rim country to the south) (Bradfield 1971; Brew 1979). Summers are hot and dry, with summer monsoon rain falling in July through September, while winters can be bitterly cold with variable amounts of snow. The nearest permanent stream (Little Colorado River) is roughly 60 miles to the south, but the southerly tilted Black Mesa feeds numerous springs in the vicinity of the Hopi villages. As a result of the general lack

of water, vegetation is sparse and large-scale agriculture is impossible. However, the Hopi have successfully resorted to various dry-farming techniques, including limited irrigation below springs, sand dune farming, and floodwater fields (Brew 1979; Hack 1942:19–38). However, given the particularities of the Hopi homeland, crops generally do well and have provided for the Hopi for over 1,000 years.

As a result of the limited areas of arable soil, water, and the labor force necessary to prepare, plant, and harvest the numerous disconnected farm plots, a communal-family system of land tenure has developed. Basically, demarcated areas and springs belong to various villages, with the land further subdivided into parcels assigned to various matrilineal clans (Kennard 1979). These plots are usually marked in the field by boulders (boundary stones) set up at its corners and marked with the clan symbol. Within the clan allotment, the land is again subdivided for use and given to the women of each household (Kennard 1979). A household's land holdings are usually disconnected and spread over various landforms to ensure that not all fields will fail in any given year. These parcels generally stay within the family and are inherited by the women. Given that many of the Hopi villages have been in the same place for well over 500 years, most, if not all, of the best land and water sources on southern Black Mesa have been claimed.

However, Kennard (1979:555) reports that a man has the opportunity to establish his own land holdings, provided that they are beyond the limits of the established fields and that he must continually cultivate them. If he fails to do so, he will likely lose the land to the village or other usurpers. More recently with the availability of motor vehicle transport, some distant farm plots are on the order of 20 to 30 miles (32 to 48 km) south of the Hopi mesas. As a result of this process, coupled with other factors, including

periods of arroyo downcutting, drought, and large-scale crop failures on established landholdings, new villages may develop in these distant areas. For example, Moenkopi became established on Moenkopi Wash as a result of large-scale crop failures nearer to the Hopi mesas; this "new" town is located 40 miles to the northwest of Oraibi, one of the oldest Hopi villages (Kennard 1979:555). However, this represents a somewhat extreme example of distance, as most new Hopi settlements occur within a 10 to 15 mile (16 to 24 km) radius of the three mesas.

The Hopi also demonstrate another method of village fission and the establishment of new "daughter" villages away from the parent village. New villages are often created to relieve overcrowding at the mother village or to release tensions and hostilities that arise between rival clans (Connelly 1979). Connelly (1979:542) reports that a "mother" village retains colonial-like relationships with its "satellites," but all form mutualistic bonds and provide various services (e.g., additional work force, defense). Factionalism is another process that often splits communities and leads to the formation of new villages away from the "mother" village. For example, in the late 1800s, Oraibi became divided between the "Friendlies" (those in favor of increased contacts with the Anglo population) and the "Hostiles" (those who wanted less contact) (Dockstadter 1979). Finally, in 1906, the village split, with the Hostiles leaving Oraibi after losing a physical battle with the Friendlies and moving seven miles (11 km) to the northwest edge of Third Mesa and founded the village of Hotevilla. A smaller village, Bacabi, was built the following year near Hotevilla, while a smaller satellite of Oraibi (New Oraibi) was built along the wash below that town. This type of conflict does not appear to be a recent phenomenon among the Hopi, as the ancient town of Awatovi east of First Mesa was

destroyed in 1700 for permitting Spanish missionaries back in their village after the Pueblo revolt of 1680 (Brew 1979:522).

An example of the general antiquity of the practice of Hopi village land holding and tenure practices is found in the story of Hano, a village built by Tewa-speaking immigrants from the upper Rio Grande Valley (Dozier 1966). Upon the Pueblo reconquest by the Spanish in 1692, a group of Tewa Indians fled to the Hopi country instead of resubmitting to the Spanish. The Tewa migration tradition holds that they were invited by the Hopi, who wished to have the Tewa protect their villages from Spanish and Ute incursions. In return, they were promised a village site, good springs, and good farmland to plant their crops. However, upon their arrival at First Mesa, the Tewa were at first not permitted to build a village, nor were they given farmland. Eventually, after successfully fighting off the Hopi enemies (as traditionally told by the Tewa), they were finally given land on First Mesa for their village (Hano, or Tewa Village) and access to springs and farmland, but only poorer locations initially (Dozier 1966:1, 25–26). As Dozier (1966:25) states:

> "The strain on the land resource is another factor that would have placed the incoming Tewa in an unfavorable position. Garden plots had to be found near the mesas because of the constant threat of enemy raids. Good arable land was undoubtedly already appropriated, yet the Tewa had to be accommodated. It is not surprising that antagonisms developed between the two groups."

The antagonisms eventually subsided, and for the most part the Hopi and Tewa are culturally indistinguishable, but the Tewa sense of identity distinct from that of Hopi remains in evidence. It is unknown what the Tewa land tenure practices were prior to

their migration, but now they are identical to those of the Hopi.

Although examples of land tenure/population stress and internal conflict leading to new village creation are found in the Hopi study, this may not be the case among all the Pueblo groups in the Southwest. The presence and/or level of conflict in the historic and ancient pueblos is currently a contentious issue among anthropologists and Indian groups, but it is likely that some form of conflict and alliance manipulation was a common thread among them. However, in the case of Cochiti Pueblo in northern New Mexico, we find another example of the presence of well-established land tenure systems in place in an otherwise "egalitiarian" society.

Cochiti Pueblo today is primarily made up of one large village that is surrounded by fields along the banks of the Rio Grande (Lange 1959). But, apparently in the recent past, other smaller villages existed, and within them "there is a small amount of unassigned farming land which can be given to landless families, but this is not the rule" (Aberle [1948] in Lange 1959:103). In addition, Lange (1959:77) mentions a historical 1782 reference made to Cochiti settlers in the Cañada drainage eight miles (13.5 km) northwest of Cochiti Pueblo who were suffering from famine. The cause of the famine is described as environmental, but why there were settlers in the Cañada drainage is not discussed.

As at Hopi, land tenure is practiced at Cochiti Pueblo. Farmland is inherited through the family and is generally divided among all children (Lange 1959:40–42). Alternatively, land can be purchased or traded, homesteaded, or petitioned for use (Lange 1959:41–42). The latter two alternatives are similar to the Nahua example. For potential homesteaders, permission is sought from the pueblo governor to clear an unused portion

of land, but this land is usually only suitable for dry-land farming, as the best land along the river and its canals is already apportioned. Suitable areas for dry-land farming include the hills, arroyos, and tributaries above Cochiti Pueblo. However, if a piece of owned property (presumably anywhere on the reservation) is not in use, a person can petition to acquire it and put it into production. If granted, the land becomes part of that family's land holdings and can be later inherited, provided that it remains in use. Apparently, idle land is fair game for usurpers, but available land/population stress at Cochiti Pueblo does not appear to be as critical as seen in the Nahua and Hopi examples.

As can be seen from the Hopi and Cochiti examples, land tenure is found at several levels of social inclusion. Although Pueblo groups have been described as egalitarian, it is clear that when critical resources (arable land, water) are involved, a system of access control and inheritance (land tenure) develops. These systems are managed at various levels (village, clan, household, individual), and the regulations governing them can be complicated. It is also clear that if a landless person or family is denied access to prime resource areas, they have the ability to establish new land holdings beyond the established borders of current land holdings. It has also been shown that in many instances villages will develop in these peripheral areas, either from the growth of small farmsteads on the periphery or from internal factionalism and strife, as seen with the Oraibi example. In essence, the peripheral areas act as safety valves for releasing demographic, environmental, and social pressures that might otherwise severely damage the very fabric of Pueblo society. A third ethnographic example reinforces these observations.

The Egyptian Fellahin

In the Egyptian language, the pluralized term "*fellahin*" (*fellah*) translates roughly into "peasants" (Ayrout 1963). Although much has been written about ancient Egypt, far fewer studies of recent historic to modern Egyptian peasants have been undertaken. An important study was originally written in 1938, and reprinted with an update in 1963 (Ayrout 1963). The study focuses on rural peasants of Egypt, which in the 1930s constituted the majority of Egyptian society. Modern Egypt is becoming more urbanized with its burgeoning population but remains largely rural; however, clearly the *fellahin* are part of a larger nation and are affected by the larger society, economy, and government. Although twentieth century Egypt cannot be classified as a subsistence-level farming society, the fact remains that much of its rural *fellahin* population still lives a hand-to-mouth existence, despite decades of attempts at land reform and modernization into a capitalistic economy (Ayrout 1963:1–11). Because arable land in Egypt is largely confined to the narrow Nile River Valley and several large oases in the Libyan Desert, this precious resource has been divided and controlled for literally thousands of years (Ayrout 1963:7–11; Hassan 1994). As might be expected, the *fellahin* as a social class have been marginalized since pharaonic times; thus, population stress, limited resources, and land tenure practices play a major role in their lives.

The Nile, a northward flowing river arising in the lakes and mountains of northeastern Africa, brings life to an otherwise harsh and barren landscape (Ayrout 1963:7–11; Hassan 1994). A linear strip of vegetation and farmland stretches for almost 700 miles in Egypt, lying between the great expanse of the Saharan (Libyan) Desert to the west and the Eastern Desert towards the Red Sea. In predynastic Egypt (before about

3100 B.C.), the Nile Valley was first occupied by groups of semi-nomadic hunters and gatherers who exploited the then richer environment of the Sahara, and they were followed by pastoralists and horticulturalists as the surrounding environment became progressively drier (Spencer 1993). Eventually, a great agricultural society arose in the valley, forming one of the first great civilizations in the world (Spencer 1993; Wenke 1999). Tremendous agricultural surpluses were generated from the rich Nile alluvium, aided by yearly inundations and an extensive system of canals that pushed the boundaries of arable land literally to the doorstep of the desert. As Ayrout (1963:10) states, "quite abruptly, the desert starts exactly where the Nile water does not reach the soil." However, cultivating the valley margins always represented the riskiest strategy for the *fellahin*, as lower than normal flood levels would leave the outermost canals dry, and the vicious desert winds blowing from the west could bury exposed fields under huge new sand drifts (Hassan 1994:162–164).

As a result of the potential wealth of the black earth (*kemet* in ancient Egyptian), most of the land was eventually controlled by the government, religious institutions, and the wealthy, leaving the poorer classes of society with small tracts of land (Ayrout 1963). The *fellahin* were often left with no land or the most marginal of lands and were often forced into renting land, selling their labor, or migrating into the cities. A large, landless subclass within the overarching society resulted, beginning roughly with the Roman occupation and continuing to the present day. Conditions have worsened with the exploding population boom of the twentieth century (Hassan 1994). Land is at such a premium because of its limited quantity, and because the largest cities keep expanding ever outward (e.g., Cairo), that peasant villages are often located along the margins of the

desert, or if located in the valley, are restricted from expanding outward by law (Ayrout 1963:87–90). Villages are built upward as much as possible, often on top of the ruins of previous villages, creating mounds (*tells*) that often date back to pharaonic times. Similar laws apply to living areas/hamlets (*izbas*) of workers associated with large, privately owned estates. Sometimes these hamlets grow into full-sized villages, but in rural areas, this growth is carefully monitored and checked when necessary so as not to destroy any amount of cultivated land (Ayrout 1963:18). This creates another process where new villages are established along the desert margins, but which also serves to increase transportation and distance costs for the workers. However, because new village expansion into rocky areas and along the desert margins is not regulated by law, new hamlets often grow into large villages. This process is also seen in pharaonic times, where worker villages, such as Deir el Medina adjacent to the Valley of the Kings and the worker's quarters at Akhetaten (Tell el Amarna) were established along the desert margins (Lacovara 1999; Reeves and Wilkinson 1996).

In the twentieth century, the Egyptian government has tried various land reforms and resettlement programs to deal with the desperate and landless poor (Ayrout 1963:25–28). Laws were enacted to try to protect the small peasant land holdings from seizure, and some large estates were broken up and put for sale to the *fellahin*. However, as the *fellahin* often lacked the capital for land purchases, and banks are often unwilling to lend money to the extremely poor, these reforms have met with varying degrees of success. The government also attempted to establish new towns deeper into the desert, coupled with extensive irrigation public works (primarily pumping ground water), but this was only moderately successful (Ayrout 1963:25). It should be noted that in more recent

times, the Egyptian government is again building new residential and commercial districts in the deserts, along with better funded and executed irrigation projects, in order to deal with tremendous modern population growth (over 60 million) (Hassan 1994).

Land tenure practices involving the *fellahin* have resulted in several important trends. First, the long established land claims by others with more wealth and power left little land for the *fellahin*. More recent land reforms have given land back to the *fellahin*, but the bulk of the best land is still under the control of others (Ayrout 1963:17, 154–155). Ayrout (1963:16) states that:

> "Official publications in the days of the monarchy [pre-1952] used to claim that Egypt was a country of small landowners. Two and a half million fellahin out of six million cultivators owned land, and the proportion sounded very good. However, less than 10 percent of these landowners owned two and a half feddans [unit of land size, roughly one acre], which is the average holding necessary to maintain a peasant family satisfactorily."

Exacerbating this problem is the system of inheritance among the *fellahin*, where the land was traditionally divided among the male children, thus reducing the size of one's land holdings even further (Ayrout 1963:16). However, similar to the situation of the Nahua, the limited available land usually went to the eldest son, leaving the remaining sons without land or livelihood. The remaining male siblings either worked for their brother on the inherited land, or they moved to the margins of the valley and attempted to purchase cheap land and make a go of it (or more recently, they migrate to the large cities and become urbanized poor).

As has been suggested for the ancient Hohokam people in the deserts of the

Phoenix Basin, those farmers at the end of the canal line are in the most precarious of positions unless mitigative measures are taken to protect access (Rice 1998). Throughout their history, the *fellahin* appear to have been at such a social disadvantage that it would have been difficult for them to take the necessary steps to protect their own interests. However, because of the exploding Egyptian population and the severely limited amount of good farmland, most of which is tied up in long-standing land claims and ownership, many are forced to accept the difficulties and costs of living along the margins of the highly productive farmland.

Discussion of Ethnographic Examples

As the preceding ethnographic examples demonstrate, several common factors that lead to colonization of peripheral areas and the subsequent development of new towns and villages are present in all cases. The two most important overriding variables for this research are population pressure and limited prime or good arable land. These two variables, when occurring in conjunction with each other, lead to a third variable: land ownership and the often-complex rules of land tenure and inheritance. Land ownership and the rules devised for retaining rights to it appears to develop first in prime areas, as should be expected. In cases where population has not put undue strain on the amount of land or water available, more relaxed and fluid forms of land use and ownership appear. This is seen in the case of Cochiti Pueblo, or the Raramuri of northwestern Mexico (Graham 1994), who apparently still have the ability for some degree of mobility and fluidity (but in both cases, land tenure is still practiced). However, when conditions change to the point where more restrictive land owning and tenure rules

are needed, a landless group often arises. As seen above, this "crisis" point can occur as the result of environmental and social problems, usually limited good arable land and water coupled with high population density, but can also result from forceful usurpation of land once held by others, and by larger-scale conflict. The landless group then puts additional strain and pressure on the existing land claims and resources.

It is at this point that the landless people are either pushed, or choose, to migrate to agriculturally peripheral areas, where they begin the land ownership process again. These areas tend to be more than a comfortable day's walking distance (greater than 4 to 5 km) from the mother village, and sometimes empty or "no-man's" zones open up between mother and peripheral settlement areas. In many cases, new villages arise that often mimic the older and sometimes larger home villages in the services they provide and the modes of living (activities, architectural styles, subsistence, etc.). The rights and rules associated with land ownership appear to be transferred to the newly colonized areas. The costs of colonizing new areas can be tremendous, even detrimental to one's health and well being (as seen in the Nahua case), but these costs become acceptable in the face of the alternatives. These alternatives include starvation, leaving the society for a new way of making a living, or potentially the dissolution of the social entity. With these conditions in mind, coupled with the expectations derived from cultural ecology and land tenure systems, a model can now be devised that sets boundaries, outlines potential causes and actions, and describes the results one should see on the ground for ancient societies.

A Model for Studying and Understanding Population Movement into Peripheral Areas

The previous theoretical and ethnographic discussions have provided a way to detect land tenure systems in ancient agricultural societies. The ethnographic examples outlined commonalities and patterns describing some of the social and environmental conditions under which land tenure systems operate, while the theoretical discussion provides a framework for interpreting the patterns observed in the archaeological record. The common variables identified in the ethnographic literature for the development and continuance of land tenure systems include:

1) Overpopulation of an area, or alternatively, population and resource imbalances arising from other causes;
2) Limited arable land and constraints on agricultural intensification;
3) An inability to expand land holdings in prime agricultural areas due to existing land claims;
4) The creation of a landless group within the society; and
5) The potential for conflict as stress and tensions rise.

We have also seen that when the choice is made by the landless to colonize agriculturally peripheral areas, certain patterns are found, including:

1) Establishment of a new village in a favorable location (as much as possible), usually over 4 to 5 km distant;
2) The institution of land tenure systems and ownership rights in colonized areas;
3) The development of additional satellite communities or special use sites

around the village; and

4) Often the creation of a "no-man's land" between the mother and daughter villages.

The attributes listed above provide the sets of expectations necessary to determine if conditions and patterns similar to these are found in the prehistoric record. Because of the problems inherent with ethnographic analogy (Wylie 1985), it is not expected that these conditions and outcomes will be exactly replicated prehistorically. However, they do provide a standard against which common occurrences and variations can be measured in order to detect land tenure systems in societies that have left no written record describing their activities and ways of doing things. What these societies have left behind are their settlements and material culture, from which a tremendous amount of information can be gleaned. Specifically for this study, estimated population densities can be calculated, chosen site locations can be investigated, settlement patterns can be deciphered, material culture can be studied, and local variable environmental conditions can be mapped. To be able to articulate these variables and create "middle-range" theory, models become very useful.

The Model

In order to detect land tenure, it is first imperative to understand cultural and social dynamics in prime areas. Based on the preceding discussions, for land tenure to develop, population and resource base imbalances should arise in prime agricultural areas, or at least the threat of imbalances should be present. As Minnis (1985a) has earlier modeled, a number of low-cost and reversible options should be tried first. However, if

the situation is not remedied, then people will take more drastic measures to protect their own well being; in this case, traditionally farmed land is privatized, whether at the village level or some smaller group level (corporate groups). This process allows the group to control access to the land, to harvest the fruits of their labor, and to pass along their rights to their heirs. Because of the conflict that appears to become more prevalent once this system is instituted, villages will become more regularly spaced and potential empty zones may open up between villages. A satellite system of smaller sites should spring up around the main village to function as both shelters and de facto ownership markers, which provides a physical presence at farm plots ("use it or lose it").

If the population continues to increase but the prime land cannot be increased to follow suit, additional stresses begin to build within the society. If this situation continues, a marginalized landless group within the society may develop, either from internal growth, changes in inheritance patterns (e.g., primogeniture), and in-migration. If this occurs, we should see the first signs of new village establishment in areas along the margins of established land claims, that is, in areas previously viewed as too agriculturally marginal for large-scale development. It is important to note that these patterns (stress in prime areas and peripheral village establishment) should not occur simultaneously, but should be sequential. That is, we should see a time lag, as the costs of establishing new villages and agricultural fields and devices in marginal areas can be expensive in many ways, and the impetus must be great enough to outweigh the costs.

Once a new village is established, most likely in a location that has the most favorable natural conditions available (in this case, arable land, potential water sources, and natural resources to supplement the lower expected crop yields), signs of land tenure

and ownership should develop. In this case, these signs should include the enlargement of the primary habitation site into a new village and the creation of satellite sites. The satellites may have multiple functions, but they should also serve to mark farm plots, especially if they are relatively close to the main village (that is, not at an inconvenient distance as might be expected). The "new" village itself should be established at least 4 to 5 km away from the mother village, if not further, and an "open" area may develop between them. These distances (greater than a comfortable day's walking distance) serve to separate groups who may have experienced some level of conflict. Although low-level conflict is difficult to detect archaeologically, the presence of an empty zone may be one such sign (LeBlanc 1999).

The development of peripheral communities thus serves several purposes. First, these interactive communities provide a stronger foundation upon which to claim land tenure and ownership. The ethnographic data show that, oftentimes, if you develop it, you stand a good chance of owning it (at least eventually). An ephemeral, short-term presence does not send a strong message of intent to stay in peripheral areas. Second, each site may contribute unique services to the overall community, such as differential resource extraction activities, depending upon location and catchment area. Third, the larger the settlement, the more workers are potentially available, and thus more effort can be expended to develop the land and resources. Fourth, the new village and peripheral area may offer a place of refuge for other landless and/or disaffected members of society, until the carrying capacity of the new settlement is approached or reached. The latter two points may also contribute to defensive posturing and protection, if needed. There are likely other potential benefits of such peripheral community systems as well.

Archaeological Measures

In order to operationalize the model, it is necessary to delineate what data are necessary from the archaeological record. This includes both survey and excavation data, and, oftentimes, specialized analytic data. First, an accurate, diachronic estimate of population change for a prime agricultural area must be generated. This can be accomplished primarily through large-scale survey and various methods for estimating population. Second, a study of the resources available and their abundance or presence/absence must be estimated. This can be done with soil survey maps, biotic maps or transects, weather and rainfall data, and catchment area analyses. Third, the carrying capacity of the land must be generated to see if the potential for imbalances or shortfalls of a critical resource(s) in relation to population is evident. Fourth, a settlement pattern analysis must be undertaken to detect evidence of community clusters, empty zones, and small structures located in areas that defy logic or common sense with regard to environmental factors. These small structures may be demarcating land parcels and may be located within the non-strenuous walking range of the main village.

Once these data are obtained for prime agricultural areas, a similar data set is required for areas on its periphery. The same steps may be undertaken, but more detailed analytic studies may become necessary to determine or estimate the range of possible functions of a site, duration of occupation, and critically, dating of the site. As the model indicates, all of the sites within a peripheral community should be contemporaneous and collectively date later than the onset of stresses in the prime area, and the large site should show evidence for being a multi-functional, permanent habitation. By studying sites of varying sizes, and presumably variable functions, it should be possible to discern

differences in site use, occupational intensity, and kinds of daily activities; all of these factors are essential for understanding interactive patterns within a community.

Across the Southwest, large sites are generally believed to be permanently occupied villages and towns within which a wide range of daily activities take place (Anyon and LeBlanc 1984; Judd 1925; Kidder 1924; Lowell 1991; Wills and Leonard 1994). In contrast, smaller sites are often thought to represent shorter-term occupations, with use ranging from as short as one or more seasons (Binford 1977; Greenwald 1993; Haury 1956b; Nelson et al. 1978) to possibly several decades (Montgomery 1994). The range of activities at smaller sites is more restricted as a function of duration and intensity of occupation and the nature of intended and actual site use (e.g., a seasonal hunting camp versus a farmstead) (Kent 1991).

These differences in site occupation and use should be archaeologically visible. For example, if many marginal area sites are functioning as short-term farmsteads in an overall strategy for increasing agricultural production for the benefit of prime area villages, then it is important to confirm that these sites are functioning as defined. However, if it can be demonstrated that at least some of the larger peripheral area villages are no different in terms of material culture, occupational intensity, and site use than large primary villages, then we might infer that these sites are more than just temporary or short term shelters.

Accurate dating of the sites is crucial; we must know which sites, and by extension, site types, are contemporaneous, and which are not. If all of the sites are contemporaneous, then we can generate statements that underscore the complexity of community-level social interactions and relationships (Adler 1996; Downum 1993; Fish

et al. 1992). If on the other hand, many of the sites are not contemporaneous, then the argument for land tenure is somewhat weakened, as the sites may have been used sequentially, indicating shorter-term special use activities and not full-time habitation. In addition, it must be shown that peripheral area sites date later than the onset of stresses in the primary areas in order for the model to accurately predict land tenure expansion. If the initial occupation of the primary site is coeval with "mother" village, then the argument for land tenure and associated social stresses are again weakened.

Ceramic analysis will be especially useful for evaluating site function, intensity of occupation, and site dating. It is generally believed that at short-term occupation sites, the frequency of pottery will be low within the overall artifact assemblage, and most of that pottery should be utilitarian, i.e., corrugated and plain wares which are primarily cooking and/or storage vessel types (Nelson et al. 1978). Sites that are permanently occupied should exhibit a wide range of ceramic types, including imported or exotic wares. Treasured, expensive, or heavy items should be left at the main habitation site to avoid accidental breakage or loss during the trip to distant farmsteads and field houses, if permanent occupancy of distant areas is not anticipated (Graham 1994:44–48).

Architecture is another important aspect of determining duration and intensity of occupation at habitation sites (Diehl and Gilman 1996). Ethnographic studies have demonstrated that the durability of structures co-varies with anticipated length of occupation and is reflected in the materials used for construction, the shape of the structure, and the presence/absence of certain types of features (Diehl 1992; Gilman 1987; Kent 1991). Specifically, sites that are occupied for short stays are often built from perishable materials (wood, brush, and skins), are round, and have few interior features,

such as hearths and burials. Sites that are occupied for longer periods of time, or on a permanent basis, are often built with sturdy and durable materials, such as adobe and rock, are more square to rectangular in form, and contain a higher number of interior features, such as hearths, storage pits, sleeping and work stations, and burials. In other words, sites are built to last or to be easily maintained when people expect to return frequently or to live there permanently.

It is also important to study subsistence activities in order to determine what people were consuming and in what frequencies. Faunal and floral analyses are more direct studies of actual subsistence, although investigating ground stone and tool assemblages is just as important. The presence or absence of ground stone, in addition to ground stone type, can inform us on what kinds of grinding activities were taking place. For example, large basin and trough metates, coupled with large or two-handed manos, strongly indicate processing of maize (Hard 1990; Hard et al. 1996a). On the other hand, smaller grinding implements may suggest processing other items, such as nuts and berries. Lithic tool assemblages can tell us if hunting was an important activity and whether hunters concentrated on large or small game (Nelson 1984). Alternatively, the lithic assemblage may indicate the processing of wild and domestic plant foods only (or some combination of all of the above). These data are important to determine (if possible) whether a site functioned as a specialized resource station or if it exhibits traits of a permanent agricultural village.

With the model and expectations in hand, it is now possible to investigate a prehistoric case study that is archaeologically well known, and one that is known to exhibit some of the patterns detailed above. Additionally, many of these required data

sets have been generated by previous researchers, while others have been generated specifically for this dissertation.

CHAPTER III

ENVIRONMENTAL BACKGROUND FOR SOUTHWESTERN NEW MEXICO

Southwestern New Mexico is topographically varied, ranging from rugged mountain terrain to wide river valleys to warm and dry low-lying deserts (Figure 3.1). Several peaks in the Gila Mountains Wilderness are over 10,000 ft (3,050 m) in elevation, supporting a dense forest cover at higher elevations and supplying runoff for the region's three main rivers: the Mimbres River draining the southern flanks of the Black Range and Pinos Altos mountains on the east side of the continental divide; the Gila River draining the Mogollon mountains on the west side of the continental divide; and the San Francisco River draining the northern flanks of the Mogollon and Blue mountains. The Mimbres River flows into the Deming Plain, which contains no outlet to the sea, and sinks into the desert sands. The Gila River flows across southern Arizona, eventually joining the Colorado River above the Gulf of California at Yuma; however, it is now a dry watercourse below Coolidge Dam in eastern Arizona (McNamee 1994). The San Francisco River flows across east-central Arizona, eventually joining the Gila River in southeastern Arizona. Because Pueblo period Mimbres use of the San Francisco River valley is sparse (other Ancestral Pueblo/Mogollon groups came to use this area after the Pithouse period), it will not be included in the discussion below.

Numerous creeks, semi-permanent streams, and ephemeral drainages discharge runoff into the Gila and Mimbres Rivers from the Mogollon highlands in southwestern New Mexico, while drainages on the east side of the Black Range drain into the Rio Grande (Beck and Haase 1969). Ponderosa pine forest cover thins at lower elevations

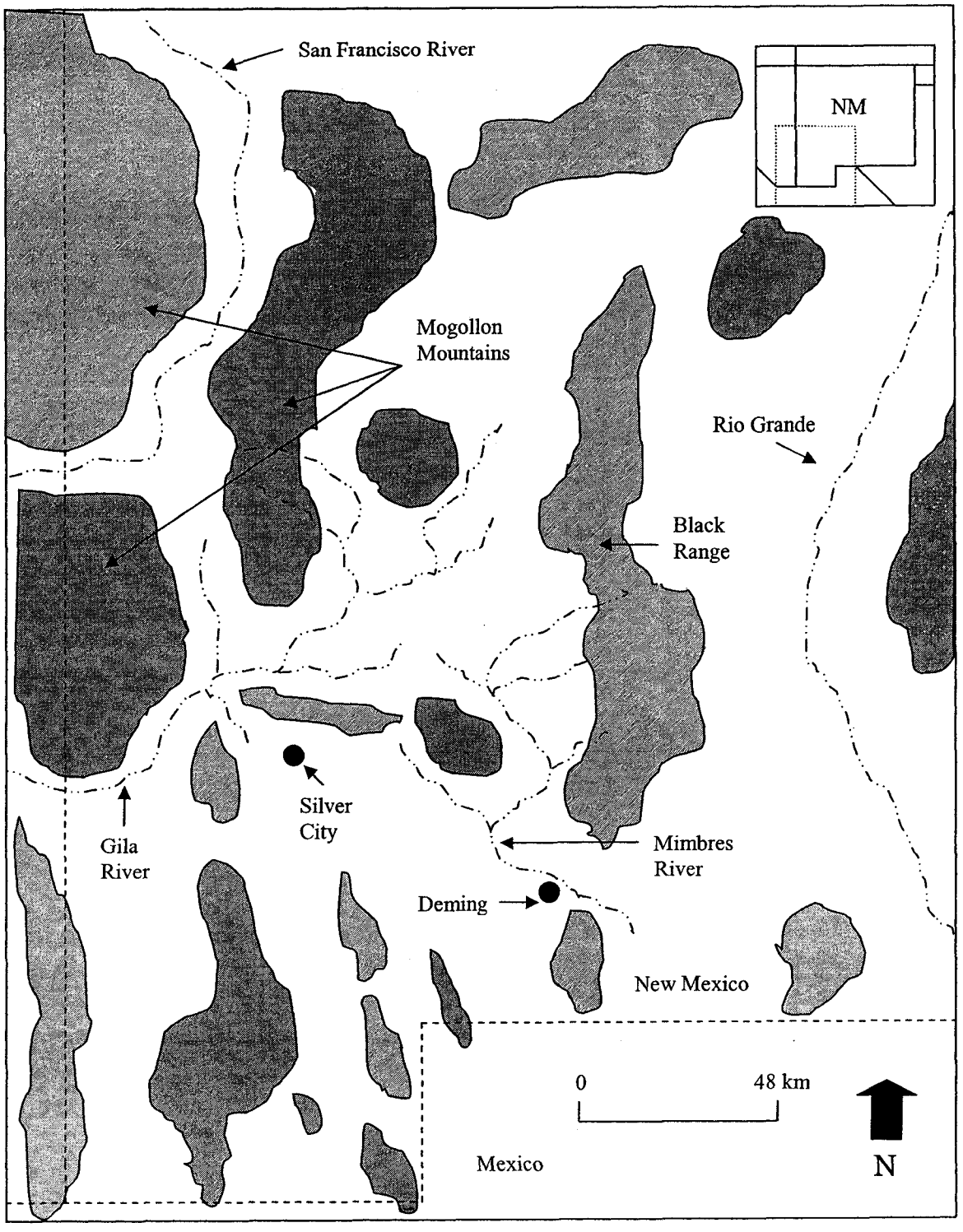

Figure 3.1. General overview of southwestern New Mexico in the North American Southwest.

(below 6,500 ft [1,981 m]) and is replaced by piñon-juniper woodlands at middle elevations (6,500 to 4,500 ft [1,981 to 1,372 m]), and by Chihuahuan scrublands in the deserts to the south and extensive grasslands to the north (Beck and Haase 1969; Brown 1994). The Rio Grande valley to the east forms a traditionally drawn boundary between the "southwestern" and "south-central" sections of New Mexico (LeBlanc and Whalen 1980). To the northwest lies the formidable Mogollon Rim and highlands of east-central Arizona; to the southwest the basin and range Sonoran Desert topography typical of southern Arizona; to the south and southeast the basin and range Chihuahuan desert scrub; and to the east the generally low-elevation mountain ranges of the Rocky Mountain orogeny on the east side of the Rio Grange (Kottlowski 1967).

Much of southwestern New Mexico is a volcanic province, formed during repeated volcanic and tectonic activity from the post-Cretaceous period, 230 million years ago (mya), to the recent past, about 1 mya (Elston 1965; Kottlowski 1967; Trauger 1965, 1972). Volcanic rock forms the backbone of most of the mountain ranges in the area, including the Black Range, Pinos Altos, Mogollons, and the Burros. In fact, the center of the mountain massif of the Gila Wilderness is thought to be the remains of a massive volcanic caldera that exploded several million years ago (Elson 1965), similar to the much better known Jemez Caldera of northern New Mexico. In addition to the granitic cores of the mountain ranges, extensive basalt and andesite lava flows cover much of the study area, although greatly eroded today. Cemented ash and tuff can be found in various outcrops, primarily west of the continental divide, and obsidian sources are found in the Mule Creek (west of the Mogollon Mountains) and Antelope Wells (Bootheel of New Mexico) areas. Although southwestern New Mexico is primarily a

volcanic province, non-igneous rock outcrops do occur, including sandstone and conglomerates, with occasional limestone and cherty-limestone (Elston 1965; Kottlowski 1967).

Economically important volcanic rock was not only exploited by ancient populations, but by modern mining companies as well when gold, silver, and copper were found throughout the mountainous areas (Hayes 1999). The ancient inhabitants of the area extensively used the locally available rhyolite, basalt, chalcedony, and obsidian for stone tool production (M. Nelson 1984), and they may have mined for turquoise, and perhaps copper, in the Santa Rita area east of Silver City (Hayes 1999). In addition, the ancient inhabitants made use of vesicular basalt for ground stone tools, and schist and greenstone for the production of tabular knives, hoes, axe heads, and mauls (Anyon and Leblanc 1984; Nelson and LeBlanc 1986).

The streams and rivers flowing from the highlands have in many cases carved deep, rugged canyons into the native bedrock, forming nearly inaccessible land barriers and "boxes" that may have impeded ancient settlement and travel (Lekson 1986). Where the rivers exit the mountains, broad flood plains and terraces tend to develop, composed primarily of gravels, sand, and silt on the banks and large boulders and cobbles in the riverbed (Parham et al. 1983). These broad flood plains are highly fertile but often require irrigation to support agriculture (Parham et al. 1983) due to the generally low yearly rainfall total for the lowlands. Archaeological evidence has shown that the ancient Mimbres people most likely engaged in irrigation agriculture along the middle and lower Mimbres River and some of its tributaries (Herrington 1981; Shafer 1999a), leading to high population density levels. The Gila River terraces also show evidence for ancient

human occupation and agriculture, but to date, little evidence for irrigation; the Gila River may have been too large and wild (similar to the Rio Grande) for successful small-scale irrigation (MacNamee 1994).

Because of elevation and topographic differences across southwestern New Mexico, temperature, rainfall, and biotic regimes vary greatly. Southwestern New Mexico experiences distinct yearly rainfall patterns, with most of the precipitation falling during the summer monsoon season, generally from the end of June to the beginning of September, with moisture coming off the Gulf of California to the southwest and the Gulf of Mexico to southeast (Gabin and Lesperance 1977). Winter rain and snow often add a significant amount to yearly totals, with snowmelt supplying much of the spring runoff for the Mimbres and Gila Rivers. The spring and fall seasons are generally dry and warm, while the summers are hot in the lowlands and pleasantly warm to cool in the highlands; scattered afternoon thunderstorms occur nearly on a daily basis during the monsoon season (Knox 1983). The average yearly rainfall total and temperature for Deming, located on the low-lying Deming Plain along the Mimbres River (4,331 ft [1,320 m]), are 9.04 in and 59.3 degrees F (Gabin and Lesperance 1977). Rainfall increases, and temperatures decrease at the mid-elevation (6,247 ft [1,904 m]) Mimbres Ranger Station (17.33 in and 51.3 degrees F). The GOS Ranch, in the Sapillo Valley at an elevation of 6,350 ft (1,935 m), receives the highest amount of rainfall (18.69 in) and records an average temperature (53.3 degrees F), similar to the Mimbres Ranger Station. Rainfall and temperature averages for the Mimbres Valley grade downward between the Mimbres Ranger Station and Deming as elevation decreases.

The biotic environment of southwestern New Mexico responds accordingly. As

noted previously, heavy forest cover of Ponderosa pine is characteristic of much of the higher elevations, with the highest peaks changing to stands of Douglas Fir, blue spruce, and aspens (Brown 1994). Those peaks above 10,000 ft (3,048 m) are often treeless, which is characteristic of the Arctic zone (Brown 1994). Between 8,500 ft and 6,500 ft (2,591 and 1,981 m), Ponderosa pine dominates, with piñon-juniper intermixed at lower elevations. Most ponderosa pine disappears below 6,500 ft (1,981 m), except in sheltered canyons and other protected landforms. The lower elevation woodlands are often described as shrub chaparral, containing sparse to thick stands of juniper, mesquite, oak, and acacia (Brown 1994), which changes to desert chaparral communities below 4,500 ft 1,372 m).

The desert plains and valleys contain typical Chihuahuan life forms, including mesquite, chamisa, creosote, yucca, and cacti. Riparian vegetation, including cottonwood, black walnut, box elder, desert willow, and live oak, is found along the banks of the major rivers and to a lesser degree along semi-permanent watercourses (McNamee 1994). Grasslands are reported to have been common prior to the onset of the cattle industry during the nineteenth century (Hayes 1999; McNamee 1994), but have now been largely replaced by desert scrub grasslands and disturbance weeds and cacti, such as broom snakeweed and cholla (Brown 1994). Water sources are scarce in the desert, with few oases known; water tends to drain from the mountains in well defined rivers and streams, and then flow underground where the watercourses of the Mimbres River meet the sandier deserts.

Animal distributions occur in conjunction with the various biotic zones noted above, but may have differed slightly when the Mimbres people occupied the region. The

lowlands support browsing animals such as antelope, mule deer, peccary, and jackrabbits (Brown 1994), while the highlands support higher densities of mule and whitetail deer, elk, bear, and mountain lions. Coyotes, and in the recent past, wolves, roam both the deserts and highlands. Various species of fish and other aquatic/riparian animals, such as turtles, beaver, and raccoons, inhabit the better-watered river and stream valleys, but were more common prior to the mid- to late-nineteenth century (Hayes 1999). Economically important birds occur in all areas of the Southwest, including quail, turkey, and pheasant (Brown 1994). Avian predators are common, including hawks and owls, while bats make the numerous caves and rockshelters in the area their home.

In sum, southwestern New Mexico forms a varied and rich biotic and geological zone. Many areas are suitable for human habitation, farming, and exploitation of numerous kinds of natural resources, and are often within short walking distances of each other. But, like anywhere else in the semi-arid Southwest, the natural resources are not equally distributed or abundant, and they often respond negatively to sustained human pressure and over-exploitation (Hayes 1999; MacNamee 1994; Minnis 1985a). However, within this patchiness, the Mimbres and Gila River valleys form linear desert oases in their lower elevations. While the distinction between the lush bottomlands and irrigated terraces along the rivers and the more arid deserts and foothills that surround them is not as dramatic as seen in the Nile River valley, the differences in vegetation cover, available water, and arable land can be consistently drawn (Parham et al. 1983). Where these differences begin to fade in upstream areas as the woodland and forest cover becomes more uniform, other problems are encountered by agriculturalists. These problems include cold air drainage, limited sun exposure from dense and often towering tree cover

and narrow canyons, narrow to nonexistent terraces for habitation and crops, short growing seasons, and intermittent water flow (Sandor 1983). Although the upper elevation sections of the rivers of southwestern New Mexico cannot be described as arid, they nonetheless represent agriculturally peripheral zones compared to the lower elevation, warmer, wider, and better watered valleys in the desert foothills and plains.

Given these environmental conditions, permanent human habitation should be rare or intermittent in the deserts, dry foothills, and high elevations and should be more or less limited to supplemental farming and seasonal wild food hunting and gathering (see Minnis 1985a). As will be shown later, this was the case for much of Mimbres history, but peripheral area use dramatically changed during the Pueblo period, despite the limitations noted here.

CHAPTER IV

ARCHAEOLOGICAL BACKGROUND FOR SOUTHWESTERN NEW MEXICO

Ancient occupation of southwestern New Mexico has a long documented time depth, ranging from Early Archaic hunters and gatherers (Vierra 1994) to pithouse and pueblo village farmers to late Athabaskan (Apachean) nomadic raiders. The latter were first documented in the early 1500s by early Spanish conquistadors on their northward march from Mexico to the fabled seven golden cities of Cibola (Martin 1959; Simmons 1977), and they represent the only Native American group in the area to be chronicled in early written reports. The descendants of both ancient and historic groups still live throughout New Mexico today.

Semi-sedentary to sedentary ancient farmers in southwestern New Mexico belong primarily to the "Mogollon culture" (Haury 1936; Martin 1959; LeBlanc 1983), an encompassing term that ties together a number of regional cultural traditions linked by similar material culture traits, settlement and subsistence patterns, and environmental location (LeBlanc 1989; Wheat 1955). Some of these traits and patterns include the ubiquitous brown ware pottery of the region; distinctive pithouse and communal structure architecture during the Pithouse period; primary occupation in the high country of east-central Arizona and southwestern New Mexico; heavy reliance on both agriculture and hunting and gathering for subsistence; and a preference for extended inhumation burials under house floors (Haury 1936; LeBlanc and Whalen 1980; Wheat 1955). Later Pueblo period occupations in the Mogollon region appear to become a variable mix of Mogollon-Ancestral Pueblo, Mogollon-Hohokam, and Mogollon-Chihuahuan traits and cultural

patterns (Sauer and Brandt 1930; Haury 1936; Kidder et al. 1947; LeBlanc and Nelson 1986; Lekson 1996; Martin 1959; Wheat 1955). Some argue that Mogollon continuity is evident in the Archaic to Pithouse periods (e.g., Martin et al. 1952; Wheat 1955), while others argue for inclusion of the Mimbres Pueblo period as well in this continuum (e.g., LeBlanc 1989; Shafer 1999a). The latter cite evidence for a smooth evolutionary trajectory, including the *in situ* evolution of pottery style and decoration (Brody 1977; Scott 1983), the presence of transitional styles of architecture (Lekson 1990; Shafer 1995), and continuity of village location through time (Anyon and LeBlanc 1984; LeBlanc 1983). Others argue that the sudden appearance of pueblo-style architecture, nucleated villages, and the prevalence of Cibola White wares in the San Francisco River drainage area indicate Ancestral Pueblo swamping of the Mogollon region, i.e., cultural replacement (Haury 1936; Wheat 1955). Recently, others have argued for something in between these extremes (Creel 1999; M. Nelson 1999), along the lines of the spread of cultural ideology without necessarily the replacement of people (see Crown 1994).

The following is an overview of the archaeology and prehistory of Southwestern New Mexico that traces the development of knowledge over time from various archaeological investigations. It also incorporates the changing ideology and paradigms that governed the research and colored the interpretations, where appropriate.

Paleoindian Period (9800–7200 B.C.)

Despite occasional Paleoindian style projectile points and tools (Clovis and Folsom) reportedly found in southwestern New Mexico (M. Nelson 1980; Peterson 1988), no conclusive habitation, butchering, or work station sites dating to this time

period are known (M. Nelson 1980). Paleoindian rockshelter and open-air resource processing sites are present at lower elevations in nearby southeastern Arizona (Haury 1956; Sayles and Antevs 1941), in addition to similar sites along the Rio Grande (Agogino and Rovner 1964; Judge 1973) and in eastern New Mexico (Hester 1975). In fact, some of the earliest "type" sites for Clovis and Folsom occupations are found on the high plains of eastern New Mexico. However, the absence of conclusive evidence for Paleoindian occupation in southwestern New Mexico should not be taken as evidence that these sites are not present, given that this area is surrounded by known or suspected sites dating to this early time period.

The upland/mountainous environment of southwestern New Mexico may have limited the megafauna herds often targeted by Paleoindians, resulting in, perhaps, fewer hunter-prey encounters and subsequently, archaeological sites. In addition, open-air Paleoindian sites in the Southwest are often uncovered through the effects of erosion and stream downcutting, processes that may be more negligible in the uplands of southwestern New Mexico than the desert basins and grass plains of southern Arizona and eastern New Mexico. Because Paleoindian groups are believed to be nomadic hunters, gatherers, and opportunists (Agenbroad 1988; Bement 1999), cultural remains left behind at open-air ephemeral camps are nearly guaranteed to be sparse and difficult to find almost 10,000 years later. More archaeological evidence for southwestern New Mexico is required before the nature of Paleoindian use and occupation of this region is understood.

Archaic Period (7200 B.C.–A.D. 200)

Later Archaic period groups are better represented in the archaeology of southwestern New Mexico, perhaps as a result of decreasing mobility, increasing population, and changing subsistence-settlement patterns. Martin et al. (1949) describe Archaic period sites in the Pinelawn valley of the San Francisco River as short-term open-air camps marked by stone tool production debris, large corner-notched projectile points, unshaped ground stone, large hearths, and processed animal bone; they found no evidence for the use of cultigens or shelters.

Sayles and Antevs (1941) and Sayles (1983) described similar assemblages for southeastern Arizona that spanned many thousands of years, and they named the southern Southwest Archaic tradition the Cochise culture. They detected enough change in material culture and subsistence patterns to define four developmental "stages": Sulphur Spring, Cazador, Chiricahua, and San Pedro. The Cazador phase, a "transition" between Paleoindian-like sites and Archaic sites, was never accepted by other southwestern archaeologists, however. The Sulphur Spring phase appeared to overlap the Paleoindian period in terms of dating and material culture, but it generally lacked association with extinct forms of mammals. Ground stone was often recovered at early Cochise culture sites and was a common occurrence at Archaic sites thereafter. The San Pedro phase terminated, they argued, with the advent of pottery and agriculture accompanying the rise of sedentism and pithouse villages, around A.D. 200. However, recent work on late Archaic villages in southern Arizona and northern Chihuahua have demonstrated that the use of cultigens and increasingly sedentary behavior occur almost 1,500 years before the appearance of pottery in some areas of the Southwest (e.g., Hard and Roney 1999;

Huckell 1995; Roth 1992).

The Cochise culture phases have slowly disappeared from usage in southwestern New Mexican and Arizona archaeology and have been replaced by more widely applicable early, middle, and late Archaic terminology (Cordell 1997). Each is defined by broad changes in material culture and settlement-subsistence patterns, similar to Sayles and Antev's stages, but with the benefits available from numerous research and contract archaeology projects that focused on the Archaic period. As radiocarbon dating techniques have been refined through technological and methodological improvements, the kinds of artifacts that cluster temporally and stylistically are better known, and the time of arrival of domesticated food has been narrowed. Specifically, changes in projectile point morphology and typing, coupled with more refined dating, have enabled archaeologists to better estimate the age of lithic scatter sites containing diagnostic projectile points (e.g., Roth 1992; Sliva 1999; Sliva and Stevens 2002). Concurrently, changes in other lithic industries, for example ground stone, are also tracked through time with more confidence. With more precise dating of material culture and sites, broader changes in subsistence and settlement for the Archaic period can be better understood.

Perhaps one of the most important revolutions in southwestern archaeology has been the refinement of the arrival of agriculture and its consequences for our understanding of the transition to sedentism and agricultural lifestyles (Hard and Roney 1999; Huckell 1995; Minnis 1992; Wills 1988). Traditionally, the adoption of agriculture was always coupled with the rise of sedentary lifestyles and the use of pottery for food storage and cooking (e.g., Haury 1962). During the 1960s and 1970s, excavations at several important southwestern Archaic period sites recovered evidence of maize in deep

levels. Direct radiocarbon dating of the maize cobs and cupules resulted in a clustering of dates at ca. 3000 B.C., indicating to these early researchers that the use of maize was part of Archaic period subsistence for thousands of years (Dick 1965). Importantly, the evidence was used to suggest that the arrival of maize in the Southwest had little impact on traditional Archaic settlement and subsistence patterns, i.e., extensive mobility and hunting and gathering (e.g., Ford 1981). As Minnis (1985b) states, the adoption of agriculture was a non-event for southwestern groups; they maintained their mobile lifestyles and merely incorporated planting and harvesting maize and other cultigens as part of their seasonal exploitation of different environments (but see Hard and Roney 1999; Wills 1988).

However, recent redating of samples from these same sites, coupled with dating of samples from new sites, has demonstrated that maize cobs consistently produce dates hundreds to thousands of years older than they actually are due to the C^{13}/C^{14} problem (grasses absorb carbon at different rates) (Wills 1988). All of the earliest dates for maize cluster around 1500 B.C., considerably later than previously thought. On the heels of this important announcement came the discovery of pithouse village sites in the Tucson Basin and the Globe highlands of southeastern Arizona that produced evidence for large-scale maize agriculture and sedentism—but no pottery—and which also dated as early as 1500–800 B.C (Doyel and Hoffman 2003; Huckell 1995). Clearly, the adoption of maize did produce a significant change in subsistence and settlement for at least some southwestern groups, contrary to Ford, Minnis, and others. Recent research in northern Mexico is also pointing to the same conclusion (Hard and Roney 1999). The Late Archaic period is now defined as a time of agricultural adoption and significant

behavioral change, including increasing sedentism for some areas, and is dated from 1500 B.C. to A.D. 200, the first appearance of pottery.

Despite the advances in our understanding of the Late Archaic in the Southwest, corroborating evidence for the early appearance of maize agriculture and sedentism in southwestern New Mexico is sparse at best. In fact, Late Archaic sites in this region tend to reflect high degrees of mobility and low amounts of maize agriculture. Little evidence for Late Archaic villages, at least on the scale of the Tucson sites, has been reported thus far, and when structures are found, they tend to be scattered shallow and ephemeral pithouses (Minnis 1980; Turnbow 2000) located on high landforms unsuitable for maize agriculture (Stokes 1995). A possible exception is the Winn Canyon site on the Gila River in the Cliff Valley, which produced several pithouses and dates that precede 200 B.C. (Fitting 1973). It appears that the highlands of the Mogollon region lagged behind southern Arizona and northern Mexico with regard to groups adopting an agricultural lifestyle, contrary to earlier opinions that saw these same highlands as corridors for agriculture coming out of Mexico (Haury 1950; Martin 1959; Martin et al. 1952) based on the early erroneous dates of Bat Cave (Dick 1965) and others.

But there is no reason to expect simultaneous transitions from one form of lifestyle to another across the Southwest, given the highly variable nature of its environment and resources (Stokes and Roth 1999). In fact, Late Archaic groups in the Mogollon region of southwestern New Mexico resemble Minnis' earlier description of the "agricultural non-revolution" paradigm popular just a short time ago. All evidence so far indicates that Late Archaic groups moved about the landscape of southwestern New Mexico in small groups, relying heavily on wild foods but no doubt still growing or

trading for maize, squash, and beans (Diehl and LeBlanc 2001; LeBlanc 1983; Minnis 1980). When agriculture did become more important to Mogollon groups, around A.D. 200, significant cultural changes occurred, and the "Mogollon" tradition was born.

The Mimbres-Mogollon Sequence (A.D. 200–1150/1200)

Although the Mogollon were first defined as a highland, pithouse dwelling people (Danson 1957; Haury 1936; Wheat 1955), recent research has demonstrated that the Mogollon extensively used and occupied lowland environments (Whalen 1994), and that later pueblo occupations were essentially Mogollon in character as well (Anyon et al. 1981). The latter point is a departure from earlier views that suggested a strong Ancestral Pueblo influence on Mogollon pithouse dwelling people radically altered their material culture and domestic architecture (Haury 1936; Kidder 1932; Wheat 1955). However, the only Mogollon region in southwestern New Mexico that was demonstrably affected by Ancestral Pueblo groups is the Reserve-San Francisco River area, where Reserve and Tularosa phase ceramics and architecture have few Mogollon antecedents (LeBlanc 1989) (Figure 4.1). True to the general Mogollon pattern, the Mimbres occupied and used highland and lowland topographic and biotic zones, although they clearly favored well-watered river and stream valleys for habitation and subsistence purposes (Lekson 1986).

The Mimbres-Mogollon Tradition

The Mimbres cultural sequence is divided into three periods, as first defined by Haury (1936) and then Anyon et al. (1981): Early Pithouse, Late Pithouse, and Classic (Table 4.1). The Early Pithouse period began about A.D. 200 and evolved into the Late

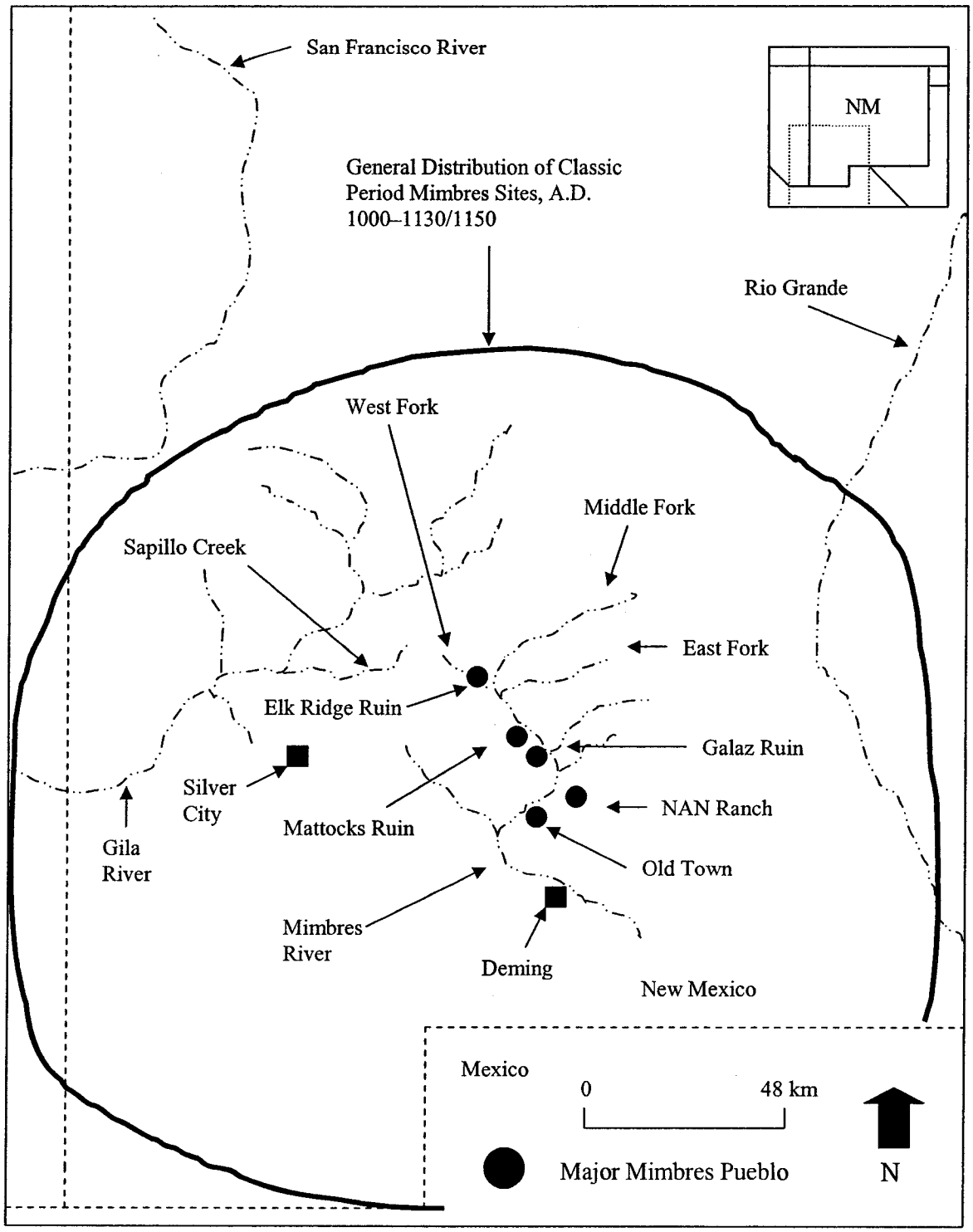

Figure 4.1. The Mimbres-Mogollon region in southwestern New Mexico.

Table 4.1. Mimbres-Mogollon cultural periods and major attributes.

Period	Phase	Dates (A.D.)	Major Attributes
Early Pithouse	Cumbre[1]	200–550	Round or bean-shaped pithouses, plain and red wash pottery
Late Pithouse	Georgetown	550–650	Round to D-shaped pithouses, scored, incised and textured Alma Plain pottery, some red ware pottery
	San Francisco	650–750	Sub-square pithouses, red ware and Mogollon Red-on-brown pottery
	Three Circle	750–1000	Square to rectangular pithouses, Three Circle Red-on-white, Styles I and II Black-on-white, Neck Banded corrugated pottery
Transitional	Mangas[1]	950–1050	Masonry houses in shallow pits, Style II Black-on-white pottery
Classic (Pueblo)		1000–1140	Masonry surface pueblos, Style III Black-on-white, Mimbres Polychrome, and Mimbres corrugated pottery
Postclassic		1140–1200	Confined to Rio Grande Valley, masonry rooms in farmsteads, abandonment of large villages, increase in northern and eastern trade ware pottery
Post-Mimbres	Animas/Black Mountain	1150–1325/1350	Adobe architecture, linear roomblocks, plazas, possible ballcourts, Mexican/Jornada pottery, Black Mountain centered in southern Mimbres Valley, Animas in the bootheel of New Mexico
	Cliff	1325/1350–1450	Adobe architecture, large pueblos, plazas, compound walls, Salado polychrome pottery, centered in the Gila River valley

[1] These phase names are not universally used in the literature.

Pithouse period by A.D. 550. The Late Pithouse period, which is divided into three phases (Georgetown, San Francisco, and Three Circle), terminated by A.D. 1000 in most Mimbres areas. A number of researchers also suggest that the use of a transitional phase is warranted (Fitting 1973; Lekson 1988, 1990; Shafer 1995). The proposed Transitional period (Shafer 1995), sometimes referred to as the Mangas phase, marks the change from pithouse to pueblo occupation and is viewed as lasting over a hundred years (about A.D. 950–1050). This view of the Mangas phase is quite different from alternate scenarios that suggest a relatively quick transition occurring at A.D. 1000, thus leaving no room for a transitional phase (Anyon et al. 1981; Gilman 1980). The debate on the validity of the

Mangas phase has not been resolved, but the accumulating evidence seems to point to the existence of transitional architecture at some sites (semi-subterranean masonry rooms mixed with pithouses) and thus, of a transitional phase. The Classic period, A.D. 1000–1140, is the pueblo village stage of the Mimbres, as described by Mimbres Foundation researchers (Anyon et al. 1981; Gilman 1980; LeBlanc and Whalen 1980), and others (Cosgrove and Cosgrove 1932; Shafer 1995). This period appears to last beyond 1140 along the eastern slopes of Black Range, where it has been termed the Postclassic Mimbres period (Hegmon et al. 1999).

Diagnostic traits of the Early Pithouse period include plain brown ware ceramics (Alma Plain, Alma Rough, and other derivatives), early San Francisco red ware ceramics (a red wash applied to the vessel after firing), and shallow to moderately deep, rounded pit structures (Haury 1936; Fitting 1973; LeBlanc 1980; Martin 1943). The entry ramp of the pit structure often has interior lobes, giving the house a bean or kidney shape. Late Pithouse period cultural traits include true San Francisco red wares and D-shaped pit structures for the Georgetown phase (A.D. 550–650), and Mogollon Red-on-brown ceramics and subsquare pit structures with rounded corners for the San Francisco phase (A.D. 650–750). For the Three Circle phase (A.D. 750–1000), Three Circle Red-on-white and Mimbres Black-on-white Styles I and II (Boldface and Transitional) ceramics are considered hallmarks (Anyon 1980; Haury 1936). Additionally, Three Circle phase pit structures often have squared wall corners with masonry and/or plaster, although the superstructure apparently remained pole and brush with dirt covered roofs. Overall, many pit structures also have plastered floors, although this is generally more common in the San Francisco and Three Circle phases.

The Classic, or Pueblo period, is characterized by surface masonry architecture, primarily using river cobbles with copious amounts of mud mortar, and Style III (Classic) Black-on-white ceramics (Anyon et al. 1981; Gilman 1980; Shafer 1995). The change from pithouse to pueblo architectural forms has received considerable attention across the Southwest. The pueblo form of domestic architecture may reflect changing social organization, specifically that larger family or kin-level corporate groups began to replace smaller nuclear family, pithouse dwelling social units. The pithouse-to-pueblo transition is often argued to be the result of population pressure, storage needs, control of resources, defense, and alliance building (Adler 1996; Gilman 1987; Kohler 1992; Sebastian 1992), although not all of these factors were necessary, separately or together.

Ceremonial structures change from large pit structures, or kivas, used during the Pithouse periods to a more varied approach to communal gathering places during the succeeding Classic period (Anyon and LeBlanc 1980). The subterranean kiva of the Pithouse period may have survived into the early Classic period, but these structures were replaced with semi-subterranean, cobble-walled rooms that had roof entries and ventilator shafts (Anyon and LeBlanc 1984; Shafer 1995; Stokes 1999c). In addition, extra-large surface rooms were often incorporated into the pueblo (Shafer and Taylor 1986), and walled or partially walled open plaza areas are also known at some sites (Anyon and LeBlanc 1984; Brook 1977; McKenna and Bradford 1989; Stokes 1995).

The pottery produced during the Classic period is world-renowned for its expert artistic execution and for depicting scenes of mythology, ritual activities, the natural world, and everyday life of the ancient Mimbres people (Brody 1977). These aspects of Classic Mimbres pottery continue to be of importance to archaeologists for interpreting

non-tangible aspects of Mimbres life (e.g., see Hegmon and Trevathan 1996; Shaffer and Gardner 1995; Munson 1999; Shaffer et al. 1995). The Classic Mimbres people also continued to produce plain brown wares and corrugated ware for more utilitarian purposes, in addition to importing other ceramic types, primarily from the Jornada, Reserve, and northern Mexico areas (Cosgrove and Cosgrove 1932; Scott 1983; Woosley and McIntyre 1996). Unfortunately, the desirability of Mimbres painted pottery on the modern antiquities market has led to extensive pothunting, and in some cases total destruction, of most Mimbres pueblos (Graybill 1977; LeBlanc 1983; Minnis and LeBlanc 1979).

Subsistence

Ethnobotanical and faunal studies have shown that subsistence practices of the Mimbres changed through time, from early hunting and gathering coupled with opportunistic horticulture during the Late Archaic and Early Pithouse periods (Diehl and LeBlanc 2001; Martin et al. 1952; Minnis 1985a; Pool 1994) to heavy dependence on agriculture to supply the bulk of the diet during the Classic Mimbres period (Gilman 1980; Minnis 1985a). Population growth and gradually increasing reliance on agriculture are thought to co-occur during the Late Pithouse period, which is reflected in the presence of larger pithouse villages during the San Francisco and Three Circle phases (Anyon 1980). However, more recent analyses of Mimbres subsistence practices indicate that a more mobile hunting and gathering lifestyle, coupled with reliance on some agriculture, better explains the archaeological record for at least the Georgetown and San Francisco phases (Lekson 1988, 1992a; Stokes and Roth 1999; but see Diehl 1996, 1997

for arguments against including the San Francisco phase with this statement). The adoption of a more settled and agricultural lifestyle may not have occurred until late in the Three Circle phase, or even later, in many parts of the Mimbres area.

Settlement Patterns

General settlement patterns through time are believed to reflect changes in subsistence strategies and demography (Blake et al. 1986; LeBlanc and Whalen 1980). Early pithouses are most often located on high landforms directly overlooking well-watered valleys, which is perhaps an indication of a hunting and gathering subsistence strategy that emphasizes the exploitation of both highland and lowland environments (LeBlanc 1980). Oftentimes, defense is also argued as a factor for settlement decisions made by the Early Pithouse period people (LeBlanc 1980, 1983), although actual conflict has not yet been demonstrated for this period. During the Late Pithouse period, villages were moved down to low landforms directly above good agricultural land, and this movement has been interpreted as evidence for growing reliance on agriculture for subsistence (Anyon 1980; Minnis 1985a). However, it is also clear that more variation exists for the location of Late Pithouse period sites and villages, ranging from desert settings (Minnis and Wormser 1984; Schriever 2002) to tops of knolls, bluffs, and hills (Haury 1936; Linse n.d.; Oakes 1999; Stokes 1995; Stokes and Roth 1999; Woosley and McIntyre 1996). In most cases, seasonal movements and environmental factors are cited for this variability, and the "low landform" scenario appears to best apply to sites along the Mimbres and Gila Rivers where large terraces and flood plains exist.

For the Classic period in the major river valleys, the majority of large pueblo

villages are located on the same low landforms, with many being built directly on top of Late Pithouse villages (Gilman 1980). However, because of tremendous population growth that occurred during the Classic period (Blake et al. 1986), and related shortages of good agricultural land and water in the Mimbres River valley (Minnis 1985a), marginal agricultural zones in side drainages and upland areas were used for supplemental provisioning. Evidence for this is seen in the proliferation of check dam and terrace systems on minor drainage channels and hill slopes and by the appearance of short-term habitation structures in upland and tributary settings (Blake et al. 1986; Herrington 1978; Minnis 1985a; Sandor 1983). In many of these areas, evidence for previous occupation is minimal, and this shift in settlement and subsistence patterns is viewed as an adaptation to food, environmental, and demographic stresses (Blake et al. 1986; Minnis 1985a).

The "Demise" of the Mimbres

The Mimbres cultural pattern disappears from the archaeological record after A.D. 1140 in the Mimbres and Gila River valleys and adjoining tributaries, but it may have survived to A.D. 1200 or so along the eastern slopes of the Black Range (Gomolak and Ford 1976; Hegmon et al. 1995; M. Nelson 1993, 1999). Prior to A.D. 1140 in this area, several large Mimbres pueblos were known, but it appears that after the commencement of large-scale migrations across the Mimbres region at this time, an influx of people moved into the Rio Grande valley. They built small, scattered farmsteads instead of large pueblos, or they remodeled existing field houses into farmsteads. Their material culture became much more varied in terms of pottery present, but they continued

to produce the familiar Mimbres Classic Black-on-white. Social customs appear to be much more flexible and variable during this time, termed the "Postclassic" by M. Nelson (1999) and Hegmon et al. (1999). After A.D. 1200, occupation continues in the area, but most traces of the Mimbres cultural pattern disappear from the archaeological record.

The post-A.D. 1140 time period in the larger Mimbres region was traditionally referred to as the Post-Classic (Animas/Black Mountain and Cliff phases), although Hegmon et al. (1999) suggest using the term Post-Mimbres to differentiate it from the Black Range use of "Postclassic" that stresses continuity of the Mimbres culture. The original Post-Classic stressed the dramatic discontinuities in material culture, architecture, and burial practices evident after A.D. 1140 (Nelson and LeBlanc 1986). Some of these new patterns include adobe pueblos, similar to the Salado, Jornada, and Chihuahuan villages to the west, east, and south of the Mimbres River; the replacement of Mimbres Black-on-white pottery with first Chihuahuan and Jornada styles (e.g., Ramos Polychrome, Playas Red, El Paso Polychrome, and Chupadero Black-on-white) during the Animas phase (A.D. 1150–1275/1300), followed by Salado wares (Gila Polychrome and Roosevelt Red Wares) during the Cliff phase (A.D. 1300/1350–1450); and more emphasis on cremation burial practices. These new cultural patterns were limited to the Gila River in the Cliff valley, the lower Mimbres River, and the desert grasslands to the south and southwest in the New Mexico bootheel, with the higher elevation areas to the north virtually abandoned after A.D. 1130–1140, at least in the northern portion of the Mimbres Valley and in the adjacent Sapillo Valley. A few late occupations are known for the highlands, including the Gila Cliff Dwellings (Anderson et al. 1986) and perhaps the nearby TJ Ruin (Bradford and McKenna 1989), while to the

northwest, the Ancestral Pueblo-influenced Reserve and Tularosa phases succeeded the earlier Mogollon tradition.

Although many archaeologists argue for regional abandonment immediately following the close of the Classic period, followed by partial colonization by new groups of people (LeBlanc 1989; Nelson and LeBlanc 1986; Shafer 1999a; Shafer and Taylor 1986), others suggest that limited changes in material possessions and building styles may be distorting our interpretations of the Mimbres post-A.D. 1140 period (Creel 1999; Lekson 1993). Creel points out that many Black Mountain phase traits at the Old Town Ruin in the lower Mimbres Valley are identical to Classic Mimbres characteristics, including burial practices and certain architectural elements, such as using adobe for pueblo wall construction. The main differences occur primarily in the ceramic assemblage: Style III pottery ceases to be produced, and more Jornada and northern Chihuahuan pottery is imported. However, explanations that address the issues of why Classic Mimbres Style III pottery ceases to be produced and why many Mimbres areas are abandoned by A.D. 1140 remain unclear. M. Nelson (1999) suggests that Mimbres movement from the upper Mimbres Valley to the eastern slopes of the Black Range after A.D. 1140 should not be unexpected, nor should it be considered abandonment of their former homeland. She argues that large-scale movements of people are part of the adaptive strategy of the Mimbres, which would include adopting new building styles and material culture if they were determined to be useful.

The simultaneous appearance of these sometimes radical cultural changes has led a number of researchers to suggest that the Classic Mimbres succumbed to outside pressures and movements of people and ideologies (Di Peso in Woosely and McIntyre

1996; LeBlanc 1989). One scenario suggests that the Classic Mimbres system failed because it was in a weakened condition brought about by years of environmental over-exploitation, unsustainable population growth, and successive years of bad climatic conditions (Minnis 1985a:189; Shafer 1982, 1999a), eventually leading to a total, but temporary, abandonment of their homeland. Often related to this argument is the growing influence of Casas Grandes in northern Mexico. This large and complex polity just south of the international border is thought to have disrupted the Classic Mimbres lifestyle enough to allow for its disintegration (LeBlanc 1989; see Woosley and McIntyre 1996 for a discussion of Di Peso's views). Although it seems possible that the Mimbres were greatly affected by the rising power, ideology, and mercantilism of Casas Grandes, the timing, scope, and effects of this new regional polity on other nearby groups are still largely unknown. Whatever was responsible for the "demise" of the Mimbres, the result was that the social and ideological alliances that bound the Mimbres region together for nearly a thousand years came to an end in much of their former territory, at least in archaeological terms.

CHAPTER V

SURVEY DATA FOR THE GREATER MIMBRES RIVER VALLEY AREA OF SOUTHWESTERN NEW MEXICO

Chapter II examined four ethnographic examples of peripheral land use and colonization by agriculturalists in environmental settings with easily demarcated divisions of good and poor arable land and then set forth a set of expectations with which to analyze and interpret the results of research on the Mimbres culture, an ancient agricultural society that inhabited southwestern New Mexico. The semi-arid environment of the Mimbres heartland, similar in many respects to several of the ethnographic examples examined earlier, was discussed in detail in Chapter III. The previous chapter set the stage for what we know and do not know about the ancient Mimbres, including the circumstances surrounding their movement into agriculturally peripheral areas away from the main river valleys. Because so little research has been done away from the main Mimbres Valley, especially excavation work that would provide important social, subsistence, economic, and dating information for these peripheral areas, the hypotheses advanced by earlier researchers for prehistoric use of peripheral areas remain untested (Blake et al. 1986; Graybill 1975; Minnis 1985a). Although mentioned in Chapter IV, this chapter examines in more detail these hypotheses and their origins and ramifications and then outlines a new way of viewing existing and recently derived survey and excavation data for a more explicit understanding of Mimbres peripheral land use.

Two kinds of data are available for this investigation: large-scale survey results and test excavations, the latter of which is presented in the next chapter. This chapter

examines important survey data gathered from the late 1960s through the mid-1970s in the upper, middle, and lower Mimbres Valley, supplemented with more recent survey data for a nearby major drainage, the Sapillo Valley (see Figure 4.1). The hypotheses currently governing the way archaeologists think about peripheral land use in the Mimbres area were generated directly from the earlier survey data and it is important to closely examine these projects and their data sets. In addition, the survey data are critical for this dissertation because the study of large-scale settlement patterns can be accomplished with the wide-ranging coverage provided by these three data sets. It is important to determine if community clusters are found in peripheral areas of the Mimbres River; alternatively, the survey data may produce only evidence for short-term, ephemeral use of these areas. Settlement patterns in the main valley are fairly well known, but much less so for the side drainages.

In the case of the early 1970s Upper Mimbres Archaeological Project on Gila National Forest property (Graybill 1975), the data generated have remained virtually unexamined since Graybill's original synthesis and report. In the late 1960s to early 1970s, Graybill surveyed transect zones and block areas in portions of the east, west, and middle forks of the Mimbres River (i.e., the upper Mimbres River), and the GOS Ranch area of the adjoining upper Sapillo Valley. Stokes (1995) later sample surveyed the Sapillo Valley and reexamined a number of Graybill's sites in the GOS Ranch area, which borders the west fork of the Mimbres River (although on opposite sides of the Continental Divide). Specifically, the restudy used ceramic data from various pithouse and pueblo sites for comparative ceramic tabulations between Graybill's sites in the GOS Ranch area and new sites in the Sapillo Valley. The Sapillo Valley survey forms a large

and important data set for understanding Mimbres settlement patterns in high elevation, forested areas. However, other than this restudy, Graybill's survey and site data have been little used by other researchers, other than for occasional site tabulation purposes (Lekson 1992a; Roth et al. 2001). Graybill's survey data, despite some of the limitations discussed below, remain a virtually untapped source of information regarding Mimbres expansion into agriculturally peripheral areas in the upper Mimbres Valley.

The other primary data set was compiled by the Mimbres Foundation during its research and salvage work in the middle and lower Mimbres Valley and many of its tributaries (LeBlanc 1975, 1976, 1977, 1983). The Mimbres Foundation conducted both survey and excavation, and from these data came seminal publications standardizing Mimbres archaeological thought. These include refined developmental sequences (Anyon et al. 1981); demographics (Blake et al. 1986); ceremonial architecture (Anyon and LeBlanc 1980); cultural ecology and land use (Minnis 1985a; Minnis and Wormser 1984; Nelson and LeBlanc 1986); catchment analysis (Hastorf 1980); material culture studies (Gilman et al. 1994; Scott 1983); mortuary patterns and social stratification (Gilman 1990); and updated regional cultural summaries and commentaries (LeBlanc 1983, 1989; LeBlanc and Whalen 1980). Others have used these data for additional material culture studies (e.g., Bray 1982; Brody 1977; Fenner 1977). In addition, reports of excavation and analysis at both large (Anyon and LeBlanc 1984; Nelson and LeBlanc 1986) and small sites (Diehl and LeBlanc 2001; Minnis and Wormser 1984; Nelson et al. 1978) in the Mimbres Valley have been published or are in preparation (Gilman and LeBlanc n.d.).

However, other than a demographic study (Blake et al. 1986), very little has been

published regarding the distribution of small Mimbres sites in peripheral areas (although a small sites monograph is now in preparation; Roger Anyon, personal communication, 2001). Those few publications detailing the results and interpretation of small habitation sites have had a lasting effect on most subsequent interpretations of Mimbres cultural adaptation, especially in peripheral areas. Of these reports, only Minnis and Wormser use excavation data generated at a site located in an area peripheral to the Mimbres Valley—the desert in the foothills of the Florida Mountains near Deming (see Schriever 2002 for a recent reinterpretation of the data). The collective results were used to argue for short-term and ephemeral Mimbres use of peripheral areas during the Late Pithouse and Pueblo periods. These researchers concluded that peripheral areas were strictly used on a temporary or seasonal basis for wild food gathering and/or small-scale dry farming (see also Minnis 1985a).

Of course, other surveys and excavations have taken place within the Mimbres region, both in the main Mimbres Valley and a few of its tributaries. Important work has been conducted at Old Town ruin, the southernmost large multicomponent village in the main valley (Creel 1992, 1999) and at NAN Ranch ruin, another large village approximately 4 km upstream (Shafer 1995, 1999a). Other large pueblos have been thoroughly excavated in the past by academically trained or supervised personnel (Bradfield 1929; Cosgrove and Cosgrove 1932; Nesbitt 1931) and by avocationalists (Evans and Ross 1985; Mills and Mills 1972; Parsons 1955).

Of these projects, only one included a substantial amount of survey; the NAN Ranch project conducted by Harry Shafer of Texas A&M University undertook extensive survey on NAN Ranch property in the main valley and Gavilan Canyon (Shafer and Creel

1999). Other surveys or excavations have been conducted as graduate research projects (Herrington 1979; Hogg 1977; Lekson 1978; Ravesloot 1979; Stokes 1995); academic field schools, for example, Fitting's (1972) large scale survey of the Gila River Valley in the Cliff, New Mexico area; or as a result of federally mandated cultural resource survey and mitigation projects on the Gila National Forest and other jurisdictions (e.g., Brown 1999; Kelley 1991). In general, a large database exists for Mimbres archaeology, with varying utility and accessibility for this dissertation research. As a result, I focus on the Mimbres Valley and its tributaries and the large-scale projects that have taken place in these areas, but I will refer to these other smaller projects where appropriate.

The Upper Mimbres Archaeological Project

Chronologically, Graybill's (1975) survey research in the upper Mimbres Valley was conducted and published first. As a result, his observations, methods of data presentation and analysis, and conclusions reflect, at times, an awkward transition between pre-1960s Mimbres archaeology and the refinements in chronology, terminology, typology, taxonomy, and cultural ecology that came later. As such, the value of the data for this dissertation varies in usefulness. For example, Graybill used topographic maps (on file at the Gila National Forest) to record the locations of sites in the upper Mimbres and Sapillo Valleys, and he provided extensive data tables covering such things as estimated site size, ceramic types, and estimated cultural period. All are extremely important variables for this research.

However, recent reexamination of the location and size of several sites in the middle fork of the Mimbres River (discussed in the next chapter) revealed inaccuracies

for both variables. Because few site maps are available from his study (in fact, it is unknown if most sites were even mapped), many important site characteristics are lost, such as room configuration and placement, pithouse or kiva depressions, if present, and areas of artifact concentrations. Graybill was extremely reluctant to assign a pithouse component to any site that had a pueblo component, even if pithouse period ceramics were present. His ceramic typology reflects what was in use at the time (see Cosgrove and Cosgrove 1932) and not the more refined typologies available today (Scott 1983; Shafer and Brewington 1995). The ceramic data can be used to detect the possibility of a pithouse component at pueblo sites, but their presence cannot be confirmed through any other measure with the available data. All of these problems introduce a level of vagueness and uncertainty in the database, but they can be overcome to a degree with careful scrutiny of the available information.

Graybill's (1975:1–4) primary focus for research was cultural ecology, specifically Mimbres adaptations in the higher elevations of the upper Mimbres Valley and upper Sapillo Valley (i.e., the Ponderosa pine landscape of the Gila National Forest in these valleys). Settlement pattern analysis was a major part of his research, as were hydrologic variables including varying periods of aggredation and downcutting, and by extension, rainfall patterns and their effects on ancient agriculture (Graybill 1975:2, 50–59). His approach, then, was two-fold. First, an intensive pedestrian survey of the upper Mimbres and Sapillo valleys had to be done in the absence of existing data for these areas, and second, detailed analysis of arroyos, cut-banks, and cross-trenches had to be completed in order to understand current and ancient hydrologic and climatic patterns. Analysis of the data took several more years, culminating in the completion of his

dissertation and subsequent publication by the Forest Service (Graybill 1975).

Graybill's survey methodology consisted of two basic strategies: block survey and stratified reconnaissance. The former is considered to be complete survey coverage given the way Graybill describes his methodology, while the latter was a sampling strategy based on targeted landforms (Graybill 1975:47–50). The decision to employ one or the other strategy primarily depended upon the size of geographic and topographic units (e.g., river bottom/terrace versus hilly terrain). In general, the valley bottom and narrow terraces from approximately the Mimbres Ranger Station near Cottonwood ruin north to the three forks junction was completely surveyed. The valley bottom in the west fork from its junction with the main Mimbres River to the continental divide was completely covered; no terrace systems are found in this area, only gentle upward slopes to the bases of the nearby hills, ridges, and cliffs. However, only the lowest landforms in the middle fork were completely surveyed, from its junction with the east and west forks north to the current Bloodgood Ranch, approximately 12 km upstream. In the east fork, the first 8 km were surveyed. The remaining "hilly" areas were examined by reconnaissance transects.

Graybill's survey also encompassed part of the upper Sapillo Valley, which is separated from the west fork by the continental divide. The elevation of the continental divide is 6,450 ft (1,966 m), and the area is covered with thick stands of Ponderosa pine, interspersed with piñon/juniper woodlands and a large mountain parkland (the GOS Ranch) near the divide. As a result of this coverage of the upper Mimbres and Sapillo valleys, Graybill recorded over 200 sites; however, it appears that Graybill did not use the Sapillo Valley data in his publication, leaving only 168 sites in the Mimbres Valley (Table 5.1). The Classic (Pueblo) period accounts for 124 of these sites. The 18 Pithouse

period sites were divided into Georgetown phase (n=9) and Three Circle phase (n=9) sites, which appear to be mutually exclusive. No Early Pithouse period sites were found (not unexpected given the low landforms Graybill targeted), and no multicomponent pithouse and pueblo sites were recorded, although surely some must exist given the well-established pattern of Mimbres pueblos overlying Mimbres pithouse villages (LeBlanc 1983; Lekson 1992a). Eleven additional sites are described as containing "questionable" pueblo architecture and 13 others as occupations not assigned to the pithouse or pueblo periods; it is not clear what factors were present that did not allow Graybill to assign these latter sites to a period, phase, or cultural group.

Table 5.1. Site types and frequencies recorded by Graybill (1975) for the upper Mimbres River Valley.

Site Type	Number of Sites
Probable Georgetown phase	9
Probable Three Circle phase	9
Probable pueblo architecture	124
Questionable pueblo architecture	11
Not assigned to pithouse or pueblo periods	13
Sherd scatter	2
Total Sites	*168*

Because one very large site was buried under alluvium and was not found by Graybill during his west fork of the Mimbres survey (the 100+ room Elk Ridge ruin), some of his conclusions regarding limited Mimbres upland adaptations were understandable. Within his database, only one very large site (Cottonwood ruin) was present, and this was located near the Ponderosa pine/piñon-juniper transition in the main valley. As a result, he concluded that the Classic Mimbres adapted to the high altitude, forested environment by exploiting wild foods; focusing on the best arable lands, which

were often limited by soil type and available water (e.g., the east fork); and living in generally small habitations along the margins of arable land, as few "Type 4" (large) sites were found (Graybill 1975:152–160). However, he also observed "clusters" of Classic period sites and suggested that:

> "if it can be demonstrated that sites with different pueblo sizes or types are contemporaneous, it would then be of interest to attempt to determine whether the spatial clusters of these represent anything akin to community forms of social organization, or whether relative site sizes and placements are reflections of both functional and organizational patterns during Period B [Pueblo period]" (Graybill 1975:154).

It is surprising that, up until now, no one has taken up Graybill's suggestion. In the end, the settlement patterns he observed generally were most comparable to those of the Pine Lawn Valley and San Francisco River area, which are topographically and environmentally similar to the upper Mimbres (Graybill 1975:147–152). These patterns include limited Pithouse period occupation; site locations on mesa or hill tops; an increase in sites with pueblo architecture at the end of the Pithouse period/beginning of the Reserve phase (Classic Mimbres period in the Mimbres Valley); and generally small pueblo village sizes, compared to later Tularosa phase villages in the San Francisco River drainage system.

To account for the larger Mimbres pueblos, Graybill tentatively suggests in-migration from other Mimbres areas or from the Ancestral Pueblo region. He further suggests that this demographic change was, in part, possibly brought about by the appearance of hardier and larger strains of maize during the Three Circle phase, which

may have been better able to survive in the higher elevation and lower water volume in the upper Mimbres region (Graybill (1975:152–154). As a result of his research, the warmer, wetter, and wider middle and lower Mimbres valleys were seen as the primary loci of occupation prior to and during the Classic period, while the uplands served as a secondary locus for short-term, small-scale agriculture and wild food procurement (Blake et al. 1986; Minnis 1985a). This notion of the duality of Mimbres adaptation remains an entrenched part of Mimbres archaeology.

Reanalysis of Graybill's Pueblo Period Data

Graybill found 124 sites with "probable pueblo architecture" in an area stretching from the Mimbres Ranger Station northward to the east, west, and middle forks of the Mimbres River, and to the GOS Ranch in the Sapillo Valley (Graybill 1975:161–165) (Figure 5.1; see Table 5.1). Graybill recorded site size in actual area, if the size of the rubble mound could be accurately measured, or he estimated its size. He also recorded 11 sites with "questionable" cobble architecture; these few sites are not included in the following analysis. As a result, it is possible to get estimates of the number of rooms at each site using a standard of 15 m^2 for the average Mimbres room size (see Anyon and LeBlanc 1984:189; Stokes 1995:62). Graybill did not attempt to estimate the number of rooms, likely because room sizes had not been systematically recorded prior to his research (e.g., Bradfield 1929; Cosgrove and Cosgrove 1932), and he did not conduct any excavation work. However, using the 15 m^2 standard room size generated by Anyon and LeBlanc (1984) from the Galaz Ruin, it is possible to categorize the sites into site size classes that are comparable to data generated by other researchers (Table 5.2; Figure 5.2).

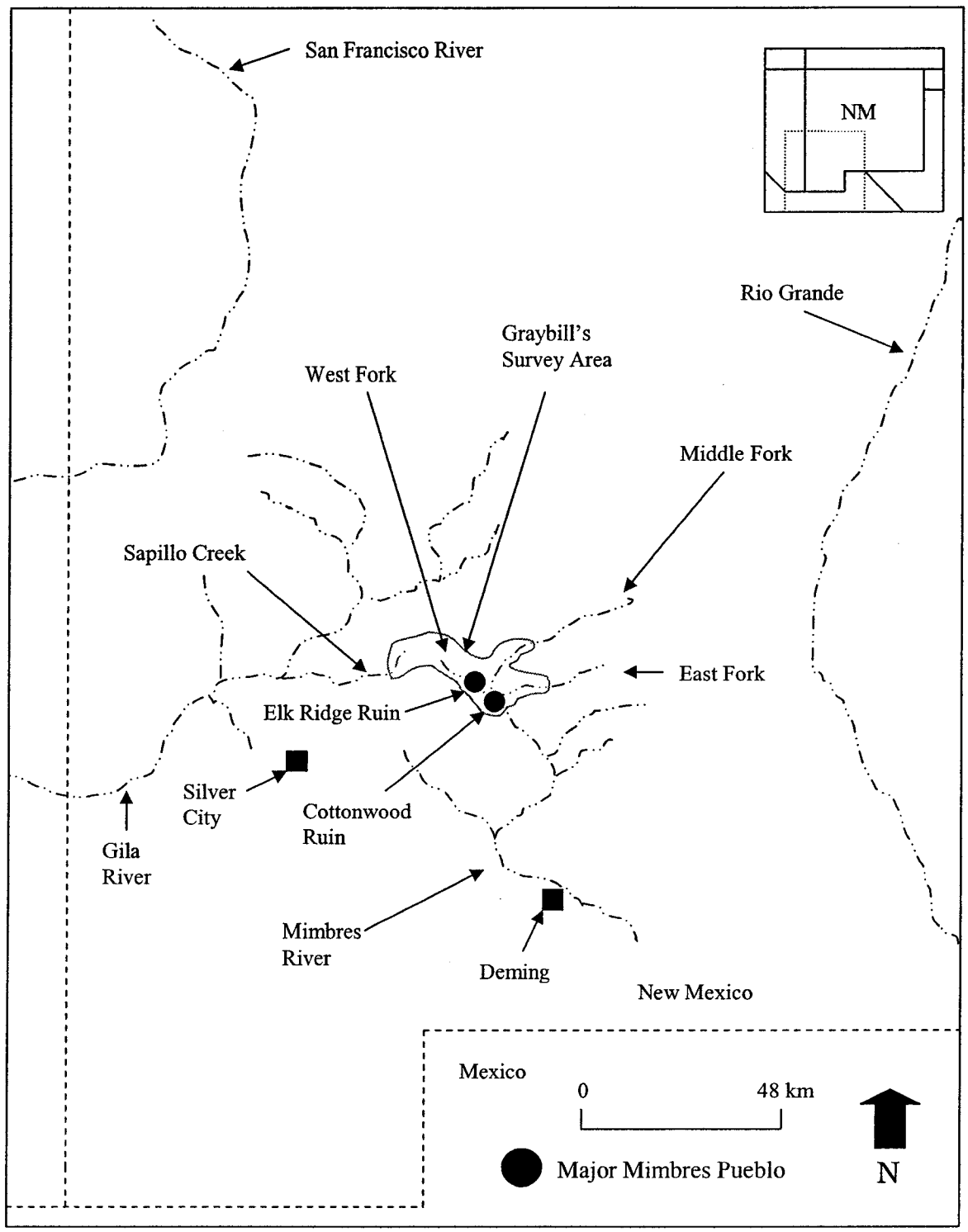

Figure 5.1. Location of Graybill's (1975) survey areas in the upper Mimbres and Sapillo valleys.

Table 5.2. Site size, frequency of occurrence, and estimated number of Classic period rooms generated from Graybill's (1975) survey data.

Estimated or Actual Site Size in m^2	**Frequency of Sites**	**Estimated Number of Rooms (15 m^2 estimated average per room)**
6–139	94	1–9 (field house)
148–258	19	10–17 (small farmstead)
294–416	6	20–28 (large farmstead)
592–795	3	39–53 (medium pueblo)
1,015	1	68 (large pueblo)
1,525 (Cottonwood Ruin), Elk Ridge Ruin (ca. 1,800)	2	102–120+ (very large pueblo)
Total	*125 sites*	*1,146 total rooms*

Of these sites, the largest was the Cottonwood ruin (Site #3 in Graybill's tabulation), estimated to have 102 rooms (1,525 m^2 of architecture) in four distinct room blocks (Graybill 1975:161). The only other comparably large pueblo is Site #134 with 68 rooms (1,015 m^2) (Graybill 1975:163). Graybill missed the Elk Ridge ruin along the west fork, which contained at least 100 rooms, but may have contained over 120 rooms, many of which were destroyed by bulldozing (Morrison 2002). The next cluster of sites (n=3) occur in the 592–795 m^2 size range (39–53 rooms), followed by those in the 294–416 m^2 size range (n=6) (20–28 rooms) (Table 5.2). A large number of sites (n=19) fall into the 148–258 m^2 size range (10–17 rooms), followed by the largest subset of sites (n=94) in the 6–139 m^2 size range (1–9 rooms).

The distribution of sites between 1 and 9 rooms is continuous, with a peak in the 1 to 2 room range, and it likely represents a range of short-term to extended-use field houses. The break between 9 and 10 rooms is used here as convenient dividing point between site size clusters, and it is represented by a low occurrence of sites at the 10-room range between two peaks (ca. 150 m^2). The limited excavation data on sites with

0	6
1	0, 1, 4, 8, 8, 8, 8
2	0, 0, 0, 0, 1, 2, 3, 3, 4, 4, 4, 5, 6, 7, 7, 8, 9
3	0, 1, 1, 3, 3, 3, 3, 3, 5, 5, 6, 6, 9
4	0, 0, 1, 2, 3, 4, 5, 5, 6, 9, 9, 9
5	0, 0, 1, 2, 2, 4, 5, 5, 7
6	0, 2, 2, 2, 3, 4, 4, 5, 5, 7
7	1, 4, 5, 6, 7
8	0, 1, 2, 4, 6
9	0, 0, 5, 5, 6
10	3, 8
11	0, 4, 9
12	3, 8, 8, 8
13	9
14	8
15	0, 0, 5
16	1, 4
17	0
18	
19	3, 4, 5
20	
21	0, 3, 6
22	
23	8
24	6, 7, 9
25	0, 8
26	
27	
28	
29	4
30	0, 0
31	
32	
33	
34	3
35	
36	
37	
38	8
39	
40	
41	6
42	
43	
44	
45	
↓	
59	2
60	
↓	
66	1
67	
68	
69	
70	
↓	
79	5
80	
↓	
101	5
102	
↓	
152	5

Figure 5.2. Stem and leaf histogram of site sizes (m^2) using Graybill's (1975:161–165) survey data.

more than 10 rooms seem to indicate a change in possible site function and intensity of occupation, potentially a shift from "field houses" to "farmsteads," with those with more than 20 rooms representing more sedentary, longer term occupations (Stokes 1997, 2000a).

It is clear from Table 5.2 that the Cottonwood ruin is the single largest site in Graybill's study area (as is Elk Ridge ruin, which does not appear in Graybill's data, but is included in this analysis). The Cottonwood ruin is situated along the main Mimbres River near where it widens and emerges from the Ponderosa pine ecozone. Its size is comparable to the dozen or so "very large" Mimbres villages further downstream (e.g., Mattocks ruin, Galaz ruin, Swarts ruin, NAN Ranch, and Old Town) and along the lower elevation major tributaries (e.g., Cameron Creek). Several smaller sites occur in the area surrounding Cottonwood ruin (about 0.5 mi [1 km]). These four sites include two field houses (Graybill's Sites 1 and 4, with two rooms each) and two farmsteads (Sites 2 and 5, with 14 and 26 rooms respectively). This type of site size patterning and distribution is commonplace in the lower Mimbres Valley and is suggestive of interactive community systems (Stokes 1997, 2000a) similar to Hohokam platform mound communities in nearby Arizona (Fish and Fish 1994; Fish et al. 1992; Wilcox 1979).

Conventional wisdom until recently maintained that the Cottonwood ruin was the last major Mimbres village along the northern end of the main valley. The recently discovered Elk Ridge ruin on the west fork is situated in a relatively wide flood plain near the three forks junction (Morrison 2002). This portion of the west fork is unlike the middle and east forks which narrow considerably upstream of the junction. When Elk Ridge ruin was discovered in 1989 (and nearly destroyed by bulldozing), conventional

wisdom again suggested that this was likely the last undiscovered large Mimbres village. The fact that this site was nearly equal in size to many of the large main valley pueblos, and that it occurred along the edge of the bottomland in a comparatively narrow valley, gives pause to the assumption that large, permanent habitations away from the main valley are non-existent—or that high-elevation environments are wholly unsuitable for subsistence-level farming.

In addition to these few, widely spaced large villages, Graybill recorded several medium-sized sites and one medium-large site. These four sites range between 39–68 rooms (Graybill Sites 41, 52, 61, and 134), and based on limited excavation at similar sized sites (LeBlanc 1975; Stokes 2000a), they appear to be permanently occupied villages, unlike short-term and/or seasonal field houses and farmsteads. All of these sites are located at higher elevations than Cottonwood and Elk Ridge ruins. For example, Site 134 near the three forks is at 6,600 ft (2,012 m), and Site 41, at 6,500 ft (1,981 m), is located in the middle fork beyond the first narrows. Graybill Sites 52 and 61 are located further up the north fork, with Site 52 approximately two km beyond Site 41 and Site 61 (LA 5841) an additional three km upriver. Elevations are 6,600 (2,012) and 6,840 ft (2,085 m), respectively. These medium-sized pueblos are also situated amid a satellite system of several smaller field house and farmstead sites.

Farmsteads, with 10–28 rooms, are the second most common site size category (n=25). These sites are uniformly distributed at all elevations, although few were found in the east fork drainage. Farmsteads are usually thought of as seasonal habitations for one or two family groups, and they are used when certain farming duties require extended stays at one location (e.g., the planting and harvesting seasons) (M. Nelson 1999).

Because these smaller habitations likely housed related families, their locations may mark family landholdings that require an extended presence to ensure continued land tenure (e.g., Adler 1996; Kohler 1992; Lange 1959, Wilcox 1978). Interestingly, in the Postclassic period on the eastern slopes of the Black Range, new excavation evidence points to the changing role of farmsteads, from seasonal to fully sedentary (M. Nelson 1999). This change in site function may have been a consequence of Mimbres social reorganization after large-scale population movements and large site abandonments in the post-A.D. 1140 Mimbres world (Hegmon et al. 1999).

Clearly, field houses (1–9 rooms) make up the bulk of Graybill's database (n=94). Because these types of structures were often built for short-term use, they were likely abandoned on a regular basis throughout the Classic Mimbres period. In addition, small structures like these can fulfill many functional requirements, including convenient shelter on a day-to-day basis; overnight lodging for longer trips to distant fields, hunting grounds, ceremonial locales, or resource procurement areas; and short-term occupation of a week or longer (Lange 1959; Moore 1978; Nelson et al. 1978; Varien 1999; Wilcox 1978). Because of the multi-functional role of the field house, and its utility for many different environmental zones, it is not surprising that they are consistently the most common type of habitation structure found in the Greater Southwest.

Summary of Graybill's Survey Data

Although several important data classes were not readily available for this study, including site maps, incomplete concordance between Graybill's report and records at the Gila National Forest and the Laboratory of Anthropology, and, on occasion, slight

inaccuracies in site location, the existing database has proven to be extremely useful. The data in Graybill's (1975) report, coupled with additional information gleaned from the sources noted above, provided important clues to site size, site type, and time period. Of the 168 sites in the data tables in his final report, 18 were Late Pithouse period and 124 were Classic Mimbres (Pueblo) period; the others were artifact scatters, sites with questionable cobble architecture, and unassignable sites.

The nine Georgetown phase and nine Three Circle phase pithouse sites seem to indicate that Pithouse period use of Graybill's study area was generally limited, but perhaps constant at a low level, throughout this period. The absence of San Francisco phase sites in the database is not unusual, as the only surface indication of this phase is Mogollon Red-on-brown pottery, which is not common compared to other painted types, including red wares and later Mimbres Style I black-on-white pottery (Stokes 1995). There may, in fact, be San Francisco phase components at some of these sites, as red wares were recorded at many sites; in addition, because pithouse components at pueblo sites are often hard to detect, more may exist in Graybill's survey area than is accounted for. Most of the known pithouse sites were located in the three forks area, with a large cluster around the Three Circle pithouse village (Graybill Site 65). Another cluster was found further up the west fork, one site was found in the east fork (Site 134), and one in the middle fork beyond the first narrows (Site 43). Undoubtedly, other pithouse sites exist beneath the larger Mimbres pueblos (Lekson 1992a), but their extent is unknown.

The 124 pueblo sites appear to be distributed as expected, size-wise. Seventy-six percent were field houses (n=94), 20 percent farmsteads (n=25), 3 percent medium-sized pueblos (n=4), and 1 percent large pueblo village (n=1). Elk Ridge ruin is not included in

the large category because it was not part of Graybill's data set, but its inclusion would not significantly change the distribution pattern. The largest sites, including Elk Ridge ruin, are found at the low-end of the elevation range in the study area and at wider, better-watered valley locations. The three medium-sized sites and one medium-large site were found at higher elevations (Sites 41, 52, 61, and 134). The three in the middle fork are situated in slightly wider sections of a generally narrow and heavily forested valley corridor. One of these, Site 61 (LA 5841) was recently test excavated (Stokes 2000a) and will be discussed further in the next chapter.

Community systems were present within Graybill's site data set, which are defined as a single large site surrounded by several farmsteads and numerous field houses (Fish and Fish 1994; Stokes 1997, 1999b). The community systems are usually separated by at least several kilometers (Stokes 1999b). Not only do the two largest sites (Elk Ridge and Cottonwood ruins) have satellite systems of smaller sized sites, but the four medium-to-medium-large sized pueblo villages do as well (Table 5.3; Figure 5.3). These community clusters occur in the west fork (Elk Ridge ruin community), middle fork (Sites 41, 52, and 61), and main valley (Cottonwood ruin). The east fork (McKnight Canyon) may have one community, but it appears to be smaller in scale than the other communities, with just one 23-room farmstead/small pueblo, one large field house, and two field houses. The existence of a purported medium-sized pueblo in the east fork, which may have been the large farmstead recorded by Graybill, was not verified during a recent reconnaissance by the author and the Forest archaeologist to the project area in the spring of 1999. The east fork remains in question.

An interesting aspect of the community systems in the west and middle forks is

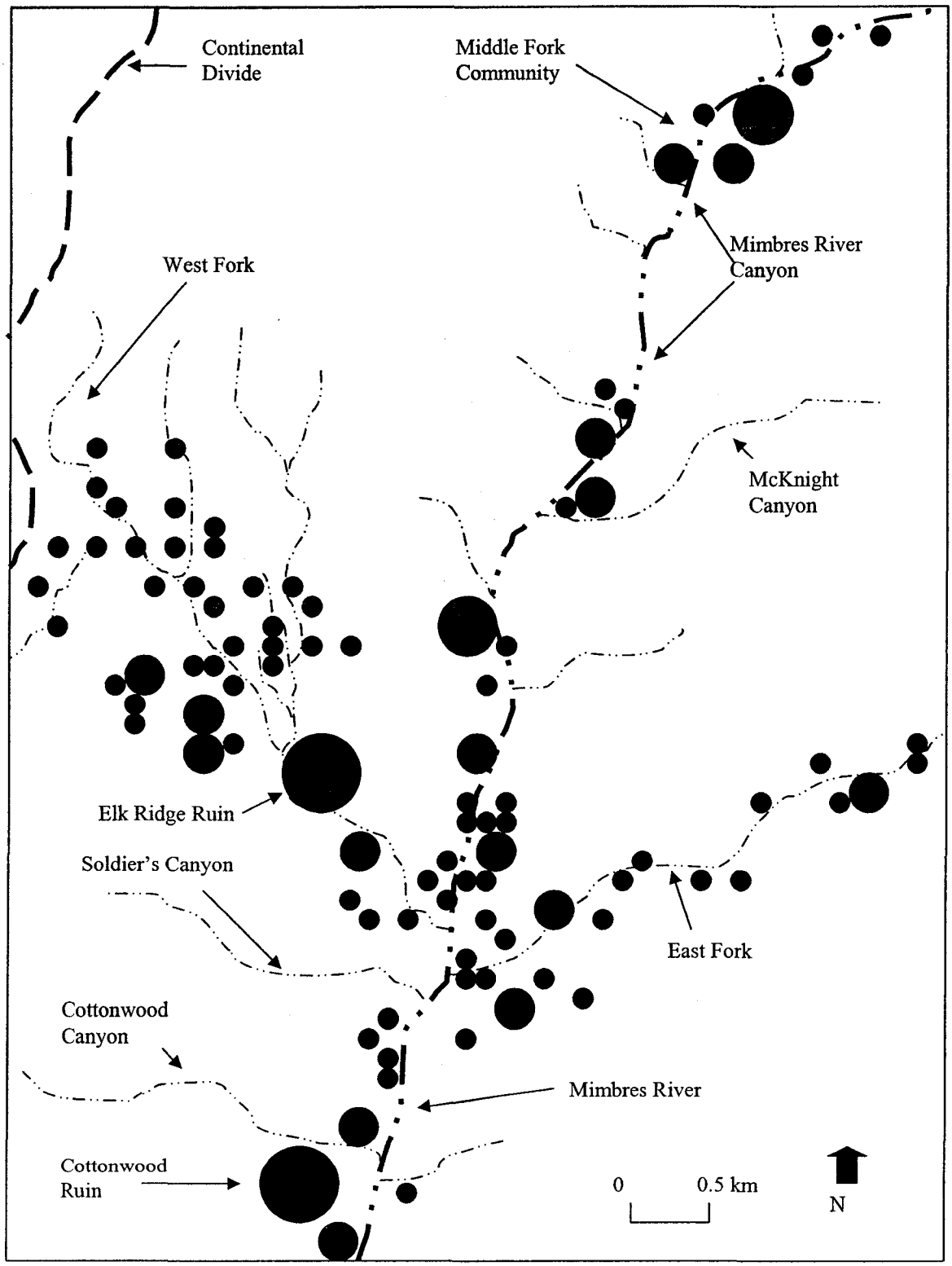

Figure 5.3. Map of the community clusters found in the upper Mimbres River. Largest dot=Large village; Medium-large dot=Medium-sized village; Medium-small dot=Farmstead; and Small dot=Field house. Note: dots not to scale.

Table 5.3. Classic period communities in the upper Mimbres Valley.

Community Cluster	Location in Valley	Site Types and Frequency
Cottonwood ruin	Main valley, near the Mimbres Ranger Station	One 100–120+ room pueblo Three 10–17 room farmsteads Seven 1–9 room field houses
Elk Ridge ruin	West Fork	One 100–120+ room pueblo Four 10–17 room farmsteads 25 1–9 room field houses
Graybill Site 41	Lower portion of Middle Fork	One 39–53 room pueblo Four 10–17 room farmsteads 15 1–9 room field houses
Graybill Site 52	Middle portion of Middle Fork	One 39–53 room pueblo Three 10–17 room farmsteads One 1–9 room field house
Graybill Site 61 (LA 5841, Cooney Ranch #1)	Upper portion of Middle Fork	One 39–53 room pueblo Two 10–17 room farmsteads Four 1–9 room field houses
Graybill Site 134	Unknown	One 68 room pueblo
Graybill Site 16[1]	East Fork (McKnight Canyon)	One 23 room farmstead One large field house Two several room field houses

[1] The east fork community is problematical due to the small size of the primary site, whose actual size was not verified in the field. Forest Service personnel suggest it is larger than indicated by Graybill.

their large areal extent. The three largest sites nearest the three forks junction appear to be situated to command a large section of valley. The farmsteads surrounding Elk Ridge ruin are widely dispersed, compared to the upper middle fork community comprising Site 61. The lower middle fork community is the most widely spread out (Site 41), but is also far narrower than the west fork or the main valley. The number of field houses in the three forks is quite high compared to the main valley.

Clearly, the results of Graybill's important survey work in the Ponderosa pine environmental zone of the Mimbres River and its main tributaries, coupled with the discovery of the Elk Ridge ruin, have shown that the three forks area was just as heavily

occupied as the middle and lower Mimbres River Valley, somewhat contrary to Graybill's interpretation of more limited occupation due to the seasonal use of the area. But just as importantly, reanalysis of his data have shown that the upper reaches of his study area were also intensively occupied, including the upper middle fork and the upper Sapillo Valley, albeit at a somewhat smaller scale. Subsequent resurvey of the Sapillo Valley demonstrated that this area was even more heavily occupied during the Classic period than Graybill thought (Stokes 1995; Stokes and Roth 1999). Despite Graybill's interpretation that the upper reaches of his study area were limited to smaller-scale, short-term, and/or seasonal occupation, reanalysis of the data indicates this does not appear to be the case. As will be shown below, a second major survey of the Mimbres area, undertaken by the Mimbres Foundation, reinforces these findings.

The Mimbres Foundation Survey of the Middle and Lower Mimbres Valley

One of the central questions posed above concerns the wider applicability of the reanalysis results of Graybill's survey data: specifically, do other agriculturally peripheral areas along the drier margins of the Mimbres Valley also contain evidence for being more intensively occupied than previously thought? Additionally, if evidence is found for intensive use and occupation of these areas, do the community systems described for the upper Mimbres Valley also occur? If peripheral community systems do indeed exist on a large scale, then they must have been an important aspect of Mimbres settlement behavior, allowing researchers to study the implications for population expansion and stress; variable land use and the conditions under which it is used; residential mobility; and potentially land tenure.

A major, multi-year survey and excavation program was undertaken along the upper (to the Gila National Forest boundary), middle, and lower Mimbres River Valley and major tributaries in the mid- to late-1970s. This research program was conducted by the Mimbres Foundation, an organization created by Steven LeBlanc for the purpose of large-scale study of the Mimbres culture. LeBlanc and others saw that Mimbres sites were being destroyed at an alarming rate by vandalism and bulldozing, and they wished to rescue as much data as possible before these sites were destroyed (LeBlanc 1975, 1983). This was indeed "salvage archaeology" in its truest sense, as the number of Mimbres villages began to decline rapidly as a result of a significant change in pothunting strategy: the use of the bulldozer (LeBlanc 1983).

Although the Mimbres research program was varied, the primary goals of the Mimbres Foundation were to:

1) Survey as much area as possible within a restricted time frame in order to understand broad-scale settlement and population dynamics;
2) Test excavate vandalized pueblos to see what types of data remained (which prior to that time were believed to be minimal);
3) Excavate at several large sites before they were scheduled to be bulldozed by professional pothunters; and
4) Purchase sites for permanent protection (Anyon and Leblanc 1984; Blake et al. 1986; LeBlanc 1975, 1983).

Although the project goals were ambitious, they were met with success, including an extensive three-year survey (Blake et al. 1986); excavations at a variety of site types in the main Mimbres Valley (Anyon in prep; LeBlanc 1975, 1976, 1977, 1983; Nelson et al.

1978); large-scale excavations at major Mimbres sites (Anyon and LeBlanc 1984; Diehl and LeBlanc 2001; Gilman and LeBlanc in prep; LeBlanc 1976, 1977; Nelson and LeBlanc 1986); and the purchase of the Mattocks site (LeBlanc 1983).

Over 10,000 ha in the Mimbres Valley and its major tributaries were surveyed, from the boundary of the Gila National Forest at Allie Canyon to 3 km south of the Luna-Grant county line where the Mimbres Valley opens onto the low elevation Deming Plain (Blake et al. 1986:444–448). The project area was divided into 12 environmental zones: bottomland/benches along the upper, middle, and lower Mimbres River valley; landforms above the benches in all three valley sections; wide bottom side drainages; narrow bottom side drainages; mountain parks; mountain slopes/flanks; flat hilltops/mesa tops; and rolling desert (Blake et al. 1986:447). The majority of the total acreage occurred in the final five categories.

The survey located 30 Early Pithouse period sites, 27 Late Pithouse period sites, and 69 Classic Mimbres period sites (Blake et al. 1986:451) (Table 5.4), in addition to several post-Classic sites in the middle and lower valley. For population estimation purposes, Blake et al. (1986) increased these totals by approximately 250 to 280 percent to estimate a valley-wide site occurrence rate; however, for the purposes of this study, only their actual site counts are used. They calculated a total of 2,217 Classic period rooms for the 69 pueblo sites, roughly twice the number estimated for Graybill's sites (see Table 5.2). Their estimated valley-wide room total (5,909) is five times the number found by Graybill, although it is unclear if they are including his results in this estimated total. They do not state what their conversion factor was (Blake et al. 1986:449), but it is likely they used data from their work at the Galaz Ruin (15 m^2 average room size)

(Anyon and LeBlanc 1984). Site sizes (rubble mounds) were generally recorded within ranges, and using their room conversion factor, they discerned five site size classes: 1–9, 10–24, 25–49, 50–124, and 124–200 rooms (Blake et al. 1986:449) (Table 5.4). These generally compare well with the estimates generated for Graybill's survey data (1–9, 10–17, 20–28, 39–53, 68, and 100+ rooms); however, because Blake et al. used ranges of site size and not actual counts per site, some non-overlap is evident between the two project areas.

Table 5.4. Survey results from the Mimbres Foundation's work in the Mimbres Valley (adapted from Blake et al. 1986).

Period	Number of Sites	Number of Rooms	Number of Sites per Size Range[1,2]				
			1–9	10–24	25–49	50–124	125–200
Early Pithouse	30	221	22	6	2		
Late Pithouse	27	486	12	6	4	5	
Classic	69	2,217	12	35	8	9	5
Totals	*126*	*2,924*	*46*	*47*	*14*	*14*	*5*

[1] For the pithouse periods, the size range refers to number of individual pithouses.
[2] These totals are presented as percentages in Blake et al. (1986:458), but were converted to actual numbers for the purposes of this table. Given how the data were presented, it is not possible to determine how many sites, for instance, cluster nearer to "10" in the 10–24 size range.

From their data, Blake et al. (1986:462) conclude that the Mimbres Valley was heavily occupied throughout the Late Pithouse and Classic periods, with significant Early Pithouse and Post-Classic occupations. Valley population, site frequency, and site size steadily grew through time (they estimate that the Late Pithouse period totals are underestimated), with a sharp decline for the Post-Mimbres period Black Mountain and Cliff phases. The growing population increasingly expanded out of the main valley, culminating in the Classic period occupation and use of all environmental strata examined during survey (Blake et al. 1986:462–464).

Blake et al. (1986) compared their results to Graybill's survey data and observations and concluded that the sudden large increase in Classic period site frequency observed by him was the result of population expansion out of the lower elevation Mimbres Valley during this time period. Blake et al. (1986:464) also state that while they assumed that only pueblo sites containing seven rooms or less were seasonally occupied field houses (all larger sites were permanently occupied), they surmise that larger sites in marginal areas were likely seasonally occupied. The occupants of these seasonal habitations in the marginal areas surrounding the main Mimbres Valley likely returned to the larger main valley sites during winter. Thus, they suggest that these sites were used during the spring and summer seasons, or in other words, for the purpose of supplemental agriculture during the planting through harvesting seasons, with a possible change to permanent residency later in the period (see Minnis 1985a).

Finally, Blake et al. (1986) argue that the focus of permanent, intensive occupation was confined to the five environmental strata bordering the main valley. These are valley bottoms and benches in the three sections of the main valley; landforms immediately above the benches in the upper Mimbres Valley only; and wide-bottom side drainages (Blake et al. 1986:464). The seven strata that contained the majority of survey acreage contained only 0.6 percent of total floor area for all cultural periods. These included landforms above the benches in the middle and lower Mimbres valleys; narrow-bottom side drainages; mountain parks; mountain slopes and flanks; flat hill and mesa tops; and open, rolling deserts. Clearly, when they state that the Classic Mimbres expanded beyond the main valley, they mean the portions of side drainages with wide valley bottoms (e.g., the three forks area in Graybill's survey area).

Reanalysis of the Mimbres Foundation Survey Data

Site data for the Mimbres Valley and its tributaries above Old Town ruin in the lower valley were gathered from the New Mexico State archaeology archives in Santa Fe (Laboratory of Anthropology-ARMS division). The focus was on acquiring important information such as period of occupation, estimated or actual site size, site location, site function, and intensity of occupation. The focus of the data search was the Mimbres Foundation survey records, but it also included other smaller survey results (e.g., Gila National Forest and Texas A&M's NAN Ranch project surveys). Site location data were plotted onto USGS 7.5′ topographic quadrangles (Allie Canyon, Dwyer, Hay Mesa, Hendricks Peak, Hurley East, Maverick Mountain, North Star Mesa, San Lorenzo, Santa Rita Mine, Taylor Mountain, and Whitehorse Mountain). Site records were copied and included site forms, plan maps, artifact summaries (if present), and any other additional forms that could be useful. It became clear that several well-known larger sites in the Mimbres Valley were not included in the data files, e.g., Baca ruin (Evans et al. 1985), probably due to the Mimbres Foundation's inability to secure permission to survey all private parcels of land in the valley (Blake et al. 1986). A data dump was generated from the computer files at ARMS, and several reports were copied from their library holdings. The data dump site records were checked against existing plan maps for accuracy regarding estimated site size; in many cases, it was found that large site sizes in the computer included the extent of the artifact scatter, not just the rubble mound. In these cases, actual rubble mound sizes were recalculated from the plan maps.

The raw site size data, usually recorded within ranges of square meters (but occasionally were recorded in feet that had to be converted to meters) (Figure 5.4) were

0	4, 5, 5, 6, 6, 6, 7, 7, 8, 8, 8, 8, 9, 9
1	0, 2, 2, 5, 6, 8, 8, 9
2	0, 0, 0, 0, 4, 5, 5, 7
3	2, 3, 6, 6, 6
4	0, 4, 5
5	0, 0, 4, 0
6	0, 0, 0, 2, 2, 4, 4, 4, 4, 5, 6
7	5
8	0
9	0, 0, 6, 6
10	0, 0, 0, 0, 0, 4, 5
11	2, 6
12	0, 0
13	5
14	
15	0, 0, 0, 0, 4
16	0
17	
18	
19	5
20	0
21	
22	
23	
24	0, 0
25	0
26	
27	0
28	8
29	
30	0, 0, 0, 0, 0
31	
32	0, 2
33	
34	
35	
36	0
37	4, 5, 5, 5
38	4
39	
40	0
41	
↓	
60	0
↓	
64	4
65	
66	0
67	5
↓	
71	6
↓	
75	0, 0
↓	
80	0
↓	
85	0
↓	
120	0
↓	
127	5
↓	
180	0, 0, 0
↓	
300	0, 0

Figure 5.4. Stem and leaf histogram of site sizes (m^2) in the main Mimbres Valley and tributaries.

Table 5.5. Site size, frequency of occurrence, and estimated number of Classic period rooms generated from Mimbres Foundation and Laboratory of Anthropology survey data.

Estimated or Actual Site Size in m^2	**Frequency of Sites**	**Estimated Number of Rooms (15 m^2 estimated average per room)**
4–135	71	1–9 (field house)
150–322	20	10–21 (small farmstead)
360–400	7	24–27 (large farmstead)
600–850	9	40–57 (medium pueblo)
1,200–1,275	2	80–85 (large pueblo)
1,800–3,000	5	120–200+ (very large pueblo)
Total	*114 sites*	*2,092 total rooms*

converted to estimated rooms for each Classic period site. This process enabled a recreation of the collapsed site size data set published in Blake et al. (1986), and a refined site size distribution was created that did not rely on "continuous" distribution ranges but on actual clusters. Based on estimated site size, expressed in number of rooms, six distinct size classes became evident: 1–9 rooms, 10–21 rooms, 24–27 rooms, 40–57 rooms, 80–85 rooms, and 120–200^{+} rooms (Table 5.5). Within these ranges, several peaks occur within the 1–9 room range, but all such sites are likely short-term field houses based on the few excavations at these site types conducted thus far and the general lack evidence for activities associated with long-term site use. It also seems likely that all of the sites that fall into the 10–21 and 24–27 room range function as longer-term farmstead occupations, again based on the limited excavations conducted at these site types and the evidence produced that indicate longer-term use. They will be collapsed into one size category (10–27 rooms). Because a substantial gap occurs between 27 to 40 rooms, and again between 57 to 80 rooms, it is likely that the 40–57 room group comprises more sedentary and permanent medium-sized villages. All sites over 80 rooms are likely

permanent villages, based on previous excavations of sites that fall into this range in the Mimbres Valley, and they will be combined into a large site category. It is recognized that there could be significant social and economic differences between the 80–120 room villages and the exceptionally large 200+ room sites, but these are not critical for the purposes of this research. These revised size ranges (Table 5.5) compare favorably to the ranges generated for Graybill's data.

The next step was to convert the uniformly sized site plots on the topographic quadrangles at ARMS to four gradated sized "dots" to represent the four size classes, with the dots increasing in size in conjunction with site size (Figure 5.5). The results were dramatic; whereas before the topographic maps exhibited no sense of site size distribution, the revised plotting accomplished this. It becomes immediately obvious that site clusters do occur (i.e., community systems) with some frequency, with generally one large site centrally located amid a satellite system of smaller sites comprised of the three remaining size classes. The communities in the main valley are generally composed of sites from all four size classes, although most clusters have only one very large site (e.g., Montezuma, Mattocks, and Galaz ruins), but they may contain any number of other site size combinations. In one case, a main valley community cluster did not contain a single large site, but instead had two medium sized villages (40–57 rooms) very near each other. The community systems were often found where large tributaries joined the main valley, for example, at the Galaz (Noonday Canyon), Perrault (Gallinas Canyon), Swarts (Tom Brown Canyon), and NAN Ranch (Gavilan Arroyo) communities, and they may be a function of increased water flow that results (Figure 5.5).

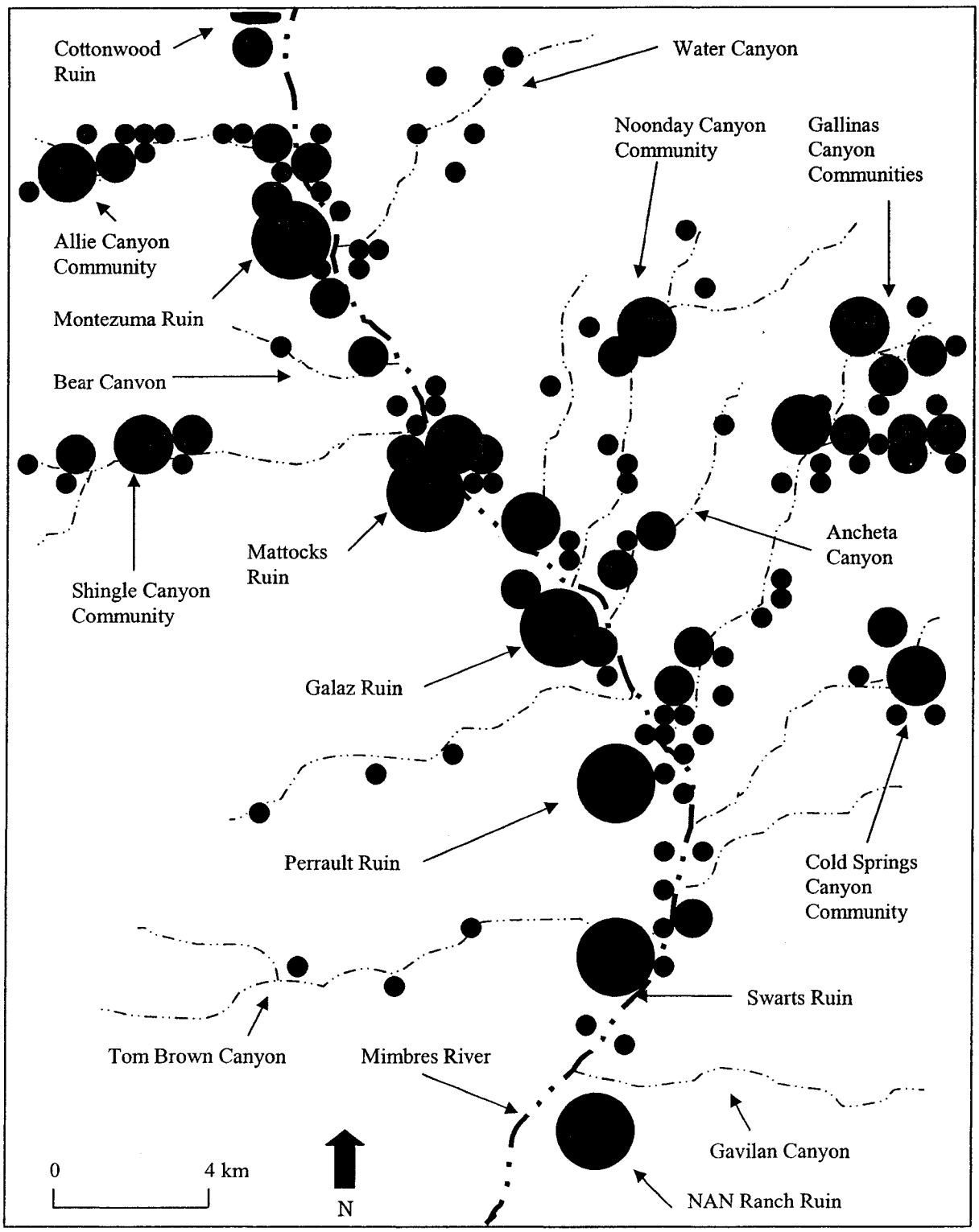

Figure 5.5. Map of the Mimbres Valley showing the locations of site clusters. Largest dot=Large village; Medium-large dot=Medium-sized village; Medium-small dot=Farmstead; and Small dot=Field house. Note: dots not to scale.

It appears that community clusters are not a unique phenomenon in the Mimbres Valley, but are quite typical. This is not unexpected given the generally agreed upon scenario of high population density and intensive farming, including probable canal systems, for the Classic period Mimbres (Blake et al. 1986; Herrington 1979, 1981; LeBlanc1983; Minnis 1985a; Shafer 1982, 1999a). Given that good, arable farmland and available water were likely at a premium during the Classic period (Minnis 1985a), it would not be a surprise if some form of land tenure based on either family or corporate level cooperatives (e.g., Adler 1996; Kohler 1992; Lange 1959) was in use during this period (Shafer 1998, 1999b; Stokes 1997, 1999b). It is likely that the community clusters observed in the Mimbres Valley are coincident with land holdings in the immediate area.

The fact that these community clusters are roughly evenly spaced apart in the valley also adds credence to this observation and is what would be expected to occur under central place theory (King 1984; Stark and Young 1981; Wood 1978), discussed earlier in Chapter II. Granted, large Mimbres communities were not likely centers of mercantilism, but they likely were the focus of daily life, trading, ritual activity, community integration, and subsistence activities (Anyon and LeBlanc 1984; Shafer 1995, 1999b). As a result, zones of influence and resource control should surround these communities in the same manner as mercantile centers. This observation is important because it demonstrates, in conjunction with the survey data, that the Classic period Mimbres were highly organized socially, economically, and ideologically (see also V. Powell 2000; Shafer 1998, 1999b). I argue that this is what is being manifested on the landscape of the Mimbres River valley.

Of special interest to this study is the occurrence of peripheral area community

systems that became evident in the Mimbres Foundation survey data. Sites were plotted in the same manner described above for the Mimbres Valley, revealing that 54 percent (n=6) of the major tributary canyons they studied (n=11) have community clusters very similar to the main valley (Figures 5.6–5.9; Table 5.6). These include Allie, Cold Springs, Gallinas, Noonday, Shingle, and Gavilan Canyons. All community clusters are located between 6.5 to 13 km (4 to 8 mi) from the Mimbres River and generally occur in wider sections of their respective canyons. Most of these side drainages have "empty" zones between the main valley site clusters and the upper canyon site clusters. The peripheral communities all have one medium sized pueblo (40–57 rooms) and are surrounded by one to several farmsteads and numerous field houses. The larger sites are generally located where several drainages intersect, for example, in the middle fork, Allie Canyon, Gallinas Canyon, Noonday Canyon, and Cold Springs communities. In the lower Mimbres Valley, Shafer and Creel (1999) report that a similar community system exists deep into Gavilan Canyon above NAN Ranch ruin where several springs occur. However, per request of Harry Shafer (personal communication, 1999), the Gavilan Canyon data were not used for this study and will not be discussed further in the dissertation.

Interestingly, two community clusters were found in upper Gallinas Canyon and are separated by approximately 2.4 km. This is the only example found where two peripheral communities occur in the same tributary canyon, other than in the middle fork of the Mimbres River, although each community is more-or-less situated on a different drainage in Gallinas Canyon. In addition, two isolated farmsteads and several field houses cluster approximately 2 km further upstream from Community Cluster #1.

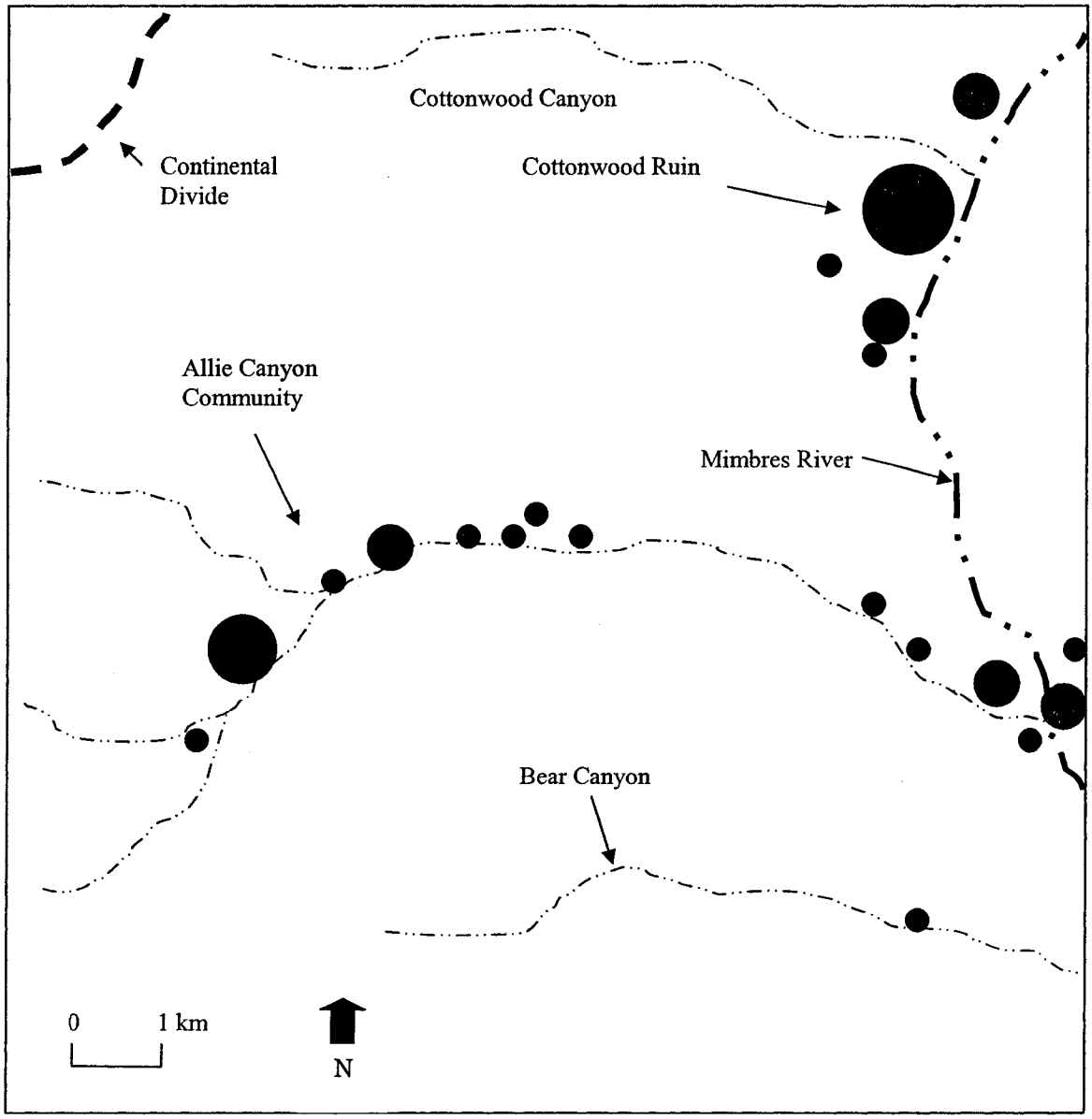

Figure 5.6. Map of the Allie Canyon community cluster. Largest dot=Large village; Medium-large dot=Medium-sized village; Medium-small dot=Farmstead; and Small dot=Field house. Note: dots not to scale.

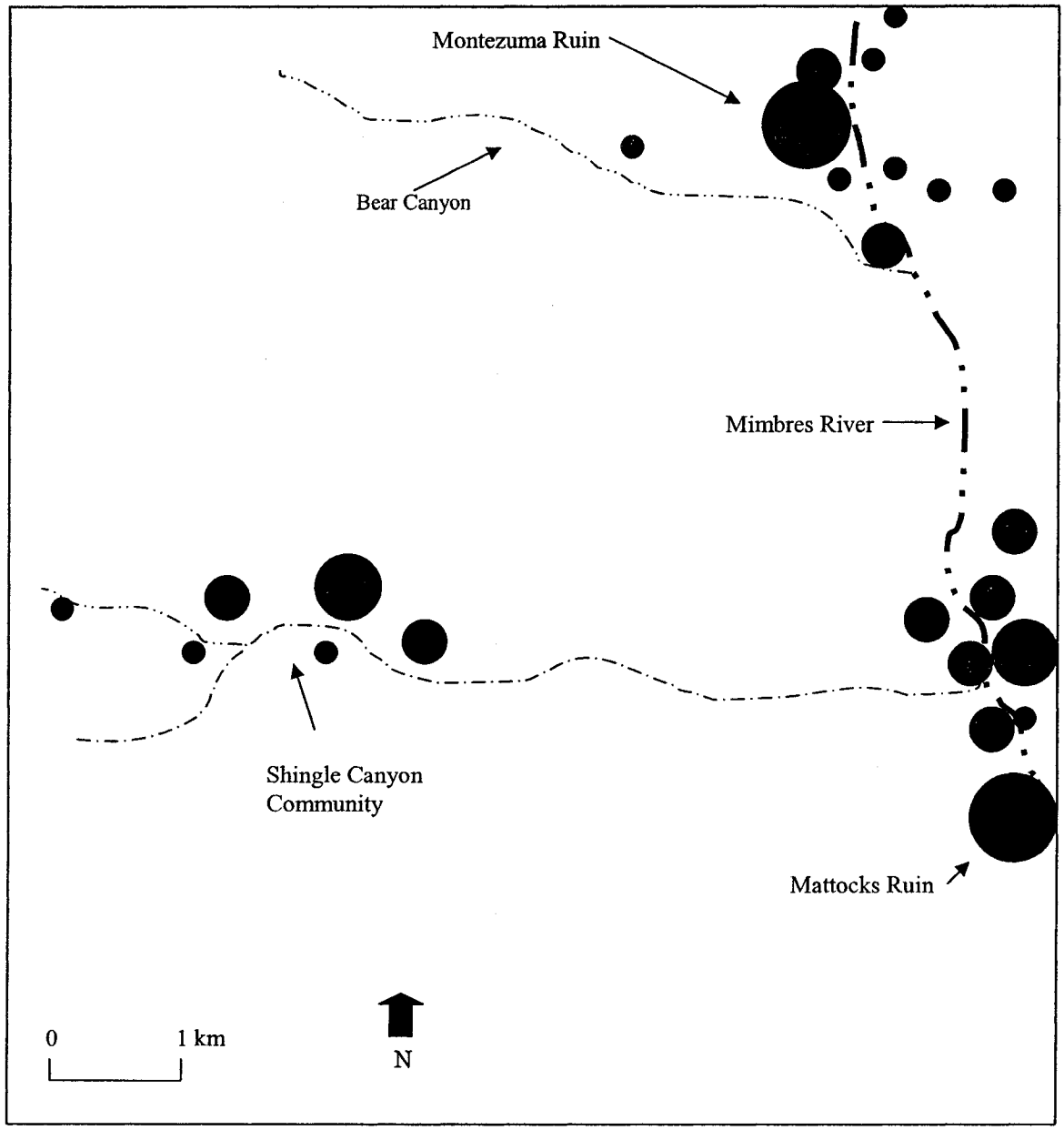

Figure 5.7. Map of the Shingle Canyon community cluster. Largest dot=Large village; Medium-large dot=Medium-sized village; Medium-small dot=Farmstead; and Small dot=Field house. Note: dots not to scale.

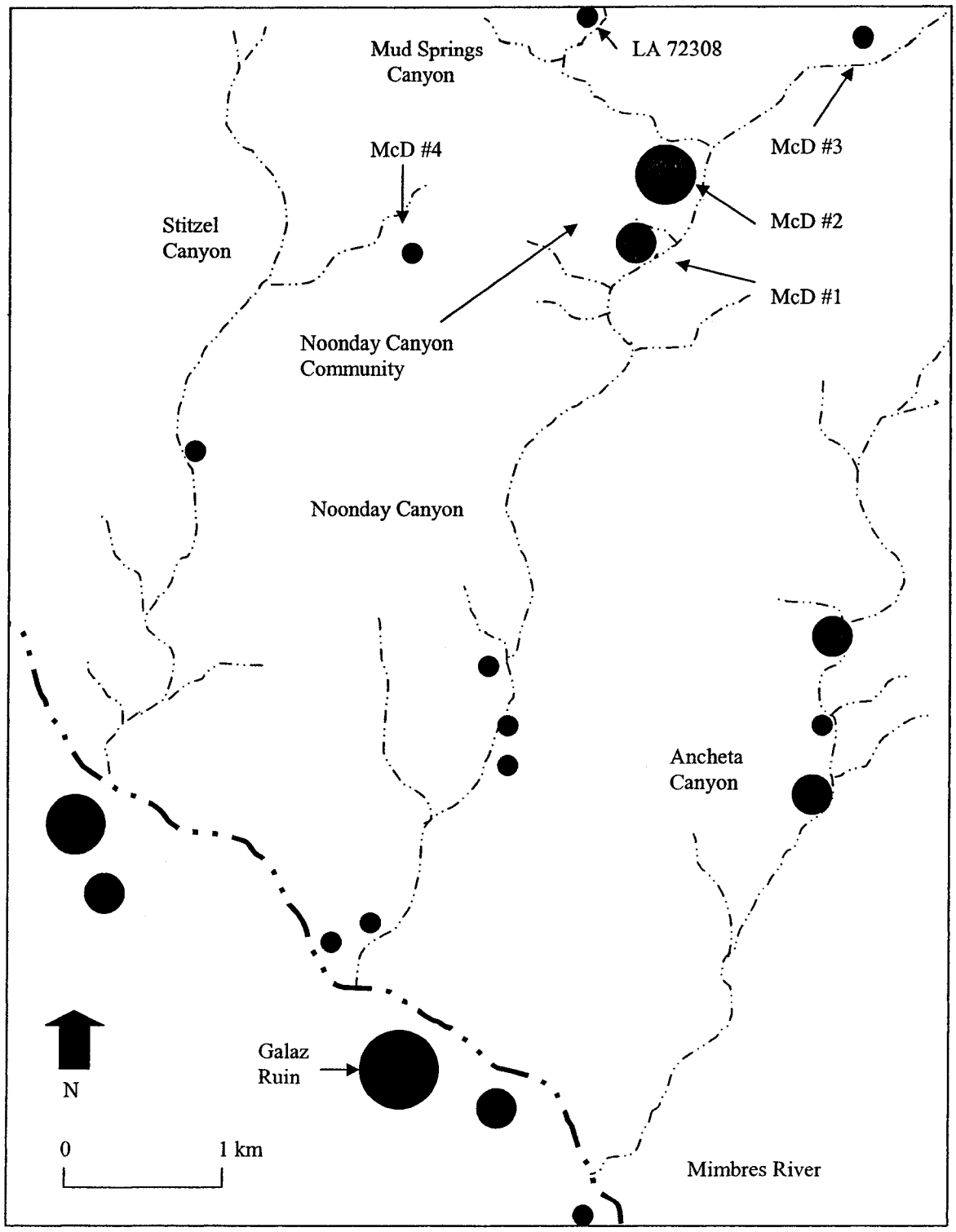

Figure 5.8. Map of the Noonday Canyon community cluster. Largest dot=Large village; Medium-large dot=Medium-sized village; Medium-small dot=Farmstead; and Small dot=Field house. Note: dots not to scale.

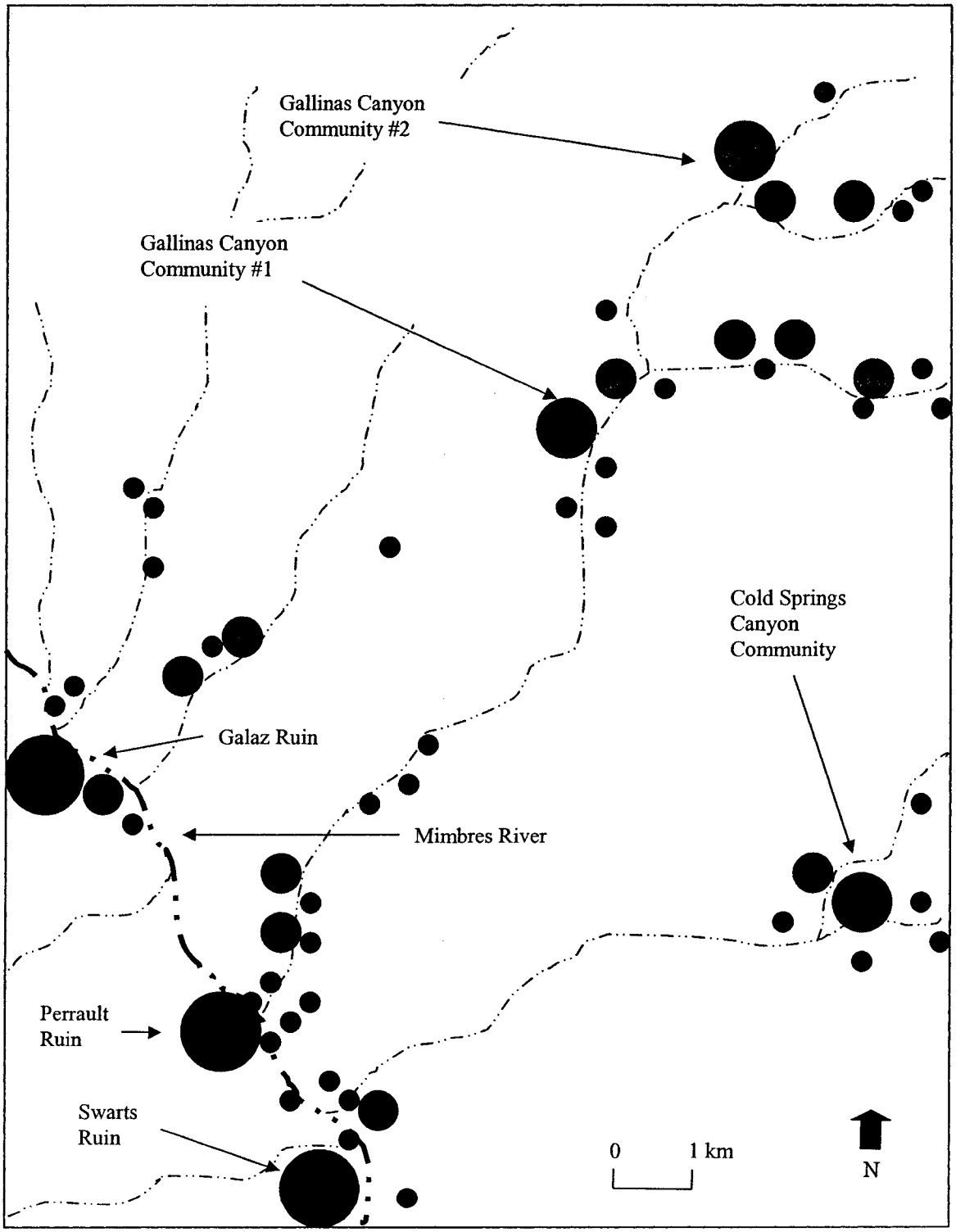

Figure 5.9. Map of the Gallinas Canyon and Cold Springs Canyon community clusters. Largest dot=Large village; Medium-large dot=Medium-sized village; Medium-small dot=Farmstead; and Small dot=Field house. Note: dots not to scale.

Table 5.6. Side drainages of the Mimbres River with and without community systems[1,2].

Side Drainage	Location	Community System	Site Types and Frequency
Allie Canyon	Upper Mimbres Valley	Yes	One 40–57 room pueblo One 10–21 room farmstead Six 1–9 room field houses
Ancheta Canyon	Middle Mimbres Valley	No	Two 10–21 room farmsteads One 1–9 room field house
Bear Canyon	Upper Mimbres Valley	No	Two 10–21 room farmsteads Two 1–9 room field houses
Cold Springs Canyon	Lower Mimbres Valley	Yes	One 40–57 room pueblo One 10–21 room farmstead Five 1–9 room field houses
East/Water Canyons	Upper Mimbres Valley	No	Six 1–9 room field houses
Gallinas Canyon	Middle Mimbres Valley	Yes	*Community #1* One 40–57 room pueblo One 24–27 room farmstead Five 1–9 room field houses *Community #2* One 40–57 room pueblo Two 10–21 room farmsteads Three 1–9 room field houses *Other sites in area* Two 10–21 room farmsteads Four 1–9 room field houses
Hot Springs Canyon	Lower Mimbres Valley	No	Three 1–9 room field houses
Noonday Canyon	Middle Mimbres Valley	Yes	One 40–57 room pueblo One 10–21 room farmstead Three 1–9 room field houses
Shingle Canyon	Middle Mimbres Valley	Yes	One 40–57 room pueblo Two 10–21 room farmsteads Three 1–9 room field houses
Tom Brown Canyon	Lower Mimbres Valley	No	One 1–9 room field house
Gavilan Canyon	Lower Mimbres Valley	Yes	Site data not available for this study

[1] All community clusters are located from 6.5 to 13 km above the Mimbres River, and all sites within the cluster generally occur within a 1-km radius of the largest site.
[2] Although other large tributaries occur along the Mimbres River, no sites were reported within them, likely due to lack of survey coverage than actual conditions (see Blake et al. 1986).

However, Gallinas Canyon is one of the better-watered side drainages of the Mimbres River and likely could have supported two communities.

Other examples of peripheral community systems include Allie Canyon, which contains one medium-sized pueblo and is surrounded by one farmstead and numerous

field houses, and Shingle Canyon, which also contains one medium-sized pueblo surrounded by two farmsteads and three field houses. In most cases, few surface structure sites of any kind are found between the peripheral community and the main valley community at the mouth of the drainage. In side drainages that do not contain known peripheral community systems (see Table 5.6), the canyon either does not widen appreciably or only does so deep into the foothills or mountains. These drainages occur in all three sections of the valley. Several do contain one or more farmsteads (Ancheta and Bear Canyons), but because farmsteads are generally viewed as seasonal occupations, at least in the Mimbres Valley (but see Nelson 1999), they are not viewed in this dissertation as forming the anchor of a permanent, viable community under the conditions outlined previously.

Summary of the Mimbres Foundation Survey Data Reanalysis

The results of this reexamination of the Mimbres Foundation survey data have demonstrated that: 1) community systems appear to be real components of Classic Mimbres settlement patterns, and 2) that many agriculturally marginal side canyons also contain sizable communities. A sizable portion of the Mimbres population could have been sustained by either permanent residency at peripheral communities, or by seasonal or long-term mobility between these communities and main valley pueblos. In addition, all community systems in the main valley appear to be separated from each other by 3 to 5 km, while peripheral communities are separated from the main valley by 6.5 to 13 km. Areas in between main valley communities contain some farmsteads and field houses, but are essentially empty areas, whereas virtually no sites occur between the main valley and

the peripheral communities. The main valley communities generally occur where large side drainages enter the Mimbres River, which likely provided an influx of additional water to the river. A similar pattern was found in peripheral areas.

All of these factors point to the presence of land tenure and resource control in both the main valley and the tributary canyons based on the model parameters established earlier (e.g., community systems situated at the best locations in the valley with regard to land and water, no-man's zones between the communities, field houses and farmsteads located close to the main village and not at inconvenient distances), and are indicative of complexly organized social and economic systems sustaining the Classic period Mimbres people during what most researchers agree was a time of potential population and subsistence stress. Community systems in the main valley should be an expected outcome of central place theory under these conditions, but their occurrence in many side drainages is less expected. The fact that they do occur in these agriculturally marginal areas is evidence for substantial out-migration from the main valley after the Classic period began, a process that may have started during the Three Circle phase but clearly accelerated during the Classic period.

That people were willing to endure the hardships of subsistence-level agriculture in these marginal areas (albeit offset to a degree by other subsistence opportunities in the hinterlands) is evidence for various stresses in the main valley becoming untenable. Perhaps the lack of access to good arable land and water due to long-standing land tenure claims by established Mimbres families and/or corporate groups (e.g., Shafer 1999b) forced this out-migration en masse to the side drainages during the Classic period. Those families without either long-standing land claims or ties to established families willing to

assist in their survival may have faced difficult choices under these circumstances, including the decision to leave for the tributary valleys. Once landless migrants established claims in the "best" locations in the side drainages, for example, where several drainages intersect, smaller-scale communities were eventually established to maintain their land access rights. At least at the survey level, these peripheral communities appear to mimic those in the main valley, which should be expected given that the migrants were most likely enculturated within the fabric of Mimbres society. It is not a great leap of faith to suspect that the same ideological principals that governed the main valley communities were transported to peripheral communities with the migrants.

If the community settlement system uncovered in the Graybill and Mimbres Foundation survey data is "real," it should be replicated in other Mimbres areas as well. I now turn to a third major survey data set, which is the Sapillo Valley in the Gila National Forest.

The Sapillo Valley Survey Project Data

The Sapillo Valley lies across the continental divide from the west fork of the Mimbres River (see Figures 4.1 and 5.1) and is entirely within the Gila National Forest. The valley is marked by three distinct environmental zones: 1) a wide, open parkland surrounded by high cliffs and mountain slopes in the upper valley (the GOS Ranch area); 2) the narrower middle valley with numerous springs, also bordered by high cliffs; and 3) the rugged and isolated canyon of the lower valley (Stokes 1995; Stokes and Roth 1999). Although Sapillo Creek is a major tributary of the Gila River and has permanent stream flow below artificial Lake Roberts, it is more easily accessible to the populations living in

the Mimbres Valley than the Gila Valley due to the generally low and easily traversed continental divide compared to the steep, rugged canyons along the Gila River. Elevation along the continental divide is 6,600 ft (2,012 m), but drops substantially to 5,200 ft (1,585 m) at the confluence of Sapillo Creek and the Gila River.

Ponderosa pine forests are common within and bordering the valley, but piñon/juniper woodlands are also common, especially on south facing slopes. Riparian vegetation occurs along the middle and lower valleys, including cottonwood, willow, black walnut, mountain mahogany, and box elder trees (Sandor 1983). Springs occur in the middle and lower valleys, but large amounts of water are often flushed through the numerous tributaries of Sapillo Creek from the bordering foothills and mountain slopes after heavy rains. The volume of water that can potentially flow into the Sapillo Valley during heavy storms is significant enough to cause major erosional damage along the bottomlands (Sandor 1983; Stokes 1995). However, underground water flow is sufficient for sustaining extensive grasslands in the upper valley and orchards in the middle valley (Trauger 1972).

Due to the generally high elevation of the valley, growing seasons are short, with an average cold season (October through April) temperature of 39.5 degrees F and an average summer temperature (May through September) of 64.7 degrees F (Gabin and Lesperance 1977; Stokes 1995:14). Rainfall averages 8.7 inches during the cold season and 11.2 inches during the summer season. Most rain falls between June and October during the summer monsoon season, with a secondary spike between December and February. Similar to the Mimbres Valley, the Sapillo Valley lies within an extensive volcanic province, with outcrops of basalt, rhyolite, cemented ash and tuff, Gila

conglomerates, and granite (Elson 1965; Trauger 1965).

Although Graybill (1975) surveyed the upper Sapillo Valley for his dissertation research, the remainder of the valley was virtually unknown. Several "large" sites were known from research and Forest surveys, including the Gatton's Park site (LA 11075/AR-03-06-05-002) in the upper valley (O'Bagy Davis 1995) and the Lake Roberts Vista site (LA 71877/05-215) in the middle valley (Bettison and Roth 1992; Danson 1957). The former was thought to contain upwards of 68 rooms (Graybill 1975), with the latter containing approximately 10 to 25 rooms (Bettison and Roth 1992; Stokes 2000b). Despite the lack of systematic valley-wide survey data, conventional wisdom held that it was unlikely that additional large sites would be found in the valley (Lekson 1992b), primarily because the Sapillo Valley was viewed as a place for seasonal occupation only.

As part of the overall research program that Bettison and Roth (1992) initiated for the Lake Roberts Vista site, the valley was sample surveyed in 1993 as the Sapillo Valley Survey Project (Stokes 1995). Sample units were placed perpendicular to the orientation of the valley and crossed from one high landform to a similar landform on the opposite side of the valley (Stokes 1995; Stokes and Roth 1999). Survey units were uniformly 320 m in width, but varied from 402 to 1,609 m in length, depending upon the width of the valley section. Because of time and budget constraints, the entire valley could not be surveyed; as a result, 20 percent of the units were randomly selected for survey. The survey resulted in the discovery of 62 sites, including 26 that were previously recorded (e.g., the Gatton's Park site). Site types included habitations from the Late Archaic to Classic Mimbres periods, artifact scatters, isolated architecture, rock shelters/cliff dwellings, rock art, a check dam system, and historic period trash scatters (Stokes 1995)

(Table 5.7). Based on site frequency by period, site size (Figure 5.10), and other criteria, Stokes (1995) and Stokes and Roth (1999) concluded that the valley was frequently visited, but lightly populated, until late in the Three Circle phase of the Late Pithouse period. During the Classic (Pueblo) period, the population of the valley increased by 10-fold over the earlier pithouse period estimated population.

Table 5.7. Site type frequencies from the Sapillo Valley Survey Project (Stokes 1995).

Site Type	Frequency	Size Categories and Frequency[1]			
		1–9	10–16	20–61	80–100+
Late Archaic w/pithouse	1	1			
Early Pithouse	5	5			
Late Pithouse[2]	14	10	2	1	1
Classic[2]	31	16	3	11	1

[1] For the pithouse periods, the size categories refer to number of pithouses; for the Classic period, number of rooms is used.

[2] Eleven of these sites are multicomponent pithouse/pueblo habitations, but are counted separately for the purposes of this table. In addition, only the two largest sites predate the Three Circle phase.

Evidence for a dramatic increase in Classic period population was the discovery of a very large pueblo site, the Ponderosa Ranch Ruin (LA 104065/05-584), with at least 120 and possibly 200 rooms, several medium-sized sites (46–61 rooms, n=4), and several large farmstead/small pueblo sites (20–33 rooms, n=7) (Table 5.8). In fact, of the four medium-sized pueblos, Gatton's Park (LA 11075/05-002) was the smallest site. Given the substantial size, architecture, burials (exposed by pothunters), and dense trash middens, these five large sites all give the appearance of being permanently occupied residences.

Although the Sapillo Valley can be considered somewhat agriculturally marginal because of its higher elevation compared to the Mimbres Valley, the survey data establish

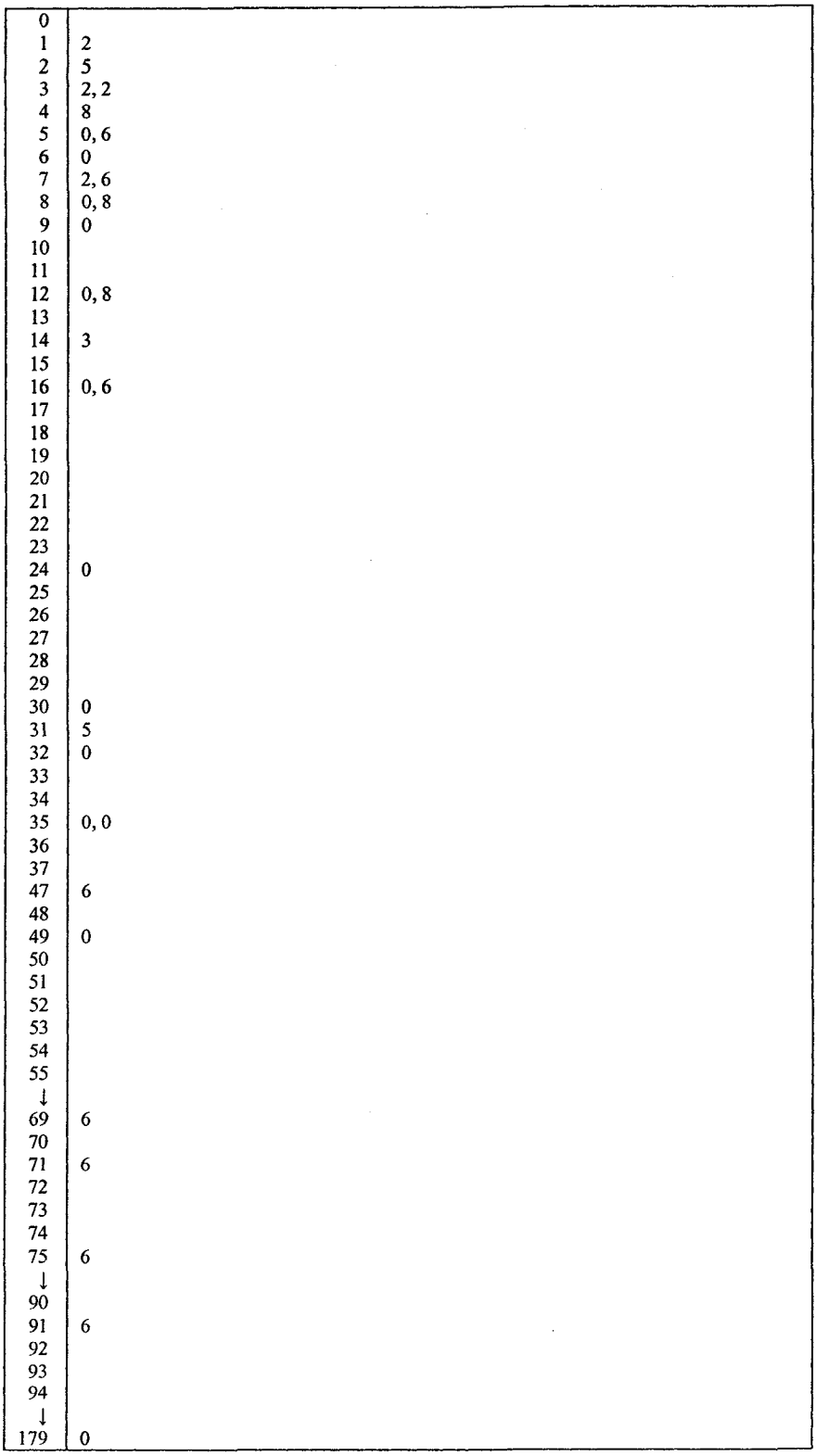

Figure 5.10. Stem and leaf histogram of site sizes (m^2) in the Sapillo Valley survey area.

Table 5.8. Site size, frequency of occurrence, and estimated number of Classic period rooms generated from the Sapillo Valley Survey Project data (Stokes 1995).

Estimated or Actual Site Size in m^2	**Frequency of Sites**	**Estimated Number of Rooms (15 m^2 estimated average per room)**
12–166	18	1–11 (field house)
240	1	16 (small farmstead)
300–490	7	20–33 (large farmstead)
696–916	4	46–61 (medium pueblo)
1,790	1	120+ (very large pueblo)
Total	*31 sites*	*608 total rooms*

that it was heavily and permanently occupied during the Classic period. Topographically, the habitable area resembles the upper Mimbres River Valley, especially the three forks area. Given that community clusters were found in the three forks area (e.g., centered on the Cottonwood and Elk Ridge ruins), similar patterns should be present in the Sapillo Valley. However, one major constraint with the database is the lack of large-scale survey coverage compared to the data generated by Graybill and the Mimbres Foundation. In the Sapillo Valley, survey unit widths were only 320 m, and many units were over 2,000 m apart, leaving wide gaps of unsurveyed land between them. The Sapillo Valley Survey Project was simply not set up with the current study parameters in mind.

Unfortunately, Graybill did not focus on his Sapillo Valley survey data for his dissertation research, and most of these sites (sites #164 to the low 180s) were not included in his data tables (Graybill 1975: Appendices I and II). Although these sites are plotted on his topographic maps, little corresponding data exist at either the Gila National Forest or the Laboratory of Anthropology. Only those sites that were revisited during the Sapillo Valley Survey Project have complete site type, site size, and artifact information. One large-scale Forest survey (Kelley 1991) was useful for examining the Lake Roberts

Vista site area. However, it is likely that the best that can be hoped for with the Sapillo Valley data are glimpses of partial community clusters, given that several medium-sized to large sites were discovered. Even with the data problems noted above, it is clear that partial community clusters are present (Table 5.9; Figure 5.11). In the upper valley (GOS Ranch area), community clusters appear to be centered on the Gatton's Park site, LA 104089/05-608, LA 75046/05-487, and LA 99841/05-454.

Table 5.9. Potential community clusters in the Sapillo Valley.

Community Cluster	Location in Valley	Site Types and Frequency
Gatton's Park (LA 11075/AR-03-06-05-002	Upper Valley	One 46–61 room pueblo One 20–33 room farmstead One 10–16 room farmstead Two 1–9 room field houses
LA 104089/05-608	Upper Valley	One 46–61 room pueblo Two 20–33 room farmsteads One 1–9 room field house
LA 75046/05-487	Upper/Middle Valley transitional area	One 46–61 room pueblo Two 20–33 room farmsteads One 10–16 room farmstead Three 1–9 room field houses
LA 99841/05-454	Upper Valley	One 46–61 room pueblo One 20–33 room farmstead Three 1–9 room field houses
Ponderosa Ranch ruin (LA 104065/05-584)	Middle Valley	One 120+ room pueblo One 10–16 room farmstead Six 1–9 room field houses
Lake Roberts Vista[1] (LA 71877/05-215	Middle Valley	One 20–33 room farmstead Four 1–9 room field houses

[1] The Lake Roberts Vista site did not occur in any of the survey units but was adjacent to one that crossed Lake Roberts and another that crossed the valley just below the lake. It is used here because data are available for the site (Bettison 1997; Bettison and Roth 1992; Roth and Bettison 1995; Stokes 2000b).

There appears to be partial overlapping for the LA 75046/05-487 and LA 99841/05-454 communities, and the Gatton's Park and LA 104089/05-608 communities. It is difficult to assess what smaller sites "belong" to which cluster. For the middle valley, three survey units tend to occur near each other, giving a fairly good coverage of this area. One very

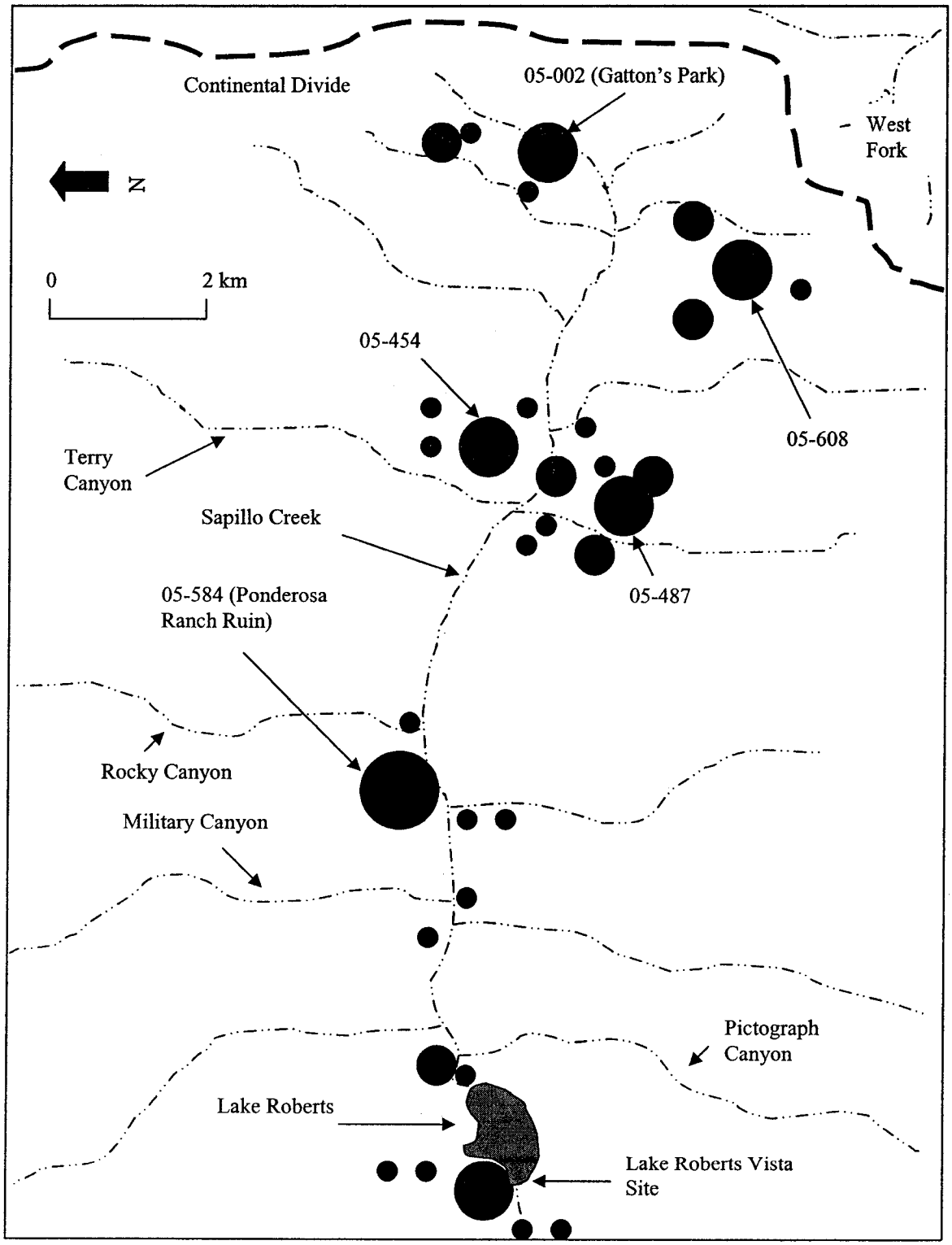

Figure 5.11. Map of potential community clusters in the Sapillo Valley. Largest dot=Large village; Medium-large dot=Medium-sized village; Medium-small dot=Farmstead; and Small dot=Field house. Note: dots not to scale.

large site is found on the north side of the valley (Ponderosa Ranch ruin), which is surrounded by one farmstead and several field houses. Discerning community clusters below Lake Roberts becomes more problematic due to pockets of unsurveyed private property and destruction of sites due to dam, motel, house, and ranch construction. The sites that were recorded tend to be farmsteads and field houses. It appears that community clusters are not (or possibly no longer) present below the Lake Roberts Vista site.

The distribution of potential community clusters in the Sapillo Valley resembles somewhat skewed versions of the patterns found in both the main Mimbres Valley and its side drainages. In the Sapillo Valley, one community is anchored by a very large site (Ponderosa Ranch ruin), but is surrounded by only one farmstead and few field houses, unlike what we see for very large sites in the Mimbres Valley. The other communities are defined by one medium-large site that is often surrounded by numerous farmsteads and field houses. In this respect, the clusters resemble some of those in the side drainages, which are of a comparable size. However, it must be remembered that the Sapillo Valley was not completely surveyed, and with complete coverage, some of these skewed patterns may be smoothed, potentially resulting in a pattern that more closely fits the Mimbres Valley. Interestingly, the major clusters in the Sapillo Valley are roughly 3 km apart, which is very similar to distances separating major villages in the Mimbres Valley.

On a larger scale, the Ponderosa Ranch ruin is located near the center of the Sapillo Valley, and as it is likely the largest village in the valley by far, it may in fact be serving as the "central node" for the entire valley. Its location between Military and Rocky Canyons, and on a prominent bluff above Sapillo Creek, places it where several potential "cross-roads" converge. Sapillo Creek serves to link the Sapillo Valley with the

Mimbres Valley across the low elevation continental divide, while Military Canyon serves as the best route to the upper Gila River valley and the Gila Cliff Dwellings/TJ ruin area. In fact, the canyon received its name from United States military units following an established trail to the upper Gila River while pursuing Mimbres Apache groups (McKenna 1965). The lower Sapillo box canyon is virtually impassable and does not provide a good route to the Gila River. In addition, Rocky Canyon provides a good route to the east fork of the Gila River. As a result, Ponderosa Ranch ruin is ideally situated to monitor the flow of people and goods between the upper Gila and Mimbres valleys, in addition to being located near numerous springs, large side canyons, and good, arable land.

Summary of the Sapillo Valley Survey Project Data

The survey data for the middle and upper Sapillo valleys (Kelley 1991; Stokes 1995) demonstrates that community systems also exist in this somewhat agriculturally marginal area. Clearly, the intensity of Classic period occupation in the Sapillo Valley was much greater than the side drainages of the Mimbres River, and it was likely the result of the Sapillo Valley's larger size, more arable land and reliable water, abundant natural resources, and important travel routes. These factors may have served to offset the potential difficulties for subsistence-level farmers of short growing seasons, cold air drainage, more limited direct sunlight, and the potential for devastating floods. There is little doubt that these factors were overcome, as evidenced by the high Classic period population density and the extensive network of agricultural terraces and checkdams on the slopes above the valley (Kelley 1991; Sandor 1983; Stokes 1995). However, the

timing of greatly increased population density appears to occur late in the Late Pithouse period (Stokes and Roth 1999), not earlier as seen in the Mimbres Valley, nor later as seen in other peripheral areas, such as the eastern slopes of the Black Range. The timing of population movement into the Sapillo Valley generally coincides with established patterns of increasing population density and potential food and social stresses building in the Mimbres Valley (Blake et al. 1986; Minnis 1985a), but it appears to have been affected first by out-migration from the Mimbres Valley (Stokes 1995; Stokes and Roth 1999).

If good agricultural land and available water were initially becoming scarce under increasing population pressure in the Mimbres Valley during the late Three Circle phase, as perhaps indicated by the population study undertaken by Blake et al. (1986) and the cultural ecological study undertaken by Minnis (1985a), then the first marginalized families likely would have gone to the underpopulated Sapillo Valley. The Sapillo Valley had by far the best agricultural land, water, and natural resources of any area surrounding the middle and upper Mimbres Valley, and should have been extremely attractive to migrants. Given the difficulties present in this high elevation valley for agriculture, colonization of the Sapillo Valley would not have been easy, and thus perhaps explains why settlement pattern trends there are not in lock-step with the Mimbres Valley (Stokes and Roth 1999). However, if the Sapillo Valley did serve as the first "safety valve" for an expanding Mimbres Valley population, it may have delayed colonization of other peripheral areas for several generations, a pattern that I believe is evident in the overall settlement pattern data for the region.

Summary of the Three Survey Data Sets

The presence of potential community clusters in the Sapillo Valley reinforces the patterns observed in the Graybill and Mimbres Foundation data sets for the upper, middle, and lower Mimbres River and its major tributaries. The size categories for each valley generated from their respective size-class data are very similar (Table 5.10) and demonstrate that the three areas can be directly compared with each other. Because these four areas cover much of the greater Mimbres Valley region, it seems that the existence of Classic Mimbres community systems is now incontrovertible. The data also show much more limited Late Pithouse period use of agriculturally marginal areas, except for a late Three Circle phase population movement into the Sapillo Valley. Mass movement into the side drainages, including the Sapillo Valley, appears to be a primarily Classic period phenomenon. The exact timing of this "event" requires excavation data and better dating for peripheral communities, but the few excavation projects in these areas indicate that many of the side drainages may not have been permanently occupied until a generation or two into the Classic period.

Table 5.10. Comparison of site size categories expressed by number of rooms for the three survey areas.

Survey Area	Site Size Category in Number of Rooms					
	Field House	**Small Farmstead**	**Large Farmstead**	**Medium Pueblo**	**Large Pueblo**	**Very Large Pueblo**
Lower & Middle Mimbres Valley[1]	1–9	10–21	24–27	40–57	80–85	120–200+
Upper Mimbres Valley[2]	1–9	10–17	20–28	39–53	68	102–120+
Sapillo Valley[3]	1–11	16	20–33	46–61	None	120+
Number of sites	*183*	*40*	*20*	*14*	*3*	*8*

[1] Primarily Mimbres Foundation and Laboratory of Anthropology data.
[2] Primarily Graybill (1975) data, supplemented with data from the Laboratory of Anthropology.
[3] From the Sapillo Valley Survey Project data (Stokes 1995).

Shafer and Creel (1999) report that movement deep into Gavilan Canyon was late in the Classic period, which was also suggested by Stokes (1997, 2000a) for the Noonday Canyon and Middle Fork communities (see next chapter). However, the Sapillo Valley data indicate an earlier movement of people into the valley. If the first marginalized families were leaving the Mimbres Valley at this time (about the end of the Late Pithouse period/beginning of the Classic period), it is likely that they would target the best available agricultural land not currently under land tenure rights to other families. Given that the Sapillo Valley was lightly occupied until late in the Three Circle phase, and that it presents a far better choice for farmers than many of the Mimbres River side drainages, it is not surprising that the Sapillo Valley was colonized first. It would also provide enough time and resources for an extremely large village to develop (i.e., Ponderosa Ranch Ruin). The fact that community clusters developed in agriculturally peripheral areas, with possible "empty" zones between them and the main valley community clusters, also points to aspects of land tenure coming into play.

Although the combined survey data are intriguing and informative, some excavation data are now available for several of the peripheral areas in the Mimbres Valley. These data can be used to demonstrate some of the concepts and observations that have been presented in this dissertation, including the timing of movement into peripheral areas; the duration and intensity of occupation for the large, central nodes of the peripheral community systems; trading relationships and cultural ties; and subsistence practices. These data are presented in the next chapter.

CHAPTER VI

EXCAVATION DATA FOR TWO PERIPHERAL AREA COMMUNITIES

The previous chapter presented survey data that covered most of the greater Mimbres Valley area, including the lower, middle, and upper Mimbres River, and the middle and upper Sapillo valleys. Plotting the Classic (Pueblo) period surface structure sites by size on topographic quadrangles revealed that Mimbres communities exist both in the main valley and over 50 percent of its tributaries studied by the Mimbres Foundation and Donald Graybill. Potential community clusters were also detected in the Sapillo Valley, but due to the sampling strategy employed for that valley, these remain incompletely defined.

In the main Mimbres Valley, the communities were composed of one large or very large pueblo (80–100+ room), several farmsteads (10–28 rooms), and numerous field houses (1–9 rooms). On occasion, a medium-sized pueblo village (30–61 rooms) was part of the community cluster, or several of these replaced the single large village. In the upper Mimbres Valley, one very large pueblo was found that anchored a widely dispersed community of farmsteads and field houses in the west fork, with a similar single occurrence of a very large site anchoring a community in the middle Sapillo Valley. For the tributaries, similar community systems were detected, but the large pueblos were replaced by medium-sized pueblos but still retained the satellite systems of farmsteads and field houses. These peripheral area communities were generally between 6 and 12 km upstream in the side drainage, often where two or more drainages intersect, where the valley bottom widens, and/or near environmental zone changes. Finally, it has

been suggested in this dissertation that these communities appear to be permanently occupied and that they were formed late in the Classic period. The cause for this migration into the side drainages at this time, I argue, is the result of food and population stresses in the main valley during the Classic period (Blake et al. 1986; Minnis 1985a).

In an attempt to demonstrate some of the claims presented above regarding movement into peripheral areas, several test excavation projects were undertaken in two peripheral communities of the main valley. These are the Noonday Canyon community (Stokes 1997) and the Cooney Ranch community in the upper middle fork of the Mimbres River (Stokes 2000a) (Figure 6.1). Both contain the remains of a medium-sized pueblo, one or more farmsteads, and several field houses (Figures 6.2 and 6.3). In addition, both occur in different environmental zones; the Noonday Canyon project area is a drier, lower elevation environment, while the upper middle fork of the Mimbres River is a higher elevation, heavily forested canyon (Figures 6.4 and 6.5).

The Noonday Canyon community was reconnaissance surveyed by Thomas McDermott (ranch owner) and Robert Stokes in 1995 (Stokes 1996, 1997). Prior to the purchase of the ranch by Mr. McDermott, the previous landowner denied permission for survey to the Mimbres Foundation (who surveyed up to the ranch property). In the middle fork, Donald Graybill (1975) surveyed the Cooney Ranch area for his dissertation research. The larger sites were reinvestigated in early 1999 by Robert Schiowitz, Gila National Forest archaeologist, and Robert Stokes (Stokes 2000a). During that time, several other small surface structure sites on Forest property were visited, while several other Graybill sites were revisited during and after test excavations at Cooney Ranch #1 (LA 5841). The Cooney Ranch community was in relatively good condition despite years

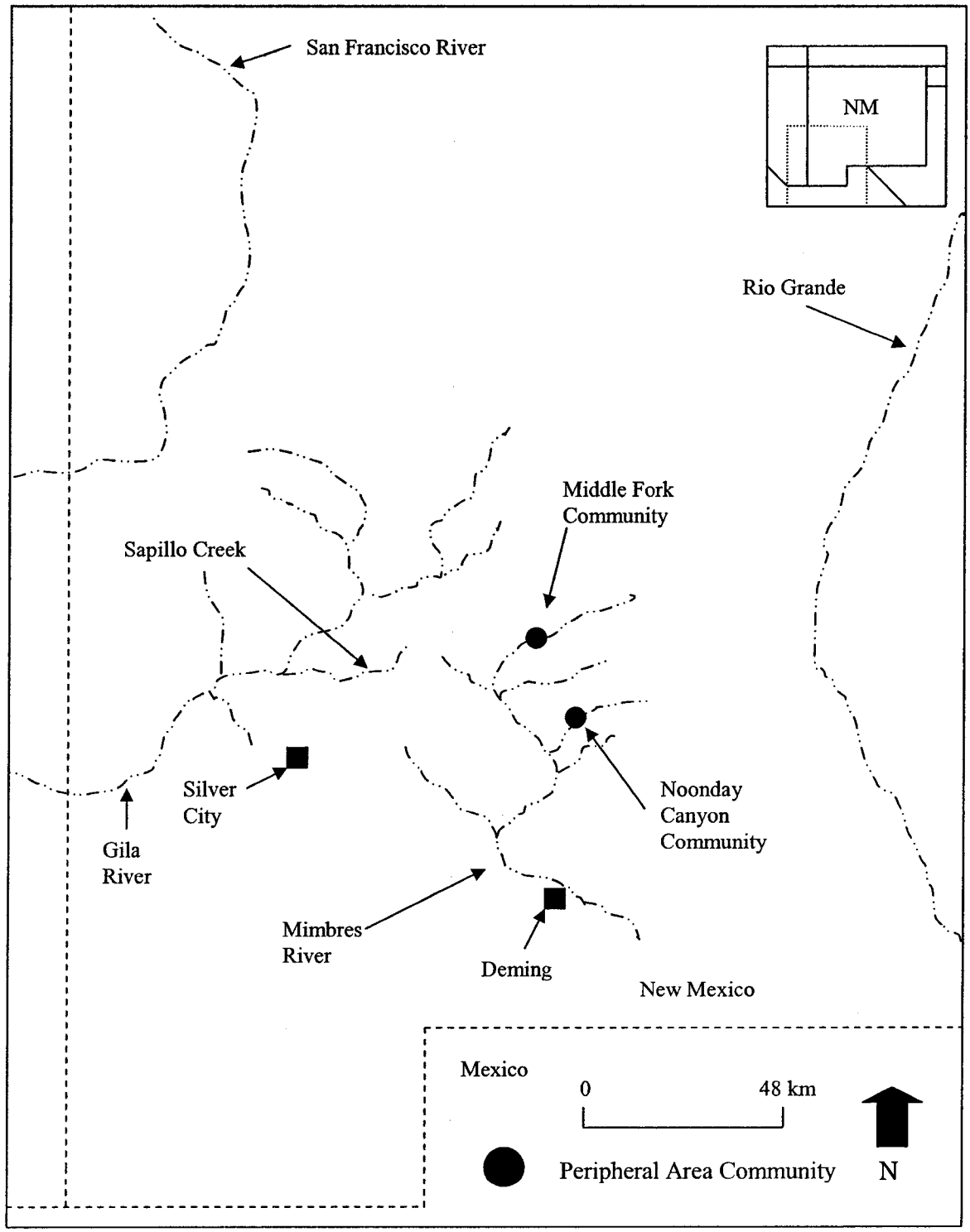

Figure 6.1. Location of the Noonday Canyon and Cooney Ranch communities in the Mimbres Valley area, southwestern New Mexico.

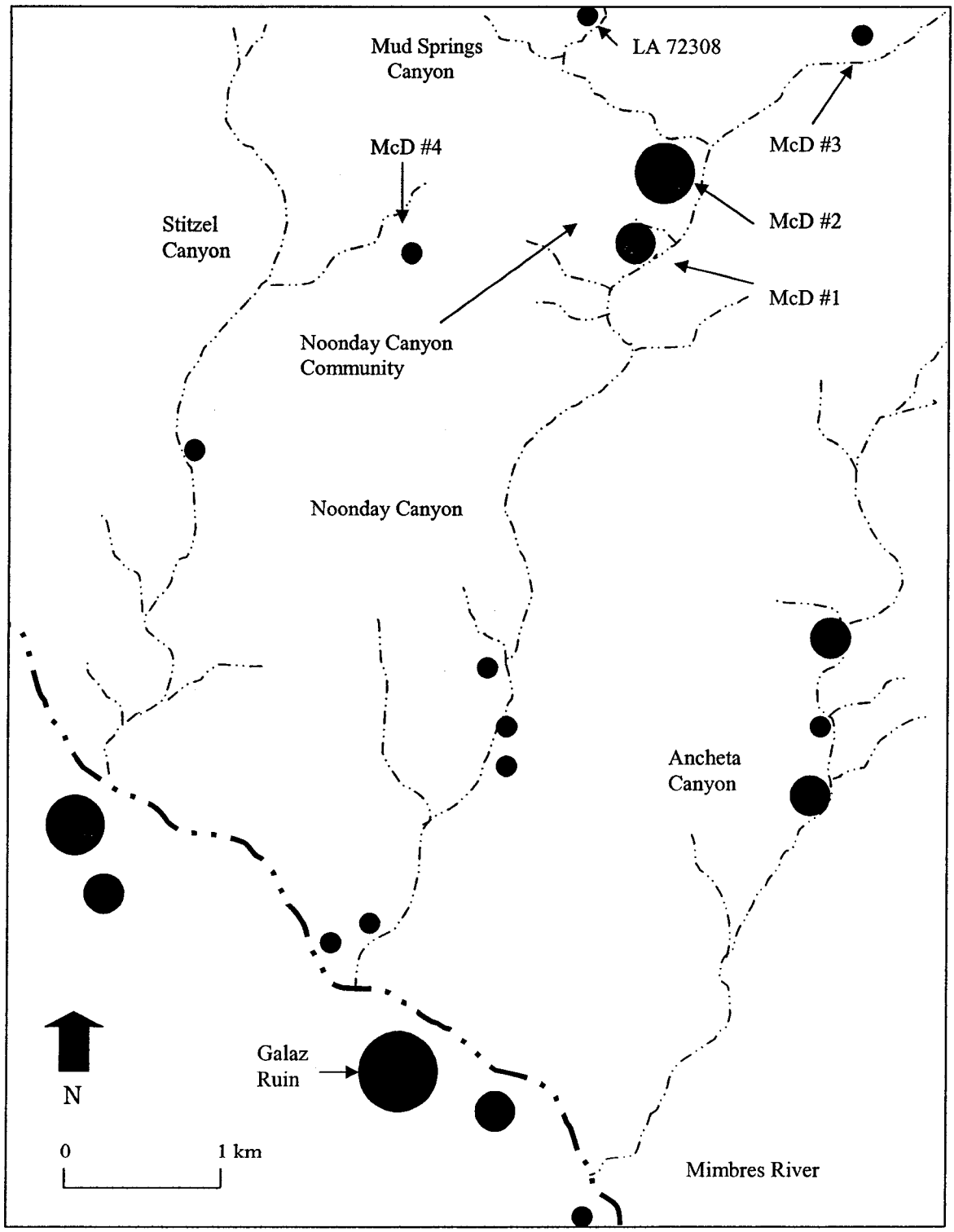

Figure 6.2. The sites on McDermott Ranch and Gila National Forest that comprise the upper Noonday Canyon community. Largest dot=Large village; Medium-large dot=Medium-sized village; Medium-small dot=Farmstead; and Small dot=Field house. Note: dots not to scale.

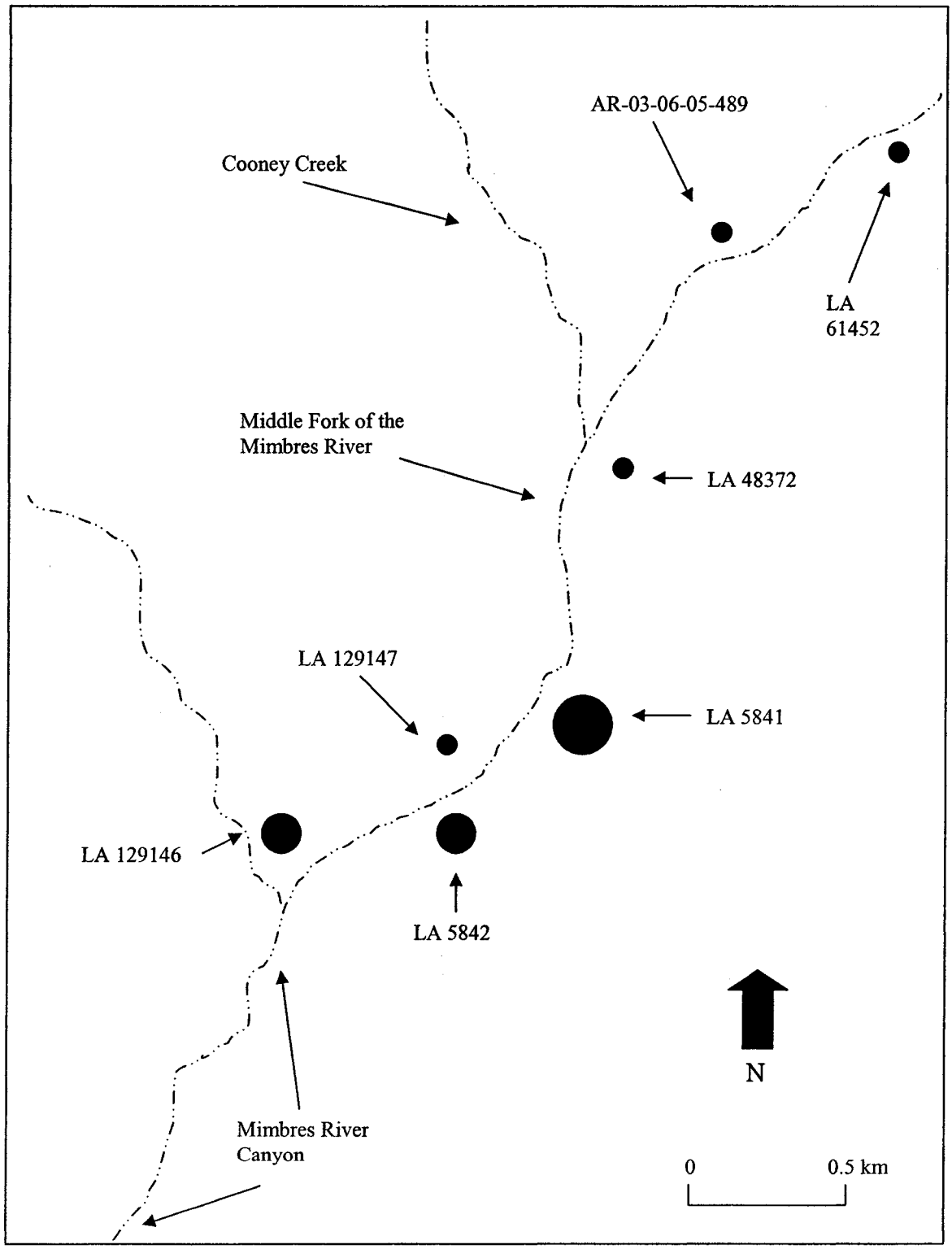

Figure 6.3. The sites on Cooney Ranch and Gila National Forest that comprise the upper middle fork of the Mimbres River (Cooney Ranch) community. Large dot=Medium-sized village; Medium-small dot=Farmstead; and Small dot=Field house. Note: dots not to scale.



Figure 6.4. Photo of the McDermott Ranch area in upper Noonday Canyon community, facing south. Note McD #2 rubble mound at edge of terrace.

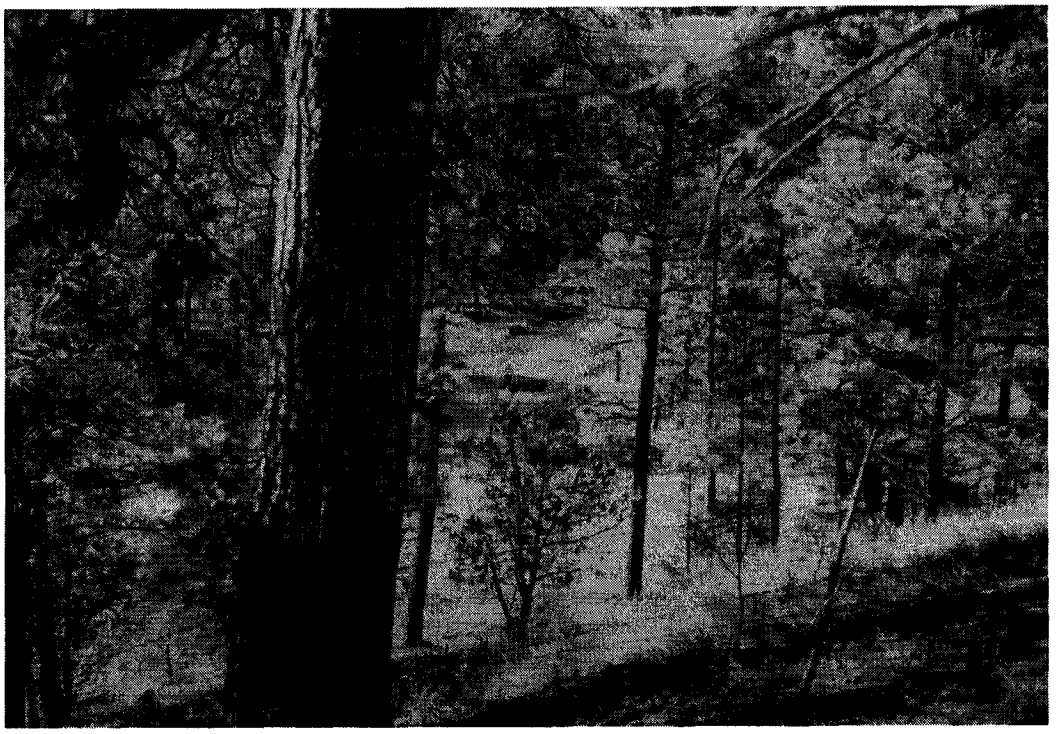

Figure 6.5. Photo of the Cooney Ranch area in the upper middle fork of the Mimbres River, facing north.

of hand potting. However, several sites in the Noonday Canyon community had been fully to partially bulldozed during the 1970s or early 1980s; the remaining smaller sites were hand potted.

The goals of the two test excavation projects were to:

1) Acquire basic excavation data for variously-sized Classic Mimbres surface structure sites in under-investigated peripheral areas in order to ascertain their functions within the community;
2) Acquire materials suitable for carbon dating and cross-dating the sites, especially painted Mimbres pottery suitable for microseriation, in order to determine when the community was founded;
3) Acquire basic subsistence data suitable for understanding subsistence practices in peripheral areas, especially for determining if agriculture was an important component of the subsistence strategy;
4) Investigate potential trading and cultural relationships between these communities and other Mimbres areas in order to determine potential social ties across southwestern New Mexico;
5) Investigate the surrounding natural environment and its effect on site location in order to determine if optimum agricultural and natural resource locations were chosen, and;
6) Investigate the duration, timing, and intensity of occupation at these communities and how these data articulate with the timing of population and food stress in the Mimbres Valley (Stokes 1997, 2000a).

The overarching theoretical orientation for these research projects was cultural ecology, including settlement history; environmental-cultural relationships; subsistence and diet; and resource use, production, and distribution. However, many overlapping sets of theories are used for studying land use and settlement (see Chapter II), including site catchment analysis, central place theory, and decision-making, and were found to be extremely useful for this research (see Chapter VII).

The results of the two excavation projects varied, primarily due to several overriding factors, including field time available and severity of damage at some sites, which served to limit the available data. However, all of the research goals stated above were met with varying degrees of success. Basic excavation data were obtained from four sites, including the two larger sites, one farmstead, and one field house. The field house, farmstead, and one of the larger sites were examined at McDermott Ranch in upper Noonday Canyon, while only the large site (LA 5841) was investigated at Cooney Ranch in the upper middle fork of the Mimbres River. Additional work had been planned for Cooney Ranch, but for various reasons did not take place. Several of the sites on McDermott Ranch were fully to partially bulldozed, which affected data recovery efforts.

Both project areas provided good ceramic samples to use for cross-dating and characterizing the direction of cultural affiliation and/or trade. Unfortunately, only LA 5841 provided a datable charcoal sample from a relatively good context (probable roof fall from Room 2), which dated to the middle Classic period (ca. A.D. 1040 to 1110). No samples submitted for tree-ring analysis were datable. A partially intact raised adobe hearth was found on the floor of Room 1 at LA 5841, but it was in such poor condition that no archaeomagnetic samples were taken.

Faunal remains recovered from the two projects provided useful information, but were somewhat meager for the Noonday Canyon community. Unfortunately, macrobotanical remains were less than fruitful for either community. A few burned seeds and possible fragments of maize and squash were recovered from LA 5841, but little else was found. However, ground stone was common at both communities, and it indirectly measures the intensity and reliance on maize agriculture (see Adams 1999; Diehl 1996; Hard 1990; Hard et al. 1996). As a result, ground stone analysis became especially important for investigating subsistence activities and the intensity of maize production.

The surrounding natural environment was investigated using personal observation and existing Forest Service and other published data (e.g., Brown 1994; Hastorf 1980). The natural environment included hydrologic and biotic variables, including drainage patterns and site location, potential pockets of arable land, natural vegetation patterns, possible available prey, and climate. The results of analysis can be used for investigating aspects of central place theory and can be compared to catchment analyses done in the greater Mimbres area (see Hastorf 1980; Findlow 1978; Findlow and DeAtley 1974). These results are presented in Chapter VII.

The test excavation research and its results, plus additional observations on the presence/absence of midden deposits, possible sequential intra-site use, contemporaneity of sites in the community, durability of architecture, and variety of artifact types, can be used for investigating intensity and duration of site occupation (Diehl 1992; Mills 1994; Schlanger 1990; Stone 1993). The results of investigation for these variables can be used to suggest which sites were occupied simultaneously, and thus provide good evidence for the development of multi-site communities (Fish and Fish 1994), and whether any, or all,

of the sites represent long-term, possibly permanent sedentary habitations. Findings for the latter would indicate occupation and use of peripheral areas beyond seasonal use, which is an important variable for determining when and how peripheral areas were used. A finding of limited occupation would serve to undermine the validity of the peripheral community system as a haven for permanent occupation by landless people from primary occupation areas.

Excavations at the Upper Noonday Canyon Community (The McDermott Ranch Project)

Noonday Canyon is a large tributary of the Mimbres River, which heads in the nearby western slopes of the Black Range (see Figure 6.1). It joins the Mimbres River at the town of San Lorenzo on the east bank, almost directly opposite one of the largest Mimbres villages known, the Galaz Ruin (Anyon and LeBlanc 1984). As such, it is placed in the middle portion of the valley.

General Background

The McDermott Ranch Archaeological Project (MRAP) was modest in scale but produced a number of important observations that have direct bearing on the formation of community systems in peripheral areas, including environmental variables for understanding site placement (Stokes 1997, 1998). The results also hinted at the late development of these communities in comparison to the *in situ* evolution of Late Pithouse villages to Pueblo period villages in the main valley (Anyon and LeBlanc 1984; Cosgrove and Cosgrove 1932; Creel 1999; LeBlanc 1983; Shafer 1999a). Sites were selected for test excavation based on site type seriated by size, largely defined by the size

of the rubble mound, and by accessibility for excavation, as several sites were located in remote, hard to reach places on the ranch (Stokes 1997:43). One site representing each site size group was chosen in order to examine potential variability in site type, function, intensity of occupation, and age. The three sites that met these criteria, including accessibility, were McD #1 (LA 119340), a 10–15 room farmstead; McD #2 (LA 119341), a 30–40 room medium-sized pueblo; and McD #4 (LA 119343), a 4–6 room field house. The latter is located along the west side of a steep-walled side canyon of Stitzel Canyon, which borders Noonday Canyon to the west. The two larger sites are located on high terraces along the west side of Noonday Canyon; the sites are located approximately 30 m above Noonday Creek in this area. A moderately high ridgeline separates the field house from the two larger sites.

McD #2 had been nearly completely bulldozed in the 1970s; McD #1 had a sizable bulldozer trench through it; and McD #4 was extensively hand potted. However, it was believed that the farmstead and field house still contained important data based on results from other potted Mimbres sites, while the larger site had minimal potential. As a result, testing strategies varied somewhat from site to site (Stokes 1997:44–47). For all three sites, intensive surface collection was undertaken to ensure an adequate sample of artifact types and frequencies at each site. At the two larger sites, the area between the pueblo and the terrace edge contained higher numbers of artifacts and were designated midden areas. The field house site produced the fewest number of surface artifacts. All ceramics, ground stone, lithic tools, cores, bone, crystals, and unusual items were collected; effort was not expended to find microflakes on the surface. However, all excavated fill was screened, and flotation samples were collected, which resulted in the

recovery of some microflakes.

Test excavation units were generally 2×2 m, but some varied in response to architectural elements and other factors. Test units were placed over architectural elements that were thought to be at least partially intact, or were placed to straddle pothunting holes, as previous experience has shown that damage tends to be conical from the top down. The large backdirt piles at McD #2 presented a special challenge. Because they were too substantial for large-scale screening, it was decided that shovel probes would be judgmentally located in order to acquire "subsurface" samples of artifacts. The bulldozer wall cuts were also faced and searched for truncated features, rooms, walls, pithouses, or other features in the profile. The results of excavation are presented below.

Test Excavation Results

The results of test excavations were generally positive in terms of assessing and evaluating the research questions outlined earlier in this section. Analyses and discussion of the data, and their significance for understanding Mimbres subsistence and settlement organization with reference to the research goals of this dissertation, will follow this brief descriptive presentation of site-specific excavation results. Strengths and weaknesses of the data recovered from each site will be discussed to understand why certain classes of data were not wholly sufficient for a thorough analysis of some research questions. The results of this first phase of test excavation at peripheral communities shaped some of the ideas and methods that guided later work in the upper middle fork of the Mimbres River.

McDermott Site Number One

Based on its size, McD #1 was believed to be a small farmstead, containing between 10 and 15 rooms, located approximately 400 m south of the large site (McD #2) (Figure 6.6). Unfortunately, due to extensive pothunting damage, few architectural details or intact deposits were encountered. Numerous artifacts were collected from the fill of the two units excavated, one of which was in the pueblo and the other in a small pit depression adjacent to the pueblo rubble mound. Complete excavation details can be found in Stokes (1997).

Surface Collections

The area immediately to the east of the pueblo contained a continuous, but light, surface scatter of artifacts (east midden). It extended eight to 10 meters towards the edge of the terrace, and roughly 30 m north to south. The surface collection resulted in the recovery of 207 ceramic sherds, primarily corrugated and plain wares; seven lithic flakes; one piece of unworked chrysacolla; three mano fragments; one metate fragment; and one long bone fragment of a medium-sized mammal. In total, less than 500 ceramic sherds from the site were collected, with even fewer lithic and ground stone artifacts. Although limited, the artifacts provided several important clues towards understanding the role of this site in the community system (discussed below in the analytical analysis section).

McDermott Site Number Two

Based on the size of rubble mound and bulldozer scars, McD #2 was thought to be the badly disturbed remains of a 30 to 40 room pueblo situated near the confluence of

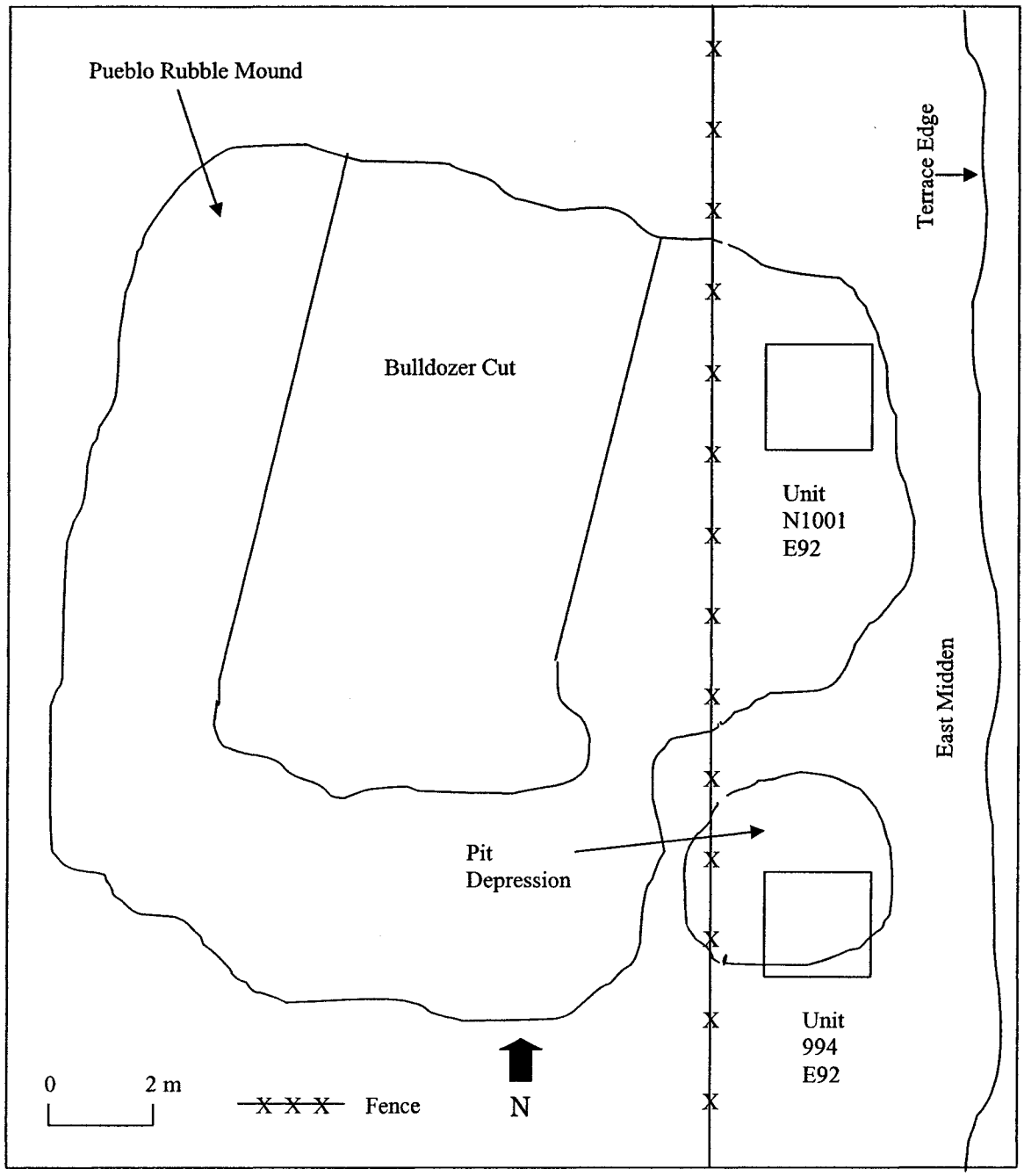

Figure 6.6. Plan of McD #1 showing the location of the two test units and east midden area.

Mud Springs and Noonday Canyon creeks (Figure 6.7). Because of its damaged condition, only one unit was excavated along the wall of the bulldozer cut, uncovering a possible undefined subsurface pit. Surface collections and shovel probes resulted in a sizable collection of artifact nonetheless.

Surface Collections

Two main areas were targeted for surface collection. The primary collection area was a dense midden located between the eastern edge of the pueblo and the terrace bluff, which was designated as the East Midden. The second area consisted of the remaining perimeter of the pueblo, which had a noticeably less dense artifact scatter.

A total of 503 ceramic sherds were recovered from the East Midden, which, when microseriated, included one Mimbres Style III-late sherd, 44 Style III-middle sherds, seven Style III-early sherds, one Style II-III sherd, and one Classic Polychrome sherd (Style III-late). A total of 128 additional indeterminate Mimbres Black-on-white sherds was collected, for a total of 182 Mimbres painted sherds (36 percent of the total sherd collection). Other painted wares included one Reserve Black-on-white sherd and 11 indeterminate Cibola White wares (Rinaldo and Bluhm 1956) or a Black Range variety of Cibola White wares (Lekson 1989). The remaining sherds included 120 corrugated, 165 plain ware, and two red wares.

Lithic materials recovered include 63 flakes, of which four were pieces of obsidian. A great variety of lithic raw material types are represented, including local (basalt, rhyolite, and chalcedony) and nonlocal (obsidian, chert, and silicified shale) varieties of knappable rock. Many of the flakes exhibit edge-wear damage, although no formal tools were recovered from the surface. One silicified limestone core was found,

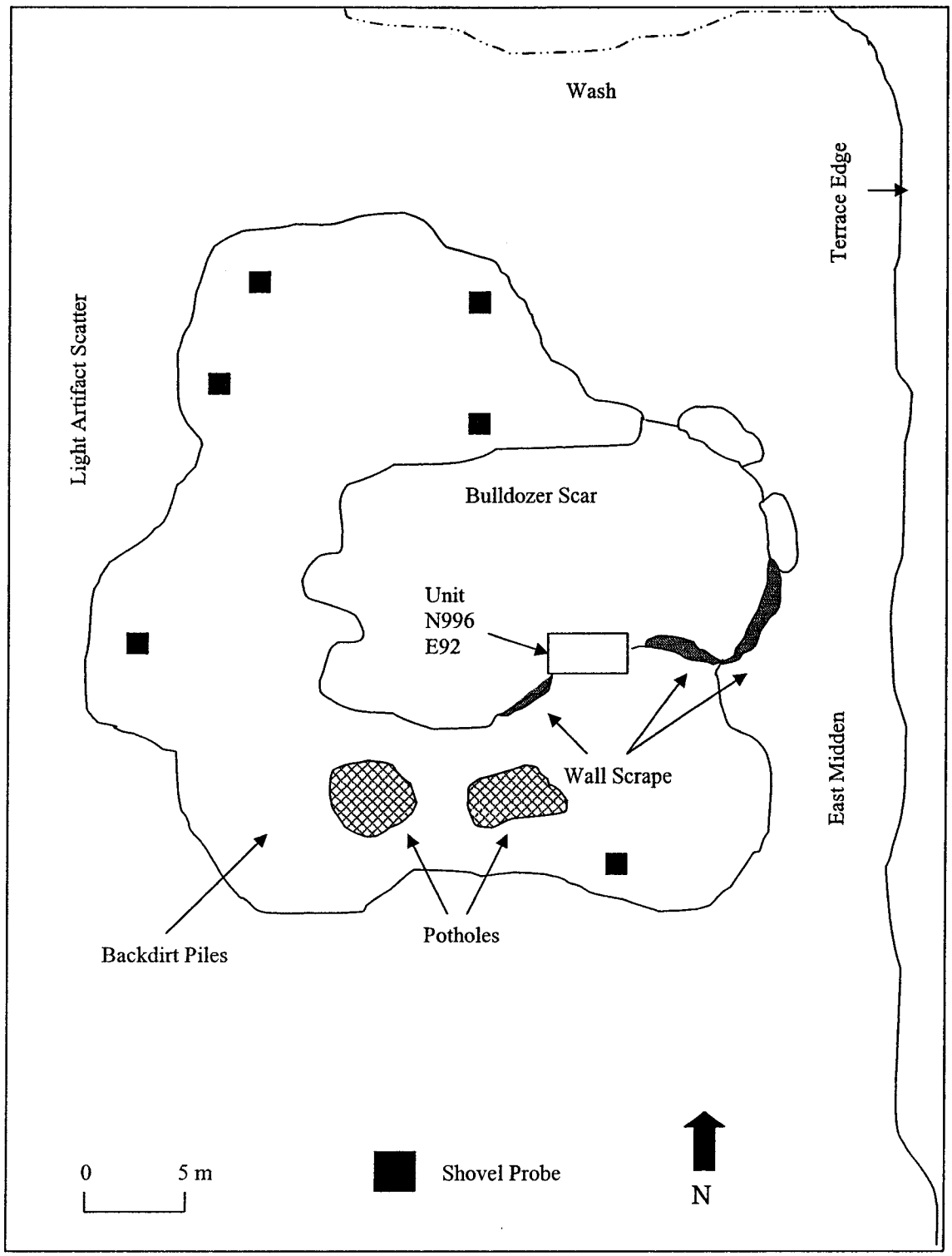

Figure 6.7. Excavation areas at McD #2, including the test unit, shovel probe tests, wall scrapes, and surface collection areas.

suggesting perhaps that an unknown source area is located in the vicinity of the site. Two quartz crystals were found, as were two unworked chrysocolla nodules (a relative of turquoise). One tabular (plano-convex) vesicular basalt mano fragment was collected, which exhibits a well-worn grinding surface. Lastly, three pieces of burned bone were found, including the distal end of a jackrabbit humerus.

Far fewer artifacts were found outside of the east midden, suggesting that the inhabitants of the pueblo used this area as their primary extramural trash area. Most of the materials collected in the non-midden area came from the western edge of the pueblo. Artifacts found included nine Mimbres Style III-middle sherds and 17 indeterminate Mimbres Black-on-white sherds; 11 corrugated sherds; and 11 plain wares. Five lithic flakes were found, including two pieces of obsidian. Two of the flakes exhibit marginal retouch and have been classified as formal tools (see the lithic analysis section).

McDermott Site Number Four

Based on size and visual inspection, McD #4 was believed to be a three-room field house that, although partially hand potted, appeared to be in relatively good condition. It was located amid a moderately dense juniper cover, with several piñons noted in the vicinity. Three units were excavated, and all were located in the western half of the structure (Figure 6.8). Pothunting activities had uncovered a short segment of one interior cobble wall between the two westernmost rooms. Also exposed were portions of exterior walls across the structure, which provided a good indication of its general outline. The two western rooms were chosen for excavation because one appeared to be significantly larger than the other, possibly indicating one was a habitation room and the

other a non-habitation/storage unit.

Surface Collection

Surface collection activities were not concentrated in any one area because a well-defined midden area was not present. The majority of surface artifacts were recovered on the north side of the structure and downslope to the west, although artifacts were found completely surrounding it. The surface collection greatly enlarged the total artifacts from the site, which included 62 ceramic sherds, of which 19 were painted Mimbres Style III-middle Black-on-white and Cibola white wares, and the rest were corrugated and plain wares. Seventy-five lithic flakes were recovered, including several that exhibited use wear. The lithic raw materials used at this site were primarily locally available basalts, rhyolites, and chalcedonies.

Analytic Results for the Noonday Canyon Community Sites

In this section, a detailed analytic treatment of the different artifact classes and architectural elements from the three McDermott Ranch sites will be presented. The strengths and weaknesses of each data set will be examined so that their overall impact on the research questions can be evaluated, especially in light of the extremely limited data available for the large site. However, the following section that discusses the results of test excavation of LA 5841 (Cooney Ranch #1) in the upper middle fork of the Mimbres River community will greatly augment the data for interpreting large sites. The discussion of each analytic data set focuses on its own particular relevance to the research goals.

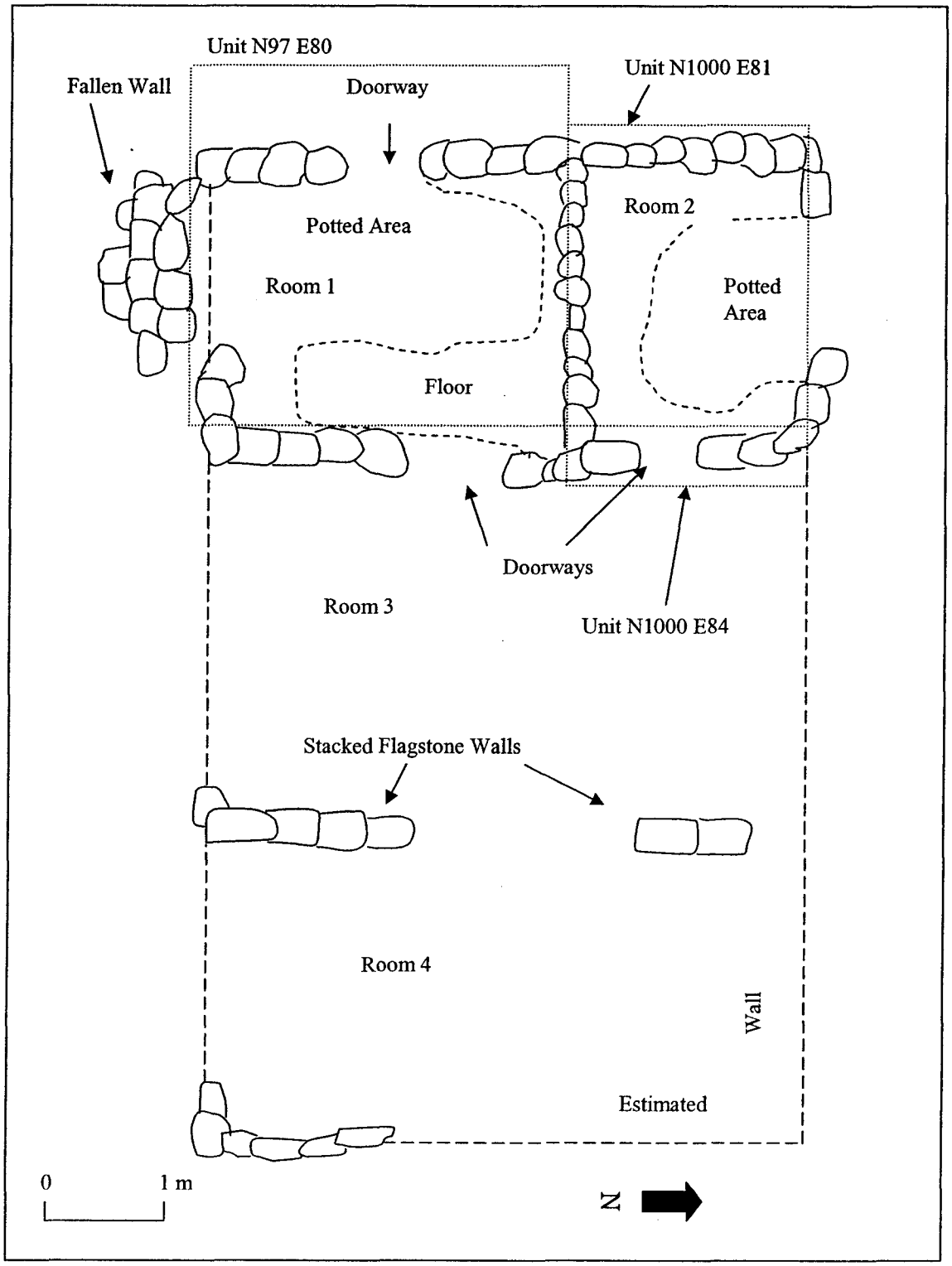

Figure 6.8. Plan map of McD #4, including excavation units and exposed walls.

Architectural Analysis

This discussion of architectural elements, construction techniques, and archaeological implications for the three McDermott Ranch sites will be brief, primarily because only McD #4 produced in situ architectural data (Table 6.1). However, some inferences can be drawn based on the construction materials present and general pueblo outline for the other two sites.

McD #1 is comprised of two major architectural units, an apparently contiguous-room small pueblo and a pit structure. Based on the estimated size of the pueblo rubble mound, the structure probably contained between 10 and 15 rooms prior to its partial bulldozing. The building material is primarily rounded river rock and cobble, although blocky pieces of bedrock were observed in the rubble mound as well. The architectural stone was presumably set in mud mortar in order to achieve wall stability and strength, and based on the amount of rock present in the rubble mound, it is assumed that the rock walls were full height and probably supported some of the roof weight. Although the pueblo has been subjected to bulldozing and severe hand potting, its general outline is an L-shaped configuration. There is little information on possible floor treatment, except that the area investigated may have had a packed earth floors.

McD #2 was the largest pueblo in the community, with an estimated 30 to 40 rooms (based on the bulldozer scar and rubble mounds). Unfortunately, no intact architectural features were discovered during the limited excavations, except for a small portion of a subsurface feature. However, the same building materials used for McD #1 (rounded river rock and cobble) were also found at this site, except in much greater numbers. It is likely that the pueblo had full-height masonry walls. A number of flat slabs

Table 6.1. Pueblo size and room dimensions at McDermott Ranch.

Site Number[1]	Pueblo Size (m)	Pueblo (m^2)	Room Size (m), N/S by E/W	Room (m^2)
McD #1	10×12 to 10×15	120 to 150		
McD #2	20×30	600		
McD #3	6×10	60		
McD #4	5×10	50		
Room #1			3×3	9
Room #2			2×3	6
Room #3			5×4	20
Room #4			5×3	15
McD #5	8×8	64		
McD #6 (rock circle)	3×4	12		

[1] Dimensions for McD sites 3, 5, and 6 are based on survey data only.

of rock were also found which suggests door or roof covers, which is another common element found at large Mimbres pueblos (see next section for Cooney Ranch #1). The configuration of the rooms cannot be reconstructed due to the severe bulldozing. It is unfortunate that little more can be said about the architecture of this important site.

McD #4 is a small, rectangular shaped surface structure, containing four rooms. Two rooms were excavated, revealing a number of architectural elements, some of which were intact. The amount of architectural stone present suggests that the structure had full-height stone and mud mortar walls for its perimeter, but it may have had only partial height interior walls. Large, blocky rocks were primarily used for the bottommost course of every exterior wall portion uncovered, with most measuring 30×30×40 cm. The

architectural stones found in the fill were generally smaller in size, suggesting that the upper wall segments were constructed using smaller blocky rocks and rounded river cobbles. The interior walls included an alignment between Rooms 1 and 2 that used smaller sized blocky rocks and river cobbles and a partial height stacked flagstone wall between Rooms 3 and 4. The flagstone wall may have been original to the structure, but the wall between Rooms 1 and 2 may have been added later to subdivide a larger room. This wall was not bonded to the other walls.

Several doorways were noted. Room 1 contained a well-defined doorway in the middle of the west wall that opened to the outside. Another possible doorway was found directly opposite the first along the east wall. This doorway opened onto the interior of the structure (Room 3). Room 2 contained a well-defined doorway in the middle of its east wall, which opened into Room 3. Room 2 may not have had an exterior doorway, meaning that it was only accessible from Room 3 in the middle of the structure. Room 2 may have functioned as a storage unit given its access from Room 3 and lack of definable floor features. Despite wall scraping in the remaining portions of the site, no other doorways were found. The function of Room 1 could not be determined, but prior to its subdivision into Rooms 1 and 2, this area may have been a habitation room.

Two general observations can be made about the architecture of this site. First, the construction materials and building techniques are very similar to larger Mimbres pueblos more so than field houses, which tend to have low masonry walls that supported a less durable superstructure (Anyon and LeBlanc 1984; Cosgrove and Cosgrove 1932; Parsons 1955; Shafer and Taylor 1986). River rock using copious amounts of mud mortar is a common construction style for the larger Mimbres pueblos, with most walls being

full-height masonry constructions. Conversely, Nelson et al. (1978) report that small pueblos and field houses often contain only enough rock to construct low walls (less than a meter in height), which is also seen in other upland field house sites (e.g., Brown 1995). These low walls likely supported a pole and brush superstructure. This type of construction falls into Diehl's (1992) and Diehl and Gilman's (1996) short-term habitation style based on ethnographic evidence. However, the substantial nature of the exterior walls at McD #4 indicates that this structure was meant to stand for longer periods of time with regular maintenance, suggesting longer-term use, possibly cyclical or seasonal visitation for extended periods of time (Diehl 1992; Binford 1977).

Although far less architectural data were obtained for the other two sites, all three appear to have been substantially built habitations of varying lengths of occupation. The remaining field house sites on the McDermott Ranch may not fit this scenario, which is expected given the multi-functional roles of field houses. The fact that all three tested sites appear to have been solidly built suggests that they were meant to stand for long periods of time, further indicating intended long-term use. Seasonally or occasionally used structures, which we might expect for non-permanently occupied settlements, should be constructed of lighter, less durable materials that are easy to construct, thus less labor is invested (Diehl 1992). Less labor invested in a habitation site could indicate weaker ties to land holdings, whereas the ethnographic data presented earlier in this dissertation show that one of the first things people do when claiming land is invest a large amount of labor preparing it, modifying it, and building substantial structures upon it as a way to demonstrate intended ownership. The three investigated McDermott Ranch sites resemble the latter pattern.

Ceramic Analysis

The importance of ceramic analysis for this dissertation is two fold. First, microseriation of the Mimbres painted wares (Shafer and Brewington 1995) allows for a more precise dating of each site than earlier, more traditional ceramic dating methods (e.g., Brody 1977; Cosgrove and Cosgrove 1932; Scott 1983). This approach will help to determine when the communities came into existence and whether, or how many, sites are roughly contemporaneous, given the lack of chronometric dates. Secondly, the distribution and frequency of ceramic types, and their presumed function or use, will provide clues for determining the function and intensity of occupation at each site (Nelson et al. 1978; Schlanger 1990). For example, based on previous excavations at different types of Mimbres surface structure sites, short-term use sites should contain high percentages of utilitarian ware and few painted wares (<10 percent) (Nelson et al. 1978). Seasonally used sites (e.g., farmsteads) should contain higher frequencies of painted wares, in the range of 10–30 percent of the total assemblage (Brown 1999:85; Parsons 1955). Permanently occupied Mimbres villages should have painted wares (including imported ceramic types) comprising at least 30–40 percent of the total assemblage, if not more (e.g., see Anyon and LeBlanc 1984; Lekson 1990).

A summation of the microseriation criteria developed by Shafer and Brewington (1995) is presented in Table 6.2. Ceramic raw frequency data for the three sites are presented in Tables 6.3, 6.4, and 6.5, while Table 6.6 presents percentages of microstyle and functional class types for each site. For the purposes of this analysis, functional classes are broadly drawn to envelope just two presumed uses: utilitarian and domestic (serving). Utilitarian pottery consists of storage and cooking vessels, while domestic

Table 6.2. Mimbres Black-on-white pottery microseriation attributes (adapted from Shafer and Brewington 1995).

Style Designation	Date Range	Description (most common characteristics)
Style III-late	A.D. 1110–1140	Single thick framing line extending from the rim, polychrome pottery.
Style III-middle	A.D. 1060–1110	Single or a series of medium framing lines, and/or a series of thin framing lines, offset from bowl rim, fine-line hachuring and borderlines, flare-rim bowls.
Style III-early	A.D. 1010–1080	Design elements hanging from a single thin framing line offset from bowl rim, fine-line hachuring and borderlines.
Style II-III	A.D. 970–1020	Series of thin framing lines bordered on top by a thicker framing line, with pendants hanging from the bottommost framing line.
Style II-late	A.D. 970–1020	Series of thin framing lines bordered by thicker framing lines that are not offset from each other, thin hachure lines bordered by thicker lines.
Style II-early	A.D. 880–980	Design elements begin at rim, no framing lines, straight-line hachure with same size borders, saw tooth design elements, tightly drawn scrolls.
Style I	A.D. 750–900	Wavy hachure lines with same sized borderlines, large scrolls, rounded saw tooth design elements, cruder wavy brush work.

Table 6.3. All ceramic types and frequencies, including microseriated ceramic type frequencies for McD #1.

Type	N994E92 Level 1	N994E92 Level 2	N994E92 Level 3	N1001E92 Level 1	Surface Midden	Total
Style III-late	1	0	0	0	0	1
Style III-middle	0	2	0	4	4	10
Style III-early	0	1	0	0	0	1
Style II-III	0	1	0	0	0	1
Style II-late	0	0	0	0	0	0
Indeterminate B/w	3	7	0	9	26	45
Red ware	0	0	0	0	0	0
Cibola B/w	0	0	0	0	0	0
Corrugated	34	37	3	37	93	204
Plain ware	17	43	1	58	84	203
Total	*55*	*91*	*4*	*108*	*207*	*465*

Table 6.4. All ceramic types and frequencies, including microseriated ceramic type frequencies for McD #2.

Type	N996E92 Level 1	East Wall Scrape	Shovel Probes	Surface East Midden	Surface Non-Midden	Total
Style III-late	0	0	0	4	0	4
Style III-middle	3	1	4	51	9	68
Style III-early	1	1	1	7	0	10
Style II-III	0	0	0	1	0	1
Style II-late	0	0	0	1	0	1
Indeterminate B/w	13	9	4	155	17	198
Red ware	0	0	0	2	0	2
Cibola B/w	0	0	1	12	0	13
Corrugated	20	11	9	124	11	175
Plain ware	20	15	14	165	11	225
Total	*57*	*37*	*33*	*522*	*48*	*697*

Table 6.5. All ceramic types and frequencies, including microseriated ceramic type frequencies for McD #4.

Type	N997E80 Surface/ Level 1	N1001E81 Level 1	N1001E81 Level 2	N1000E84 Level 1	Surface	Total
Style III-late	0	0	0	0	0	0
Style III-middle	0	0	0	0	5	5
Style III-early	0	0	0	0	0	0
Style II-III	0	0	0	0	0	0
Style II-late	0	0	0	0	0	0
Indeterminate B/w	0	2	3	1	13	19
Red ware	0	0	0	0	0	0
Cibola B/w	0	0	1	0	1	2
Corrugated	4	4	1	1	26	36
Plain ware	4	4	1	3	17	29
Total	*8*	*10*	*6*	*5*	*62*	*91*

(serving) pottery consists of bowls and small storage vessels. The former includes plain ware and corrugated pottery, while the latter includes painted wares, red wares, and if present, plain or corrugated bowls. It is understood that pottery vessels can crosscut many different functional uses depending upon their context of use (e.g., burial vessels) at the time (Arnold 1985:144–165). However, in simplistic diagnostic use for this research, it is assumed that short-term use sites will contain few domestic types of pottery in comparison to using large numbers of storage vessels (e.g., storage of agricultural goods), while permanent villages will have a great need for both utilitarian and domestic pottery (Anyon and LeBlanc 1984; Nelson et al. 1978). Farmsteads should fall in between these "extremes."

For all three sites, the modal microstyle type is Style III-middle (A.D. 1060–1110), with very few other painted types represented (Tables 6.3–6.5). Total sample size (all ceramic types) appears to be adequate for McD #1 (n=465) and #2 (n=697), but it is problematic for McD #4 (n=91), the field house. Samples of less than 100 items are generally thought to be unrepresentative (potential sampling error), with increasing error as the sample gets smaller (Thomas 1976). Because the total for McD #4 is very close to 100 items, and field houses are generally believed to contain low occurrences of ceramics (Nelson et al. 1978), this small sample set is likely at least marginally representative. However, it is unknown what percentage the samples are of the total ceramic population at each site. To further compound the sampling problem, the percentage of typable sherds useful for microseriation within the three assemblages is fairly small, which reduces the sample size another degree. Because the microseriation technique requires specific sherds to be present in the assemblage, only those sherds with microstyle characteristics, primarily rim sherds, can be used with a higher degree of success (Shafer and Brewington 1995). At McD #4, only five sherds were useful for microseriation (the bulk fell into the Indeterminate Mimbres Black-on-white category). However, certain other factors may mitigate these sampling problems to a degree.

First, even with small sample size bias, the frequency of occurrence for the various pottery types in the usable assemblage should mimic to a degree the frequency distribution of types actually present at the site. In other words, the bias may be spread evenly across the pottery type spectrum. If a site contains 70 percent (n=70) of Type 1, 20 percent (n=20) of Type 2, and 10 percent (n=10) of Type 3, and only 20 percent of these

sherds are usable for microseriation, the resulting idealized frequencies would still reflect the overall pattern: Type 1, n=14; Type 2, n=4; and Type 3, n=2. Although the absolute number in each pottery type is small in this hypothetical sample set, the distribution is similar. Of course, other factors may also account for sampling problems in ceramic data sets, including pothunting and casual surface collecting, a problem evident at all three sites. Although this type of bias is difficult to quantify, it is likely that large sherds were generally targeted for collection, leaving smaller sherds behind, both painted and unpainted. The loss of larger sherds is significant because larger painted sherds generally display more stylistic attributes useful for seriation. However, large sherds of all types probably would have been collected, which again may tend to distribute the bias somewhat evenly across the pottery type spectrum. Because of the sampling problems discussed here, conclusions generated in this section will retain a degree of uncertainty.

McD #1 has a modal peak at Style III-middle (A.D. 1060–1110) on a magnitude of an order of ten compared to the other painted types (Table 6.3). Although one sherd each was found for Styles III-late (A.D. 1110–1140), III-early (A.D. 1010–1080), and II-III (A.D. 970–1020), their low frequency and presence can be explained by the overlap that occurs between each microstyle type, especially those styles overlapping Style III-middle (Shafer and Brewington 1995). Overlapping may occur because of some lag time in accepting a "new" style on pottery across the Mimbres region and curation of some older vessels by successive generations (Shafer and Brewington 1995). The single sherd of Style II-III may be related to the nearby pit structure, although its upper range also overlaps with Style III-early.

Based on these assumptions, it appears that the surface structure component of

McD #1 was initially built sometime after A.D. 1020 but probably not before 1050 to 1060, where the overlap between Styles III-early and middle occurs. It appears to have fallen into disuse by A.D. 1110–1120, just prior to the large-scale abandonment of many Mimbres areas around A.D. 1130 to 1150 (LeBlanc 1983; Shafer 1999). Because only one Style II-III was recovered (a transitional pithouse to pueblo type) and no datable organic remains were recovered from the pit structure, it is impossible to date this component. The suggested date range for the surface structure component of this site is A.D. 1050 to 1120, while the pit structure appears to be Three Circle phase of the Late Pithouse period based on the rock facing of the structure. It is possible that the pit structure is coeval with the farmstead, as suggested by Gilman (n.d.) for the large Mattocks Ruin, who suggests that a similar pit structure adjacent to a room block may have been used as a temporary shelter while the surface rooms were being constructed.

McD #2 has the largest sample of Mimbres painted wares suitable for microseriation, including the pottery recovered from test excavation and from the earlier reconnaissance survey (which was not reported in Stokes 1997), for a total of 84 microseriated sherds (Tables 6.4). Similar to McD #1, the modal peak occurs at Style III-middle (n=68), although there is a significant number of Style III-early sherds (n=10). Four sherds of Style III-late (one being a polychrome) is small for the overall sample size, which suggests that the site was not in use much past the introduction of this style around A.D. 1110. Styles II-III and II-late each have one sherd, and both date to the A.D. 970–1020 transitional time period. The higher number of Style III-early sherds, in conjunction with the two transitional sherds, indicates that the pueblo was in use before nearby McD #1 and was probably built sometime during the Style II-late, II-III and III-

early overlap period (ca. A.D. 1010 to 1020). Based on the distribution of microseriated pottery types, the large site was likely occupied between A.D. 1020 and 1120.

McD #4 contains the smallest sample suitable for microseriation (n=5) (Table 6.5), and any conclusions drawn from this sample remain tentative. However, all five sherds fall into the Style III-middle category, a situation that might not have occurred if the site had been occupied earlier or later than this time frame. Because of the lack of evidence for earlier or later occupations, the date range of Style III-middle will be suggested for this site, although it is likely that the site was used for a shorter period of time than indicated here. Thus, McD #4 may date from A.D. 1060 to 1110.

Discussion of the Dating of the Three Sites

The range of dates obtained for the three tested sites indicates that all of the structures could have been contemporaneous, with a general overlap in occupation from A.D. 1050 to 1120. Although the larger site appears to have been constructed first, and the field house may have fallen into disuse the earliest, all three likely formed a community of interacting habitation and special use sites. Additionally, the field observations made in 1995 on the two other non-tested field house sites that comprise part of the Noonday Canyon community revealed only the presence of Style III-middle painted sherds (the surface samples were extremely small). These sites also appear to be roughly contemporaneous with the tested sites. The microseriation data indicate that the upper Noonday Canyon area was not occupied on a permanent basis until the middle Classic period, sometime around A.D. 1040 to 1050. The presence of a well-defined pit structure adjacent to the pueblo at McD #1, and the general lack of pithouse period

sherds, argues against a substantial pithouse component and more for pithouse use coeval with the pueblo (sensu Gilman n.d.). The area seems to have been abandoned by A.D. 1120 or so, slightly earlier than the generally accepted date for the larger-scale abandonment of much of the Mimbres and Sapillo valleys (LeBlanc 1983; Shafer 1999; Stokes 1995).

Site Function Based on Ceramic Analysis

Part of the strategy for understanding potential site function is assessing ceramic functional type distributions at each site. For a surface structure site to be short-term and/or special-use, it was suggested earlier in this section that the overwhelming majority of sherds should be utilitarian (plain wares and corrugated) and that ceramic abundance in the overall artifact assemblage should be low. Painted sherds are expected to be less than 10 percent of the total ceramic assemblage and exotic (trade) wares should be rare. Seasonal sites, such as farmsteads, should have painted wares in the range of 10 to 30 percent, with some exotic types present but overall remaining rare items in the assemblage. Permanent villages should have over 30 percent painted wares, with a modal frequency somewhere between 30 and 40 percent. Data from the McDermott Ranch sites are presented in Table 6.6 and are used to evaluate the ceramic criteria for site function outlined above.

McD #1 has a painted type frequency of 12.6 percent of the total ceramic assemblage, which falls into the predicted range for farmsteads, but at the low end. No exotic wares were found, which also fits the expectations. Because this site is located near a modern home and has been the scene of pothunting and surface collecting for

years, the occurrence of painted sherds would tend to decrease over time. If it can be assumed that at least 40 percent of the painted sherds had been previously collected, and then factored this percentage back into the ceramic data set, the new estimated painted ware frequency of 19 to 20 percent would fall within the expected range for a farmstead. This frequency is in line with another farmstead recently excavated in the uplands between Mimbres and Silver City, which had a frequency of 23.7 percent painted wares (Brown 1999:85). The high percentage of utilitarian wares (87.4 percent) indicates that storage and potentially cooking were important functions of this site. The ceramic data support the contention that this site is a seasonally used farmstead.

Table 6.6. Ceramic microseriation and functional type percentages per site[1].

Type	McD #1	Percentage of Functional Type	McD #2	Percentage of Functional Type	McD #4	Percentage of Functional Type
Style III-late	0.2	Painted	0.6	Painted	0.0	Painted
Style III-middle	2.0	12.6	9.8	42.6	5.5	28.5
Style III-early	0.2		1.4		0.0	
Style II-III	0.2		0.1		0.0	
Style II-late	0.0		0.1		0.0	
Indeterminate Mimbres B/w	10.0		28.4		20.8	
Red ware	0.0		0.3		0.0	
Cibola B/w	0.0		1.9		2.2	
Corrugated	43.8	Utilitarian	25.1	Utilitarian	39.6	Utilitarian
Plain ware	43.6	87.4	32.3	57.4	31.9	71.5

[1] Total number of ceramics for: McD #1 = 465; McD #2 = 697; and McD #4 = 91.

McD #2 was argued to be the primary site for the Noonday Canyon community. The painted ware frequency for this site, which had the highest overall sample size, is 42.6 percent. This percentage of painted ware falls within the expected range for a full-time habitation site. Factoring in up to 40 percent additional painted sherds potentially removed by pothunting and surface collecting would push the estimated percentage even higher into the expected range. Additionally, 11 sherds of Cibola White ware (a traded ceramic type) indicate that rare (exotic) ceramic vessels were brought to the site, although it was not possible to determine how many vessels these sherds represented. This is also the only site that contained red wares. The proportion of painted and utilitarian wares is more balanced, indicating that storage was also important. Together, these lines of ceramic evidence indicate that McD #2 was a permanently, or at least intensely, occupied and multi-functional village.

McD #4 presents some contradictory evidence for what had been originally assumed to be a simple short-term/special activity site. The total ceramic assemblage was small when compared to the other two sites, but the ceramics comprise almost 50 percent of the total artifact assemblage from this site. This finding does not correlate well with reported observations from LA 12109, a 7–10 room field house in the Mimbres Valley, where the ceramic assemblage was insignificant compared to the lithic assemblage (Nelson et al. 1978). Additionally, the percentage of painted wares, at 28.5 percent, which includes one Cibola White ware sherd, falls within the expected range for farmsteads, not short-term, special-activity field houses. A similar pattern emerged at another upland field house between Mimbres and Silver City, which contained 22 percent painted wares (Reed 1995:56). However, both ceramic assemblages were less than 100

items. The frequency of utilitarian wares is high, suggesting that storage was also a major function of the site, similar to McD #1.

These findings have many implications, including sample size errors, misinterpreted assumptions regarding artifact assemblages at field houses, and the potential multi-functional roles of small surface structures in general (see Laumbach and Kirkpatrick 1985; Moore 1978; M. Nelson 1993b, 1999; Parsons 1955). Although McD #4 appears to be something more than just a "simple" field house, the other field houses in the Noonday Canyon community may produce different results (as now might be expected). It seems that McD #4 represents a small site that was more intensively occupied than was originally suspected, based not only on the ceramic data presented here, but also on architectural data that were hinted at earlier in this report. However, it does not appear that the site was a permanent habitation; it may have been repeatedly used over a long period of time, allowing the types of artifacts recovered to gradually build up over time.

Lithic Analysis

The structure of the lithic analysis section will generally follow the discussion found in Nelson et al. (1978) and M. Nelson (1984) so that direct comparisons can be made with their findings for a small field house (LA 12109) and a large village (Galaz Ruin) in the Mimbres Valley. The implications of the Mimbres lithics industry at the McDermott Ranch sites will be used to evaluate their possible functions, to detect potential trade items, and to compile additional artifact data for evaluating intensity of site occupation.

Upper Noonday Canyon is located in the midst of an extensive volcanic province that provided the vast majority of lithic raw materials to ancient inhabitants. Some of the more common lithic raw material types locally available include basalt, andesite, glassy and coarse-grained rhyolite, chalcedony, and quartzite; no obsidian sources are known to occur in the Mimbres Valley area (Shackley 1995). Other available, but generally non-local, raw material types include chert, jasper, and dolomite, including its derivatives (e.g., silicified limestone, siltstone, and shale). Other useful local rock types are vesicular basalt, sandstone, silica-cemented sandstone, cemented volcanic tuff and ash, granites, ochre, hematite, quartz crystals, and chrysacolla, a coarse-grained relative of turquoise. These latter raw material types were primarily used for ground stone tools, pigment, jewelry, and ceremonial items. All of the local raw material types are readily available as either surface or stream gravels. Low-grade chert, jasper, and dolomites occur in low frequency as stream outwash. However, it was found that only higher quality cherts, jaspers, and dolomites occurred in the collection, and together with obsidian, will be treated as "exotics" because of the greater investment in time and energy needed to acquire these materials from elsewhere in the southern New Mexico (Jeske 1989; Morrow and Jeffries 1989).

The analysis will focus on the frequency and distribution of raw material types (e.g., local versus exotic), reduction stages present at each site, and frequency of cores and tools per site, which includes both purposefully retouched flakes (unifacial and bifacial tools) and expedient tools. This will be followed by a functional analysis of the lithic assemblage at each site. These measures can provide information useful for understanding the various functions requiring stone tools at each site, including

subsistence activities, especially cultivated food processing, and the amount of effort invested in technology and manufacture, including effort to obtain exotic materials and the amount of energy expended in formal tool production. If the larger sites are permanently occupied, then the lithic analysis should show evidence for a wide range of raw materials, expedient and formal tools, and tools thought to be specifically manufactured for cultivated food processing, as discussed below.

Nelson et al. (1978) outline several expectations regarding the nature of lithic assemblages at small sites in Mimbres Valley, where the primary task of food producers is to process cultivated plants that require chopping and scraping of gritty fibrous material. However, processing many wild plants, such as prickly pear cactus and perhaps mesquite, would also require these flake tool types (in addition grinding stones). Their scenario assumes that crops were grown near the structures and were then processed at the field house prior to returning to the main village with the crops. Emphasis was apparently placed on removing the unwanted, bulky parts of the plant, and not grinding meal into flour for consumption, which presumably took place at the main village.

The best tools to accomplish these tasks are coarse-grained implements that have resistant, durable edges, and tools with relatively large edge angles (greater edge surface for processing and durability). Nelson et al. (1978:202) state that, "such tools would be effective because coarse materials would maintain an even edge and are less likely to break than brittle, glassy materials when used in the chopping and scraping of gritty plant fibers." They further argue that these tools should form a preponderance of the total lithic assemblage, but they should not comprise the total assemblage. This is suggested because other activities are presumed to occur at some (perhaps all) field houses as well,

including occasional hunting and processing of small game animals (e.g., rabbits). Finally, opposite conditions are thought to characterize main villages, where exotic materials, formal tools, a wider variety of tool types, and all stages of lithic reduction should form much higher percentages of the lithic assemblage due to the multiplicity of domestic tasks performed there (Nelson 1984).

The expectations generated by Nelson et al. (1978:202–204) for Mimbres Valley field houses include:

1) Local raw material types should form the overwhelming majority of types present in the assemblage because exotic materials, which require travel or trade to acquire (thus increasing their value due to greater expended energy), should be found in higher frequencies at primary villages;
2) Larger flakes should be present in higher frequencies than smaller flakes with more acute edge-angles;
3) A preponderance of coarse-grained raw material types should occur in the assemblage;
4) Primary and blocky debris (core preparation flakes, decortication flakes) should exhibit signs of tool use at a higher frequency than other flake types;
5) Bifaces should be rare at field houses because of limited hunting and processing of meat, and because of curation (taken back to the primary village); and
6) By extension, the frequency of biface thinning flakes should be very low compared to other lithic stage categories.

Before examining the McDermott Ranch lithic materials more closely, several

caveats regarding these assumptions and the data set need to be noted. First, Nelson et al. (1978) use flake type weight (gm) averages for assessing the validity of expectation number two. In general, primary flakes and many secondary flakes tend to be large and heavy and would produce the categories with the highest average weights (at least in the Southwest where quarrying was apparently not extensively practiced). For this analysis, primary and secondary flakes will be considered "larger flakes," and tertiary and biface thinning flakes will be "small flakes." However, there are only so many primary flakes that can be removed from a core, while the frequency of interior flakes can be much greater. It will be assumed that if large flakes are the desired stage of reduction at small agricultural sites, then core reduction would slow down considerably for secondary flakes (leaving large cores in the assemblage), and production of tertiary flakes should nearly cease. Primary and secondary flakes should dominate the assemblage, with a lesser frequency of tertiary flakes. Conversely, at more permanent habitation sites, or at small sites where the focus was on hunting activities, smaller flakes should dominate the assemblage because of continued core reduction and formal tool production.

The absence or low frequency of biface thinning flakes might be expected because, as noted by M. Nelson (1984), these small artifacts are too easily missed during excavation and screening with 1/4" mesh (which makes flotation so important), and that they can easily be removed from the site assemblage through natural processes (Schiffer 1976). Low frequencies of biface thinning flakes can result from a number of factors independent of tool production at a site.

Although the McDermott Ranch lithic data set is generally small, with less than 200 items per site, with the total from McD #1 less than 100, a number of interesting

patterns developed that will be of use with regard to evaluating aspects of the research goals discussed earlier.

Local versus Exotic Raw Material Types

The distribution patterns of local versus exotic lithic raw material types across the three sites (Tables 6.7–6.10) match the predictions outlined above fairly well. At McD #4, the smallest site, 96.4 percent of the assemblage was locally available raw materials. Very few exotic materials appear in the assemblage (n=5), and of these, one is a large, thinning flake (Table 6.10). It appears that the three exotics can be explained as either biface finishing or resharpening flakes, a task generally not reported for field houses. The other two chert flakes were different colors, and one was an expediently used secondary flake. The lack of other chert flakes and cores suggest that these raw material types were probably brought to the site from elsewhere, and they were the result of tool reworking at the site. Overall, the lithic assemblage for McD #4 conforms to the predictions of Nelson et al. (1978).

McD #1 was interpreted to be a seasonal farmstead, while McD #2 was interpreted as a permanently occupied village. Although locally available raw materials comprise the majority of the lithic assemblages at both sites (not unexpected based on the suitability and abundance of local materials), it is clear that exotic materials are more frequent at McD #2. At the main village (McD #2), 25.6 percent of the assemblage is comprised of exotics (Table 6.10). Included is obsidian, and while not common at either site (McD #1, n=2; McD #2, n=6), it must be stressed that no obsidian was found at McD #4. It was predicted that main villages should contain the highest percentage of exotics, which is true for McD #2, and it is interesting that the percentage of exotics at McD #1

Table 6.7. Lithic raw material types and reduction stages at McD #1.

Reduction Stage/ ToolType	Ba[1]	Rhy (C)	Rhy (G)	Chal	Qzt	Dol	Chrt	Obs	Total
	Local					*Exotic*			
Primary	2	1		1					4
Secondary	9	3	1	5	1	1	1	1	22
Tertiary	11	4	4	6			5	1	31
Biface thinning flake	1	1		1					3
Angular debris	2		1	1			1		5
Core									0
Core rejuvenation flake									0
Marginal retouch	1	1							2
Facial retouch									0
Projectile point							1		1
Expedient flake tool	1			3					4
Other tool									0
Hammerstone									0
Total	*27*	*10*	*6*	*17*	*1*	*1*	*8*	*2*	*72*

[1] Key: Ba=Basalt/Andesitic Basalt; Rhy (C)=Coarse Grained Rhyolite; Rhy (G)=Glassy Rhyolite; Chal=Chalcedony; Qzt=Quartzite; Dol=Dolomite/Silicified Shale; Chrt=Chert; Obs=Obsidian.

Table 6.8. Lithic raw material types and reduction stages at McD #2.

Reduction Stage/ Tool Type	Ba[1]	Rhy (C)	Rhy (G)	Chal	Qzt	Dol	Chrt	Obs	Total
	Local					*Exotic*			
Primary	7	1	1			2	2		13
Secondary	27	5	6	6		4	8	1	57
Tertiary	16	5	4	14		5	3	2	49
Biface thinning flake								1	1
Angular debris									0
Core	1			1		1			3
Core rejuvenation Flake									0
Marginal retouch	1		2			1			4
Bifacial retouch				1					1
Projectile point									0
Expedient tool	4	1		1			4	1	11
Other tool								1	1
Hammerstone	1								1
Total	*57*	*12*	*13*	*23*	*0*	*13*	*17*	*6*	*141*

[1] Key: Ba=Basalt/Andesitic Basalt; Rhy (C)=Coarse Grained Rhyolite; Rhy (G)=Glassy Rhyolite; Chal=Chalcedony; Qzt=Quartzite; Dol=Dolomite/Silicified Shale; Chrt=Chert; Obs=Obsidian.

Table 6.9. Lithic raw material types and reduction stages at McD #4.

Reduction Stage/ Tool Type	Ba[1]	Rhy (C)	Rhy (G)	Chal	Qzt	Dol	Chrt	Obs	Total
	Local					*Exotic*			
Primary	10	2	2	1					15
Secondary	22	3	9	3					37
Tertiary	14		11	6					31
Biface thinning flake	2	2					3		7
Angular debris	1		1						2
Core			1						1
Core rejuvenation Flake	2								2
Marginal retouch	1								1
Facial retouch									0
Projectile point							1		1
Expedient tool	3		9				1		13
Other tool	1		2						3
Hammerstone	1								1
Total	*57*	*7*	*35*	*10*	*0*	*0*	*5*	*0*	*114*

[1] Key: Ba=Basalt/Andesitic Basalt; Rhy (C)=Coarse Grained Rhyolite; Rhy (G)=Glassy Rhyolite; Chal=Chalcedony; Qzt=Quartzite; Dol=Dolomite/Silicified Shale; Chrt=Chert; Obs=Obsidian.

Table 6.10. Percentage of local versus exotic lithic raw materials.

Site Number	Local Lithic Raw Materials[1] (Ba, Rhy, Chal, Qzt)	Exotic Lithic Raw Materials (Chrt, Obs, Dol)
McD #1	84.7% (n=61)	15.3% (n=11)
McD #2	74.4% (n=105)	25.6% (n=36)
McD #4	95.6% (n=109)	4.4% (n=5)

[1] Key: Ba=Basalt; Rhy=Rhyolite; Chal=Chalcedony; Qzt=Quartzite; Chrt=Chert; Obs=Obsidian; Dol=Dolomites.

falls almost exactly in between the percentages of sites 2 and 4. This finding suggests that McD #1 was not as intensively occupied as McD #2. The data presented here appear to support the interpretation of McD #4 functioning as a field house, McD #1 as a seasonal farmstead, and McD #2 as a permanently occupied main village.

Flake Size and Grain Texture of Lithic Materials

As stated earlier, larger flakes of coarse-grained lithic materials should characterize an assemblage primarily used for processing gritty plant fibers (cultivated plants) and should dominate the lithic assemblage of agricultural field houses (Nelson et al. 1978). For this analysis, expectations number two (larger flake size) and three (higher percentages of coarse-grained materials) are combined because they seem to be closely related. Primary and secondary flakes are grouped together, as are tertiary and thinning flakes. Both categories are then separated into coarse-and fine-grained material types (Table 6.11). Coarse- grained versus fine-grained raw materials by reduction group are presented horizontally in the table, while the number of coarse- or fine-grained flakes in each group (and their ratios expressed in percentages per sites), are presented vertically in the first two columns. The last two columns present the total flakes and their percentages per group for each site.

All three sites exhibit higher frequencies of coarse-grained flakes compared to finer-grained flakes, with McD #4 having the highest total percentages (61 percent). However, all three sites are remarkably similar. Within the flake size groups, frequencies of coarse-grained large flakes compared to fine-grained large flakes varies from site to site, but McD #4 again has the highest percentage (71 percent of the large flakes). McD

Table 6.11. Percentages of flake size correlated with lithic raw material grain texture.

Flake Size Group	Percentage of Coarse-Grained Materials[1]	Percentage of Fine-Grained Materials[2]	Total Flakes	Percentage of Assemblage
McD #1				
Primary/Secondary	65% (n=17)	35% (n=9)	26	43%
Tertiary/Thinning	50% (n=17)	50% (n=17)	34	57%
Ratio of n	*50% to 50%*	*35% to 65%*		
Total coarse- vs. fine-grained	*(n=34) 57 %*	*(n=26) 43 %*	*60*	
McD #2				
Primary/Secondary	66% (n=46)	34% (n=24)	70	58%
Tertiary/Thinning	52% (n=26)	48% (n=24)	50	42%
Ratio of n	*64% to 36%*	*50% to 50%*		
Total coarse- vs. fine-grained	*(n=72) 60 %*	*(n=48) 40 %*	*120*	
McD #4				
Primary/Secondary	71% (n=37)	29% (n=15)	52	58%
Tertiary/Thinning	47% (n=18)	53% (n=20)	38	42%
Ratio of n	*67% to 33%*	*43% to 57%*		
Total coarse- vs. fine-grained	*(n=55) 61 %*	*(n=35) 39 %*	*90*	

[1] Key: Coarse-grained lithic materials=Basalt, coarse-grained rhyolite, quartzite, and dolomites.
[2] Key: Fine-grained lithic materials=Glassy rhyolite, chalcedony, chert, and obsidian.

#1 and 2 have very comparable ratios of coarse-to fine-grained large flakes (65 and 66 percent, respectively). Clearly, the abundance of locally available coarser-grained raw material in the area is reflected in these totals. Interestingly, this is not carried through to the smaller flakes. McD #1 has an even ratio of coarse- to fine-grained small flakes, while McD #2 has slightly more small coarse flakes (52 to 48 percent). Surprisingly,

perhaps, McD #4 has a higher percentage of fine-grained small flakes compared to coarser-grained flakes (53 to 47 percent). This was the only case where an inverse relationship appeared in the data.

Another interesting pattern emerged from examining the ratios of fine-grained flakes. McD #4's ratio of large fine-grained to small fine-grained flakes (43 to 57 percent) was close to the even ratio of McD #2, while McD #1 had a much higher ratio of small fine-grained flakes compared to large fine-grained flakes (65 to 35 percent). This suggests that fine-grained core or large flake reduction was important at both the smaller sites, not just the larger site. This finding was expected for the larger site, and possibly the farmstead, where more varied subsistence-oriented tasks should be present, but not necessarily for the field house. If sharper but less durable flakes are thought to reflect meat, bone, and hide processing (M. Nelson 1984), then it appears that these tasks were being performed at the field house at higher rates than might be expected if it were agriculturally-based. This contrasts with the presumed function of LA 12109 in the Mimbres Valley (Nelson et al. 1978). It appears that both fine-grained and coarse-grained tool production was practiced at the three Noonday Canyon sites.

Seemingly in contradiction, the ratios of larger to small flakes, with all materials combined, indicate that at the largest and smallest sites more cores were being initially reduced, with a significant fall-off for smaller flakes (58 to 42 percent for both sites). However, McD #1 produced more smaller flakes than large, almost the inverse ratio as seen for the other two sites. This suggests that perhaps more formal tools were being produced at the farmstead compared to the other two sites. The tool patterns per site will be discussed below.

Flake Use-Wear Patterns (Expedient Tool Use)

The pattern that quickly becomes evident for all three sites is that primary flakes were not in high demand for expedient tool use (n=1), while secondary (n=13) and tertiary (n=14) flakes were (Table 6.12). The only utilized primary flake was recovered from McD #2, the largest site in the community, not the field house. The expectations for expediently used tool types at field houses, and agricultural sites in general, are not met, which seemingly contradicts the conclusions generated from the analysis conducted above. That is, while each site had high percentages of coarse-grained large flakes, it seems that primary flakes were virtually ignored as potential tools in favor of smaller flakes (which should have more acute edge angles).

Although other evidence suggests that plant food processing was important at all three sites, the assumption that primary flakes make the best processing tools because of cutting-edge thickness and added strength from the cortex remaining on the dorsal side may not hold for all sites. Their use may depend more on context of place and function. One potential explanation for the lack of utilized primary flakes might be that initial plant food processing was infrequent and non-intensive at a particular site (i.e., they were largely processed elsewhere), leaving little evidence for use-wear on primary flakes. However, this scenario does not seem to hold when considering other lines of evidence, which indicate processing of cultivated food. Utilized large flakes may have been curated because of their potential multiple uses (Binford 1979). However, because they are easily manufactured, especially from coarser-grained raw materials, curation behavior does not seem likely.

Table 6.12. Correlation of expedient flake tools, flake size, and lithic grain texture.

Grain Texture Class	Primary	Secondary	Tertiary	Total	Percentage
McD #1					
Coarse-grained	0	1	0	1	25%
Fine-grained	0	1	2	3	75%
Total	*0*	*2*	*2*	*4*	
McD #2					
Coarse-grained	0	3	2	5	45%
Fine-grained	1	1	4	6	55%
Total	*1*	*4*	*6*	*11*	
McD #4					
Coarse-grained	0	2	1	3	23%
Fine-grained	0	5	5	10	77%
Total	*0*	*7*	*6*	*13*	

The distribution of coarse- to fine-grained expedient tools indicates, despite the small numbers, that fine-grained tools were more important at McD #1 (75 percent of the site total, n=3) and McD #4 (77 percent, n=10), while McD #2 had a fairly even distribution (55 percent, n=6). At McD #1 and 2, most of the fine-grained tools were made from tertiary flakes, while McD #4 had an even distribution between secondary and tertiary flakes. Of the coarse-grained flakes, most were utilized secondary flakes. These patterns suggest that, first, fine-grained expedient tools were important at all three sites, strengthening the argument that meat and hide processing were common tasks, and second, that secondary coarse-grained flakes may have functioned as plant processing tools instead of primary flakes. More processing of both meat and plant material seems to have occurred at McD #2 and 4 compared to McD #1. However, the data on expedient

tools suggest that no one site was functioning specifically as just a plant-processing center. It seems that multiple tasks were being performed at each site that required the use of expedient tools.

Marginal and Facial Retouch (Prepared/Formal Tool Use)

Nelson et al.'s (1978) expectations for formal tools at small sites suggest that these items should be rare, as only minor amounts of wild game hunting and processing is thought to have occurred at these sites. As indicated in Table 6.13, very few prepared tools were recovered at any of the McDermott Ranch sites. Three tools were found at McD #1, including two coarse-grained marginal retouch tools (basalt and rhyolite), and one expediently produced chert projectile point fragment. Six formal tools were found at McD #2, including four marginal retouch (one basalt, two glassy rhyolite, and one dolomitic), one facial retouch made of chalcedony, and one obsidian burin-like tool. Five formal tools were recovered at McD #4, including one large (4.6×2.5 cm), corner-notched, straight-stemmed Archaic-type chert projectile point, one basalt marginal retouch flake, one basalt chopper, one glassy rhyolite punch, and one glassy rhyolite burin-like tool. Several formal tools may have functioned as scrapers or knives, although many of the formal tools could have been used for chopping and cutting fibrous plant material (chopping tools and knives). In addition to processing meat, bone, and hides (scraper, knives, punches, and burins), these tools could be used for additional tasks not listed here. The projectile point appeared to be an offering embedded in the basal portion of the southeast wall corner of Room 1.

Table 6.13. Distribution of formal lithic tool types per site.

Tool Type	McD #1	McD #2	McD #4
Marginal retouch	2	4	1
Facial retouch	0	1	0
Projectile point	1	0	1
Punch	0	0	1
Burin-like tool	0	1	1
Chopper	0	0	1
Total	*3*	*6*	*5*

Surprisingly, McD #4 had the most diverse formal lithic tool assemblage. The tools recovered suggest both plant and wild game processing. The size of the projectile point indicates that wild game larger than rabbits were possibly hunted from this field house, if it were Classic period and not an Archaic tool. These large points are often found in later contexts and may result from being surface finds by the Classic period occupants of a site. Interestingly, the point was embedded within the lowest level of wall fall rock in Room 1, and may in fact have been an offering, perhaps to ensure good hunting? The scrapers, knives, punches, and burins suggest some processing of meat, bone, and hide on site, as opposed to returning whole animals to the main village for processing there (although it does not rule out this activity at large sites). The general lack of these tools at McD #1, and their presence, albeit in reduced numbers, at McD #2, appears to correlate well with this suggestion.

However, many of the formal tools found at McD #4 also indicate that processing plant food was important (choppers, knives, and scrapers). Based on these data and the data presented previously on expedient tool and flake size patterning, processing of wild

game and plant foods were important co-functions at both the smallest and largest sites, but not necessarily at the farmstead (McD #1). It appears that despite McD #4's small size, it had a much more varied role to play in the upper Noonday Canyon community than did McD #1.

Other Lithic Items: Crystals, Chrysacolla, and Ochre/Hematite

Only eight pieces of chrysacolla (a copper-based mineral), ochre/hematite, and quartz crystals were found. All were unworked. McD sites #1 and #2 contained the crystals and chrysacolla, plus several pieces of ochre, but McD #4 contained only three pieces of ochre. Ocher and hematite can be ground into pigments, and they were found in higher numbers at McD #4. The pieces collected represent a small sample of the ochre actually present at this site. If hunting large game was one activity centered at this site, then we might expect to see evidence for "face and body" painting, as recorded ethnographically for many modern pueblo peoples (Dozier 1966; Lange 1959; Ortiz 1969), in addition to painted hunters' faces found on pictorial Mimbres bowls. However, none of the samples at the McDermott Ranch sites appeared to be worked or ground.

Summary of Lithic Analysis

The lithic analyses performed above tend to support the suggestion that plant processing and wild game processing were important activities at all three sites, although to varying degrees. The analyses seem to indicate that McD #1 is consistently a little different than the other two sites, with less emphasis on hunting, although this could be an artifact of fewer "tasks" being performed there. It appears that, in many ways, people

at the sites were self-sufficient, but they were none-the-less dependent upon each other at the different sites. The field house, McD #4, could have been used as a repeated hunting base-camp, with many kinds of activities carried out there, including processing of wild foods and, apparently, cultivated food. However, it lacks evidence for a permanent occupation, and it is likely that the occupants returned to the large village, McD #2, with their fruits of labor. McD #2 consistently produced evidence for a wide range of activities that required many different types of stone tools of varying characteristics and raw material types. This is expected for a village-type habitation. McD #1 remains somewhat more problematical. The lithic analysis shows more restricted activities, and not necessarily all agriculturally related. The lack of utilized large flakes at any of the sites contradicts expectations for agriculturally oriented sites. However, the sampling strategy employed for McDermott Ranch may be diluting some of these patterns. Other lines of evidence may help to clarify the situation.

Ground Stone Analysis

Thirteen pieces of ground stone were recovered from the three sites during excavation and surface collecting (Table 6.14), although only four pieces were nearly complete specimens (within the 85–100 percent range). Additionally, one large "boulder" mortar was discovered in the vicinity of McD #4, but was not collected. Manos were the most common type of ground stone (n=9), and they have a variety of shapes and sizes, presumably reflecting differences in function rather than age. Two-handed rectangular is the most common form of mano (n=5) at all three sites, suggesting that large-scale processing of maize was an important function (Diehl 1996; Hard 1990). The other mano

Table 6.14. Ground stone analysis and metric measurements per site.

Specimen Number	Type and Percent Present	Plan Shape/ Cross Section	Raw Material	No. of Sides Used	Length (cm)[1]	Width (cm)[1]	Thick-ness (cm)[2]
McD #1							
FS#174	Mano (100%)	Ovoid/Wedge	Granitic	1	19.5	11.0	3.5–2.4
FS#177	Mano (90%)	Ovoid/Wedge	Granitic	1	12.5+	9.3	3.5–2.0
FS#194	Mano (20%)	Indeterminate	Granitic	1	7.6+	6.4	4.6
FS#173	Metate (50%)	Slab/Tabular	Granitic	1	15.5+	9.4+	7.7
FS#193	Metate (15%)	Slab/Indeterm	Granitic	1	6.1+	6.7+	9.5
McD #2							
FS#132	Mano (25%)	Rectangular/ Tabular	Vesicular basalt	1	6.7+	9.2	3.8
FS#137	Mano (35%)	Ovoid/Indeterm	Granitic	1	12.9+	7.1	4.8
FS#144	Mano (100%)	Rectangular/ Tabular	Sandstone	2	22.5	10.4	3.8
FS#148	Metate (10%)	Indeterminate	Vesicular basalt	1	8.5+	6.5+	2.1+
McD #4							
FS#100	Mano (85%)	Rectangular/ Tabular	Fine grain basalt	1	20.3+	10.1	4.7
FS#101	Mano (45%)	Rectangular/ Tabular	Sandstone	1	9.0+	8.7	3.6
FS#104	Mano (45%)	Rectangular/ Wedge	Vesicular basalt	1	9.8+	9.5	3.3
FS#119	Metate (50%)	Slab/Tabular	Fine grain basalt	1	11.8+	10.5+	0.9
No FS#	Mortar (100%)	Boulder	Fine grain basalt	1	13.0	16.0	8.0 (depth)

[1] = Metate measurements are for grinding surface only; [2] = Thickest to thinnest part.

forms are ovoid and single-handed rectangular; several have wedge shaped cross-sections. Smaller, one-handed manos (also called hand stones) are generally thought to reflect less-intense processing of grains, nuts, and other foods (Diehl 1996; Hard 1990; Hard et al. 1996). Differences in cross-section shape probably reflect both intensity and duration of use and direction of grinding. Grinding in one direction without alternating the orientation of the mano will eventually result in a wedge shaped cross-section, while frequently changing the orientation will result in a more uniform cross- sectional use-wear pattern (Adams 1999). Light-or short-term use of ground stone will produce a grinding implement that exhibits minor amounts of use-wear. All three use-wear patterns (heavy, moderate, and light grinding) are present at the McDermott Ranch sites.

Metates were fewer in number (n=4), and no complete specimens were found, although they may occur in unexcavated portions of the sites. Of the metates that were found, three were slab shaped with tabular cross-sections that often did not exhibit deeply scoured depressions. The single vesicular basalt metate fragment, although listed as indeterminate in shape, may in fact be the only remnant of a trough metate found. The lack of trough metates large enough to accommodate the two-handed rectangular manos is perplexing because it represents an incomplete set of food processing tools. Trough metates must have existed at the sites and should have been left behind by the inhabitants because of their bulkier shape and weight; however, these large items may have been collected by pothunters. The presence of slab and shallow basin metates suggests that these were used in conjunction with the ovoid manos for lighter processing activities.

The distribution of ground stone types and raw materials used among the sites reveals several interesting patterns. First, it is assumed that raw materials used for ground

stone production reflect, among other constraints, the type of food to be processed and the reduction stage of food grinding (Hard 1990). For example, dried maize kernels require rougher-textured grinding surfaces for maximum processing efficiency prior to final grinding into flour on finer-grained implements. Grinding maize goes through several distinct steps, as seen archaeologically at a number of sites, e.g., Gran Quivera (Hayes et al. 1981:44). A rough, pitted surface piece of ground stone (e.g., vesicular basalt) is selected for initial grinding so that the kernels will catch in the vesicles and will be broken up into smaller pieces. Otherwise, the dried maize kernels would require pounding first in a mortar; pounding directly on a metate may send kernels flying, but it can be done. The coarse-ground meal is then transferred to a smoother-textured metate (e.g., sandstone, granite, or fine-grained basalt, if available) for processing into flour. Processing seeds and nuts often does not require coarse-grained metates, although they often require a pounding slab or mortar for de-shelling. The meal, minus the shell, can then be processed on a fine-textured metate or grinding slab.

It is interesting that the ground stone pieces recovered from McD #1 are all made of fine-grained granitic raw material and that both the manos and metates suggest smaller scale processing of food. The two ovoid manos show signs of being heavily used, and the metates seem to match the type that would be expected to co-occur with one-handed manos. Although maize was almost certainly part of the diet for the people living at this site, the ground stone suggests that processing wild nuts or softer food items was a major task at this site. Of course, fine-grained grinding of maize into flour could also be accomplished on slab metates using one-handed manos.

McD #2 shows a somewhat different pattern of ground stone and raw material

types present. Two of the three manos are two-handed and rectangular, and the single metate fragment may be from a trough metate. One of the two-handed manos and the metate fragment are vesicular basalt, while another mano is made from sandstone. This pairing of mano/metate shape (rectangular manos and trough metates) and raw material types (vesicular basalt) indicates that large-scale processing of maize was occurring here. The presence of an ovoid, single-handed mano of a fine-grained raw material type also indicates that the ancillary processing of nuts and other lower-frequency food items was also a component of subsistence.

McD #4 is more problematic. The original assessment of this site as a short-term habitation structure, probably associated with hunting and wild food collecting, may need to be refined once again. It contains two-handed rectangular manos of both coarse- and fine-grained raw materials that suggest larger-scale processing of maize, from coarser to fine-scale grinding. All three manos are two-handed and rectangular and represent three gradational types of textured raw materials. The single metate was approximately half of a slab metate with only a slight grinding depression area. The manos do not necessarily match the metate, but they can be used together. It is possible that the expected trough metates were either removed from the site by pothunters or by the inhabitants, or that they remain buried in the remainder of the unexcavated structure. However, the presence of a fine-grained basaltic boulder mortar within short walking distance from the structure is strong evidence that nut processing was one task performed at this site, given the presence of piñon trees in the area. Based on the data recovered, it appears that grinding maize was an important task at this field house site, in addition to wild food processing.

The results of the ground stone analysis generally pattern as expected and indicate

that processing of maize and wild foods were important activities, despite the small sample size of ground stone tools. The large site (McD #2) contained evidence for all stages of maize processing (coarse-grained and fine-grained tools, rectangular manos, and trough metates), while the farmstead contained evidence for grinding processed maize into flour only. The field house (McD #4) contained evidence for processing both maize and wild foods. Although the evidence does not necessarily indicate the scale of cultivated food processing nor the duration of occupation at the sites, it does show that occupants of the Noonday Canyon community were farmers and collectors.

Faunal Analysis

The faunal analysis, conducted by Kari Schmidt (Stokes 1997) will be brief because very little bone was recovered from any of the sites (Table 6.15). Because of the limitations of the data set, any conclusions drawn remain tentative, but suggestive. Faunal remains found at McD #2 include deer and fragments of unidentifiable large mammals. None of the large bones show visible evidence for "cooking" over a high heat source. This suggests that they were being processed for transport elsewhere (perhaps to the Mimbres Valley), that the meat was removed from the bone prior to cooking, and/or that the meat was cooked in an environment that did not significantly alter the bone (e.g., in a stew). Several pieces of smaller bone, including jackrabbit, were also found, and most show some evidence for burning. These data indicate that larger game animals may have been processed for transport while smaller animals were eaten at this larger site. Faunal remains from McD #1 are consistent with those at McD #2, while McD #4 produced virtually no bone. Of the bone that was recovered at McD #4, all were small fragments,

and all were burned, suggesting that rabbits and other small animals were eaten here, but not large game. It is possible that large game was once present at the site but was transported elsewhere prior to processing and/or consumption, which might be expected if this were a short-term habitation site.

Table 6.15. Faunal analysis and frequency of mammal bone size per site.

Faunal Size	**Burned/Cooked**	**Unburned**	**Total**
McD #1			
Mammal-Large	0	4	4
Mammal-Medium	2	0	2
Mammal-Small	0	0	0
Unidentified	2	0	2
McD #2			
Mammal-Large	0	3	3
Mammal-Medium	4	0	4
Mammal-Small	0	0	0
Unidentified	0	0	0
McD #4			
Mammal-Large	0	0	0
Mammal-Medium	0	0	0
Mammal-Small	0	0	0
Unidentified	3	0	3
Total	*11*	*6*	*17*

The patterns observed indicate that small animals were consumed on site, and that large animals were not. However, evidence exists for the processing of large game (faunal remains and lithic tools) at McD #2. It is possible that large game was processed

and prepared for trade with Mimbres Valley residents, possibly in exchange for pottery and other food.

Flotation Analysis

The results of the flotation analysis were less than satisfactory. Samples were taken from every unit and level and all were processed, but very little material was recovered that would aid in evaluating the research goals outlined for this chapter, or for elucidating patterns in prehistoric diet and behavior. Most of the organic material recovered was modern detritus, indicating extensive mixing of the fill, an unfortunate result of pothunting and rodent activity. Biface thinning flakes were recovered from the samples taken from all three sites, indicating that tool finishing was perhaps a common task, although differing in kind and scale for each site (as discussed earlier). The lack of ancient organic material is disappointing, but perhaps should not be unexpected based on where the samples were taken. All samples came from fill context, which had several serious problems. First, although pothunting has mixed much of the fill, some ancient floral material should have been recovered but was not. Second, the contexts where the greatest concentrations of macrobotanical remains should occur (e.g, hearths and pits) were not encountered. However, much of the evidence from the other analyses seems to indicate that plant food processing was an important task at the Noonday Canyon community. Clearly, however, more data are needed from better contexts at these sites.

Brief Summary of the McDermott Ranch Test Excavation Data

As shown in the preceding analyses, the available data tend to be limited but are

suggestive of several economic and settlement patterns that can be used to characterize the Noonday Canyon community. First, ceramic microseriation indicates that all of the sites are more-or-less contemporaneous, with the large site, McD #2, built and occupied first, followed closely by the farmstead, McD #1, and then later by the field house. The initial building activity seems to be a generation or two (about A.D. 1040 to 1050) after the commencement of pueblo-style habitation structures in the Mimbres Valley. All sites were abandoned by A.D. 1120, but some perhaps earlier (e.g., McD #4). By all indications, the large site (McD #2) appears to have been a permanently occupied, multi-functional village that formed the anchor of the community, while the farmstead (McD #1) exhibits fewer signs of permanent habitation. The tested field house (McD #4) shows clear signs of being a shorter-term domicile but was still solidly built in anticipation of repeated use. It exhibits signs of functioning as both a hunting lodge and as an agricultural field house. Perhaps the sites forming an upland community in agriculturally marginal areas were, by necessity, multi-functional in order to prosper.

The ceramic analysis demonstrated that the percentages of painted versus utilitarian (unpainted) wares generally patterned as expected, with the exception of McD #4, which contained more painted wares than anticipated. The ceramic functional analysis also indicated that the largest site (McD #2) contained a relatively mix of bowls and jars, while the other two contained far more jars than bowls, indicating that storage and perhaps cooking were important functions at these two sites. The presence of exotic wares at the largest site also indicates that treasured items were present, which is common for permanently occupied sites.

The lithic, ground stone, and mineral analysis results indicate that processing

cultivated foods were important activities, as well as processing wild foods. It also demonstrated that more exotic lithic raw materials were present at the largest site than the others, again indicating its role as a permanently occupied village. The presence of ocher at the field house is suggestive of pigment processing, perhaps as a ritual associated with hunting. However, no ornamental items were found at any of the sites.

Unfortunately, the faunal and macrobotanical remains were less fruitful, perhaps owing to the highly disturbed nature of the sites. The few faunal remains recovered indicated that both large and small game was hunted and processed, with the largest site containing evidence for both. It was perhaps acting as the central place for gathering these food items, for eventual processing, consumption, and perhaps trade. Only modern macrobotanical remains were recovered from the flotation samples, and the wood sample from McD #4 submitted for tree-ring analysis was not datable.

In order to more fully explore aspects of peripheral area communities, and a large "anchoring" site in particular, data from another testing project are presented below.

The Mimbres Periphery Study in the Upper Middle Fork of the Mimbres River

In order to expand the scope of research beyond re-evaluation of survey data and limited testing in Noonday Canyon, other possible peripheral area community clusters were targeted for research. The Mimbres Periphery Study (MPS) was originally designed as a month-long series of test excavations at two new community clusters, plus additional excavations at McD #1 and #4 on McDermott Ranch, in 1999. However, torrential monsoon rains limited the time available for the study, and as a result, only the large site at Cooney Ranch was investigated (Stokes 2000a). Despite the limited testing that

resulted, the data obtained from this single site were prodigious for the limited level of work expended there. As a result, important excavation data are now available regarding the role of large sites in peripheral communities.

Site Descriptions

There are seven sites that comprise the Cooney Ranch community in the middle fork of the Mimbres River: one large site, two farmsteads, and four field houses (see Figure 6.3). The large site, LA 5841 (Cooney Ranch #1), is Graybill's Site #61 (Graybill 1975) and Forest site number AR-03-06-05-79. The site is located at the edge of a narrow terrace on the east side of the middle fork of the Mimbres River. It contains evidence for Three Circle phase through Classic Mimbres period habitation. The pithouse component is known by the presence of one pithouse under the pueblo, by a large pit structure that appears to be a Late Pithouse period kiva, and by a handful of late Three Circle phase ceramics. After a hiatus in occupation (discussed below), a cobble surface structure was built that is estimated to contain at least 40 rooms (Stokes 2000a). The rooms appear to be contiguous and roughly form a U-shape around the kiva depression. Two areas containing high amounts of artifacts were located to the southeast and southwest of the pueblo, and were designated as midden areas. Because a room wall was observed in the Forest Service road crossing along the edge of the site near the southeast midden, and numerous cobbles observed on the surface, an unknown number of intact rooms may underlie the midden.

The remaining sites that comprise the Middle Fork community include two farmsteads, LA 5842 (Graybill Site #60, AR-03-06-05-78) and LA 129146. Both are

located just downstream of LA 5841, on either side of the river where the valley begins to narrow to form the Mimbres Canyon. The former is estimated to contain between 10 and 12 rooms and the latter approximately 15 rooms. One field house (LA 129147) is located almost directly across the river from LA 5841. This U-shaped structure contains between three and five rooms. Three other field houses are located to the north of LA 5841, two on the same side of the river (LA 48372 and 61452) and the other in between on the opposite side (FS-03-06-05-489). LA 48372 is thought to contain two rooms, LA 61452, approximately two to three rooms, and 05-489 has four rooms. The latter is Graybill Site #138. Sites LA 129146, 129147, 48372, and 61452 could not be positively correlated with specific site numbers from Graybill. All of the sites have been hand potted but remain in relatively good condition. Ceramics on the surface of each site were examined, but because no middens were evident, except at LA 5841, few painted wares were found. Several Style III-middle sherds were found at both the farmsteads.

Feature and Architectural Summary

It appears that a late Three Circle phase site of undetermined size is overlain by a medium-sized Classic Mimbres pueblo at LA 5841. Within the pueblo, parts of two rooms (Rooms 1 and 2) were uncovered during excavations, with an intact doorway between them (Figures 6.9–6.12). The doorway contained an in situ door slab, and broken door slab fragments were found nearby. The masonry wall dividing the rooms was two courses wide and up to eight courses high. Room 1 contained remnants of a plastered floor that was badly decayed and potted. Half of a raised adobe collared hearth was found on the floor, and beneath the floor evidence was found for a Three Circle

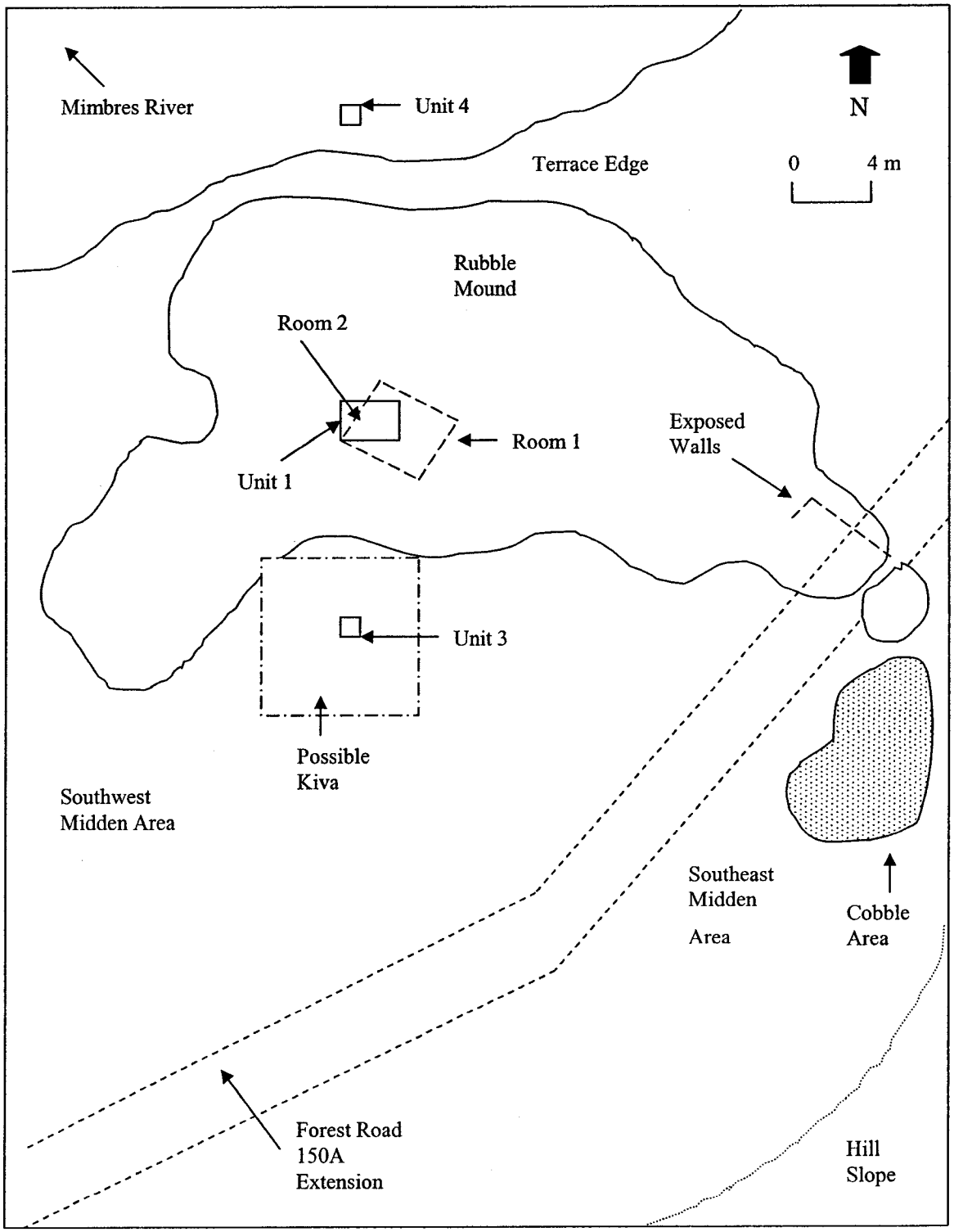

Figure 6.9. Plan map of Cooney Ranch #1 (LA 5841) showing the locations of architectural areas and test units.

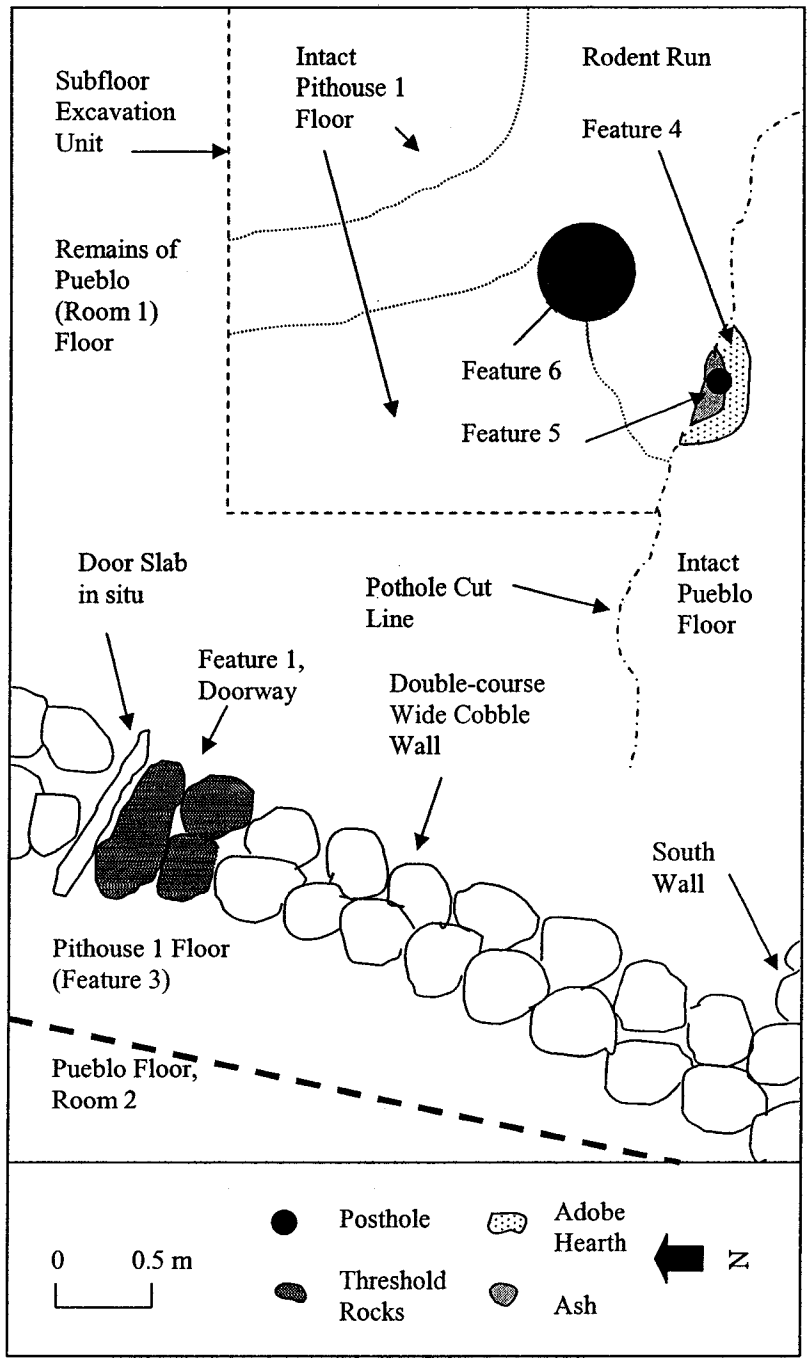

Figure 6.10. Plan map of Unit 1 (LA 5841) showing Rooms 1 and 2, dividing wall, Pithouse 1, and features.

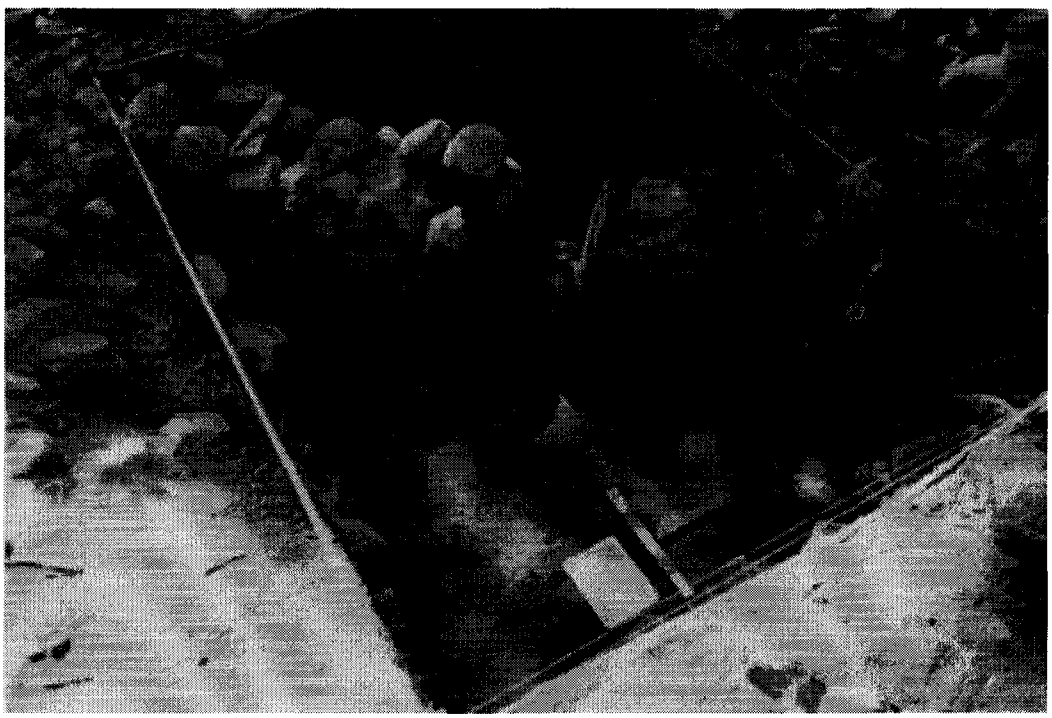

Figure 6.11. Photograph of Rooms 1 and 2 in Unit 1 (LA 5841), facing northwest. Note the two-course wide cobble wall, doorway, and in situ door slab.



Figure 6.12. Close up photograph of two-course wide cobble wall between Room 1 (top) and Room 2 (bottom), facing southeast. Note in situ door slab and threshold stones. Dark area between wall and right side of photo is a portion of Pithouse 1.

phase pithouse (Pithouse 1), including a large posthole and remnants of a plastered floor. In Room 2, a cache of artifacts was found, including a nearly complete Reserve Obliterated corrugated jar, a bone awl, several cores, and half of an antelope jawbone. The edge of the pithouse was found in this room. In the large pit depression adjacent to the pueblo, a deep test unit found limited artifacts in the fill, but uncovered an earthen floor and a large central posthole (Feature 2), with the post missing. The unit discovered little evidence that the structure had burned, but this kiva structure appeared to have been cleaned out prior to abandonment.

Artifact Analyses

Over 5,000 artifacts were recovered during the excavation project, with ceramics comprising 1,686 of them, a surprisingly large number given the general scarcity of artifacts noted on the surface of the rubble mound. The approach to artifact analysis for the MPS was similar to that used for McDermott Ranch, including the expectations generated for what to expect for the three site size classes found at peripheral community clusters. Because of the much larger sample of artifacts from LA 5841, the results of ceramic seriation (traditional and microseriation) and typology, lithic analysis, ground stone analysis, faunal analysis, and exotics were much more robust. The two excavation data sets together provide good insights into understanding Mimbres settlement in and use of peripheral areas.

Ceramic Analysis

This analysis is limited to pottery typology and distribution patterns in order to

address the research goals of this project. Understanding the range of pottery types present, the types and frequencies of trade wares, chronologically ordering the deposits, and dating the deposits and site are critical components of this research. With these data, it will be possible to determine when the site was occupied, the direction of primary social interaction and trade, and the intensity of occupation.

Table 6.16 presents the results of ceramic analysis for all of the excavation units and surface collection areas combined for an aggregate site total. Nearly 1,700 sherds (n=1,686) were recovered from all contexts and are distributed among 27 different pottery types. The high diversity of pottery types is surprising as this number approaches that reported for many large Mimbres River sites (e.g., Anyon and LeBlanc 1984; Cosgrove and Cosgrove 1932). Painted wares (n=318; 19 percent) are composed primarily of traditionally seriated Mimbres Black-on-white styles (n=303; 95 percent), with Cibola White wares and Reserve Black-on-white (n=8; 3 percent) and Chupadero Black-on-white (n=7; 2 percent) comprising the total of imported painted wares found at LA 5841.

It is interesting to note that no trade wares from the south (e.g., Chihuahua, Jornada, and Hohokam wares) are found in the assemblage. This observation does not preclude the occurrence of southern pottery types at LA 5841, nor does this suggest that northern or upland Mimbres sites lack southern trade wares in general. For example, two Hohokam area Sacaton Red-on-buff sherds were found at the Lake Roberts Vista site in the nearby Sapillo Valley (Stokes 1999b). In general, the painted ceramic assemblage seems to correlate well with similar findings at other Classic and late Classic northern Mimbres pueblo sites (e.g., McKenna and Bradford 1989; M. Nelson 1999).

Table 6.16. Ceramic analysis results for LA 5841 (Cooney Ranch #1), all units combined for site total.

Pottery Type	All Contexts
Utilitarian Wares	
Plain ware	573
Plain-scored	15
Plain-punched	2
Plain-incised	3
Alma Plain rough	1
Reserve Plain corrugated-obliterated	488
Reserve Plain corrugated-clapboard	71
Reserve corrugated-punched	8
Reserve corrugated-pinched	1
Reserve Indented corrugated	127
Reserve Indented and Incised corrugated	1
Reserve Obliterated tooled	33
Tularosa Patterned corrugated	6
Tularosa Patterned corrugated-Reserve var.	15
Tularosa Fillet rim	1
Indeterminate corrugated	2
Starkweather smudged decorated	3
Red ware	17
Red ware obliterated corrugated	1
Total–Utilitarian Wares	*1,368*
Painted Wares[1]	
Style I B/w	0
Style I–II B/w indeterminate	5
Style II B/w	6
Style II–III B/w indeterminate	41
Style III B/w	87
Indeterminate Mimbres B/w	164
Reserve B/w	3
Cibola White ware	5
Chupadero B/w	7
Total–Painted Wares	*318*
Site Total	1,686

[1] The Mimbres Black-on-white series reflects the traditional typology (e.g, Scott 1983), not the microseriation, which will appear in a later table.

For utilitarian pottery types (n=1,368; 81 percent), plain ware, decorated plain ware, and textured ware form over 40 percent of the total (n=594; 43 percent). It is likely that most of these sherds can be typed within the Alma Plain series; however, late Mimbres plain wares have not been satisfactorily linked to Pithouse period Alma Plain wares. Plain brown wares in the Mimbres region are not part of a distinct subset of brown wares as seen in the Jornada Mogollon area (e.g., El Paso Brown ware), although some ceramic analysts in the Mimbres area use Jornada Brown and El Paso Brown in their findings (e.g., Reed 1995). Without temper and paste analyses for plain wares at LA 5841, it is impossible to determine if they were made locally or were brought in from elsewhere (e.g., the Mimbres Valley, the Reserve area, or the El Paso area).

Corrugated and textured wares from the Reserve area are more distinctive, however, (Martin and Rinaldo 1950; Rinaldo and Bluhm 1956). At LA 5841, 10 different Reserve area corrugated and textured wares were identified (excluding the indeterminate corrugated and red ware categories), totaling 752 sherds (45 percent of the total ceramic assemblage and 55 percent of the utilitarian wares). Interestingly, no typical Mimbres corrugated sherds were recovered (Anyon and LeBlanc 1984). Reserve Plain corrugated (obliterated and clapboard varieties) appears to be common in the Mimbres area in general, although clapboard corrugated is known as a transitional corrugated type (Three Circle Neck-Banded to true clapboard) and appears to decrease through time during the Pueblo period in the Mimbres and Reserve areas. Many of the other textured wares found at LA 5841 are generally only reported at the largest Mimbres Valley pueblos (e.g., Anyon and LeBlanc 1984; Cosgrove and Cosgrove 1932) and are thought to be late types. These include Reserve Indented, Tularosa Patterned, and Tularosa Fillet rim, each

being commonly smudged on the interior of bowls and some jars; however, many vessels are also exterior blackened.

One apparently rare type for the Mimbres area, Reserve Obliterated Tooled, is represented by only one bowl at the Galaz Ruin (Anyon and LeBlanc 1984:607, plate 143-E). At LA 5841, 33 sherds of Reserve Obliterated tooled were recovered, representing at least four different vessels based on differences in paste color, temper, smudging, and number and depth of tool punctures. Although Martin and Rinaldo never described this type in their analytical reports from the Reserve area, Roger Anyon, Harry Shafer, and Robert Schiowitz all agree that it fits comfortably into the Reserve Textured ware series (personal communication, 1999). Several of these sherds were sent to Harry Shafer at Texas A&M University for inclusion in his INAA study for the Mimbres area. He found that these sherds clustered tightly with other corrugated/textured sherds from the Lake Roberts Vista site in the Sapillo Valley (Gottshall et al. 2002). This cluster of sherds (Cluster two in their analysis) also included a plastered wall sample and several hearth plaster samples from several Three Circle phase pithouses. It appears that a pottery production area was centered somewhere in the Sapillo Valley, given that the material used for the hearths and plastered wall match the material used for the sherds. It also appears that some of this pottery made its way to LA 5841 in the middle fork of the Mimbres River, indicating these two areas had trading and social relationships.

Three sherds of Starkweather Smudged decorated were identified at LA 5841, which is described as a late and generally rare type of pottery (Haury 1936b; Rinaldo and Bluhm 1956). This pottery type is believed to be indigenous to the Reserve area and is most likely associated with the Reserve phase (about A.D. 1050–1150), meaning that it is

a late type for the Classic period Mimbres. Starkweather Smudged decorated is identified as a highly polished black ware containing faint traces of black, linear paint designs that are hard to discern without the aid of light reflection. Most of these vessels appear to be bowls, with the design occurring on the interior.

Eighteen sherds of a red ware pottery were identified at LA 5841, and one has exterior obliterated corrugations. A similar partially reconstructable vessel was found at the Lake Roberts Vista site in a San Francisco phase context (Bettison 1997). Attributes of these red wares are similar in most respects to traditionally described San Francisco Red ware found during the Late Pithouse period (Haury 1936a) and may have originated with the late Three Circle phase component of LA 5841. San Francisco Red ware is most common during the Georgetown and San Francisco phases of the Late Pithouse period, but it begins to decrease substantially in frequency with the introduction of white-slipped painted wares during the Three Circle phase (Haury 1936a). It tends to occur in low numbers during the early Classic period (Anyon and Leblanc 1984). The low number of red wares at LA 5841 seems to be in agreement with this chronology.

It was suggested previously that permanently occupied Mimbres pueblos should contain at least 30 percent painted wares, while shorter-term structures should contain 20 percent or less. At LA 5841, the occurrence of painted to utilitarian pottery is 19 to 81 percent. Even if the red ware and Starkweather Smudged decorated sherds (n=21) are included with the painted wares, the occurrence of painted wares only increases to 21 percent. Based on this percentage, it would seem that LA 5841 falls in between percentages expected for farmstead and permanent villages and closer to the former than the latter.

However, several factors should be taken into consideration. First, the residents at LA 5841, based on their "isolation," may have placed greater emphasis on storage of goods, inflating the number of utilitarian vessels, and second, pothunters likely targeted removal of painted sherds at higher rates than plain wares. If the painted wares are increased by 40 percent (similar to the approach used at McDermott Ranch), their percentage of the new total assemblage approaches 25 percent. This is still a lower percentage than seen at McD #2 and large Mimbres sites, but it is still more than what would be expected at short-term sites. The wide variety of storage vessels and painted wares indicate a more permanent occupation of LA 5841. For a complete description of sherds by analytic unit (room, feature, excavation unit, midden area), see Stokes (2000a).

Brief Observations on Trade Wares

Although painted trade wares are not common at LA 5841, the textured ware assemblage shows great diversity, especially for a medium-sized Mimbres pueblo located in a somewhat isolated area. Overall, the assemblage resembles those reported for northern Mimbres sites (McKenna and Bradford 1989; Nelson 1999) more than mid-valley or southern Mimbres Valley sites. For example, the Galaz ruin, which is located in the middle Mimbres Valley approximately 22.5 km (17 mi) downstream from LA 5841, contains a highly varied painted and utilitarian trade ware ceramic assemblage (Anyon and LeBlanc 1984). The pottery recovered from Galaz is a mixture of northern (Reserve) and southern (Jornada) trade wares. As this site is often referred to as one of the largest and most complex major Mimbres villages in the valley, it is not unexpected that a variety of trade wares should be found there. However, higher frequencies of southern

trade wares generally occur at large sites south of Galaz Ruin. The Swarts and NAN Ranch ruins seem to contain fewer northern trade wares and more southern and Chupadero Black-on-white wares (Cosgrove and Cosgrove 1932; Shafer 1986, 1991; Shafer and Judkins 1997). The ceramic assemblage from Old Town, the last major Mimbres village before the river disappears below ground, has never been fully described, but preliminary comments indicate that southern, Chupadero Black-on-white, and perhaps Hohokam trade wares are common in the assemblage (Creel 1999).

Conversely, northern Mimbres sites, especially those in the forested uplands, contain far more northern trade wares than southern wares. Stokes (1999c) identified two Hohokam buff wares in the upper fill of Pithouse 5 at the Lake Roberts Vista (LRV) site in the Sapillo Valley, but in general, Jornada, Chihuahuan, and Hohokam pottery types are rare at upland sites. Reserve area textured wares and painted types are much more common in the LRV assemblage thus far analyzed (Bettison 1997:27), including many of the same types identified at LA 5841. Likewise, the surface collection of ceramics taken from the TJ ruin (Gila Cliff Dwellings National Monument) is also dominated by Reserve area pottery (Bradfield and McKenna 1989:21). In addition, Hegmon et al. (1999) report similar northern-focused ceramic collections at Classic and Post-Classic Mimbres sites on the eastern slopes of the Black Range, but with increasing Jornada wares on more southerly drainages.

Clearly, distance from source areas is playing a role in the frequencies and varieties of trade wares occurring at Mimbres sites. The assemblage at LA 5841 easily falls within the expected range of pottery types for northern sites; in fact, the only "southern" pottery type found is Chupadero Black-on-white, which could be coming in

from the east and not the south. The middle fork of the Mimbres River provides a natural travel route to and over the Black Range, depositing travelers into the headwaters of Seco and Las Animas Creeks, areas of significant late Mimbres occupation (M. Nelson 1999). What is most striking about the trade ware assemblage at LA 5841 is that it is composed of so many *late* Reserve textured wares, including Tularosa Patterned wares, Tularosa Fillet rim, and Reserve Indented corrugated.

Ceramic Cross-Dating of LA 5841 and its Architectural Units

Although Reserve Plain corrugated appears to have a long use-life, perhaps beginning in the late Three Circle phase of the Late Pithouse period, the other textured wares from LA 5841 are generally only found in later contexts. Re-dating of the Reserve and Tularosa phases (Reid et al. 1995) pushes the probable use-dates of Reserve textured wares later into the A.D. 1000's and early 1100's. Although most of the identifiable Mimbres Black-on-white wares using the traditional seriation are either Style III or indeterminate Style II-III (Scott 1983), this determination does not greatly aid in narrowing possible Pueblo period occupation date ranges for LA 5841. However, the microseriation technique developed by Shafer and Brewington (1995) clarifies possible use dates.

Tables 6.17 and 6.18 present the results of microseriation of Mimbres Black-on-white pottery from LA 5841. Because of the often-subtle clues in the decorated elements of Mimbres pottery necessary for microseriation, the number of sherds usable for this technique drastically declines from the traditional method. Yet, a clear pattern emerges. Two peaks occur along the time line of microstyles described by Shafer and Brewington:

one with Style II-early and the other with Style III-middle. Evidence for Pithouse period occupation of the site has been shown with Pithouse 1 and the possible kiva structure. However, microseriation seems to pinpoint the time of Pithouse period occupation to the Style II-early date range, A.D. 880–980. No Style I sherds were found, effectively eliminating occupation prior to A.D. 900, and the occurrence of Style II-late is half that of Style II-early. It seems probable that Pithouse 1 and the communal structure were occupied sometime between A.D. 900–980, the late Three Circle phase.

Table 6.17. Microseriation results for LA 5841 (Cooney Ranch #1), all units combined for aggregate site total.

Pottery Type	All Contexts
Style III-late	2
Style III-middle	53
Style III-early	3
Style II-III	1
Style II-late	2
Style II-early	4
Style I	0
Total	*65*

Table 6.18. Mimbres Black-on-white pottery microstyles and their suggested date ranges (from Shafer and Brewington 1995).

Microstyle Type	Suggested Date Range
Style III-late	A.D. 1110–1140
Style III-middle	A.D. 1060–1110
Style III-early	A.D. 1010–1080
Style II-III	A.D. 970–1020
Style II-late	A.D. 970–1020
Style II-early	A.D. 880–980
Style I	A.D. 750–900

Evidence from the communal structure and Feature 2 supports this scenario, although far fewer painted wares are available for analysis. In fact, the available evidence suggests a complicated picture of occupation, abandonment, and filling of this structure. It seems likely that this structure was cleaned out and left open after its abandonment at the end of the pithouse period (about A.D. 980). Very little charcoal was found in the fill, indicating that it did not burn upon abandonment (perhaps the occupants were intending to return). No post remains were found in Feature 2, suggesting that the center post was pulled during the Pueblo occupation and the hole filled with primarily Pueblo period deposits. Alternatively, as Creel and Anyon (2003) suggest, the Pithouse period occupants may have ritually retired the communal structure upon abandonment of it or of the site. The fact that little Pithouse period material is found in Level 5 (the bottommost level of the kiva unit) and in Feature 2 indicates that the structure did not contain substantial fill deposits prior to the pueblo occupation. The kinds of Classic period ceramics found in Level 5 and Feature 2 indicate that Classic period occupation at the site did not begin prior to A.D. 1050. After this, the pit structure was at least partially filled before trade in or local production of late Reserve area textured wares began. In sum, the possible kiva structure seems to date to A.D. 900–980, and the pueblo component after A.D. 1050.

As indicated above, the pueblo component of the site appears to date to the A.D. 1050–1110/1120 time range, based on the overwhelming presence of Style III-middle sherds (n=51) and a sharp drop-off for both Style III-early (n=3) and Style III-late (n=2). The late Reserve textured wares and Chupadero Black-on-white also confirm that the pueblo was occupied late into the Classic period. Although more of the pueblo needs to

be tested in order to acquire a larger sample of sherds suitable for microseriation, the results appear to have provided useful data. If any portion of the pueblo had been built prior to A.D. 1050, or if the pithouse component persisted beyond A.D. 980, then more Styles II-late, II-III, and III-early should be present, especially in the deeper fill levels of the possible kiva structure and in Unit 1 in Room 1. Although excavations were concentrated in the west-central portion of the site, the entire site was surface collected, and several occupational contexts were sampled. However, the styles noted above did not occur with much frequency.

In sum, based on ceramic microseriation, it seems most likely that the site was occupied briefly during the late Three Circle phase of the Late Pithouse period, about A.D. 900–980, then was abandoned for perhaps 60–80 years, and then reoccupied by Classic Mimbres people after A.D. 1050. Pueblo period occupation may have lasted at least to A.D. 1110, if not later as indicated by many of the late pottery types. Although the evidence does not directly support occupation beyond ca A.D. 1120, the fact that Rooms 1 and 2 were filled with some late trash (Style III-late, Chupadero Black-on-white, and late Reserve wares) may indicate that they were abandoned earlier than other rooms. These rooms perhaps would have little material culture associated with them if the last occupants took their possessions with them sometime after A.D. 1120. There are areas of the pueblo that appear to have nearly sterile fill deposits (eastern portion of the pueblo), and these may be later rooms. There is currently no good evidence for post-Classic Mimbres occupation of the site, other than some limited late pottery types, or anywhere else in this section of the middle fork of the Mimbres River.

Radiocarbon Dating Correlation

One charcoal sample was sent to Beta-Analytic, Inc. (Miami) for radiocarbon dating, and other samples were sent for tree-ring dating. Unfortunately, none of the tree-ring samples were suitable for this dating method. The radiocarbon sample (Beta-139515) came from Level 5 in Room 2, which is a combination of wall/roof fall and possible floor deposits. Importantly, the sample is believed to be from in situ deposits and may date the end of pueblo occupation at the site (at least the use of Room 2). The sample was wood charcoal, probably composed of several different kinds of species; a total of 8.3 gms were sent for dating.

The results are not particularly clear, but they may indicate that the abandonment of the site was late in the Mimbres period. The two sigma calibrated result is A.D. 990–1220, and the one sigma calibrated result is A.D. 1015–1170, with a central tendency occurring between A.D. 1090 and 1110. The intercept of the radiocarbon age with the calibration curve is A.D. 1040.

Although radiocarbon dating does not provide precise calendar dates similar to dendrochronology, the central tendency does generally fall within the later half of the age range for Style III-middle. If the central tendency is closer to the true age of the site, then the site may have been abandoned shortly after A.D. 1110. If the calibration intercept is closer to the true age, then the site may have been abandoned earlier than suspected, unless the sample is from original building materials, which then may date the initial construction of the site. Clearly, additional charcoal samples are needed from this site, but this date does hint that this portion of the pueblo was built after A.D. 1040, which fits the expectations of the model.

Ceramic Artifacts and Worked Sherds

Eleven ceramic artifacts and worked sherds were recovered from LA 5841 (Table 6.19). They consist of one "cloud blower," or tubular pipe fragment (Anyon and LeBlanc 1984:288–289), two cayepes (pottery scraping and smoothing tools) (Guthe 1925), three spindle whorls and/or discs, one thin ceramic handle (curved), two sherds of a miniature brown ware bowl, and two enigmatic ceramic objects with holes punctured through them. One of these enigmatic artifacts (FS 134) was found in situ in the corner of the hearth in Room 1; it is ball shaped with a flat bottom and a hole in the top. The other (FS 106) is a fragment of a nearly flat ceramic "dish" with three holes punctured through it at an angle. These two objects may have been used for supporting sticks or other similar objects upright, perhaps as incense (sage?) or prayer stick burners.

The ceramic artifacts and worked sherds from LA 5841 are in general typical for a Classic Mimbres pueblo, but they are often not seen at short-term habitation sites. The two possible cayepes suggest pottery production at the site, and the spindle whorls suggest perhaps weaving of cotton or other fibers. The cloud blower pipe and possible incense holders indicate ritualized activity occurring at the site which would be expected for a multi-functional, long-term residence.

Adobe Analysis

A total of 261 pieces of adobe were recovered from Rooms 1 and 2, weighing just over 2,550 g. The bulk of adobe came from Room 1 and its features, especially from Levels 3–5 (n=232; 2,464.8 g); very few pieces came from Room 2 or Unit 3. The presence of adobe at LA 5841 is important for several reasons. First, it is generally

Table 6.19. Ceramic artifacts and worked sherds from LA 5841 (Cooney Ranch #1).

Ceramic Artifact Description	Plain/Deco	Unit	Feature	Level
Pipe fragment, cloud blower type, 5 mm diameter tube hole and channel	Plain brown, undecorated	1	Room 1	3
Worked sherd, ground convex edge, most likely a cayepe	Plain brown, undecorated	1	Room 1	3
Spindle whorl, perforated disc, two sherds refitable	Plain brown, undecorated	1	Room 1	5
Miniature bowl-like object, small opening and interior space, flat bottom to slightly concave, possible function is to hold a stick upright (incense burner?), found in hearth	Plain brown, undecorated	1	Room 1, Fea. 4 (hearth)	5
Worked sherd, disc shaped, slightly concave, not perforated	Style III Black-on -white	1	Room 1	6
Miniature shallow bowl-like object with 3 holes poked through object; similar function as FS 134?	Plain brown, undecorated	1	Room 2	5
Miniature bowl, two sherds, unknown if refitable to same bowl	Plain brown, undecorated	1	Room 2	5
Worked sherd, one flat face, other slightly convex, ground edge, cayepe?	Plain brown, undecorated	1	Room 2	5
Spindle whorl fragment	Plain brown, smudged inter.	1	Room 2	5
Ceramic knob or leg fragment	Plain brown	1	Room 2	5
Thin ceramic handle fragment, 8–10 mm diameter, 29 mm length	Plain brown, undecorated	1	Room 2, Fea. 3	6

believed that short-term habitation structures are built for temporary use and employ easy to assemble, biodegradable materials (e.g., wood, brush, and grass); the use of these materials reflect low labor costs associated with temporary shelters (Diehl 1992). Although rock foundations or mud-coated walls are also associated with short-term structures (Nelson et al. 1978), adobe is associated with more durable and longer lasting structures. The presence of full-height rock and/or adobe walls, adobe-lined roofs, and adobe floors indicates more energy investment in the structure and by extension a longer

intended use-life. The presence of a sizable amount of adobe at LA 5841 suggests that the pueblo was built with greater labor expenditure than we might expect for a "short-term" structure and points toward the long-term and possibly permanent occupation of this site. This observation agrees well with earlier observations made regarding the masonry attributes of the pueblo.

Lithic Analysis

This analysis follows that presented for the McDermott Ranch analysis, including tool production and use; reduction stages present and their raw material distributions; and local and exotic raw materials found at the site. Differentiating between local and exotic raw material use and reduction will provide clues for understanding the importance and reliance on exotic raw materials for tools and the effort necessary for acquiring these materials. The distribution of reduction stages and raw materials using exotic versus local materials should be reflected in the types of cores found. A normal distribution of reduction debris might indicate heavy reliance on local materials for both reduction and formal tools, while an absence of a class or two of debitage could indicate reduction and/or tool production occurring elsewhere. The tools and their occurrence as either expedient or formal will provide insights into the kinds of tasks occurring at LA 5841 and the inferred intensity of site occupation.

Projectile Points

Three finished and nearly complete projectile points were recovered from LA 5841 (Table 6.20). Two are fashioned from clear (translucent) obsidian, which may be

varieties of Jemez obsidian. Because Jemez obsidian can occur as stream gravel along the Rio Grande, it is possible that this obsidian was not directly procured from the Jemez area or by trade. The third projectile point is fashioned from a fine-grained gray chert. Chert is not common in this area, and it may also represent an imported or directly procured exotic raw material.

Table 6.20. Projectile point analysis for LA 5841 (Cooney Ranch #1).

Provenience	Material	Shape	Size (cm)	Description
Unit 1, Level 4, Room 1	Clear obsidian, Jemez variety?	Triangular, side notched, slightly serrated	2.3+ × 0.85+; 0.35 thick	Dart or arrow tip of unknown type, small portion of tip and base broken, edge ground
Unit 1, Level 4, Room 2	Clear obsidian, Jemez variety?	Triangular, side notched, concave base	1.5 × 1.0; 0.4 thick	Small dart or arrow tip, reworked blade, some edge grinding, complete point
Unit 1, Level 4, Room 2, Fea. 1	Gray chert, fine-grained	Triangular, side notched	2.5+ × 1.2+; 0.3 thick	Arrow or tool tip, broken tip and base snapped at stem, probably impact/use fractures, sides parallel but begin to contract near upper break, fine flaking along edges

All three projectile points are triangular and side-notched. One of the obsidian projectile points is serrated along both blade edges, but both obsidian points exhibit edge grinding as well. The smaller obsidian projectile point is a complete specimen and has a deep, concave base, producing a pronounced flaring of the base. Its blade has been reworked and shortened. The chert projectile point is larger than the other two, and it exhibits possible impact fractures at the tip and the base, which is snapped off at the neck. It has roughly parallel sides that begin to taper towards the tip; as such, it appears to be bulkier than the two obsidian points, although it is thin in cross-section. All three points appear to have been used and then discarded.

Lithic Tools

A total of 87 lithic tools were recovered from all contexts at LA 5841 (Table 6.21). Thirty-eight (44 percent) are classified as expedient tools, and the remaining 49 (56 percent) are distributed among 13 different formal tool categories, including the three projectile points discussed above. Expedient tools here are defined as flakes that exhibit edge-wear but lack clear signs of formal flaking and shaping patterns. These flakes appear to have been used in an expedient manner; that is, they were used to accomplish a task and then were discarded (Nelson 1991). Formal tools, on the other hand, are defined as purposefully shaped lithic implements designed to satisfy certain needs and tasks, and they tend to be curated and used often (Nelson 1991). Most tools have been purposefully flaked to produce a finished product, but several are included here that do not exhibit flaking. Instead, they appear to be used for lithic reduction (hammerstones) and for work with ceramics and other materials (polishing stones).

As noted above, there appears to be almost an even split between expedient and formal tools at LA 5841, indicating that both classes of tools were important to the inhabitants of this site. Short-term habitation sites (i.e., limited function sites) should contain expedient tools made of local materials mixed with varying frequencies of formal tools, but the formal tools should be composed of a limited variety based on functional needs. If a short-term habitation site is primarily a hunting camp, tools associated with hunting and butchering would be expected, but not necessarily tools for ceramic, ornament, and clothing production. The variety of tools at LA 5841 indicates that many activities were occurring at this site, including all of the tasks mentioned here.

The projectile points, biface tips and bases, knife blades, and scrapers indicate, at

Table 6.21. Lithic tools recovered from LA 5841 (Cooney Ranch #1).

Tool Type	Frequency							
	Unit 1, Levels 1 and 2	**Unit 1, Room 1**	**Unit 1, Room 2**	**Unit 3**	**Unit 4**	**SW Midden**	**Total**	**% Raw Material[2]**
Expedient Tools	6	14	7	3	6	2	38	Rhy, 45; Ba, 26; Chal, 23; Chrt; 3; Obs, 3
Projectile Point		1	2				3	Obs, 67; Chrt, 33
Biface Tip/Base		2	3	1			6	Chrt, 50; Obs, 33; Chal, 17
Knife Blade	1			2	1		4	Chal, 50; Rhy, 50
Marginal Retouch	1	5	4		1		11	Rhy, 45; Chal, 36; Chrt, 9; Ba, 9
Unifacial Scraper		1	2	2		1	6	Ba, 33; Chal, 33; Rhy, 33
Bifacial Scraper		2					2	Chal, 50; Chrt, 50
End Scraper		3	1				4	Chal, 50; Rhy, 25; Obs, 25
Drill Base			1				1	Rhy, 100
Graver	1	1		1			3	Chal, 33; Obs, 33; Rhy, 33
Burin/Punch					1		1	Ba, 100
Chopper	1[1]		4				5	Ba, 80; Ands, 20
Hammer stone	1	1					2	Ba, 50; Rhy, 50
Polishing Stone				1			1	Rhy, 100
Total	*11*	*30*	*24*	*10*	*9*	*3*	*87*	

[1] Large bifacial tool, 30 x 22 x 11 cm. [2] Ands=Andesite; Ba=Basalt; Chal=Chalcedony; Chrt=Chert, Obs=Obsidian; Rhy=Rhyolite.

the very least, hunting and processing activities, while the drills, gravers, punches, large choppers, hammerstones, and polishing stones indicate a much wider range of domestic tasks. For example, the drill, punch, and certainly some of the scrapers suggest that perhaps hide preparation and clothing manufacture activities took place at the site. The extremely large chopping tool, measuring an astonishing 30×22×11 cm, could have been used for processing trees for domestic needs (e.g., splitting logs or stripping bark from Ponderosa pines).

Lithic tool raw material distribution indicates that for expedient tools, 94 percent of utilized flakes come from local materials (rhyolite, basalt, and chalcedony), and most formal tools are fashioned from finer-grained materials, including glassy rhyolite, chalcedony, chert, and obsidian. Basalt tends to drop out of many formal tool categories, except for tools not necessarily requiring a sharp edge or fine flaking (e.g., chopping tools, scrapers, hammerstones, and punches). The distribution indicates that exotic materials (chert and obsidian) were not used as expedient flake tools. It can be suggested that either larger flakes of these materials were reserved for formal tool production or that very few large flakes occur at the site (and by extension, that few cores will found as well). The tool assemblage indicates that exotic materials may have been brought to the site in a more finished state or as prepared blanks.

Unit 1 contained the bulk of the assemblage (n=65; 75 percent), with Room 1 containing 46 percent (n=30) of these and Room 2 containing 37 percent (n=24). The remaining eleven tools were recovered from Levels 1 and 2 of Unit 1 and are not attributed to either room. The distribution of tool types appears to be fairly equal between the two rooms, with Room 1 containing a few more tool types than Room 2. Unit 3 contained, in general, fewer tools (n=10; 11 percent), and the diversity of tool types decreases as well. Interestingly, Unit 4 contains nearly as many tools as Unit 3 (n=9; 10 percent), but they came from just two levels compared to the seven levels in Unit 3.

The most common formal tool at LA 5841 is marginal retouch flakes (n=11; 22 percent of the formal tools). These kinds of tools can be used in a wide range of tasks, including cutting, sawing, and scraping, so their higher frequency is not unexpected. Biface tips and bases (n=6; 12 percent) and unifacially retouched scrapers (n=6; 12

percent) are the next most common types. The biface tips and bases could be from several tool classes, including projectile points, drills, and punches. Their presence indicates that tasks requiring highly finished tools were important at LA 5841. All scrapers (n=12; 24 percent) constitute a high proportion of the formal tools, indicating their necessity for a multitude of tasks. Five chopping tools (10 percent) were found, most in Room 2 (n=4) and concentrated in the area of Feature 3 (Pithouse 1 in Room 2). The portion of Feature 3 adjacent to the doorway between Rooms 1 and 2 is most likely a cache of lithic tools, lithic cores, bone tools, and corrugated storage vessels.

Reduction Stages and Raw Materials

Over 2,450 pieces of lithic debitage, cores, and tools were recovered from LA 5841 (Table 6.22). All stages of reduction are present at the site, forming a unimodal, normal distribution of debitage (primary through biface thinning flakes). However, primary flakes of chert, silicified limestone, obsidian, quartzite, and andesite (n=4; 3 percent of primary flakes) are noticeably absent compared to the locally available raw materials (basalt, rhyolite, and chalcedony, n=139; 97 percent). No cores of andesite, silicified limestone, quartzite, chert, and obsidian were found at the site. Secondary, tertiary, and thinning flakes of obsidian and chert do increase in the assemblage, indicating their reduction at the site into formal tools or possible rejuvenation of formal tools. Conversely, locally available raw materials (defined here as basalt, andesite, rhyolite, and chalcedony) are plentiful and occur in all stages of reduction. In addition, all of the cores are local materials, and all of the pieces of angular (testing) debris are also local.

Table 6.22. Frequency of lithic raw material type by reduction stage and tool type, all units and levels combined, LA 5841 (Cooney Ranch #1).

Reduction Stage/Tool Type	Ba[1]	Ands	Rhy	Chal	Silic Lims, Silts	Qrtz	Chert	Obsd	Total
Primary	68	1	48	23		1		2	143
Secondary	221		156	108	1		5	12	503
Tertiary	320	1	299	363	2	2	24	5	1,016
Biface thinning	252	2	172	131			49	26	632
Angular debitage	12		11	5					28
Edge wear (expedient)	10		17	9			1	1	38
Core	20		18	9					47
Marginal retouch tool	3		6	7			1	1	18
Unifacial tool	1		3	3				1	8
Bifacial tool	1		3	3			4	2	13
Projectile point							1	2	3
Burin/spoke	1								1
Hammerstone	1		1						2
Chopper	4	1							5
Polishing stone		1							1
Total	*914*	*6*	*734*	*661*	*3*	*3*	*85*	*52*	*2,458*

[1]Key: Ba=Basalt; Ands=Andesitic basalt; Rhy=Rhyolite; Chal=Chalcedony; Silic Lims, Silts=Silicified limestone or siltstone (dolomitic); Qrtz=Quartzite; Chert=Chert; Obsd=Obsidian.

The distribution of reduction stages and raw materials demonstrates the presence of two sub-distributions: 1) a normally distributed range of local materials in all reduction stages, and 2) a non-normal distribution of exotic materials, including a total absence of cores and testing debris. It appears that locally available raw materials were heavily used at LA 5841, almost to the exclusion, percentage-wise, of non-local materials. However, non-local materials are present and do form an important part of the assemblage, especially with regard to tool production. The local materials represent a useful variety of both fine-grained and coarser-grained stone and are suitable for a wide range of stone tool needs. Mimbres area rhyolite ranges from medium-grained to glassy, and despite

inclusions, it is an excellent and durable lithic material. The local chalcedony is also fine-grained but is somewhat tougher to flake due to its fibrous nature. The basalt is most variable, ranging from coarse-grained to fine-grained to near glassy.

As noted above, 87 tools were recovered, including the three projectile points. Of these, 71 (82 percent) are fashioned from local materials (basalt, rhyolite, and chalcedony), and 16 (18 percent) are non-local materials (andesite, chert, and obsidian). This general distribution closely resembles the distribution for debitage. However, when the expedient tools are removed, tools made from exotic materials increase by 11 percent. Thirty-five of the 49 formal tools (71 percent) are made from local materials, and 14 (29 percent) are made from non-local materials. Although formal tools fashioned from exotic, non-local raw materials never approach equality with local materials, they form a significant portion of the assemblage and as a whole, occur more frequently than expected based on general raw material distribution at the site. The importation of exotic raw materials constitutes an important economic activity for the residents of LA 5841, far more than expected if the site was a short-term, special activity site. This is especially true given that the local raw materials would suffice as tool making stone for all kinds of tools, except perhaps for tools requiring a sharp edge angle; non-local chert and obsidian would be more suitable for the latter tools.

General Observations on Lithic Trends at LA 5841

The residents of LA 5841 depended greatly upon locally available lithic raw materials. Exotic materials, primarily chert and obsidian, never comprise more than 20 percent of the site total. Yet, the exotic materials are a significant component of the

assemblage given the distance to obsidian and chert sources in southwest New Mexico. Further, if LA 5841 was simply a short-term agricultural camp, then there might be little reason for the presence of exotic materials at all, given the high quality of the locally available rhyolite, basalt, and chalcedony. The fact that the residents of LA 5841 imported, or brought with them, "exotic" materials suggests that the site was multi-functional, requiring these materials for tools, and that they remained connected to larger trading networks, a scenario that might not be important if LA 5841 were a short-term residence. Additionally, the location of LA 5841 along a natural travel corridor between the Rio Grande, the upper Mimbres area, and the Reserve area, suggests that the residents perhaps played an important role in monitoring or facilitating east-west trade of goods. The lithic analysis reveals that Mule Creek-like obsidian from perhaps the lower Gila River Valley of New Mexico, Jemez-like obsidian from perhaps the upper Rio Grande Valley, and chert from perhaps the lower Mimbres Valley and/or the Rio Grande Valley, were important trade items moving through the middle fork.

The kinds of tools found also indicate a more settled and long-term occupation of LA 5841. Because a more limited range of tool types was not found at this site that would suggest a limited activity site, the wider range of tool types indicates multiple kinds of tasks. The lithic tool assemblage is very similar to the large Mimbres Valley pueblos except in absolute numbers. Many of the tools seem to indicate a high degree of animal and hide processing, while others suggest hunting, chopping, bark stripping, and pottery production. Most of the tools are made from locally available raw materials, and more formal tools are made of exotic materials. The debitage pattern shows heavy reduction of locally available materials but the importation of exotic materials in an already reduced

form. In sum, a significant lithic reduction and stone tool production industry is evident at LA 5841, indicating that, when combined with the other analyses presented in this report, the site is apparently a multi-task oriented and intensively occupied "typical" Mimbres village.

Ground Stone Analysis

A total of 16 whole or fragmentary pieces of ground stone were recovered from LA 5841 (Table 6.23). Five (31 percent) are metate fragments, seven (44 percent) are whole or fragmentary manos, three (19 percent) are door slabs with ground edges, and one (6 percent) is a possible "hoe" fragment. Two of the metates are basin-shaped, and one is vesicular basalt, while the other is a granitic material. The other three metates are slab types (flat to slightly concave grinding surfaces) and all are a silicified limestone or limestone.

Six of the seven manos are rectangular in shape, two of which are complete specimens of the "two-handed" type, while the seventh is too fragmentary for shape determination. Five manos are made from a granitic material, one is silicified limestone or dolomite, and one is vesicular basalt. All show pronounced grinding and smoothing on their working surfaces, with several showing smoothing on the opposite face, presumably from gripping and friction from repeated use. The two whole manos are heavily used to the point of exhaustion; in fact, one was found in the pueblo wall behind the in situ door slab. Six manos have only one grinding surface, except for one specimen found in Room 1, which has two grinding surfaces, producing a "wedge" shape in cross section. Based on the rectangular shape of most of the manos, it seems that trough metates should be

Table 6.23. Ground stone analysis results for LA 5841 (Cooney Ranch #1).

Type	Provenience	Raw Material	Shape	Size (cm)	Percent Present	Grinding Surfaces	Grinding Area or Comments
Basin metate	Southeast midden area	Vesicular basalt	Possibly rectangular	19.7+ × 16.2+	50–70	One, basin	19.7 × 16.2
Slab metate	Unit 1, Lev. 1	Silicified limestone	Square to rectangular	8.6+ × 7.9+	25	One, flat	8.6 × 7.9
Slab metate	Unit 1, Lev. 1	Silicified limestone	Rectangular	10.6+ × 11.8+	50	One, flat, wedge	8.0 × 8.6
Basin metate	Unit 1, Lev. 4, Room 1	Granitic	Indetermin.	13.5+ × 18.0+	30–40	One, basin	13.5 × 17.9
Slab metate	Unit 1, Lev. 4, Room 2	Limestone	Rectangular to irregular	13.2+ × 9.5+	< 50	One, flat	11.7 × 7.9
Mano	Unit 1, Lev. 1	Granitic	Rectangular	7.9+ × 6.5	25	Two, flat & convex	Very fragmented
Mano	Unit 1, Lev. 1	Granitic	Indetermin.	7.6+ × 10.0	25	One, convex	Very fragmented
Mano	Unit 1, Lev. 3, Room 1	Granitic	Rectangular	11.8+ × 9.7	50	One, convex	Concave on grip side
Mano	Unit 1, Lev. 4, Room 1	Granitic	Rectangular	21.5 × 9.8	100	One, convex	Thinned at edges
Mano	Unit 1, Lev. 5, Room 1	Granitic	Rectangular	12.6+ × 11.2	50	Two, wedge	One face is flat, other is angled
Mano	Unit 1, Lev. 6, Room 2	Silicified sandstone	Rectangular	18.1 × 9.4	100	One, convex	Thinned at edges
Mano	Unit 3, Lev. 1	Vesicular basalt	Indetermin.	6.1+ × 2.9+	<15	One, convex	Very fragmented
Door slab	Unit 1, Room 2, Fea. 1	Schist-like	Square to rectangular	8.2+ × 9.4+	<25	Flat, edge ground	Similar to in situ door slab
Door slab	Unit 1, Lev. 3, Room 1	Schist-like	Sub-rectangular	12.2+ × 10.4+	25	Flat, edge ground	Some grinding on surface
Door slab	Unit 1, Lev. 6, Room 2	Schist-like	Square to rectangular	7.5+ × 8.9+	<25	Flat, edge ground	See FS 67
Hoe blade	Unit 4, Lev. 2	Schist-like	Rectangular	10+ × 7.5	40	Edge ground on 3 sides	Similar to hoes in Mattocks report

present at the site, as none of the manos comfortably fit the basin metates. The rectangular manos (increased grinding area) suggest heavy processing of maize (Diehl 1996; Hard 1990; Hard et al. 1996).

The remaining four pieces of ground stone are actually tabular rock with ground edges. Three of the pieces are identified as door slab fragments based on their strong

similarity to the in situ door slab lining the north side of Feature 1, the doorway between Rooms 1 and 2. Although the three pieces do not refit, all were found in the vicinity of Feature 1 and may be fragments of another door slab from this feature. All four door slabs (including the in situ specimen) are flat pieces of rock from a platey, schist-like material. The possible hoe fragment (FS 151) is a rectangular fragment of the same material, with evidence of grinding on three edges. Although fragmentary, it roughly resembles the hoes pictured in the Galaz Ruin report (Anyon and LeBlanc 1984:279), the Mattocks report (Nesbitt 1931:81), and the Swarts Ruin report (Cosgrove and Cosgrove 1932:plate 44). Both Anyon and LeBlanc and the Cosgroves note the problematic nature of identifying these stone artifacts as true "working hoes," and the examination of the "hoe" from LA 5841 did not reveal significant edge wear damage or a method of hafting.

The ground stone assemblage from LA 5841 indicates a significant amount of food grinding at this site. The metates suggest low-level production of cultivated food or processing of wild food, but the two-handed, rectangular manos suggest higher levels of food production, presumably maize. However, pothunting, caching, removal of usable items, and sampling may be skewing the types of ground stone recovered. Locally available raw materials appear to have been commonly used.

Ornamental Artifacts

This section is brief due to the general paucity of ornamental items found at LA 5841. Six ornamental artifacts were recovered from Unit 1, and one bone bead was found on the surface of the southwest midden near the large pit structure (kiva) (Table 6.24). Four of the artifacts are ground and possibly incised objects made from a soapstone-like

material; one of these was further shaped into a triangular pendant (the tip was missing). All four are flat pieces of stone, and all are covered with numerous striation lines on both surfaces. Three bone beads were found; two from Room 2, Levels 4 and 5, and the other from the southwest midden area. The two beads from Room 2 were recovered from flotation samples taken from each level; each bead is extremely small but both are identical. No determination on what kind of bone was used is possible. Each is circular and flat, with a hole drilled precisely in its center. The bone bead from the surface midden is slightly larger and is partially damaged, possibly from cattle trampling. It is whiter in color and has a larger center drill hole. The bone is not identifiable as to species or element.

Table 6.24. Ornamental artifacts from LA 5841 (Cooney Ranch #1), all proveniences.

Ornamental Artifact Description	Material	Unit	Feature	Level	No.
Ground and incised flat stones	Soapstone	1		1	2
Ground and incised flat stones	Soapstone	1		2	2
Ground, triangular shaped pendant, top with hole broken off	Soapstone	1	Room 1	3	1
Ground and incised flat stones	Soapstone	1	Room 1	5	1
Small, flat bone bead	Bone	1	Room 2	4	1
Small, flat bone bead	Bone	1	Room 2	5	1
Bead fragment	Bone		SW Midden	Surface	1

Minerals

Many of the minerals recovered from LA 5841 are not necessarily "artifacts," but several do show evidence for grinding, and others may have been purposefully brought to the site for reasons unknown (Table 6.25). A total of 39 mineral specimens were recovered, six of which are chrysacolla, a copper-based mineral related to turquoise; one

Table 6.25. Minerals recovered from LA 5841 (Cooney Ranch #1).

Mineral	Provenience	Number of Pieces	Weight (g)	Worked or Modified
Chrysacolla	Unit 1, Lev. 3, Room 1	1	0.4	Unworked
Chrysacolla	Unit 1, Lev. 4, Room 1	2	1.7	One piece has a flat ground surface
Chrysacolla	Unit 1, Lev. 5, Room 1	1	0.8	Two surfaces have been ground flat
Chrysacolla	Unit 1, Lev. 4, Room 1	1	1.6	One surface has been ground flat
Chrysacolla	Unit 1, Lev. 3, Room 2	1	<0.1	Tiny fragment
Copper-based mineral	Unit 1, Lev. 4, Room 2	1	5.5	Purple-blue to metallic blue, coarse texture
Quartz Crystal	Unit 1, Lev. 5, Room 1	1	2.3	Large complete crystal, but unworked
Ochre (green - yellow)	Unit 1, Level 1	2	12.4	Unworked
Ochre (red and yellow)	Unit 1, Lev. 3, Room 1	11	27.5	Unworked
Ochre (deep red)	Unit 1, Lev. 3, Room 1	3	6.0	Very chalky and bleeds in water
Ochre (deep red)	Unit 1, Level 6, Room 1, Feature 6	1	<0.1	Very chalky, small fragment
Ochre (deep red)	Unit 1, Lev. 4, Room 2	1	2.5	Very chalky red pigment
Ochre (deep red)	Unit 1, Lev. 5, Room 2	1	1.2	Very chalky red pigment
Ochre (deep red)	Unit 1, Lev. 6, Room 2	1	4.6	Ground into a pointed stick shape, very chalky
Ochre (red)	Unit 3, Level 1	2	12.5	Unworked
Ochre (red)	Unit 3, Level 2	2	9.1	Unworked
Ochre (green-yellow)	Unit 3, Level 3	2	16.2	Unworked
Ochre (yellow)	Unit 3, Level 4	1	6.3	Unworked
Ochre (green-yellow)	Unit 3, Level 5	3	84.2	Unworked
Ochre (deep red)	Unit 4, Level 2	1	1.8	Ground into a pointed stick shape, very chalky
Total		*39*	*196.6*	

is a non-chrysacolla copper based mineral; one is a large quartz crystal; and the remaining items are variously colored pieces of ochre. Three of the six pieces of chrysacolla exhibit ground surfaces indicating (presumably) their use as a pigment. Chrysacolla is very grainy compared to turquoise and crumbles easily; its bluish-green

color would make an ideal coloring agent as a paint pigment. The other copper-based mineral shows no evidence for grinding, but its uniqueness suggests purposeful transport to the site. Although its metallic blue and purple coloring suggests a copper-based mineral, it has not been identified.

Eight of the "deep red" pieces of ochre are very chalky and "bleed" when submersed in water. In fact, two of these specimens have been ground to a "stick-like" shape with one edge further ground into a point or tip and are referred to as "pigment sticks." The remaining pieces of ochre include yellow, greenish-yellow, and yellowish-red. Ochre may have been used as a pigment, similar to modern uses by many pueblo people, especially potters (Guthe 1925). The ochre was found distributed in the fill of all three excavated units.

Faunal Analysis

A larger sample of faunal remains was recovered from LA 5841 compared to the results from McDermott Ranch, and it will be useful for understanding some of the subsistence patterns in upland communities. Jennifer Nisengard kindly undertook the faunal analysis (Nisengard 2000), and her report and conclusions are condensed here.

At lowland archaeological sites in the Mimbres area, the remains of leporids, including both jackrabbits (*Lepus* spp.) and cottontails (*Sylvilagus* spp.), dominate faunal assemblages (Cannon 1999a; Sanchez 1992, 1996; Shaffer and Schick 1995), frequently comprising between 50 and 80 percent of the assemblage. Artiodactyls, including deer (*Odocoileus* spp.) and pronghorn, (*Antilocapra americana*), also played a significant role in the subsistence economy of the ancient Mimbres people, but they are more abundant in

archaeofaunal assemblages from upland areas than from lowlands (Cannon 1999a; Shaffer and Schick 1995). The remains from LA 5841 provide an example that reinforces this pattern (Nisengard 2000).

Number of Identified Specimens (NISP)

Archaeofaunal data from LA 5841 are presented here in the form of numbers of identified specimens (NISP), which is simply the number of bones assigned to each taxon (Grayson 1984; Klein and Cruz-Uribe 1984). A variety of factors may influence NISP values. These include decisions made by ancient peoples, post-depositional site formation processes, and archaeological data collection techniques (e.g., Grayson 1984; Szuter and Gillespie 1994:71–72).

Transportation decisions made by hunters are reflected in the assemblages archaeologists recover (Lyman 1991). The faunal assemblage from a kill site may be quite different than one collected from an occupation site. A hunter may choose not to transport an entire animal but may remove the meatiest pieces to bring back to the site, resulting in different sets of elements being left at the two locations (Klein and Cruz-Uribe 1984:25). The intensity with which those procuring the animal processed the faunal remains will also impact NISP values (e.g., James 1990).

Preservation can also affect NISP values, as certain elements are more likely to survive than others (e.g. Lyman 1994). Denser bones are more likely to survive attrition than are less dense bones, thereby reducing the number of less dense bones recovered. On the other hand, less dense bones may break with a higher frequency than will denser elements, thereby increasing the number of bones recovered (Klein and Cruz-Uribe

1984:25). Finally, in-field collection decisions and screening procedures also influence NISP values. An assemblage recovered using one-quarter inch screens will be different from one collected using one-sixteenth inch screens (e.g. Cannon 1999b; Shaffer and Sanchez 1994; Szuter and Gillespie 1994:69).

Although NISP is not without problems, it suffers from fewer problems compared to alternative means of quantifying faunal materials, such as MNI, or the minimum number of individuals. This is especially true for a smaller assemblage such as the one from LA 5841 (see Grayson 1984; Klein and Cruz-Uribe 1984).

Results of the Analysis

A total of 151 bones (64 identified) (Tables 6.26 and 6.27) were collected using one-quarter inch screens during excavation, while an additional 472 specimens (22 identified and 450 unidentified) were recovered from flotation samples that were processed using a water screening method (see Tables 6.41 and 6.42) (Nisengard 2000). The faunal remains recovered using one-quarter inch screens were collected from two primary excavation areas: Unit 1 (Levels 1 and 2; Room 1; Room 2; Feature 1; and Feature 3) and Unit 3, including Feature 2.

Burning Patterns

Several specimens from this assemblage show surface modifications indicative of human activities, the predominate form of which is burning (Nisengard 2000). For this analysis, the "burn" classification was divided into three categories: unburned, charred, and calcined. Twenty-five of the unidentified specimens in this assemblage were charred,

Table 6.26. Taxon counts of faunal remains collected during excavation (one-quarter inch screening method).

	Taxon	NISP
	Birds	
	Meleagris gallopavo (turkey)	1
	Passeriformes (Perching Birds)	2
	Mammals	
	Leporidae (rabbits and hares)	1
	Sylvilagus sp. (Cottontail rabbits)	18
	Lepus sp. (Jackrabbits)	17
	Dipodomys sp. (Kangaroo rats)	2
	Sigmodon sp. (Cotton rats)	1
	Canidae (Coyotes, wolves, foxes, and dogs)	1
	Artiodactyla (even-toed ungulates)	15
	Odocoileus sp. (deer)	2
	Antilocapra americana (Pronghorn)	4
Total NISP		*64*

Table 6.27. Faunal totals by provenience (one-quarter inch screening method).

Provenience	*Meleagris gallopavo*	Passeriformes	Leporidae	*Syvilagus* sp.	*Lepus* sp.	*Dipodomys* sp.	*Sigmodon* sp.	Canidae	Artiodactyla	*Odocoileus* sp.	*Antilocapra americana*	Total NISP	Unidentified
Room 1				2	9	1			9	2	4	27	58
Room 2	1	2	1	14	6	1	1	1	5			32	24
Feature 1				1								1	1
Feature 2									1			1	
SW Midden													1
Unit 1				1	2							3	3
Totals	*1*	*2*	*1*	*18*	*17*	*2*	*1*	*1*	*15*	*2*	*4*	*64*	*87*

19 were calcined, and 43 were not burned. Only 10 specimens identifiable by taxon and element were recovered. These include one ulna (calcined) and three tibiae (charred) of Lepus sp.; one maxilla (charred) of Dipodomys sp.; one rib (charred), one femur (charred), one metatarsal (charred), and one radius (charred) from Artiodactyla; and one tibia (charred) from Odocoileus sp. (Nisengard 2000).

Worked Bone

Six worked bones were recovered. These artifacts include a bone awl; a bone needle; a charred, incised, and polished mid-shaft fragment; and three round bone beads. The large bone awl is a modified *Antilocapra americana* metapodial (Nisengard 2000). The bone needle, bone beads, and incised bone, although small, are made from cortical bone of a thickness that suggests that they may also have been crafted from artiodactyl elements (M. Cannon, personal communication 2000 in Nisengard 2000).

Faunal Remains from Flotation Samples

Remains recovered from 19 flotation samples were collected, including 22 identifiable faunal specimens and 450 unidentified bones (Nisengard 2000). The remains were collected from five features and two rooms (Tables 6.28 and Table 6.29).

Burning Patterns

Seven of the identified specimens in the heavy fraction sample show evidence of burning in the form of charring and calcination. In addition, of the 371 unidentified specimens, 93 were charred and 278 were calcined. The flotation samples were collected primarily from features within rooms including hearths and ash pits (see Table 6.29); this may explain the large percentage (100 percent) of calcined bones in the heavy faction

assemblage (Nisengard 2000).

Table 6.28. Taxon counts of faunal remains recovered from heavy fraction (one-sixteenth screening method).

	Taxon	NISP
	Fish	
	Cypriniformes (Minnows and Suckers)	1
	Birds	
	Passeriformes (Perching Birds)	1
	Mammals	
	Sylvilagus sp. (Cottontails)	5
	Lepus sp. (Jackrabbits)	1
	Rodentia	12
	Canidae (Coyotes, wolves, foxes, and dogs)	2
Total NISP		*22*

Table 6.29. Totals of heavy fraction fauna by provenience (one-sixteenth inch screening method).

Provenience	Cypriniformes	Passeriformes	*Syvilagus* sp.	*Lepus* sp.	Rodentia	Canidae	Total NISP	Unidentified
Room 1					1		1	96
Feature 1 (doorway between Rooms 1 and 2)					2		2	21
Room 2	1		1	1	6	1	10	73
Feature 2 (large pit/central posthole)			1		1		2	65
Feature 3 (fill)		1	2		1	1	5	48
Feature 4 (hearth)								12
Feature 6 (hearth or posthole)			1		1		2	135
Totals	*1*	*1*	*5*	*1*	*12*	*2*	*22*	*450*

Discussion of the Faunal Assemblage at LA 5841

One interesting aspect of this assemblage is that it was recovered from a higher elevation Mimbres site (6,840 feet) than most for which data are available (Nisengard 2000). While there are several available data sets with faunal assemblages from lowland sites (e.g., Anyon and LeBlanc 1984; Sanchez 1996), upland sites have not been the focus of a great deal of excavation and interpretation. Faunal assemblages from lowland Mimbres sites largely consist of leporid remains; artiodactyls tend to occur in lower relative abundance compared to higher elevation sites (Cannon 1999a; Shaffer and Schick 1995). The Artiodactyl Index Value (total number of artiodactyls ÷ total number of leporids + total number of artiodactyls [Szuter and Bayham 1989]) of 0.37 for the LA 5841 faunal assemblage (Nisengard 2000) is comparable to those calculated for other Classic period Mimbres sites in the upper Mimbres Valley (e.g., Montezuma and Mitchell). These sites have higher artiodactyl relative abundances compared to middle and lower valley sites (see Cannon 1999a).

The presence of several juvenile artiodactyl specimens (6 out of 21) in the LA 5841 assemblage may indicate increased harvest rates of artiodactyl populations (Broughton 1999). In turn, this may reflect a decline in the abundance of artiodactyls on the landscape during the Classic Mimbres period (A.D. 1000–1150) in this region (Cannon 1999a; LeBlanc 1983; Speth and Scott 1989). However, many of the juvenile specimens may have come from fetal or neonatal animals. The presence of fetal or neonatal elements can potentially provide information concerning the relationship between high elevation settlements and seasonality in the Mimbres region, as both deer and pronghorn calves are commonly born in April or May (Asdell 1964).

LA 5841 is a high elevation, large occupation site with a faunal assemblage that can be used to address issues of artiodactyl relative abundance, and to compare the characteristics of upland and lowland sites. However, the size of the LA 5841 assemblage is a limiting factor; larger samples from additional upland Mimbres sites are needed to supplement the initial findings presented in this section.

Summary and Evaluation of Research Goals and Excavation Results for the Noonday Canyon and Middle Fork Communities

Earlier in this chapter, six research goals were outlined that guided the two test excavation projects at peripheral communities in upper Noonday Canyon and the Cooney Ranch community in the upper middle fork of the Mimbres River. The research goals were based on aspects of cultural ecology, previously excavated Mimbres sites, and behavioral examples provided by ethnographic examples. This chapter presented the results of excavation. This section will briefly summarize those results in relation to how they address the research goals, and the inferences and conclusions drawn from them will be used in the next chapter for evaluating the overall research orientation of this dissertation and the various data sets examined (ethnographic, survey, and excavation).

The first research goal was to acquire basic excavation data for variously sized Classic Mimbres surface structure sites in peripheral areas. The two projects together have produced initial data towards this goal. The McDermott Ranch project in upper Noonday Canyon provided important data on a multi-functional field house, but more limited data for the farmstead, and unfortunately little excavation data for the completely bulldozed main village. Although the Cooney Ranch excavations were to augment data

for the three site size classes, research was carried out on the large site only. However, the data acquired from this one site was more than adequate for understanding the nature of these larger sites. In sum, good data were obtained for field houses and large sites at peripheral communities, but the data for farmsteads remain less than sufficient, but nonetheless useful. With the data gathered for the four sites, aspects of the remaining research goals can be addressed and evaluated.

The second research goal was to acquire material for radiometric dating and cross-dating the sites. The former includes charcoal for radiocarbon dating, wood samples for dendrochronology, and fired adobe or plaster samples for archaeomagnetic dating. The latter was focused on Mimbres pottery microseriation using the technique developed by Shafer and Brewington (1995), but it also included trade wares and certain types of utilitarian wares. Unfortunately for the former, very little charcoal material was obtained for any of the sites. The McDermott Ranch sites produced virtually no charcoal samples, while several samples from taken from good contexts at LA 5841. One radiocarbon date was obtained for this site that seems to place the site into the middle to late Classic period. The wood samples submitted to the Tree-Ring Laboratory from LA 5841 and McD #4 were found not to be datable for a variety of reasons (unsuitable species, not enough rings), although the species of each sample was identified (juniper, piñon, and oak). Only one partially intact, fired adobe feature was found at LA 5841, but it was unfortunately too decayed and fragile to use for archaeomagnetic dating.

The ceramic cross-dating and microseriation was much more successful. The trade wares found at LA 5841 and several of the McDermott Ranch sites included Chupadero Black-on-white, which generally post-dates A.D. 1100, and several Cibola

White wares, possibly Reserve Black-on-white, which also post-dates A.D. 1100. Many of the textured wares also occur late in the Mimbres sequence, including Tularosa Patterned corrugated, Tularosa Fillet rim, and possibly Starkweather smudged corrugated-decorated. The other textured wares occur throughout the Classic period, including Reserve Indented obliterated and Reserve Tooled. No typical "Mimbres" corrugated sherds were found. The microseriation of the Mimbres painted wares strongly indicates that the pueblo occupation of the site did not occur much before A.D. 1040 to 1050, and the site was likely abandoned by A.D. 1120. Minor amounts of late Three Circle phase pottery was identified, and it appears to correlate well with the pithouse and kiva identified at the site. However, the microseriation indicates that a hiatus in occupation occurred between the Pithouse and Pueblo period components, on the order of one to two generations.

The third research goal was to acquire basic subsistence data for these communities and to detect possible differences between the site types that might reflect site function. The results from McDermott Ranch were less than hoped for, but the collection from LA 5841 was much more substantial. Together, they indicate that larger mammals were frequently targeted and consumed and/or processed for distribution at peripheral communities. The higher elevation of site LA 5841 produced a more varied assemblage, including the presence of turkey, fish, and coyote or dog, in addition to deer and pronghorn. Both communities still showed a high reliance on rabbits, including both jackrabbits and cottontails. These are patterns expected for both upland Mimbres sites (larger mammals) and for farming societies in general (rabbits). Because the data were few from the three McDermott Ranch sites, potential site patterning and function were

not demonstrated, except that the larger sites contain the most varied assemblages.

Unfortunately, macrobotanical analysis produced very little material from any of the sites, with just a few pieces of domesticated plants found at LA 5841 (one maize cupule and one squash seed fragment), plus a few burned wild plants, including several piñon and acorn nuts. The ground stone, however, included many examples of large, two-handed rectangular manos associate with high amounts of maize processing. No accompanying trough metates were found, but the variety of manos and metates indicates a wide range of food processing, both domesticated and wild.

The fourth goal was to investigate potential social and trading relationships between these communities and other Mimbres areas. This was partially addressed through material culture studies, including observing the types of ceramics present and by INAA analysis of several corrugated sherds from LA 5841. Given the copious amounts of Mimbres painted pottery and its similarity to seriated types developed for the Mimbres Valley, it is clear that the occupants of both peripheral communities maintained strong cultural, social, and economic relationships with main valley communities. However, the painted trade wares found at LA 5841 indicate a strong relationship with groups to the north, northwest, and east as well (Chupadero Black-on-white, Cibola White wares). A weakly defined, but roughly similar pattern was observed in the McDermott Ranch data. The wide variety of Reserve textured wares strongly reinforces this pattern. INAA analysis indicates that the textured pottery submitted belonged to a tightly focused group of pottery centered in the Sapillo Valley to the northwest. These data suggest that either the occupants of LA 5841 actually did maintain strong ties to northern groups, or that this is simply a function of proximity to source areas. The fact that southern trade wares were

not found may be a function of distance. However, two late Santa Cruz or Sacaton Red-on-buff sherds were found at the Lake Roberts Vista site in the Sapillo Valley (Stokes 1999), indicating that southern and western wares do occur in some northern sites.

The fifth research goal was to investigate the surrounding environmental contexts of the communities and study their potential effects on site placement and resource potential. This research goal will be addressed in the next chapter in the form of site catchment analysis.

The sixth research goal was designed to investigate the duration, timing, and intensity of occupation of each site in the community and of the community itself. The results of architectural and material culture analyses, plus the results of dating, indicate that the pueblo components of the sites were roughly contemporaneous, and all were occupied during the middle to late Classic period. The former indicates that these sites likely formed an interactive community and not a succession of sites over time. The latter indicates that these communities did not come into being until a generation or two after the commencement of pueblo construction in the main valley. By that point, subsistence and population stresses should have been on the rise, leaving little available land in the Mimbres Valley for newcomers or new families to settle on. Thus, the movement into peripheral appears to be an outcome of landless groups of people in the Mimbres Valley, as expected based on the model developed from the ethnographic examples.

The data also indicate that the largest sites were permanently occupied, multi-functional sites that likely served as the central nodes of their respective communities. The intensity of occupation was greatest at LA 5841, where substantial pueblo walls were built, enormous amounts of trash were deposited within the pueblo, and surface middens

began to develop. This site also had the widest variety of artifact types found at any of the sites. In contrast, the farmstead (McD #1) showed signs of fewer activities and less intensive occupation. The single field house studied, McD #4, showed evidence of repeated short-term occupation and use, in the form of a substantially built structure with signs of remodeling. But this site also produced evidence that it was also multi-functional, with both cultivated and wild food related tasks occurring there. This was unexpected for a field house and demonstrates the multi-functional roles of these site types in peripheral communities (at least at McD #4).

In short, these excavations have provided important data that can be used to augment the survey results to use for testing the model developed for peripheral community development. The next chapter provides this overarching analysis, including site catchment analysis, and synthesizes the data for evaluating this dissertation's proposition that landless groups colonized peripheral areas.

CHAPTER VII

PERIPHERAL LAND USE, SITE CATCHMENT, AND LAND TENURE: EVALUATION OF THE MODEL

This chapter synthesizes the various survey and excavation data presented thus far and then examines their utility for evaluating the model presented in Chapter II for peripheral land use, settlement, and land tenure by subsistence level agriculturalists. A perfect correlation between the ethnographically derived model and the data obtained for the Mimbres culture of southwestern New Mexico was not expected. However, as will be shown in this chapter, a number of positive correlations were identified, indicating that the model is useful for potentially understanding how and why disenfranchised farmers undertake the difficulties inherent in colonizing marginal agricultural areas. This research further indicates that aspects of central place theory and catchment analysis can be useful for understanding where and how peripheral communities developed. This chapter does not attempt to explain all aspects of settlement behavior exhibited by the ancient Mimbres, but instead focuses on peripheral land use that goes beyond explanations of temporary expansion of the agricultural land base in secondary areas. Accepting that population/resource imbalances arose in Classic Mimbres society, I examine the development of rules of land tenure and resource ownership that led to the formation of a landless group of people within that society. I argue that it was this landless group that attempted to colonize agriculturally peripheral areas in an effort to stabilize the overall society (i.e., to remain a part of society instead of breaking it apart).

To briefly reiterate, the model of peripheral land use, which includes aspects of

selection/decision making, colonization, community development, and land tenure, was based on a sample of four ethnographic examples of farming societies who experienced moderate to severe limitations of available farmland coupled with expanding populations, and who developed land tenure systems in response, ultimately resulting in the development of a "landless" subgroup within the society. Most of these examples were of groups living in "oases" within harsh, semi-arid to arid environments, but as the Nahua example demonstrated, the conditions leading to land tenure are not restricted to oasis-like environments. The observed behaviors are acted within the established social ways of doing things in order to reach acceptable solutions for some, if not all, persons within the society. Because ethnographically derived models set a baseline for behavior under similar conditions, a level of predictability emerges that then can be tested with archaeological data that are believed to potentially represent similar conditions, environmental and/or social.

In this case, similar conditions are loss of access to good farmland and water for newcomers to the society or for families who, for whatever reasons, have lost their rights of land tenure. Some potential pressures exerted on subsistence level farmers in this environment include population increase and pressure to the point where the best available farmland and water become owned by those who have long standing claims to them. This may then lead to subsistence and social stresses for those segments of the society who become essentially "landless." Often, these stresses cannot be alleviated simply through traditional food sharing mechanisms or by reverting to mobility options. The latter point feeds back into growing population in a region by not allowing freedom of movement to distant places suitable for farming because these areas are already

occupied by other groups, or groups of Mimbres people who moved prior to the onset of serious resource/population stresses. This scenario serves to perpetuate a vicious cycle of food and land stress acting on a given population by forcing ever-increasing populations into restricted areas, putting further stresses onto already limited agricultural resources.

One potential option for disenfranchised groups within the society is to migrate to nearby areas with poorer arable land and/or unpredictable water supplies; that is, they choose to accept the risks and hardships of this option in order to remain a part of the larger society while making a living. This behavior was observed in most of the ethnographic groups studied who at one time, or were currently, experiencing food/land/population imbalances. In the ethnographic examples, marginalized people generally turn to one of four options:

1) Bend social rules in order to inherit or marry into a family with available land;
2) Migrate to the fringes of unclaimed arable or marginal land, if available;
3) Resort to conflict and strife, if none of the other options are viable choices, or if objections are raised regarding migrant settlements, and;
4) Leave the society and join other groups (e.g., finding wage labor in larger cities and towns).

Minnis (1985a) developed a similar set of expectations that examined how agricultural societies handled food stress, but with a focus on ecological aspects of food provisioning and the way people negotiate with one another to ensure their survival as observed in several ethnographic examples. This dissertation focuses more on the decision-making strategies of individuals within the backdrop of the overall society and its structural elements (e.g., subsistence strategies and rules for ownership and

inheritance). Minnis' research focused on the primary zones of occupation and how groups living there altered their immediate environment to the point of over-exploitation. Initially, their use of peripheral areas was viewed as primarily extractive on a temporary basis. Although there is evidence of Late Pithouse period (Three Circle phase) use of side drainages, at some point during the Classic period, Minnis (1985a:60–61) observes that a number of sites in side drainages and mountain parks appear to be permanent residences, but for short periods of time (on the order of perhaps several years). However, none of these sites were tested by the Mimbres Foundation and their significance was left somewhat in question other than to state that there was a large Classic Mimbres period population in the mountains (Minnis 1985a:61). Minnis (1985a:184) concludes that the Mimbres were ultimately unable to cope with these problems prior to their break up.

This dissertation focuses more closely on relations between communities in prime agricultural zones and those in marginal areas, the role of land tenure, the development of a landless subgroup, and the often-extreme steps taken by individuals and families to keep the society generally intact in lieu of its total collapse. Although marginal areas were previously used on a temporary basis, and sometimes more intensively during periods of food stress, the ethnographic data show that marginal areas can become permanently settled as one potential option to alleviate problems in the core areas.

The Model of Peripheral Land Use

In Chapter II, a model was developed that sought to establish a set of expectations for understanding the rise of land tenure systems and peripheral area colonization in the archaeological record based on ethnographic data and cultural ecological theory.

Succinctly, the model suggested that under conditions of dwindling prime agricultural land and water sources in the face of population pressure, land tenure systems should develop that serve to protect access rights for either individual families or larger corporate groups who have long-standing claims to certain areas. This development, the beginnings of private property in prehistory, would also serve to create a landless segment of society, i.e., those who lose access to prime farmland because of their position within the family or village, or those who are newcomers to the area and do not have connections with land-owning families. Those without land then face difficult choices: in this model, I focus on those who choose to migrate to agriculturally peripheral areas. Once established in these areas, the landless act to change their status by establishing land tenure rights to the land they have colonized. Thus, the process of land ownership begins to spread to outlying areas, with the effect of creating new villages in unexpected areas, all else being equal.

We should be able to detect the presence of land tenure systems in both primary and peripheral areas through several avenues of study, although the avenues can result in largely circumstantial evidence. These include, in the order that we should see them occur:

1) Growing population and resource base imbalances that could potentially lead to subsistence and social stresses;
2) The establishment of community systems anchored by one large village;
3) Regular spacing of community systems in a linear environment, sometimes with "empty" zones between them;
4) An overabundance of field houses and other constructions that appear to mark

fields, especially in places close to the village; and

5) The swift development of new community systems in peripheral areas after the onset of the prior conditions in primary areas, which should develop first in the best strategic locations (potential arable land, a water supply, easiest access to a wide variety of natural resources). These locations often contain evidence for earlier Late Pithouse period use, which attests to their potential within agriculturally marginal areas.

In addition, peripheral community systems should mimic those in primary areas in most ways, including settlement pattern and social activities. The latter point demonstrates that peripheral communities can be more than temporary occupations under certain circumstances.

The various data sets gathered to this point are used to test each aspect of the model for goodness of fit. Deviations are expected, but it will be shown that, overall, the data and model correlate rather well. Some of the data used here have been derived from other studies and are used to set the basic conditions through time in the Mimbres Valley, which hereafter will be known as a "primary/core area" of good to excellent arable land and water supplies. All Mimbres researchers are in agreement that the few permanent watercourses in southwestern New Mexico were magnets for settlement and subsistence after the advent of large-scale agriculturalism in this society (e.g., Cosgrove and Cosgrove 1932; Herrington 1979; LeBlanc 1983; Lekson 1986; Minnis 1985a; M. Nelson 1999; Nelson and Anyon 1996; Shafer 1982, 1999a). Less agreement is reached regarding how the Mimbres used agriculturally peripheral areas, as noted previously in this dissertation.

For tracking population change through time and its effects on potential subsistence and social stresses in the Mimbres Valley, I will use the conclusions drawn by Blake et al. (1986) and Minnis (1985a). The data used for these two studies were generated by the Mimbres Foundation's work in the Mimbres Valley, and are the same data used in this dissertation (Chapter V), but with different emphases between the two: for example, I focus more closely on the settlement patterns and dynamics in peripheral areas. The studies conducted by Blake et al. and Minnis provide important baselines of population growth and carrying capacity within a generally limited arable landscape, and they adequately outline the kinds of stresses and responses that arose as a result. It is, in fact, these two studies that partly initially fueled my interest in what was occurring in the far-flung hinterlands of the Mimbres Valley during the dynamic Classic period. These two studies show that the subsistence and social conditions in the Mimbres Valley during the Classic period were ripe for the development of land tenure systems.

For the study of community systems and their settlement patterns, one early study will prove to be useful, which was a geographer's view of settlement distribution in the middle and lower Mimbres Valley during the Classic period (Bonnie Nelson 1977). Her research demonstrated a fairly regularized, linear spacing of large pueblos in the valley (approximately 3 to 4 km apart), which generally agrees with the expectations for linear central place theory offered by Stark and Young (1981). To that, I add the reevaluation of site size distributions for the Mimbres Valley presented in Chapter V. This reevaluation demonstrates the presence of multi-tiered community clusters that are generally anchored by the large sites studied by Nelson. The reevaluation demonstrated that many field houses and farmsteads are located very close to the large, central village, and that

relatively empty zones (no sizable habitation sites) are present between the communities. Granted, these empty zones are small (as should be expected given the necessity of maximizing the available land) and are somewhat arbitrarily drawn, but they are similar to the settlement pattern observed for the Nahua, one of the ethnographic case studies discussed in Chapter II.

For the study of settlement patterns in peripheral areas, the data generated in Chapter V show that nearly identical communities and empty zones appeared in side drainages and other agriculturally marginal areas. In many of these cases, as far as can be determined from survey data, Late Pithouse period activity in these same areas was limited, suggesting that large-scale movement into peripheral areas was a Classic period phenomenon. Site size distributions also demonstrate that the communities are anchored by one larger site, with smaller farmsteads and field houses encircling it. Similar to the main valley, many of these smaller sites are located close to the main village, a situation indicative of what I argue is symbolic land tenure. The types of sites present and the timing of colonization appear to be in line with expectations, but excavation data are needed to provide evidence for better chronology, intensity of occupation, and social relationships between and among other communities and regions.

The excavation data are derived from two small-scale projects undertaken for this dissertation, both at peripheral area communities. One is the Noonday Canyon community in the middle Mimbres Valley, and the other is the Cooney Ranch community in the high elevation middle fork of the Mimbres River. The excavation data were presented in Chapter VI. The results of both studies indicate that the largest sites were full-time occupations and that the sites largely date a generation or two (about A.D. 1040

to 1060) after the commencement of the Classic period in the Mimbres Valley (about A.D. 1000). The data from Cooney Ranch indicate that strong trading and/or social relations developed with upper Gila/Sapillo Valley groups (see also Gottshall et al. 2002), in addition to maintaining ties with the Mimbres Valley. If the residents of Cooney Ranch were simply short-term, seasonal horticulturalists, we would expect little evidence for the development of widely flung trading relationships, as there would likely be no need (and perhaps no time) for such relationships. Unfortunately, because of the extensive damage to the large site at Noonday Canyon, the data were less productive in this regard for understanding the large site at that community.

New data presented in Chapter VII include aspects of central place theory and site catchment analysis in order to determine if the locations chosen for the large villages in peripheral areas provided the inhabitants the best advantages in terms of settlement and subsistence. That is, if the inhabitants were intensively farming, were the best locations chosen for this pursuit in terms of arable land and water? Were other factors also important, such as easy access to a variety of natural resources? In those cases where arable land and a variety of natural resources coincide, do large villages also appear? Recently published data with soil types mapped (Diehl and LeBlanc 2001) will be augmented with material gathered during the two excavations. The data presented will show that the large villages are located where arable land, water, and natural resources occur in close proximity. This should not be unexpected, given the often-stated marginality of peripheral areas and the expected hardships associated with them. What the data demonstrate is that the colonists chose the most optimum locations in a "bad situation" that would likely sustain permanent habitation, which was commonly observed

in the ethnographic examples.

In their totality, the data will show that many of the expectations generated by the model for detecting the presence of land tenure systems and landless groups of people colonizing peripheral areas are largely met. Deviations from the model will be discussed in order to potentially understand what the data are telling us. Does this study conclusively demonstrate that land tenure was present in Classic Mimbres society and that these early Puebloan farmers were less than egalitarian? Certainly not, but I hope to provide enough circumstantial data to suggest that the patterning we are seeing in the archaeological record could very well be indicative of some of the earliest privatization of property in the pre-Hispanic Southwest.

What Was the Population Growth Trajectory of the Mimbres through Time?

This basic question is critical for evaluating this research; without the ability to track population growth through time, it would be difficult to determine if the conditions were present for the promotion of land tenure. Fortunately, a major study was undertaken by the Mimbres Foundation to answer, in part, this question (see Chapter V). Blake et al. (1986) concluded, based on actual and estimated number of sites per cultural period and the number of people at each site, that population in the Mimbres Valley grew steadily over time but likely came to a critical threshold during the Classic period.

They project that a relatively small, but consistent, Early Pithouse period population made the Mimbres Valley their home. Studies from other Mimbres areas also support the suggestion that Early Pithouse period populations were low and that villages were generally small (e.g., Diehl and LeBlanc 2001; Lekson 1992; Linse n.d.; Stokes

1995; Turnbow 2001), although debate continues regarding their degree of mobility (e.g., Diehl and LeBlanc 2001; LeBlanc 1983; Lekson 1992; Stokes and Roth 1999).

As the Late Pithouse period progressed, most Mimbres researchers suggest that the Mimbres people became more agriculturally oriented and more settled. Blake et al. (1986) argue that Late Pithouse period villages became larger and perhaps more numerous, as the uplands were abandoned in favor of settlement near potential agricultural fields in the main valleys. However, because evidence of a Late Pithouse period occupation at multi-component sites can be hard to detect, Blake et al. (1986) tentatively suggest that although population continued to grow, it did not necessarily do so at an accelerated rate. They also doubt that any form of population and subsistence stress developed, except perhaps at the end of the period. This scenario, in its most general sense, again appears to be true for other Mimbres areas. However, Stokes and Roth (1999) suggest that low Pithouse period population densities in the nearby Sapillo Valley changed substantially during the Three Circle phase. They were able to track a sharp increase in site size and site frequency during this phase. With the use of pottery seriation, they were able to suggest even further that it was during the terminal half of the phase that population really began to increase at an accelerated rate. They suggest that in-migration from the Mimbres Valley was the likeliest source of population increase. This suggestion accords well with the conclusions of Blake et al. (1986) and Minnis (1985a) regarding what may have been occurring in the Mimbres Valley towards the end of the Late Pithouse period.

During the Classic period, population grew 10-fold over the preceding Late Pithouse period. Minnis (1985a) suggests that the Three Circle phase and early Classic

period were characterized as having good rainfall patterns that could have promoted rapid population growth by providing the conditions necessary for sustainable and bountiful harvests. If this pattern actually occurred as Minnis suggests based on his study of tree-ring data for southwestern New Mexico, then once population growth began to accelerate, it would be difficult to slow it down several generations later, outside of catastrophic events. Again, other Mimbres areas show a substantial to dramatic increase in Classic period population densities, including the Sapillo Valley (Stokes 1995; Stokes and Roth 1999), the Cameron Creek/Arenas Valley areas (Herrington 1979), and more moderately in the Gila River Valley (Fitting 1972; Lekson 1990).

By the middle of the Classic period, the population of the Mimbres Valley may have reached its height, as new village construction began to slow down, the Mattocks site perhaps being one of the last large villages to develop during the middle Classic (LeBlanc 1977). Interestingly, the middle Mimbres period appears to be the time when village establishment in peripheral areas begins to accelerate. This alone suggests that the carrying capacity—or something close to it—of the Mimbres Valley may have been reached (see Minnis 1985a), and that excess population had to go somewhere else (but not too far away). However, the population study alone does not adequately demonstrate that population had grown to the point of engendering social and subsistence stresses. The results of the population study were used by Minnis (1985a) to study its effects on subsistence and social patterns.

Was the Classic Period Mimbres Population under Social and Subsistence Stresses?

This question was thoroughly addressed by Minnis (1985a) in his study of

population responses to subsistence stress, with the Mimbres as his case study. Through the use of tree-ring analysis for southwestern New Mexico and east-central Arizona, he was able to track periods of good, adequate, and poor rainfall patterns, their persistence and periodicity, and potential effects on Mimbres subsistence patterns and society. By using the Mimbres Foundation's population and settlement pattern study, in conjunction with his own ethnobotanical analyses and estimations of arable land, available water, and field hectares needed per person, he was able to show that the Classic period people were indeed experiencing some food stress by the period's midpoint.

Minnis hypothesizes that the good conditions prevailing during the later Late Pithouse period and early Classic period fostered increased agricultural production and population growth, but a return to average conditions during the later half of the Classic period introduced periodic stresses to a rapidly growing population. During this period, he shows that much of the native riparian vegetation in the valley was replaced by cultivated food and disturbance species. Minnis (1985a:88–93) suggests that this is indicative of extensive expansion of farm fields, decreasing fallow time, increased use of woody plants for fires, and an invasion of disturbance species (e.g., cheno-ams) that replaced the original vegetation (e.g., cottonwoods). He also shows that, given the population estimates provided by Blake et al. (1986), that there were not enough hectares of land or water available to sustain the Classic period population, even if cultivated food represented only 50 percent of the diet. Under these conditions, hoarding food, relying on relatives, and harvesting less preferred foods was likely practiced, and mobility may have been restricted as well. Minnis views the proliferation of Classic period sites in peripheral areas as an attempt by Mimbres Valley residents to expand their food base by practicing a

riskier form of supplemental agriculture: dry-land/run-off farming that is completely dependant upon rainfall.

Under this scenario, it is clear that the Classic period Mimbres were indeed suffering from food stress, especially during the latter half of the Classic period when rainfall conditions were poorer and less predictable, and the population had greatly expanded during the preceding years. Peripheral areas were used for supplemental, extractive purposes. It is also implicit in Minnis' study that during the final years of the Classic period (after A.D. 1080/1090), population growth in the main valley must have slowed considerably compared to previous years (Minnis 1985a:154). It does not seem logical that the Mimbres could not control their population growth previously but did so during the latter portion of the Classic period. Only massive death rates, enforced contraception/abortion, or large-scale out-migration could account for the population growth slowdown. As there is little evidence to suggest massive death rates and no reliable archaeological method to track contraceptive and abortion practices, out-migration prior to the collapse of the Mimbres cultural pattern seems to be only option.

Were Peripheral Areas Permanently Occupied Locations or Not?

Given the scenario presented above, out-migration must have begun by the middle Classic period, if not earlier, in order to account for the possible slowdown in population growth after a critical subsistence threshold was reached. Out-migration from the Mimbres Valley to the nearby Sapillo Valley during the late Three Circle phase/Classic period has already been suggested (Stokes 1995; Stokes and Roth 1999). Of all the potential "peripheral" areas available to the Mimbres people, the Sapillo Valley would

have been attractive given its agricultural and wild resource potential (Stokes and Roth 1999). Other peripheral areas (e.g., smaller tributaries of the Mimbres River) would, by and large, present greater challenges as none that are known to me contain permanent stream flow, other than the middle fork of the Mimbres River and lower Gallinas Canyon as it nears the Mimbres River. Many other side drainages of the Mimbres River do contain small springs, but even these should have served to limit the size and permanence of human groups (Shafer and Creel 1999). In other areas, high elevations would have limited agricultural production due to shorter growing seasons, cold air drainage, limited arable land, and greater amounts of shade, while low elevation desert areas would do the same due to a general lack of water and rainfall, damage from winds and heat, and lack of arable land without the aid of irrigation. It does not seem probable that permanent villages or community systems could develop in these areas. However, it appears that they did.

Chapters V and VI presented survey and excavation data for peripheral areas that indicate that many villages are larger than previously thought, that at least some appear to be permanently occupied, and that in over half of the side drainages investigated by the Mimbres Foundation and Graybill, community systems were present. These are described as one large site surrounded by farmsteads and field houses. Many farmsteads and field houses are found in close proximity to the large site, a situation identical to the pattern observed in the Mimbres Valley. The large site at the Cooney Ranch community in the middle fork exhibits all the traits found at large main valley villages, including extensive amounts and diversity of material culture, durably built architecture, evidence for far-flung trading relationships, and importantly, burials. Although no human remains were

excavated from either excavation project, teeth from at least three individuals were found in the pothunting backdirt of the Cooney Ranch #1 site. Given the proclivity of the Mimbres to bury their dead under their floors, perhaps as a form of ancestor worship (*sensu* Crown 1996), it seems that if a loved one died at a temporary camp, they would be taken back to the home village for burial (burials are rarely found at field house sites). However, these people appear to have been buried at Cooney Ranch; although circumstantial, it suggests that this particular village was *home* for some people.

Although the large site at McDermott Ranch in Noonday Canyon was largely obliterated by bulldozing, the range of material cultural collected from the surface and test units, the long time span indicated by the ceramics (ca. A.D. 1040/1050 to 1120), and the large amount of architectural rock suggest permanent occupation. The Noonday Canyon community also contains a farmstead and numerous field houses, as does Shingle Canyon, another side drainage visited prior to the selection of Cooney Ranch for test excavation. The size of the main village, and the nearby farmsteads and field houses in Shingle Canyon mimics the settlement patterns found in Noonday Canyon and Cooney Ranch.

In the Mimbres Valley, community clusters are regularly spaced, about 3 to 4 km apart and have somewhat "empty zones" between them. These are described as containing only a few scattered field houses and no larger, permanently occupied sites or villages. Empty zones are often found across the Southwest and may result from political pressures (Whalen and Minnis 2001), warfare and violence (Haas and Creamer 1994; LeBlanc 1999), "frontier zones" between cultural groups (Hackbarth et al. 2002), and variable resource distributions and environmental conditions that physically limit where

people can live (Kroeber 1939). In the ethnographic examples used for this dissertation, empty zones opened between villages in the Nahua to avoid potential conflict and violence; in the Hopi area to demarcate landholdings and claims; and among the Egyptian fellahin because of environmental constraints and political pressures. In linear settlement systems, Stark and Young (1981) suggest that central place theory predicts that regularly spaced community systems and empty zones between them should develop in response to territory claims, resource distributions, political/alliance control and influence, and market zones.

Because the linear settlement system has never been fully studied in the Mimbres Valley outside of Bonnie Nelson's statistical analysis of the distribution of large sites, it is difficult to assess what causes led to this pattern. Powell (2000) suggests that shifting alliance building between major villages was present throughout the Classic period, and so some politico-economic cause may be at work. Given the ethnographic data, it is also just as likely that territorial behavior is being exhibited by the Classic period Mimbres. It is logical to assume that land, water, and population pressures would eventually lead to the "loss of the commons" and necessitate dividing up the resources and land. Shafer (1999b) suggests that land claims played an important role in Classic Mimbres society, and that latecomers to the valley may have been unable to secure adequate land holdings. These observations, including the often close proximity of farmsteads and field houses to the main village, indicate that the community settlement patterns seen in the Mimbres Valley likely grew as a result of, or were reinforced by, increasing levels of territorial behavior and institutionalization of land claims. This accords well with the ethnographic examples.

What then, should we make of the same community system patterns found in the side drainages? The community system pattern in the middle fork and Noonday Canyon drainages, and other tributaries of the Mimbres River (e.g., Allie Canyon and Gallinas Canyon), is too regularized and too similar to the Mimbres Valley to be happenstance. The same site size distributions and centrality of the largest site are found, as are empty zones between peripheral communities and the Mimbres Valley. I argue that communities in peripheral areas represent more than temporary habitations used for supplemental food procurement. If this were not the case, we would expect to see a pattern resembling that recorded for the Raramuri in northern Mexico (Graham 1994), where only field houses and farmsteads dot the landscape, few of which cluster near each other. For the Raramuri, the family makes up the primary social unit, moving from house to house and farm plot to farm plot during the agricultural season, and then to winter houses in the cliffs. Towns do exist, and larger-scale social interactions are common, but peripheral communities of the type seen in the Mimbres area are not found.

I argue that the Mimbres settlement pattern in peripheral areas is more reminiscent of the Nahua, Hopi, and Egyptian fellahin pattern. For the latter, out-migration to marginal areas was largely forced, permanently occupied villages resulted, and land claims instituted. By all accounts, it appears that the same land tenure practices in the Mimbres Valley were occurring in many peripheral areas. But, was the colonization of peripheral areas haphazard, as might be expected if individual families were expending limited effort because of anticipated limited stays, or is there evidence for more careful planning that might involve larger groups of people? Does evidence exist that points to permanent occupation of these communities, and if land claims were a

part of this process, do the available resources in the vicinity of the communities potentially warrant "owning" them? These questions are investigated further below.

Do Peripheral Community Locations Represent Optimum Placement with Regard to a Wide Range of Available Resources and Other Considerations?

This section involves the use of site catchment analysis and to a smaller degree central place theory in order to determine if the best locations in peripheral areas were chosen for permanent habitation, based on the potential maximization of as many important resources as possible from the main village. For peripheral communities, these resources should include the best available arable land, water, access to and from the general area, and the co-occurrence of at least two natural biotic zones (e.g., the woodland/forest transition zone). If large habitation sites are situated at the best possible location in peripheral areas, then it can be argued that possibly more planning went into their construction and development, as opposed to more random settlement that focused on limited resources.

This analysis will focus on Cooney Ranch #1 (LA 5841) in the middle fork of the Mimbres River community and McDermott #2 (LA 119341) in Noonday Canyon. A catchment radius of 4 km centered on these two sites is used here, primarily to account for the more "marginal" nature of peripheral areas. Additionally, 4 km has been shown to be near or at the upper limit of a comfortable day's walk to farm fields and resources (Chisolm 1968; Hastorf 1980). Several variables will be included in the analysis:

1) Width of potentially arable bottomland and terraces, with the widest bottomland viewed as the most optimal location;

2) Water sources at the site or nearby;
3) Ease of access to and from the site, and to nearby resources, such as forest products and game;
4) Types of resources that occur within the 4 km radius, with the expectation that at least two biotic zones fall within this area (excluding riparian zones); and
5) Strategic value of site placement in terms of potential trading routes, controlling or monitoring access, and defendable positioning.

The characteristics identified within the 4 km radius will be subjectively compared to other potential habitation areas in the general area of the community to see if more optimum placements exist.

To address point number one, topographic maps are the primary means of analysis. Unfortunately, detailed soil survey maps do not exist for northern Grant County and parts of the Gila National Forest, but generalizations can be made from the nearby Sapillo Valley (Stokes 1995), as the elevations, vegetation cover, and landforms drained are comparable. For the Noonday Canyon area, the soil survey for central and southern Grant County includes McDermott Ranch (Parham et al. 1983). It is also recognized that as a result of the advent of large-scale cattle grazing in the late 1800s in southwestern New Mexico, large areas of vegetation and soil characteristics have changed dramatically (Hayes 1999).

For point number two, topographic maps will again be used to identify the drainage patterns and their ranks, based on their varying lengths. In addition, special consideration will be given to the presence of springs noted on the topographic maps, and to personal observations and those of long-term residents and ranchers interviewed for

this research. It is expected that sites would be located along the most highly ranked drainage, with additional highly ranked drainages occurring within the 4 km radius. The basic premise of this assumption is simple: the larger the watershed of each drainage, the better chance of it carrying water, and the locations where larger drainages intersect have the better chance of carrying water on a year-round basis, or at least for much of the year. The presence of springs will also influence the rank of drainage.

For point number three, topographic maps will be used to trace the degree of ease of access into the area and to various resource zones. Although it may seem that sites located on main drainage channels are "automatically" on the best access routes, this is not always the case. For example, access to the well-known Sapillo Cliff Dwellings near the confluence of Sapillo Creek and the Gila River is virtually impossible following Sapillo Creek due to the steep walled canyons and narrows (slots) that characterize the lower valley (Stokes 1995). Access is also difficult along the Gila River; as a result, transportation costs to the cliff dwellings must have been high for the occupants. Nor is it always the case that a nearby resource zone is within easy access, especially if cliffs, rocky terrain, and other impediments block access. The contour lines on topographic maps should indicate the characteristics of the local landscape, and they will be supplemented by personal observations made during survey and excavation fieldwork.

For point number four, the various biotic zones described are those used by Diehl and LeBlanc (2001) and Brown (1994) for ease of comparison. Cooney Ranch #1 and McDermott #2 (the largest sites at each community) are plotted onto the biotic zone map presented in Diehl and LeBlanc (2001:11). Although drawn at a gross scale, the map remains useful for this study as a general guide. The analysis will be supplemented with

personal observations made during survey and excavation at the two peripheral communities.

Point number five is a more subjective analysis that takes into account several aspects of four previous points. Strategic value of site location is based on probable long-distance travel routes and can be thought of as controlling access through the "territory" by others. While other ways of getting around peripheral communities are available, this analysis will attempt to demonstrate whether the main villages are situated to control the best avenues of travel. I also examine whether the chosen site locations offer positions of defense, although archaeological evidence for conflict and warfare in the Mimbres area is minimal.

Width of Potentially Arable Bottomland and Terraces

Neither the Middle Fork nor Noonday Canyon communities are located on large, arable landforms compared to most of the Mimbres Valley. For the Noonday Canyon community, the average bottomland/level terrace width, at 800 ft (244 m), is extremely narrow in the upper portion of the catchment area (from 1,000 ft south of McD #1 to 3,500 ft north of McD #2). However, it widens noticeably below McD #1 to the Mimbres River, with an average width of 2,150 ft (655 m). The terraces are larger and flatter along the western side of Noonday Creek due to the local geology, and they would provide for large farm plots if people were willing to transport water, when available, from the creek below. Because only 6 km separate McD #2 and the Galaz ruin in the Mimbres Valley, the catchment area for the Noonday Canyon community is limited to 3 km in this direction, under the assumption that the two community catchment areas would not

overlap within Noonday Canyon. Overall, approximately 20,012,880 ft^2 (1,859,257 m^2), or 459 acres (186 ha), of bottomland and generally flat terraces are available along the creek, from 3 km below McD #2 to 2 km north of McD #2 where the Noonday and Mud Springs valleys narrow at field house sites LA 72308 and 119342.

In the upper portion of the catchment area, terraces are high above the creek, while in the lower portion, the terraces are closer to the creek. This has resulted from steeper down cutting by Noonday Creek in its upper reaches due to the elevation gradient, which is steeper around McD #2 compared to lower Noonday Canyon near the Mimbres River. Elevation drops 600 ft between the Gila National Forest boundary (around LA 72308) and the southern edge of the catchment radius, but only 120 ft between that point and the Mimbres River. Approximately 2 km north of McD #2, the topography becomes much steeper, and the drainages narrow considerably, effectively eliminating arable land. To the south of the community, Noonday Canyon continues to become more open and less rugged, with the widest portion occurring near the Mimbres River in the vicinity of Galaz Ruin.

Although the terraces could be farmed, the fields would have to rely on rainfall and runoff from the nearby ridge slopes, or on human transportation of water from the creek to the fields. A combination of the two methods has the potential to make the Noonday Canyon terraces productive but certainly much less so than bottomland farming here and in the Mimbres Valley. Most of the bottomland and terraces from approximately around McD #1 is classified as the Paymaster-Ellicott-Manzano association, with 0 to 5 percent slopes (No. 45) (Parham et al. 1983:40). This unit is found on flood plains and alluvial fans and in old stream channels and valleys. As a result, these units are elongated

in shape and are 50 to 1,000 acres in size. The main native vegetation is currently a variety of grasses. This association generally occurs between 5,000 and 7,000 ft, with average annual precipitation of 12 to 16 inches, annual air temperature of 48 to 55 degrees F, and an average frost-free period of 150 to 180 days (sufficient for maize agriculture) (Parham et al. 1983:40). The Paymaster and Manzano soils are found primarily on the flood plains and fans, and both are deep and well drained; the Manzano soil is rated as very high for water capacity. Parham et al. (1983) suggest that these soils are best suited as rangeland (its current use), but they clearly would support agriculture if watered.

The area above and to the west of Noonday Creek at McD #2 is classified as the Lonti-Ustorthents association, with 5 to 60 percent slopes (Association Number 29 on their maps) (Parham et al. 1983:30–31). This unit is on hills, ridges, and breaks, with native vegetation of mainly grasses and forbs. Elevation is 5,500 to 7,000 ft, the average annual precipitation is 12 to 16 inches, the average annual temperature is 48 to 55 degrees F, and the average frost-free period is 150 to 180 days (suitable for maize agriculture) (Parham et al. 1983:30). Soils are moderately deep to deep, but the Lonti soil is susceptible to runoff erosion. The Ustorthents soil is well drained and is found in old alluvium, primarily adjacent to drainage channels; this includes the terraces of the Mud Springs and Noonday Canyon junction area. Its usage is suggested as rangeland, but the Ustorthents soil would support agriculture if watered.

Based on the soil types present along Noonday Creek, agriculture would be possible in the generally deep, well-drained old alluvium soils, if watered, especially on the terraces and low slopes. Of the 186 available hectares of land in the catchment area, it

is unlikely that more than 50 percent was ever in production at one time due to water limitations and possibly labor limitations as well, allowing for fallow time (leaving some fields out of production for a period of time to regenerate). Thus, approximately 93 ha are estimated to have been in production at any one point in time. Minnis (1985a:114–115) estimates that 0.6 ha are needed per person per year, based on ethnographic examples from the Southwest, and he used this figure to estimate the number of people that could be supported by agriculture in the Mimbres Valley, assuming that 50 percent of the diet was cultigens. Using this same figure, it is estimated that 155 people could have been supported in the Noonday Canyon community catchment area. Given the estimated size for McDermott #2 (600 m^2; 30 to 40 rooms), it appears that more than enough potential arable land was available. If the pueblo at full capacity is estimated to be 60 people using Naroll's (1962) formula of 1/10 of total floor area, or 100 people using Casselberry's formula of 6 m^2 per person (in Blake et al. 1986), both are under the estimated total of 155 people. However, it is unlikely that the pueblo was ever at full capacity, effectively lowering its estimated population by as much as one-third to one-half.

If for whatever reasons the amount of available arable land is less than that estimated here, the surrounding hill slopes could have been terraced for additional dry-land/runoff farmland. During the reconnaissance survey of McDermott Ranch, two potential areas of terracing were found. One was located above Stitzel Canyon near McD #4, a field house. The soil association near McD #4 is the Lonti-Ustorthents. The other was found to the northwest of McD #2 along the east/southeast facing ridge slope. Due to the ranching disturbances to the general area, including blading, road building, and drainage work to feed cattle tanks, it is possible that other areas of terracing were

obliterated or altered beyond recognition. The possible pit structure found at McD #1 was suggested in the original report to be a possible water retention tank, given the fine silts and lack of gravel in the fill (Stokes 1997). No traces of small irrigation canals were found on the terraces, but with the presence of nearly permanent water in the creek below, fields could have been maintained in addition to dry-land terracing systems.

For the Middle Fork community, the bottomland and terrace system is much narrower than Noonday Canyon, and the ridge slopes are much steeper. However, the community is located within a noticeably wider area in the otherwise narrow Mimbres Canyon (so named on the Allie Canyon quadrangle). The average width of this section of the middle fork is 700 ft (213 m), and the length is 4,000 ft (1,219 m) from the edge of the Mimbres Canyon north to the last field house site, LA 61452. The total available bottomland/terrace is 2,800,000 ft^2 (260,129 m^2), or 64 acres (26 ha). The valley narrows considerable through the Mimbres Canyon (average valley bottom is 150 to 300 ft) and then again north of LA 61452 (average width is 200 to 500 ft to the 4 km radius limit from LA 5841).

Just south of Cooney Ranch sites #2 and #3, the Mimbres Canyon narrows to the point where the bottomland virtually disappears until it begins to widen again approximately 2.5 to 3 km south of Cooney Ranch #1. The valley width in this area beyond the Mimbres Canyon ranges from 500 to 800 ft, widening to 1,000 to 2,200 ft towards the three forks area near Elk Ridge Ruin. In the Middle Fork community, the largest sites are found in the widest section of valley, while only field houses are found strung along the narrower portion upstream. Clearly, Cooney Ranch #1 is located at the widest portion of this particular section of the middle fork of the Mimbres River, which is

hemmed in to the north and south by considerable valley narrowing.

Because soil maps for this area of the Gila National Forest are not available, soil characteristics of the nearby Sapillo Valley are used (Stokes 1995:9–13). The bottomland and low terraces along Sapillo Creek are characterized as "No. 10: Alluvial land, mesic, 0–15 percent slopes" by Gass (1973). They are composed of mixed alluvial soils, derived for the most part from sandstone and conglomerate, although volcanic rock contributions are also present. Rock fragment inclusions range from 10 percent gravel to 90 percent gravel, cobble, and stone. The inherent fertility of the association ranges from poor (mainly in the stream channels) to moderately high. The soils are very susceptible to erosion from flooding. Based on this information for the nearby Sapillo Valley, the bottomland at the Middle Fork community would likely be rocky and in danger of occasional erosion and might not be useful on a regular basis. The small terraces would provide much better farmland, if watered. However, it is likely that both areas were planted, as destructive floods of Mimbres River in this area would occur on such an infrequent basis that it would still be worthwhile for the farmers to expend the labor necessary to plant on the bottomland. The higher water table along the bottomlands adjacent to the river would also limit the amount of hand watering necessary, an added benefit.

Given the small number of hectares (26) of potentially arable bottomland and terraces available compared to Noonday Canyon, much of it must have been in continuous production. The 26 ha could only support 43 people, and so it is likely that every available location was planted with cultigens. The size of the main pueblo village, Cooney Ranch #1, at 465 to 500 m^2, would have contained 46 to 50 people (Naroll 1962)

to 77 to 83 people (Blake et al. 1986). Even if the population numbers are overestimated by one-third to one-half, the bottomland agricultural capacity would still be tight. It is likely that dry-land/runoff terracing systems would have been necessary. However, the general narrowness of the middle fork, its steepness, and dense vegetation cover on its slopes would limit the usefulness of terracing systems. Unfortunately, time did not permit a survey of the hill slopes while excavations were undertaken at Cooney Ranch #1. However, Graybill (1975) did not report finding extensive terracing systems in any of his survey parcels, leading one to suspect that they may not be common (but surely existed regardless). In the nearby Sapillo Valley, terracing systems appear to be common, especially on the south facing slopes, as indicated by several research projects (Kelley 1991; Sandor 1983).

Available Water Sources

Drainages were ranked based on their total length. First rank is 10+ miles [16.1 km] in length, second rank is 5 to 9 miles [8 to 14.5 km], third rank is 1 to 4 miles [1.6 to 6.4], and fourth rank is less than 1 mile [<1.6 km]. At the Noonday Canyon community, McD #2 is located along Noonday Creek, the highest ranked Mimbres River tributary drainage in the area, at 13 mi [21 km] in length. However, the site is also located 200 m south of the confluence of Mud Springs Canyon with Noonday Creek. Mud Springs Canyon is a major tributary of Noonday Creek and is a third rank drainage based on its 2.5 mi (4 km) length. Both drain the western slopes of the Black Range, but only Noonday Creek begins at the highest elevation (ca. 8,900 ft [2,713 m]) near the Black Range divide. Nearby Stitzel Canyon is a second rank tributary of the Mimbres River at

eight miles (13 km), but it does not drain the high slopes of the Black Range. It parallels Noonday Creek and some of its length falls within the 4 km catchment area of the Noonday Canyon community. To the east, Ancheta Canyon is also a second rank tributary at a length of six miles (9.5 km), and it also parallels Noonday Creek; portions fall within the 4 km catchment area as well. Neither Stitzel nor Ancheta Canyons provide water flow to Noonday Canyon, but they should have played an important role in the catchment area. In fact, both drainages contain field houses within the areas surveyed, but neither contains a peripheral area community system. Other than Mud Springs, the drainages in the catchment area tend to be short and ephemeral (fourth ranked; less than one mile in length).

Below McD #1, Noonday Creek does not flow year-round, according to the owner of McDermott Ranch. The creek often flows for long periods of time past McD #2, fed by runoff and springs in Noonday Canyon and, as its name suggests, Mud Springs Canyon. During our test excavations at McDermott Ranch (August 1 to 7, 1996), water was flowing past McDermott sites #1 and #2, despite the fact that the monsoon season had been weak that year with sporadic rains. As a point of comparison, runoff from the early August, 1999, monsoons was so great that travel by road into Noonday Canyon was virtually impossible for weeks. In general, although water is not plentiful, McD #2 is situated at the best possible location where the surface and subsurface flows of Noonday Creek and Mud Springs Canyon combine. This convergence also happens to coincide with a noticeable widening of Noonday Canyon, a set of factors that was likely not unnoticed by the ancient Mimbres inhabitants.

For the Middle Fork community, water flow in the Mimbres River is reported to

be year-round, although volume fluctuates greatly depending upon the wet and dry seasons. The middle fork drains a wide area of the western slopes of the Black Range. Marilyn Markel, a long time resident of the Cooney Ranch area, reported to me in 1999 that the Mimbres River has only gone dry during the most extreme droughts; a situation she and her husband follow closely as they rely on river water for much of their non-potable water needs. Thus, the middle fork represents the first ranked drainage based on its flow and length (17 mi [27 km]). Approximately 1/2 km upstream from Cooney Ranch #1, Cooney Creek flows into the middle fork. Because of springs in the area, this creek often flows throughout the year, especially as it nears the middle fork. However, its length (2.5 mi [4 km]) makes it only a third ranked drainage. Several other drainages emanating from the steep ridge slopes on both sides of the community are all fourth ranked drainages and only contribute runoff to the middle fork. Lastly, as noted previously in Chapter VI, because of the higher elevation of the middle fork compared to much of the Mimbres Valley, the area receives a higher amount of average yearly rainfall. Given these conditions, it appears that water is usually available, and that within the 4 km radius, Cooney Ranch #1 was situated at an optimum location: in a wide spot in the valley where the main river flows year-round and just below an important source of supplemental water (Cooney Creek).

Ease of Access into the Community and to Nearby Resources

For both communities, direct access is considered to be easy. From the Mimbres River, access to the Noonday Canyon community along Noonday Creek or along its western terrace system is generally level with moderate elevation gain for most of the

way. Following the creek itself could entail clambering over river cobbles and rock on occasion, but it would be easily passable except during periods of heavy runoff. The eastern terrace system is only easily passable for approximately half the distance to the community, while the western terrace system affords a continuous link directly to McD #2. The ridge system along the western terrace, while occasionally steep, is only considered to be moderately steep, at an average of 280 ft elevation gain. However, directly opposite of McD #2, the ridge is extremely steep and rocky, and the tops of the summits rise sharply 1,000 ft or more above the community. To the north, both Mud Springs and Noonday canyons provide access into the more rugged Gila National Forest. Thus, with only the eastern portion of the upper catchment area nearly impassable, the location of McD #2 makes the most sense with regard to ease of access to various resource areas.

For the Middle Fork community, access can be made by directly following the middle fork from the three forks area. Although the valley narrows considerably in the Mimbres Canyon area, it is not impassable to foot traffic (but often is to vehicular traffic as the Forest road is continually washed out). Modern road access requires driving up the west fork to the Continental Divide, then driving on the Forest road towards Wall Lake (which follows the ridge top), then taking the access road down to the junction of Cooney Creek and the middle fork. This circuitous route would not have been necessary prehistorically.

From Cooney Ranch #1, the valley walls tend to be steep, but they are not as rugged as the eastern portion of the Noonday Canyon community and can be climbed without much difficulty (for those used to the high elevation). From LA 5841, 600 feet

[182 m] of elevation gain separates the village from the ridge tops to the east and west. However, to the east, this occurs within a linear distance of 2,000 ft [610 m], while to the west, the distance is twice that, at 4,000 ft [1,219 m]. Clearly, the climb to the western ridge top is not as steep. From this village, travel to the north (upstream) would not be difficult, despite the closing in of the valley. Outside of the catchment area, the valley becomes much more rugged towards the Black Range. Based on the catchment area analysis, Cooney Ranch #1 appears to be located in an area that, while isolated, is easily reached and affords relatively easy access to outlying resource areas.

Types of Resources that Occur within a 4 km Radius

An examination of modern-day biotic provinces (Figure 7.1), based on the information provided in Diehl and LeBlanc (2001), reveals that both large sites are within easy walking distance of three types of natural resource zones (excluding riparian areas along the stream courses). For the Noonday Canyon community, the large site (McD #2) is situated amid the Great Basin Conifer Woodland (No. 3) province. Although much vegetation has been removed in the immediate vicinity of ranch buildings and corrals, piñon and juniper dominate the slopes. Mesquite and cholla are also found throughout the general area, but may be fairly recent invasion species. Several kilometers downstream, the province changes to the Chihuahuan Desertscrub (No. 11), dominated primarily by mesquite, creosote bush, tarbush, whitethorn acacia, succulents, cacti, and various desert grasses (Brown 1994). Several kilometers to the north (upstream in both Noonday and Mud Springs Canyons), the biotic province changes to the Petran Montane Conifer Forest (No. 2). Ponderosa pines first appear in sheltered areas, for example, around McD #3, and

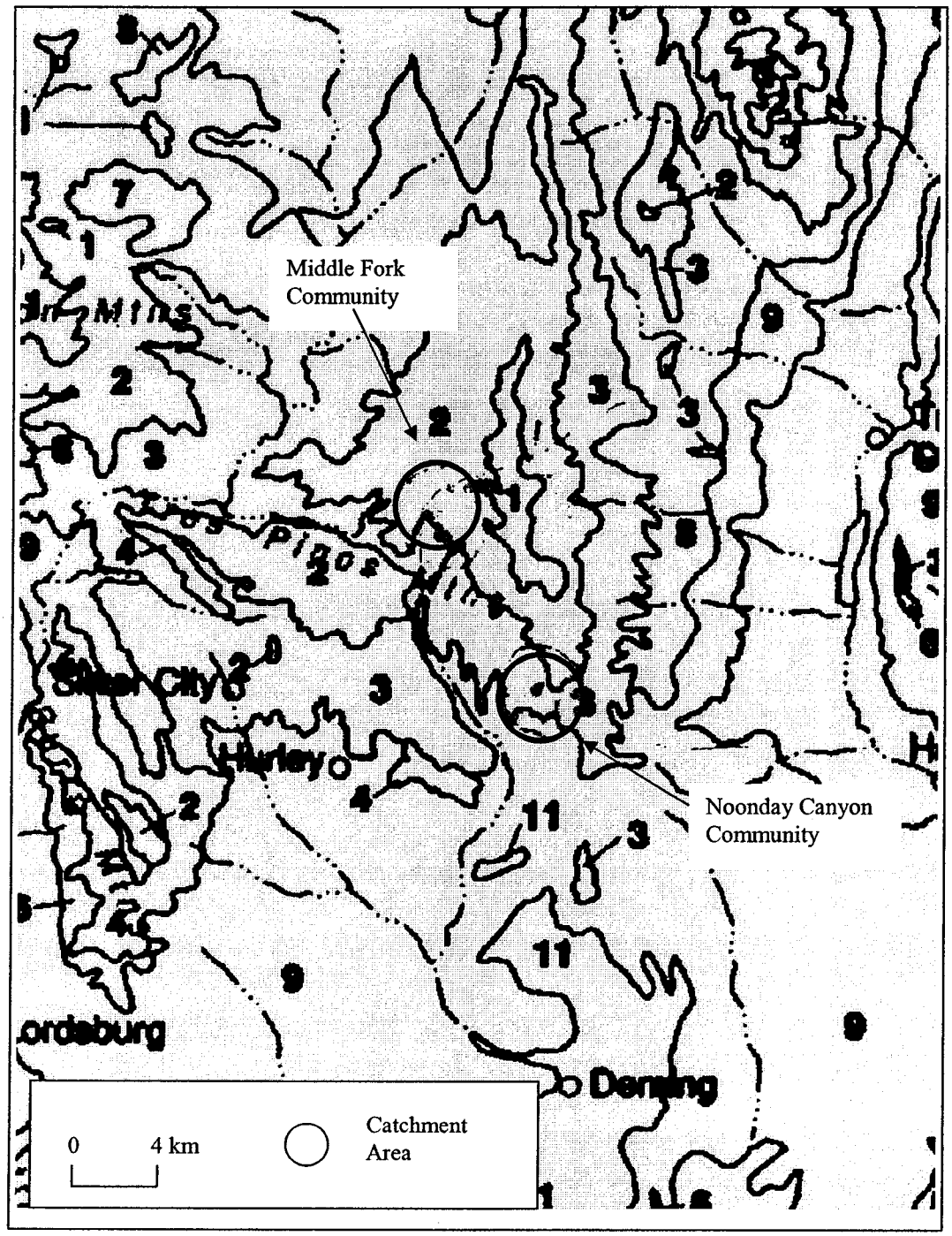

Figure 7.1. Boundaries of biotic provinces in southwestern New Mexico (adapted from Diehl and LeBlanc 2001:11, Figure 2.2). The locations of McD #2 (LA 119341) and Cooney Ranch #1 (LA 5841) serve as the central points for the catchment areas.

then on north and east facing slopes. As one gains elevation, Ponderosa pines become more numerous. With these changes in biotic provinces come associated changes in wildlife. If McD #2 had been located several kilometers downstream or upstream, one of the three provinces would have dropped out of the 4 km radius, thus narrowing the variability and variety of easily obtainable potential resources.

Cooney Ranch No. 1 in the Middle Fork community is situated in the Petran Montane Conifer Forest (No. 2). Ponderosa pines thickly cover both slopes, but are denser toward the shadier valley bottom; currently, a piñon/juniper woodland intermixed with Ponderosa pine becomes more common on the upper slopes and ridge tops that tower over the valley bottom, especially on the western ridge slope. Several kilometers to the south (downstream), the biotic province changes to the Great Basin Conifer Woodland (No. 3), although Ponderosa pines remain common in better-watered and sheltered areas down to the Mimbres Ranger Station in the Mimbres Valley. Barely within the 4 km radius of the site, the Petran Subalpine Conifer Forest is found to the north (upstream). This biotic province represents the upper elevations of the Black Range but can be found in sheltered pockets to the north of the site at lower elevations. Spruce, aspen, and fir trees are common and are intermixed with Ponderosa pines along its interface with that province. If the community had been located further downstream, this uppermost province and its potential resources would have fallen out of the 4 km radius.

Ordinarily to complete the site catchment analysis, excavated macrobotanical and faunal remains are studied to see if the expected resources are actually present. In this case, due to the limited nature of excavations and the large-scale devastation of the McDermott Ranch sites, these materials are limited. For McDermott Ranch, the faunal

remains recovered included both indeterminate large mammals (possibly artiodactyls) and rabbits. Artiodactyls in the general area include primarily Mule deer in piñon/juniper woodlands, while elk and other large mammals may be found in the higher elevations. The range of Pronghorn may have included lower Noonday Canyon. For smaller mammals, jackrabbits are more common in open areas, for example, Chihuahuan Desertscrub landscapes. Cottontails prefer denser brush found along watercourses and farm fields. The desertscrub, piñon/juniper woodlands, and riparian biotic provinces are within easy walking distance of the large site. Because it could not be determined if the larger mammal remains represented white tail deer or elk, it is unknown what higher elevation resources were actually exploited (if any at all). However, given the proximity of the Ponderosa pine forests, it would be surprising if the residents of the Noonday Canyon community did not use this biotic province. Few identifiable macrobotanical remains were recovered, other than possible burned piñon nut shells.

A better collection of material was recovered from Cooney Ranch #1. Here, as at the Noonday Canyon community, rabbits make up the majority of identifiable faunal remains, including both cottontails and jackrabbits. Currently, brush cover along the bottomlands appears to be sufficient for cottontails, while the more open piñon/juniper woodlands on the ridges above and downstream would be conducive for jackrabbits. Turkey remains were also found, and they were observed on several occasions in the Ponderosa pine and piñon/juniper transition zone on the hill slopes.

The second most common faunal group was artiodactyls, including deer and pronghorn. It could not be determined if the remains were mule or white tail deer, but mule deer are common in the area today. White tail deer are also reported in the area, but

we did not personally observed them during excavations at Cooney Ranch #1. The pronghorn remains consisted of one side of a jawbone, and it may have been a cached item. It was situated with a complete bone awl and several cores in a possible subfloor cache of items. Pronghorn at higher elevations is unusual, but given their ubiquitous depiction on Classic Mimbres bowls, they were present possibly at lower elevations in the main valley and surrounding grasslands. Higher elevation faunal resources, such as mountain sheep and bear, were not identified. Burned macrobotanical remains were of little assistance, as few identifiable species were recovered; however, these did include piñon shells, a possible squash seed, and wood comprised of Ponderosa pine, juniper, and oak.

As can be seen from this analysis, both large sites were situated for ready access to three different biotic provinces. The main valley sites were more limited, but if their primary focus was agriculture, the locations chosen for villages would be optimum for farming and directly exploiting at least one other biotic province (e.g., piñon/juniper woodlands and/or Chihuahuan Desertscrub). Given the more agriculturally marginal character of peripheral areas, having the ability to readily exploit as many biotic provinces as possible would seem to be the best choice. Both communities appear to accomplish this, despite limited evidence for potential exploitation of higher elevation resources.

Strategic Value of Site Placement

As noted previously, this section is more subjective than the others. Without knowing where ancient trail systems are located, and the exact routes taken by travelers,

it is difficult to assess the strategic value of sites. Others who study ancient warfare suggest that certain locations do provide strategic defensive benefits, such as isolated hilltops and rockshelters (Haas and Creamer 1994; LeBlanc 1999). To date, little evidence has been found for the need for truly defensive site locations for the Classic period Mimbres. This is not to say that the Mimbres people were a violence-free society; in fact, it would be most unusual if they were. Some might argue that large Mimbres sites located along the edges of steep bluffs in the high country (e.g., the TJ and Ponderosa Ranch ruins) represent defensive posturing, but no corroborative evidence has been found. A change is seen during the post-Classic period in the Gila Cliff Dwellings area, however. For the sites in this study, none can be described as defensively situated.

However, both large sites are situated along some of the best riverine routes into the Black Range, and ultimately over them and into the Rio Grande valley. The Black Range forms a formidable, high elevation north-south barrier between the Mimbres Valley and the Rio Grande Valley. Outside of traveling around the mountains to the south, the best routes might be the larger stream valleys, such as the middle fork and Noonday Canyon. The middle fork would deposit travelers at the crest of the Black Range above the headwaters of the east-flowing Arroyo Seco and Las Animas Creeks, both important late Mimbres settlement areas. Noonday Canyon would place travelers above the headwaters of North Percha Creek and the Holden Prong of Las Animas Creek. Although there is no direct evidence that these were preferred travel routes, Cooney Ranch #1 did exhibit a wide range of potential trade items from areas to the north and east. If monitoring trade was an important activity at these communities, then both sites are strategically located. This intriguing hypothesis should be investigated further, but it

is beyond the scope of this dissertation.

Summary of Site Catchment Analysis

The results of the site catchment analysis indicate that both large sites were optimally located to take advantage of the best available arable land and water resources; ease of access into and out of the community; and to take advantage of as many potential biotic resource zones as possible. As such, they are considered to be centrally located primary villages. At the Noonday Canyon community, the latter point is more pronounced, while the Middle Fork community is more entrenched within a Ponderosa pine forest. Whether the residents took full advantage of these resources is as yet unresolved with the limited excavation data, but the remains are suggestive. The sites also seem to be strategically placed with regard to monitoring possible travel routes over the Black Range, but this idea remains to be tested elsewhere. Although other locations could have been chosen to establish villages in these peripheral areas, the residents appear to have deliberately chosen the best locations that enhanced their survival potential. And, importantly, these areas are also unlikely to have been previously claimed by others, as their arable land is too limited and the natural resource base is too widespread to actively defend with consistent success (*sensu* Dyson-Hudson and Smith 1978).

Do the Mimbres Settlement Patterns in Primary and Peripheral Areas Suggest Land Tenure? Can a "Landless" Subgroup be Detected in Mimbres Society?

These are largely the central questions of this dissertation. The previous sections

have demonstrated that the underlying conditions of the Classic Mimbres period were ripe for the formation of land tenure systems and development of landless groups within the society. Later settlement patterns in peripheral areas also indicate large-scale movement into less-productive, marginal areas. These patterns largely match the expectations generated from the ethnographic examples:

1) Population growth exerts pressure on both the society and the primary resource base;
2) The best agricultural land and water become contested resources that are subjected to land tenure and control;
3) Distinct settlement clusters with "empty zones" develop in primary areas;
4) Permanent settlement of peripheral/marginal areas begins only after the onset of significant population and land imbalances, leading to;
5) New communities that that mimic older communities in most ways, including establishment at the best possible locations in peripheral areas.

Based on the ethnographic examples examined earlier that provided details into the process of land tenure systems and the establishment of a landless or marginalized class within the society under conditions of population and land stress, it is possible to detect the same processes occurring ancient societies.

Other Mimbres researchers have conclusively demonstrated that population was greatly expanding during the terminal Late Pithouse and Classic periods, and that use of good arable land and water in the Mimbres Valley was maximized early in the Classic period. Instead of randomly placed large villages up and down the Mimbres Valley, they were located roughly equidistant from each other, at 3 to 4 km (with natural conditions of

the landscape modifying site choice to a degree). The survey data show that "empty" zones (i.e., few to no permanent habitations) characterize the boundaries between large site community systems. Field houses and farmsteads within the community cluster tend to be close to the main villages and not at "inconvenient" distances; this pattern characterizes the demarcating of private land holdings in many modern and Pueblo societies. Iconographic analyses have shown alliances were likely established between various large sites in the valley and outside the valley (Powell 2000). All of these patterns are characteristic of social stress and land tenure systems.

The establishment of permanently occupied peripheral area communities indicates that as a result of expanding population density in the Mimbres Valley, groups of people chose to migrate to less hospitable areas. The formation of community systems and the establishment of "empty" zones between them and the main valley mirror settlement patterns found in the Mimbres Valley. The ethnographic data indicate that peripheral areas are usually colonized by groups without claims to existing land holdings, and who stand little chance of establishing such claims. These groups tend to settle around the fringes of society in order to remain a part of the larger society. The composition of these groups is non-first born sons and their families, and migrants to the area; the rules of land tenure under stress conditions often leads to a system of primogeniture, or inheritance by the first-born son to avoid dividing up the land holding and dispersing it. Again, the relationship between primary and peripheral areas in the Mimbres Valley, and the timing of the establishment of peripheral communities, indicates that land tenure was practiced by the Mimbres people during the Classic period and that a landless group had formed in this society.

Although Minnis (1985a:61) suggested that the presence of larger Classic Mimbres sites in peripheral areas was the result of short-term occupation (they were not occupied throughout the Classic period), the reexamined data suggest that landless groups of people permanently colonized these areas to avoid disrupting the larger society. If these people were only in peripheral areas for supplemental resource exploitation, the settlement patterns we see should not have developed. All of the available evidence, examined through the model of land tenure and peripheral area settlement and developed from ethnographic examples and cultural ecological theory, indicates that the Classic period Mimbres people, under tremendous stress from population and resource base imbalances, found a way to mitigate some of this stress.

Although the search for "elites" in Mimbres society has proven elusive, it is becoming clear that they were less-than-egalitarian, especially with regard to resource control and land ownership (but in order to cope with food stress, more encompassing bonds and alliances between families must have occurred; see Minnis 1985a). The lack of evidence for large-scale violence suggests that the land tenure system developed by the Mimbres was largely successful, at least until sustainable environmental conditions declined in the A.D. 1100s. It may be that the Mimbres social "system" was stretched as far as it could go under the conditions evident during the Classic period, and that in lieu of resorting to large-scale violence (or perhaps under the imminent threat of), the society broke up into smaller groups. Many appeared to migrate to the eastern slopes of the Black Range (Nelson 1999) or to the Casas Grandes area (LeBlanc 1989; Shafer 1999a), while others, much reduced in numbers, stayed behind at some of larger villages in the middle and lower valley (Creel 2000). The ethnographic examples showed that societies can take

a tremendous amount of stress before dissolving, and that often extreme measures are taken to ensure their continuance, including privatizing property, limiting access to resources, realigning social rules to deal with the problems, and forcing some members to become marginalized. This scenario appears to best characterize the Classic period Mimbres, their settlement patterns, and their ultimate dissolution.

CHAPTER VIII

CONCLUSIONS

This dissertation provides a method for studying and understanding movement into agriculturally peripheral areas by subsistence level farming societies. Several approaches were used to build a testable hypothesis, including an overall cultural ecological theoretical orientation that examined some of the social aspects of decision making, social strategies, and population-environment interactions. Within this approach, several related theoretical and methodological optimization decision making strategies were used: central place theory and catchment analysis. As part of the process of model building, several ethnographic examples were presented that demonstrated various ways that modern agricultural groups use peripheral areas and under what conditions these actions occur. A major component of the ethnographic study was a focus on land tenure practices, specifically understanding how land tenure develops and how it is used in the process of forcing some people to make difficult choices: remain in virtual destitution within the villages, move out of primary areas and into peripheral areas, resort to violence, or leave the society altogether.

Once these various sources and approaches were compiled, a model was developed that outlined how population pressure on limited, critical agricultural resources (primarily land and water) leads to the institution of land tenure practices and the formation of a landless subset of the society. I argue that it is this landless group that is forced out into the peripheries of established villages and land holdings in order to survive, but who also attempt to remain a part of the larger society. The established land

tenure practices of the primary villages also structured where and how peripheral areas were developed, leaving telltale archaeological signatures of the entire process.

The model set forth a series of expected conditions, potential choices, and results that can be tested in order to detect the presence of land tenure practices in ancient agricultural societies. If some of the necessary conditions are found to be present, and some, or all, of the expectations are observed in the settlement patterns, material culture, and architectural data in peripheral areas, then a strong case can be made for detecting land ownership in an otherwise "egalitarian" society. This finding would be important not only for pushing backwards in time evidence for the earliest development of land ownership and tenure practices in the ancient Southwest, but for further complicating our notions of what types of social patterns should constitute an egalitarian society.

Chapter I provided an introduction to the study and outlined the expectations of the research. The following chapter detailed the theoretical approach that guided this research, provided several ethnographic examples, and concluded with a model of peripheral area colonization and land tenure practices. An overview of the natural environment of southwestern New Mexico, the setting for the case study, was presented in Chapter III. A detailed culture history and archaeological research background for the ancient Mimbres people of southwestern New Mexico was presented in the following chapter. Chapter V presented the results of three previous large-scale survey projects in the study area and a brief summary of the results in relation to the model with a focus on settlement patterns in peripheral areas. Chapter VI presented excavation data from several sites in two peripheral area communities: the upper Noonday Canyon community and the Middle Fork community in the upper Mimbres River. This chapter was followed by a

synthesis of the survey and excavation data, and evaluated the utility of the model built on ethnographic data and cultural ecological theory for understanding peripheral area colonization and detecting the presence of land tenure systems. This included a catchment area/central place study of both peripheral area communities. The concluding chapter (Chapter VIII) briefly reviews the results of the research and provides some summary thoughts and conclusions on the ramifications of this study for southwestern archaeology and the utility of this type of approach for future studies of land tenure systems.

The Results of the Research

This dissertation examined a number of different data sets for investigating the potential for land tenure systems in ancient societies within a socio-cultural ecological framework. The ethnographic examples had several points in common that all led to the development and proliferation of land tenure systems. These are expanding population densities, limited important or critical resources, and geographic and/or political boundedness. All are argued to play interrelated roles that lead towards land tenure, privatization of property, and the development of a landless subgroup within the society. In all cases, each agricultural society faced, or at least approached, an upper limit of an acceptable level of population/resource balance within a bounded area.

Whether this boundedness was small-scale, as found with the Nahua Aztec of east-central Mexico or the Hopi/Tewa of northeastern Arizona, or large-scale as seen with the Egyptian fellahin, the results were the same. Land became owned and subdivided within families, and social and political rules developed that governed

ownership rights and inheritance. As a result, a landless, marginalized group developed; these were people who lacked the necessary family connections or status for owning land. In all cases, it was primarily these landless groups of people who migrated to the marginal areas surrounding established villages and previously claimed land and established their own new villages and landholdings. Although it was possible that these areas were used previously for short-term or seasonal resource extraction, permanent habitation and ownership did not begin until settlement by these disenfranchised groups of people. Although some had the option of leaving the society altogether for wage labor in big cities, they chose to remain as close as possible to their former villages and their extended families. The creation of a landless subset within a society, followed by their choice of colonizing peripheral areas, was a method of ensuring the survival of the overall society without resorting to warfare or dissolving it entirely.

Some of the signatures of land tenure in the ethnographic examples included marking private landholdings in some manner, including building field houses, placing boundary markers, or otherwise developing the land. In several cases, empty zones opened between primary villages, often to demarcate land but sometimes to avoid conflict. Signatures of the permanent colonization of a new area included the establishment of a new central village, followed by the creation of nearby field houses and farmsteads to mark landholdings. The new villages were established where available resources, although perhaps meager compared to the primary occupation zones, were concentrated, including dependable water sources and suitable arable land. The new villages also tended to have empty zones between them and their former home villages in primary areas. These findings, while not universal for every subsistence-level farming

society (e.g., the Raramuri of northern Mexico practice a seasonally mobile farming strategy), are consistent to the point where patterning can be established.

With the patterns in mind as outlined above, existing survey data were reexamined for the Mimbres area of southwestern New Mexico. It had been shown previously that the Classic period Mimbres likely outgrew their resource base in the Mimbres Valley, which led to use of peripheral areas and starvation foods, and ultimately to their demise as a defined cultural system. However, reexamination of the data revealed the presence of community systems in the main valley and in over half of the tributary drainages of the Mimbres River that were previously surveyed by the Mimbres Foundation and Graybill. All the communities were established between five and 10 km upstream, and all contained empty zones between the peripheral village and the Mimbres River. The peripheral communities all had a large, centrally placed village, which was surrounded by smaller farmsteads and field houses, sometimes very close to the main village. This settlement pattern was found to mimic in many ways the community systems of the Mimbres River, a primary zone of occupation. In the Mimbres Valley, large sites are generally surrounded by smaller villages, farmsteads, and field houses, but the settlement pattern is essentially the same pattern as seen in peripheral areas.

The presentation of excavation data for two peripheral communities revealed other important land tenure signatures, including the timing of initial construction, length of occupation, and the intensity of occupation. The two communities were established at least a generation or two, about A.D. 1040 to 1060, after the onset of the Classic period in the Mimbres Valley, about A.D. 1000. This timing coincided with escalating population and resource stress in the Mimbres Valley, when it would be expected that land tenure

practices would have come into play to protect the limited resources for the benefit of long-established families. If so, in conjunction with the continuing population expansion, such land tenure practices would have led to the creation of a landless group of people, whether they were migrants into the valley from elsewhere who had no claims to the land, or burgeoning families within the established society who could no longer afford to subdivide their lands among all, or least, some of their children. Additional findings included evidence that the largest sites in peripheral areas were permanent habitations, and that, at least for the large village in the Middle Fork community, the villagers were actively engaged within a wide-ranging trading network.

Supplemental site catchment/central place analysis of the two peripheral communities also revealed that optimum, centralized locations were chosen for the largest sites, based on the availability of potentially arable land, available water sources, proximity to a variety of nearby resource zones, ease of access to the communities and the resource zones, and potential travel routes to and over the Black Range to the adjacent Rio Grande Valley. All of the data gathered to evaluate the model fit rather well with the expectations generated from the ethnographic examples and socio-cultural ecological theory. The timing and social/population conditions were right for the formation of land tenure, the settlement patterns fit what the model suggested we should see, and the excavated data indicate that peripheral communities were permanent occupations.

As mentioned previously, however, other ethnographic examples did not produce the settlement patterns noted in the Mimbres Valley and its tributaries, including the Raramuri of northwest Mexico, and to a lesser degree, the Cochiti Puebloans of north-central New Mexico. For the Raramuri, peripheral community systems never developed,

primarily because a degree of mobility to various far-flung farm plots was still possible. For Cochiti Pueblo, population pressures did not seem to be an overriding factor for the development of land tenure and private property; however, land tenure was present, and many of the same outcomes were noted, including establishing claims to unused land around the margins of the pueblo by those who needed additional land. However, there are hints in the early ethnographic record that peripheral communities may have formed, but none were recorded for their recent ethnographic past. These examples do show that peripheral area communities do not necessarily need to form as a result of the land tenure process, or that population pressure is always necessary. However, the presence of both of these conditions was common to several other ethnographic examples, and they represent ways of actually detecting land tenure in prehistoric societies who also exhibit these conditions.

Implications of the Study for Southwestern Archaeology

Do the arguments presented above conclusively prove that land tenure developed in Classic Mimbres society, accounting for the creation of peripheral area communities? It likely does not to the degree of absolute certainty, but the evidence presented within the model strongly argues that land tenure was present, and that it accounts for the patterns left behind by the Mimbres. If so, then the Mimbres people would be among the earliest in the Southwest to exhibit a change in social structure from egalitarian to land-owning, allowing for the creation of privately-held property and a landless subset (at least temporarily) within its society. This finding is important, as we know that later Puebloan groups subscribed to the concept of private property, but the mechanisms and processes

behind them were not as clearly known. This research suggests that private property can develop in an otherwise "egalitarian" society in the absence of the development of elites, as opposed to what may have occurred with the roughly contemporaneous Chaco Canyon and its famous "phenomenon" of great houses, roads, ceremonial architecture, and probable elites ruling over it all (see Lekson 1999 for an overview of Chaco). A "ruling" class has never been found for the Mimbres, but this research suggests that their society became more socially complicated nonetheless, at least in terms of land tenure and ownership rights and the new level of social interaction that these entailed.

This finding has implications for research across the Southwest, especially for the study of early agricultural societies, such as the Mimbres. Archaeologists continue to be interested in evolving complexity within ancient societies, especially those that "bridge the gap" between formative agricultural groups (i.e., Late Archaic and Early Pithouse groups) and later "high" points of late prehistoric and protohistoric groups. These include the Classic period Hohokam and the presence of elites in this society of south-central Arizona, and the coalition of modern-day Puebloan groups of New Mexico and northeastern Arizona. Mid-point groups like the Classic period Mimbres and the Chaco "people" have been viewed as curious anomalies or brief experiments at social complexity that ingloriously faded into the dark pages of prehistory without contributing much to subsequent developments in the greater Southwest. However, if the concept of private property began as early as the Classic period Mimbres, then perhaps some of the "experimental" social structures developed by the Mimbres may have diffused throughout the Southwest when the Mimbres left their traditional homeland and merged into other societies.

At a broader scale, this research shows that elites are not necessary for a society to change in this manner or for the concepts of private property and land tenure to develop. If this is the case, then it is also possible that other elements of formative complex societies can develop without the necessity of elites or other forms of highly stratified societies, at least under our current understanding of complexity and stratification. What this research may be revealing is that an adjustment to how we measure social complexity is necessary. Other researchers have attempted to find evidence of social complexity and elites in Mimbres society through measures including "elite" or high status burials, public and private architecture, and differential access to goods (control of surpluses). These attempts have been largely in vain. However, if my interpretations of the data presented in this dissertation are correct, then this study may be an important key to discerning higher levels of social complexity in ancient farming societies that otherwise lack evidence. For land tenure to work, social rules must be in place that governs the ownership and transference of property beyond "gentlemen's agreements" being constantly renegotiated between affected parties. Societies without elites must have some form of land adjudication procedures to ensure its continuance and to avoid possible deadly conflict over land. In other words, under the right social and environmental conditions, an otherwise subsistence-level farming society can achieve a degree of social complexity that defies our current understanding of this phenomenon. I hope that this research is a beginning towards reshaping our views of land tenure and ownership, social complexity, and the necessity of elites as catalysts for transforming an egalitarian society into a stratified society.

REFERENCES CITED

Aberle, Sophie D.
1948 *The Pueblo Indians of New Mexico: Their Land, Economy, and Civil Organization*. Memoirs of the American Anthropological Association 70. Menasha, Wisconsin.

Adams, Jenny L.
1999 Refocusing the Role of Food-Grinding Tools as Correlates for Subsistence Strategies in the U.S. Southwest. *American Antiquity* 64:475–498.

Adams, John W., and Alice Bee Kasakoff
1976 Central-Place Theory and Endogamy in China. In *Regional Analysis, Vol. II: Social Systems*, edited by Carol A. Smith, pp. 175–187. Academic Press, New York.

Adler, Michael A.
1996 Land Tenure, Archaeology, and the Ancestral Pueblo Social Landscape. *Journal of Anthropological Archaeology* 15:337–371.

Agenbroad, Larry D.
1988 Clovis People: The Human Factor in the Extinction Equation. In *Americans Before Columbus: Ice-Age Origins*, edited by Ronald C. Carlisle, pp. 63–74. Ethnology Monographs 12. Department of Anthropology, University of Pittsburgh, Pennsylvania.

Agogino, George A., and Irwin Rovner
1964 Palaeo-Indian Traditions: A Current Evaluation. *Archaeology* 17(4):237–243.

Anderson, Keith M., Gloria J. Fenner, Don P. Morris, George A. Teague, and Charmion McKusick
1986 *The Archeology of Gila Cliff Dwellings*. National Park Service Publications in Anthropology 36. Western Archeological and Conservation Center, Tucson, Arizona.

Anyon, Roger
1980 The Late Pithouse Period. In *An Archaeological Synthesis of Southwestern and South-Central New Mexico*, edited by Steven A. LeBlanc and Michael E. Whalen, pp. 142–204. Office of Contract Archaeology, University of New Mexico, Albuquerque.

Anyon, Roger, and Steven A. LeBlanc
1980 The Architectural Evolution of Mogollon-Mimbres Communal Structures. *The Kiva* 45:253–277.

1984 *The Galaz Ruin: A Prehistoric Mimbres Village in Southwestern New Mexico.*

Maxwell Museum of Anthropology and University of New Mexico Press, Albuquerque.

Anyon, Roger, Patricia A. Gilman, and Steven A. LeBlanc
1981 A Reevaluation of the Mogollon-Mimbres Archaeological Sequence. *The Kiva* 46:209–225.

Arnold, Dean E.
1985 *Ceramic Theory and Cultural Process*. New Studies in Archaeology. Cambridge University Press, Cambridge.

Asdell, Sydney A.
1964 *Patterns of Mammalian Reproduction*. Cornell University Press, Ithaca, New York.

Ayrout, Henry Habib
1963 *The Egyptian Peasant*. Beacon Press, Boston (revised with English translation of 1938 publication).

Barth, Fredrik
1956 Ecologic Relationships of Ethnic Groups in Swat, North Pakistan. *American Anthropologist* 58:1079–1089.

Basehart, Harry W.
1967 The Resource Holding Corporation among the Mescalero Apache. *Southwestern Journal of Anthropology* 23(3):277–291.

Beck, Warren A., and Ynez D. Haase
1969 *Historical Atlas of New Mexico*. University of Oklahoma Press, Norman.

Bement, Leland C.
1999 *Bison Hunting at Cooper Site: Where Lightening Bolts Drew Thundering Herds*. University of Oklahoma Press, Norman.

Bennett, John W.
1976 Anticipation, Adaptation, and the Concept of Culture in Anthropology. *Science* 192:847–853.

Bettinger, Robert L.
1991 Chapter 4: Hunter-Gatherers as Optimal Foragers. In *Hunter-Gatherers: Archaeological and Evolutionary Theory*, pp. 83–111. Plenum, New York.

Bettison, Cynthia Ann
1997 Analysis of Ceramics from Pithouses and Associated Structures at the Lake Roberts Vista Site, Gila National Forest, New Mexico. Ms. on file, Gila National Forest, Supervisors Office, Silver City, New Mexico.

Bettison, Cynthia Ann, and Barbara J. Roth
1992 Proposed Archaeological Study of the Lake Roberts Vista Site, May 18–June 19, 1992. Ms. on file, Gila National Forest Heritage Program, Supervisor's Office, Silver City, New Mexico.

1995 1995 Season, Proposed Archaeological Study of the Lake Roberts Vista Site, July 1–August 15, 1995. Ms on file, Gila National Forest Heritage Program, Supervisor's Office, Silver City, New Mexico.

Binford, Lewis R.
1964 A Consideration of Archaeological Research Design. *American Antiquity* 29(4):425–441.

1967 Smudge Pits and Hide Smoking: The Use of Analogy in Archaeological Reasoning. *American Antiquity* 32(1):1–12.

1977 Forty-seven Trips: A Case Study in the Character of Some Formation Processes. In *Stone Tools as Cultural Markers*, edited by R. V. S. Wright, pp. 24–36. Australian Institute of Aboriginal Studies, Canberra.

1979 Organization and Formation Processes: Looking at Curated Technologies. *Journal of Anthropological Research* 35:255–273.

1990 Mobility, Housing, and Environment: A Comparative Study. *Journal of Anthropological Research* 46(2):119–149.

Blake, T. Michael, Steven A. LeBlanc, and Paul E. Minnis
1986 Changing Settlement and Population in the Mimbres Valley, SW New Mexico. *Journal of Field Archaeology* 13:439–464.

Boughey, Arthur S.
1968 *Ecology of Populations*. The MacMillan Company, Toronto.

Bradfield, Wesley
1929 *Cameron Creek Village: A Site in the Mimbres Area in Grant County*. The School of American Research, Monograph No. 1, Santa Fe.

Bradfield, Richard M.
1971 *The Changing Pattern of Hopi Agriculture*. Royal Anthropological Institute of Great Britain and Ireland, Occasional Paper 30, London.

Braidwood, Robert J.
1960 The Agricultural Revolution. *Scientific American* 203:130–141.

Braidwood, Robert J., and Linda S. Braidwood (editors)
1983 *Prehistoric Archaeology along the Zagros Flanks*. The Oriental Institute, Chicago.

Brant, Elizabeth A.
1994 Egalitarianism, Hierarchy, and Centralization in the Pueblos. In *The Ancient Southwestern Community: Models and Methods for the Study of Prehistoric Social Organization*, edited by W.H. Wills and Robert D. Leonard, pp. 9–23. University of New Mexico Press, Albuquerque.

Bray, Alicia
1982 Mimbres Black-on-white, Melamine or Wedgewood? A Ceramic Use-Wear Analysis. *The Kiva* 47:133–149.

Brew, J. O.
1979 Hopi Prehistory and History to 1850. In *Handbook of North American Indians, Vol. 9: Southwest*, edited by Alfonso Ortiz, pp. 514–523. Smithsonian Institution, Washington, D.C.

Brody, J. J.
1977 *Mimbres Painted Pottery*. School of American Research Press, Santa Fe.

Brook, Vernon Ralph
1977 A Courtyard and Two Rooms at Red Rock, New Mexico. *Transactions of the 12th Regional Archaeology Symposium for Southeastern New Mexico and Western Texas*. El Paso Archaeological Society, El Paso, Texas.

Brooks, Robert L.
2000 Warfare on the Southern Plains. In *Skeletal Biology in the Great Plains: Migration, Warfare, Health, and Subsistence*, edited by Douglas W. Owsley and Richard L. Jantz, pp. 317–323. Smithsonian Institution Press, Washington D.C.

Broughton, Jack M.
1999 *Resource Depression and Intensification During the Late Holocene, San Francisco Bay: Evidence from the Emoryville Shellmound Vertebrate Fauna.* Anthropological Records 32, University of California Press, Berkeley.

Brown, David E. (editor)
1994 *Biotic Communities: Southwestern United States and Northwestern Mexico.* University of Utah Press, Salt Lake City.

Brown, Gary M. (editor)
1999 *South Waste Rock Expansion: Archaeological Data Recovery in the Buckhorn Gulch Area at the Continental Mine, Grant County, New Mexico*. Report No. WCRM(F)140. Western Cultural Resource Management, Inc., Farmington, New Mexico.

Buckley, Walter
1968 Society as a Complex Adaptive System. In *Modern Systems Research for the Behavioral Scientist*, edited by Walter Buckley, pp. 490–513. Aldine Press, Chicago.

Butzer, Karl W.
1982 *Archaeology as Human Ecology*. Cambridge University Press, Cambridge, England.

Cameron, Catherine M., and Stephen A. Tomka
1993 *The Abandonment of Settlements and Regions: Ethnoarchaeological and Archaeological Approaches*. Cambridge University Press, Cambridge.

Cannon, Michael D.
1999a Large Mammal Relative Abundance in Pithouse and Pueblo Period Archaeofaunas from Southwestern New Mexico: Resource Depression among the Mimbres-Mogollon? Submitted to *Journal of Anthropological Archaeology*.

1999b A Mathematical Model of the Effects of Screen Size on Zooarchaeological Relative Abundance Measures. *Journal of Archaeological Science* 26:205–214.

Carneiro, Robert L.
1994 War and Peace: Alternating Realities in Human History. In *Studying War: Anthropological Perspectives*, edited by S. P. Reyna and R. E. Downs, pp. 29–65. Gordon and Breach Science Publishers, Langhorne, Pennsylvania.

Cashdan, Elizabeth
1990 Introduction. In *Risk and Uncertainty in Tribal and Peasant Economies*, edited by Elizabeth Cashdan, pp. 1–16. Westview Press, Boulder, Colorado.

Chang, K. C. (editor)
1968 *Settlement Archaeology*. National Press Books, Palo Alto, California.

Childe, V. Gordon
1936 *Man Makes Himself*. Kegan Paul, London.

Chisholm, Michael
1968 *Rural Settlement and Land Use: An Essay in Location*. Aldine, Chicago.

Clarke, David
1968 Cultural Morphology and Cultural Ecology–The Setting. In *Analytical Archaeology*, David Clarke, pp. 83–130. Methven and Co., London.

Connelly, John C.
1979 Hopi Social Organization. In *Handbook of North American Indians, Vol. 9: Southwest*, edited by Alfonso Ortiz, pp. 539–553. Smithsonian Institution,

Washington, D.C.

Cordell, Linda
1997 *Archaeology of the Southwest,* Second Edition. Academic Press, San Diego.

Cosgrove, Harriet S., and Cornelius B. Cosgrove
1932 *The Swarts Ruin: A Typical Mimbres Site in Southwestern New Mexico.* Papers of the Peabody Museum of American Archaeology and Ethnology 15(1). Harvard University Press, Cambridge, Massachusetts.

Creel, Darrell G.
1992 Research at Old Town Ruin, a Mimbres Site in Luna County, New Mexico. In *Interpreting the Past: Research with Public Participation*, edited by LouAnn Jacobson and June-el Piper, pp. 21–29. BLM Cultural Resources Series 10, Santa Fe.

1998 Status Report on Excavations at the Old Town Site (LA 1113), Luna County, New Mexico, Summer 1997. Report submitted to the U.S. Bureau of Land Management, New Mexico State Office, Las Cruces.

1999 The Black Mountain Phase in the Mimbres Area. In *The Casas Grandes World*, edited by Curtis F. Schaafsma and Carroll L. Riley, pp. 107–120. University of Utah Press, Salt Lake City.

Creel, Darrell G., and Roger Anyon
2003 New Interpretations of Mimbres Public Architecture and Space: Implications for Cultural Change. *American Antiquity* 68:67–92.

Crown, Patricia L.
1994 *Ceramics and Ideology: Salado Polychrome Pottery.* University of New Mexico Press, Albuquerque.

Crumley, Carole L.
1994 Historical Ecology: A Multidimensional Ecological Orientation. In *Historical Ecology: Cultural Knowledge and Changing Landscapes*, edited by Carole L. Crumley, pp. 1–16. School of American Research, Santa Fe.

Danson, Edward Bridge
1957 *An Archaeological Survey of West Central New Mexico and East Central Arizona.* Papers of the Peabody Museum of Archaeology and Ethnology, Vol. 44, No. 1. Harvard University, Cambridge, Massachusetts.

Dennell, Robin W.
1980 The Use, Abuse, and Potential of Site Catchment Analysis. In *Catchment Analysis: Essays on Prehistoric Resource Space*, edited by Frank J. Findlow and

Jonathan E. Ericson, pp. 1–20. Anthropology UCLA 10(1 & 2).

Dennell, R. W., and D. Webley
1975 Prehistoric Settlement and Land Use in Southern Bulgaria. In *Palaeoeconomy*, edited by E. S. Higgs, pp. 97–109. Cambridge University Press, Cambridge.

Diehl, Michael W.
1992 Architecture as a Material Correlate of Mobility Strategies: Some Implications for Archaeological Interpretation. *Behavior Science Research* 26(1–4):1–35.

1996 The Intensity of Maize Processing and Production in Upland Mogollon Pithouse Villages, A.D. 200–1000. *American Antiquity* 61:102–115.

1997 Changes in Architecture and Land Use Strategies in the American Southwest: Upland Mogollon Pithouse Dwellers, A.C. 200–1000. *Journal of Field Archaeology* 24:179–194.

Diehl, Michael W., and Patricia A. Gilman
1996 Implications from the Designs of Different Southwestern Architectural Forms. In *Interpreting Southwestern Diversity: Underlying Principles and Overarching Patterns*, edited by Paul R. Fish and J. Jefferson Reid, pp. 189–193. Arizona State University Anthropological Research Papers No. 48. Tempe.

Diehl, Michael W., and Steven A. LeBlanc
2001 *Early Pithouse Villages of the Mimbres Valley and Beyond.* Peabody Museum Press, Harvard University, Cambridge, Massachusetts.

Dick, Herbert W.
1965 *Bat Cave.* School of American Research Monograph No. 27. University of New Mexico Press, Albuquerque.

Dockstader, Frederick J.
1979 Hopi History, 1850–1940. In *Handbook of North American Indians, Vol. 9: Southwest*, edited by Alfonso Ortiz, pp. 524–532. Smithsonian Instititute, Washington, D.C.

Downum, Christian E.
1993 *Between Desert and River: Hohokam Settlement and Land Use in the Los Robles Community.* Anthropological Papers No. 57. University of Arizona, Tucson.

Doyel, David E., and Teresa L. Hoffman
2003 *Prehistoric Settlement History along Pinal Creek, Globe Highlands, Arizona.* ACS Archaeological Report No. 120. Archaeological Consulting Services, Tempe. (in press)

Dozier, Edward P.
1966 *Hano: Tewa Indian Commnity in Arizona.* Case Studies in Cultural Anthropology, Stanford University. Holt, Rinehart, and Winston, New York.

Dunnell, Robert C.
1982 Evolutionary Theory and Archaeology. In *Advances in Archaeological Method and Theory: Selections for Students from Volumes 1–4*, edited by Michael B. Schiffer, pp. 35–69. Academic Press, New York.

Dupré, J.
1987 Human Kinds. In *The Latest on the Best-Essays on Evolution and Optimality*, edited by J. Dupré, pp. 327–348. MIT Press, Cambridge, Massachusetts.

Dyson-Hudson, R., and Eric A. Smith
1978 Human Territoriality: An Ecological Reassessment. *American Anthropologist* 80:21–41.

Ellis, Florence H.
1978 Small Structures Used by Historic Pueblo Peoples and their Immediate Ancestors. In *Limited Activity and Occupations Sites: A Collection of Conference Papers*, edited by Albert E. Ward, pp. 51–59. Center for Anthropological Research, Albuquerque.

Elson, Wolfgang E.
1965 Volcanic Rocks of the Mimbres and Upper Gila Drainages, New Mexico. In *New Mexico Geological Society Guidebook, 16th Field Conference, Southwestern New Mexico II, 1965*, edited by J. Paul Fitzsimmons and Christina Lockman-Balk, pp. 167–174. Socorro, New Mexico.

Emlen, J. M.
1987 Evolutionary Ecology and the Optimality Assumption. In *The Latest on the Best-Essays on Evolution and Optimality*, edited J. Dupré, pp. 163–177. MIT Press, Cambridge, Massachusetts.

Evans, Roy H., R. Evelyn Ross, and Lyle Ross
1986 *Mimbres Indian Treasure in the Land of Baca.* The Lowell Press, Kansas City, Missouri.

Feeny, D., F. Berkes, B. J. McCay, and J. M. Acheson
1990 The Tragedy of the Commons: Twenty-two Years Later. *Human Ecology* 18(1):1–19.

Fenner, Gloria J.
1977 Flare-Rimmed Bowls: A Sub-Type of Mimbres Classic Black-on-White. *The Kiva* 43:129–141.

Findlow, Frank J.
1978 A Catchment Analysis of San Luis Phase and Animas Phase Sites in Southwestern New Mexico. *Anthropology UCLA* 10(1&2):157–178.

Findlow, Frank J., and Suzanne P. DeAtley
1974 Prehistoric Land Use Patterns in the Animas Valley: A First Approximation. *Anthropology UCLA* 6(2):1–57.

Fish, Suzanne K., Paul R. Fish, and John H. Madsen
1992 *The Marana Community in the Hohokam World.* Anthropological Papers No. 56. University of Arizona Press, Tucson.

Fish, Suzanne K., and Paul R. Fish
1994 Multisite Communities as Measures of Hohokam Aggregation. In *The Ancient Southwestern Community: Models and Methods for the Study of Prehistoric Social Organization*, edited by W. H. Wills and Robert D. Leonard, pp. 119–130. University of New Mexico Press, Albuquerque.

Fitting, James E.
1972 Preliminary Notes on Cliff Valley Settlement Patterns. *The Artifact* 10(4):15–30.

1973 An Early Mogollon Community: A Preliminary Report on the Winn Canyon Site. *The Artifact* 1&2:1–94.

Flannery, Kent V.
1965 The Ecology of Early Food Production in Mesopotamia. *Science* 147:1247–1256.

1972 The Cultural Evolution of Civilization. *Annual Review of Ecological Systems* 3:399–426.

Ford, Richard I.
1981 Gardening and Farming Before A.D. 1000: Patterns of Prehistoric Cultivation North of Mexico. *Journal of Ethnobiology* 1(1):6–27.

Francis, Julie, and Geoffrey Clark
1980 Bronze and Iron Age Economies on the Meseta del Norte, North-Central Spain. In *Catchment Analysis–Essays on Prehistoric Resource Space*, edited by Frank Findlow and Jonathan Ericson, pp. 97–135. Anthropology UCLA 10(1 & 2).

Gabin, Vickie L., and Lee E. Lesperance
1977 *New Mexico Climatological Data: Precipitation, Temperature, Evaporation, and Wind, Monthly and Annual Means 1850–1975.* W. K. Summers, Socorro, New Mexico.

Gass, Jimmy M.
1973 *Soils Report for Lake Roberts Watershed, Gila National Forest.* Southwestern Region, USDA Forest Service, Albuquerque.

Gilman, Patricia A.
1980 The Early Pueblo Period-Classic Mimbres. In *An Archaeological Synthesis of Southwestern and South-central New Mexico*, edited by Steven A. LeBlanc and Michael E. Whalen, pp. 205–270. Office of Contract Archaeology, University of New Mexico, Albuquerque.

1987 Architecture as Artifact: Pit Structures and Pueblos in the American Southwest. *American Antiquity* 52:538–564.

1990 Social Organization and Classic Mimbres Period Burials in the SW United States. *Journal of Field Archaeology* 17:457–469.

1997 *Wandering Villagers: Pit Structures, Mobility and Agriculture in Southeastern Arizona*. Anthropological Papers No. 49. Arizona State University, Tempe.

n.d. The Function of Pit Structures Contemporary with Puebloan Buildings. In *Exploring Variability in Mogollon Pithouses*, edited by Barbara J. Roth and Robert J. Stokes. Volume submitted to Anthropological Research Papers, Arizona State University, Tempe, 2002.

Gilman, Patricia A., Veletta Canouts, and Ronald L. Bishop
1994 The Production and Distribution of Classic Mimbres Black-on-White Pottery. *American Antiquity* 59:695–708.

Gilman, Patricia A., and Steven A. LeBlanc
n.d. Final Report on Excavations at the Mattocks Ruin, Mimbres Valley, New Mexico. Ms. on file with Patricia Gilman. Department of Anthropology, University of Oklahoma, Norman.

Gomolak, A. R., and Dabney Ford
1976 Reclamation of a Vandalized Prehistoric Settlement Site: Berrenda Creek Project, 1976. Ms. on file, Department of Anthropology, New Mexico State University, Las Cruces.

Gottshall, Julia Munoz, Harry J. Shafer, and William D. James
2002 Neutron Activation Analysis of Mimbres Corrugated Pottery from the NAN Ranch Ruin. In *Mogollon Archaeology: Collected Papers from the Eleventh Mogollon Conference, 20th Anniversary 1980–2000*, edited by Patrick H. Beckett, pp. 121–128. COAS Publishing, Las Cruces, New Mexico.

Graham, Martha
1994 *Mobile Farmers: An Ethnoarchaeological Approach to Settlement Organization Among the Raramuri of Northwestern Mexico*. International Monographs in Prehistory, Ethnoarchaeological Series 3, Ann Arbor, Michigan.

Graybill, Donald A.
1975 *Mimbres-Mogollon Adaptations in the Gila National Forest, Mimbres District, New Mexico*. Archaeological Report No. 9. USDA Forest Service, Southwestern Region, Albuquerque, New Mexico.

1977 Illegal Site Destruction in Southwest New Mexico. *Journal of Field Archaeology* 4:481–484.

Grayson, Donald K.
1984 *Quantitative Zooarchaeology: Topics in the Analysis of Archaeological Faunas*. Academic Press, New York.

Green, Stanton W.
1980 Broadening Least-Cost Models for Expanding Agricultural Systems. In *Modeling Change in Prehistoric Subsistence Economies*, edited by Timothy Earle and Andrew Christenson, pp. 209–241. Academic Press, New York.

Greenwald, David H.
1993 The Field House and the Structure of Social Groups. Paper presented at the 66th Annual Pecos Conference, Springerville, Arizona.

Guthe, Carl E.
1925 *Pueblo Pottery Making: A Study at the Village of San Ildefonso*. Department of Archaeology, Phillips Academy. Yale University Press, Andover.

Haas, Jonathan, and Winifred Creamer
1993 *Stress and Warfare Among the Kayenta Anasazi of the Thirteenth Century A.D.* Fieldiana: Anthropology, New Series, No. 21. Field Museum of Natural History, Chicago.

Hack, John T.
1942 *The Changing Physical Environment of the Hopi Indians of Arizona*. Peabody Museum of American Archaeology and Ethnology Papers 35(1). Harvard University, Cambridge, Massachusetts.

Hackbarth, Mark R., Kelley Hays-Gilpin, and Lynn Neal (editors)
2002 *Phoenix Basin to Perry Mesa: Rethinking the "Northern Periphery*. Papers from the 2000 Fall Symposium, Arizona Archaeological Council. The Arizona Archaeologist No. 34, Arizona Archaeology Society, Phoenix.

Hard, Robert J.
1990 Agricultural Dependence in the Mountain Mogollon. In *Perspectives on Southwestern Prehistory*, edited by Paul E. Minnis and Charles L. Redman, pp. 135–149. Westview Press, Boulder.

Hard, Robert J., Raymond P. Mauldin, and Gerry R. Raymond
1996 Mano Size, Stable Isotope Ratios, and Macrobotanical Remains as Multiple Lines of Evidence of Maize Dependence in the American Southwest. *Journal of Archaeological Method and Theory* 3(4):253–318.

Hard, Robert J., and John R. Roney
1999 An Archaeological Investigation of Late Archaic Cerros de Trincheras Sites in Chihuahua, Mexico. Center for Archaeological Research Special Report No. 25. University of Texas at San Antonio.

Harris, Marvin
1968 *The Rise of Anthropological Theory*. Harper Collins, New York.

Hassan, Fekri A.
1994 Population Ecology and Civilization in Ancient Egypt. In *Historical Ecology: Cultural Knowledge and Changing Landscapes*, edited by Carole L. Crumley, pp. 155–182. School of American Research, Santa Fe.

Hastorf, Christine A.
1980 Changing Resource Use in Subsistence Agricultural Groups of the Prehistoric Mimbres River Valley, New Mexico. In *Modeling Change in Prehistoric Subsistence Economies*, edited by Timothy K. Earle and A. L. Christenson, pp. 79–120. Academic Press, San Diego.

Haury, Emil W.
1936a *The Mogollon Culture of Southwestern New Mexico*. Medallion Papers No. 20, Globe, Arizona.

1936b *Some Southwestern Pottery Types, Series IV*. Medallion Papers No. 19. Globe, Arizona.

1950 *The Stratigraphy and Archaeology of Ventana Cave*. University of Arizona Press, Tucson.

1956a The Lehner Mammoth Site. *The Kiva* 21(3–4):23–24.

1956b Speculations on Prehistoric Settlement Patterns in the Southwest. In *Prehistoric Settlement Patterns in the New World*, edited by Gordon Willey, pp. 3–10. Wenner-Gren Foundation for Anthropological Research, New York.

1962 The Greater American Southwest. In *Courses Toward Urban Life: Some Archaeological Considerations of Cultural Alternates*, edited by Robert J. Braidwood and Gordon R. Wiley, pp. 106–131. Viking Fund Publications in Anthropology, New York.

Hayes, Alden C.
1999 *A Portal to Paradise.* University of Arizona Press, Tucson.

Hayes, Alden C., Jon Nathan Young, and A. H. Warren
1981 *Excavation of Mound 7, Gran Quivira National Monument, New Mexico.* National Park Service Publications in Archaeology 16, Washington, D.C.

Hegmon, Michelle, Margaret Nelson, and Susan Ruth
1995 Mimbres Regional Reorganization: Ceramic and Architectural Evidence of Changing Social Relations. Paper presented at the 60th Annual Meeting of the Society for American Archaeology, Minneapolis.

Hegmon, Michelle, and Wanda R. Trevathan
1996 Gender, Anatomical Knowledge, and Pottery Production: Implications of an Anatomically Unusual Birth Depicted on Mimbres Pottery from Southwestern New Mexico. *American Antiquity* 61:747–754.

Hegmon, Michelle, Margaret C. Nelson, Roger Anyon, Darrell Creel, Steven A. LeBlanc, and Harry J. Shafer
1999 Scale and Time-Space Systematics in the Post-A.D. 1100 Mimbres Region of the North American Southwest. *Kiva* 65:143–166.

Herrington, S. LaVerne
1979 *Settlement Patterns and Water Control Systems of the Mimbres Classic Phase, Grant County, New Mexico.* Unpublished Ph.D. Dissertation, Department of Anthropology, University of Texas at Austin. University Microfilms, Ann Arbor.

1982 Water-Control Systems of the Mimbres Classic Phase. In *Mogollon Archaeology: Proceedings of the 1980 Mogollon Conference*, edited by Patrick H. Beckett and Kira Silverbird, pp. 75–90. Acoma Books, Ramona, California.

Hester, James J.
1975 Paleoarchaeology of the Llano Estacado. In *Late Pleistocene Environments of the Southern High Plains*, edited by Fred Wendorf and James J. Hester, pp. 247–256. Fort Burgwin Research Center Publication No. 9. Southern Methodist University, Dallas.

Higgs, E. S., and C. Vita-Finzi
1972 Prehistoric Economies: A Territorial Approach. In *Papers in Economic Prehistory*, edited by E. S. Higgs, pp. 27–36. Cambridge University Press, Cambridge.

Hodder, Ian, and Clive Orton
1976 Chapter 4. In *Spatial Analysis in Archaeology.* Cambridge University Press, London.

Hogg, Don Jack
1977 *Report on the Excavation of Three Mogollon Pit Houses on the Upper Mimbres River, New Mexico.* Unpublished M.A. Thesis, Department of Anthropology, Eastern New Mexico University, Portales.

Hole, Frank, Kent V. Flannery, and James A. Neely
1969 *Prehistory and Human Ecology of the Deh Luran Plain.* Memoirs of the Museum of Anthropology No. 1. University of Michigan, Ann Arbor.

Huckell, Bruce B.
1995 *Of Marshes and Maize: Preceramic Agricultural Settlements in the Cienega Valley, Southeastern Arizona.* Anthropological Papers No. 59. University of Arizona, Tucson.

Hudson, J. C.
1969 A Locational Theory for Rural Settlement. *Annals of the Association of American Geographers* 59:365–381.

James, Steven R.
1990 Monitoring Archaeofaunal Changes during the Transition to Agriculture in the American Southwest. *Kiva* 56:25–43.

Jeske, Robert
1989 Economies in Raw Material Use by Prehistoric Hunter-Gatherers. In *Time, Energy, and Stone Tools*, edited by Robin Torrence, pp. 34–45. Cambridge University Press, Cambridge.

Johnson, A. W., and Timothy Earle
1988 *The Evolution of Human Societies: From Foraging Group to Agrarian State*, pp. 313–325. Stanford University Press, California.

Judd, Neil M.
1925 Everyday Life in Pueblo Bonito. *National Geographic Magazine* 48(3):227–262.

Judge, W. James
1973 *The Paleo-Indian Occupation of the Central Rio Grande Valley, New Mexico.* University of New Mexico Press, Albuquerque.

Kaplan, H., and K. Hill
1992 The Evolutionary Ecology of Food Acquisition. In *Evolutionary Ecology and Human Behavior*, edited by Eric A. Smith and Bruce Winterhalder, pp. 167–201. Aldine, New York.

Kelley, Linda
1991 FY89 and 91 Para-Archaeologist Update, Lake Roberts Area. Cultural Resources Survey Report 90-06-157, Gila National Forest, Silver City, New Mexico.

Kelly, Robert L.
1991 Sedentism, Sociopolitical Inequality, and Resource Fluctuations. In *Between Bands and States*, edited by S. A. Gregg, pp. 135–158. Center for Archaeological Investigations Occasional Paper No. 9. Southern Illinois University, Carbondale.

1995 Chapter 3: Foraging and Subsistence. In *The Foraging Spectrum*, pp. 65–110. Smithsonian Institution Press, Washington, D.C.

Kennard, E. A.
1979 Hopi Economy and Subsistence. In *Handbook of North American Indians, Vol. 9: Southwest,* edited by Alfonso Ortiz, pp. 554–563. Smithsonian Institution, Washington, D. C.

Kent, Susan
1991 The Relationship Between Mobility Strategies and Site Structure. In *The Interpretation of Archaeological Spatial Patterning*, edited by Eileen M. Kroll and T.D. Price, pp. 33–59. Plenum Press, New York.

Kidder, Alfred V.
1924 *An Introduction to the Study of Southwestern Archaeology, with a Preliminary Account of the Excavations at Pecos*. Yale University Press, Andover, Massachusetts.

1932 Introduction. In *The Swarts Ruin: A Typical Mimbres Site in Southwestern New Mexico*, by Harriet S. Cosgrove and Cornelius B. Cosgrove. Papers of the Peabody Museum of American Archaeology and Ethnology, Vol. 15(1). Harvard University, Cambridge, Massachusetts.

Kidder, Alfred V., Harriet S. Cosgrove, and Cornelius B. Cosgrove
1949 The Pendleton Ruin, Hidalgo County, New Mexico. *Contributions to American Anthropology and History* 10. Carnegie Institution of Washington D.C. Publication 585:107–152. Washington, D.C.

King, Leslie J.
1984 *Central Place Theory*. Sage Publications, Beverly Hills, California.

Kintigh, Keith W.
1985 *Settlement, Subsistence, and Society in Late Zuni Prehistory*. Anthropology Papers No. 44. University of Arizona, Tucson.

Klein, Richard, and Katherine Cruz-Uribe
1984 *The Analysis of Animal Bones from Archaeological Sites*. University of Chicago Press, Chicago.

Knox, J.
1983 Responses of River Systems to Holocene Climates. In *Late Quaternary*

Environments of the United States, Vol. 2, edited by Henry E. Wright. University of Minnesota Press, Minneapolis.

Kohler, Timothy A.
1992 Field Houses, Villages, and the Tragedy of the Commons in the Early Northern Anasazi Southwest. *American Antiquity* 57:617–634.

Kohler, Timothy A., and Carla Van West
1996 The Calculus of Self-Interest in the Development of Cooperation: Sociopolitical Development and Risk Among the Northern Anasazi. In *Evolving Complexity and Environmental Risk in the Prehistoric Southwest*, edited by Joseph Tainter and Bonnie B. Tainter, pp. 169–196. Addison-Wesley Publishing, Reading, Massachusetts.

Kottlowski, Frank E.
1967 Rocks that Shape the Enchanting Landscapes. In *Mosaic of New Mexico's Scenery, Rocks, and History*, edited by Paige W. Christiansen and Frank E. Kottlowski, pp. 33–53. New Mexico Bureau of Mines and Mineral Resources, Socorro, and University of New Mexico Press, Albuquerque.

Kroeber, A. L.
1939 Relations of Environmental and Cultural Factors. In *Cultural and Natural Areas of Native North America*, pp. 205–217. University of California Press, Berkeley.

Lacovara, Peter
1999 The City of Amarna. In *Pharaohs of the Sun: Akhenaten, Nefertiti, Tutankhamen*, edited by Rita E. Freed, Yvonne J. Markowitz, and Sue H. D'Auria, pp. 61–71. Museum of Fine Arts, Boston, and Bulfinch Press, Boston.

Lange, Charles H.
1959 *Cochiti: A New Mexico Pueblo, Past and Present.* University of New Mexico Press, Albuquerque.

Larson, Donald O., Hector Neff, Donald A. Graybill, J. Michaelson, and E. Ambos
1994 Risk, Climatic Variability, and the Study of Southwestern Prehistory: An Evolutionary Perspective. *American Antiquity* 61:217–242.

Laumbach, Karl, and David T. Kirkpatrick
1986 The Black Range Project: A Regional Perspective. In *Proceedings of the Third Mogollon Conference*, edited by Michael Foster and Terry O'Laughlin. The Artifact 23(1–2):23–39, El Paso Archaeological Society.

LeBlanc, Steven A.
1975 *Mimbres Archaeological Center: Preliminary Report of the First Season of Excavation, 1974.* The Institute of Archaeology, University of California, Los Angeles.

1976 Mimbres Archaeological Center: Preliminary Report of the Second Season of Excavation, 1975. *Journal of New World Archaeology* 1(6):1–23.

1977 The 1976 Field Season of the Mimbres Foundation in Southwestern New Mexico. *Journal of New World Archaeology* 2(2):1–24.

1980 The Post-Mogollon Periods in Southwestern New Mexico: The Animas/Black Mountain Phase and the Salado Period. In *An Archaeological Synthesis of Southwestern and South-central New Mexico*, edited by Steven A. LeBlanc and Michael E. Whalen, pp. 271–316. Office of Contract Archaeology, University of New Mexico, Albuquerque.

1983 *The Mimbres People, Ancient Painters of the American Southwest.* Thames and Hudson, New York.

1989 Cultural Dynamics in the Southern Mogollon Area. In *Dynamics of Southwestern Prehistory*, edited by Linda S. Cordell and George J. Gumerman, pp. 179–208. Smithsonian Institution Press, Washington, D.C.

1999 *Prehistoric Warfare in the American Southwest.* University of Utah Press, Salt Lake City.

LeBlanc, Steven A., and Michael E. Whalen
1980 *An Archaeological Synthesis of South-Central and Southwestern New Mexico.* Office of Contract Archaeology, University of New Mexico, Albuquerque.

Lee, Richard B.
1968 What Hunters Do for a Living, or, How to Make Out on Scarce Resources. In *Man the Hunter*, edited by R. Lee and I. DeVore, pp. 30–48. Aldine Press, Chicago.

1969 !Kung Bushment Subsistence: An Input-Output Analysis. In *Environment and Cultural Behavior: Ecological Studies in Cultural Anthropology*, edited by Andrew P. Vayda, pp. 47–79. Natural History Press, Garden City, New York.

Lekson, Stephen H.
1978 *Settlement Patterns in the Redrock Valley, Southwestern New Mexico.* Unpublished M.A. Thesis, Department of Anthropology, Eastern New Mexico University, Portales.

1986 Mimbres Riverine Adaptations. In *Mogollon Variability*, edited by Charlotte Benson and Steadman Upham, pp. 147–155. Occasional Papers No. 15. University Museum, New Mexico State University, Las Cruces.

1988 The Mangas Phase in Mimbres Archaeology. *The Kiva* 53:129–145.

1989 An Archaeological Reconnaissance of the Rio Grande Valley in Sierra County, New Mexico. *The Artifact* 27(2):1–102.

1990 *Mimbres Archaeology of the Upper Gila, New Mexico.* Anthropological Papers No. 53. University of Arizona Press, Tucson.

1992a The Surface Archaeology of Southwestern New Mexico. *The Artifact* 30(3).

1992b *Archaeological Overview of Southwestern New Mexico.* Report Submitted to the New Mexico State Historic Preservation Division, Santa Fe. Human Systems Research, Las Cruces, New Mexico.

1996 Southwestern New Mexico and Southeastern Arizona, A.D. 900 to 1300. In *The Prehistoric Pueblo World A.D. 1150–1350*, edited by Michael A. Adler, pp. 170–171. University of Arizona Press, Tucson.

1999 *The Chaco Meridian: Centers of Political Power in the Ancient Southwest.* AltaMira, Sage Creek, California.

Linse, Angela R.

n.d. Mogollon Village and Pithouse Period Settlement: New Perspectives Using a Structure-Scale Approach. In *Variation in Mogollon Pithouses*, edited by Barbara J. Roth and Robert J. Stokes. Volume submitted to the Arizona State University Publications in Anthropology series, Tempe, 2002.

Lowell, Julie C.

1991 *Prehistoric Households at Turkey Creek Pueblo, Arizona.* Anthropological Papers No. 54. University of Arizona Press, Tucson.

Lyman, R. Lee

1992 Taphonomic Problems with Archaeological Analyses of Animal Carcass Utilization and Transport. In *Beamers, Bobwhites, and Blue-points: Tributes to the Career of Paul W. Parmalee*, edited by J. R. Purdue, W. E. Klippel, and B. W. Styles, pp. 125–138. Illinois State Museum Scientific Papers, Vol. 23, Springfield.

1994 *Vertebrate Taphonomy.* Cambridge University Press, Cambridge.

McCay, Bonnie J., and J. M. Acheson

1987 Human Ecology of the Commons. In *The Question of the Commons*, edited by Bonnie McCay and J. Acheson, pp. 1–34. University of Arizona Press, Tucson.

McKenna, James

1965 *Black Range Tales: 60 Years of Life and Adventure in the Southwest.* The Rio Grande Press, Chicago (reprint of 1936 volume).

McKenna, Peter J., and James E. Bradford
1990 *TJ Ruin: Gila Cliff Dwellings National Monument, New Mexico*. Southwest Cultural Resources Center Professional Papers No. 21. National Park Service, Santa Fe, New Mexico.

McNamee, Gregory
1994 *Gila: The Life and Death of an American River*. University of New Mexico Press, Albuquerque.

Martin, Paul S.
1943 *The SU Site: Excavations at a Mogollon Village, Western New Mexico, Second Season 1941*. Anthropological Series 32(2). Field Museum of Natural History, Chicago.

1959 *Digging into History: A Brief Account of Fifteen Years of Archaeological Work in New Mexico*. Popular Series, Anthropology, No. 38. Chicago Natural History Museum, Chicago.

Martin, Paul S., John B. Rinaldo, and Ernst Antevs
1949 *Cochise and Mogollon Sites, Pine Lawn Valley, Western New Mexico*. Fieldiana: Anthropology 38(1). Chicago Natural History Museum, Chicago.

Martin, Paul S., and John B. Rinaldo
1950 *Sites of the Reserve Phase, Pine Lawn Valley, Western New Mexico*. Fieldiana: Anthropology 38(3). Chicago Natural History Museum, Chicago.

Martin, Paul S., John B. Rinaldo, Elaine Bluhm, Hugh C. Cutler, and Roger Grange, Jr.
1952 *Mogollon Cultural Continuity and Change: The Stratigraphic Analysis of Tularosa and Cordova Caves*. Fieldiana: Anthropology 40. Chicago Natural History Museum, Chicago.

Metcalf, D., and K. R. Barlow
1992 A Model for Exploring the Optimal Trade-off Between Field Processing and Transport. *American Anthropologist* 94:340–360.

Mills, Barbara J.
1994 Community Dynamics and Archaeological Dynamics: Some Considerations of Middle-Range Theory. In *The Ancient Southwestern Community: Models and Methods for the Study of Prehistoric Social Organization*, edited by W. H. Wills and Robert D. Leonard, pp. 55–66. University of New Mexico Press, Albuquerque.

Mills, Jack P., and Vera M. Mills
1972 The Pitts Site: A Prehistoric Mimbres Village in Western New Mexico, Featuring a Study of Mimbres Architectural Features. *The Artifact* 10(4).

Minnis, Paul E.
1980 The Archaic in Southern New Mexico. In *An Archaeological Synthesis of Southwestern and South-central New Mexico*, edited by Steven A. LeBlanc and Michael E. Whalen, pp. 63–102. Office of Contract Archaeology, University of New Mexico, Albuquerque.

1985a *Social Adaptation to Food Stress: A Prehistoric Southwestern Example.* University of Chicago Press, Chicago.

1985b Domesticating Plants and People in the Greater Southwest. In *Prehistoric Food Production in North America*, edited by Richard I. Ford, pp. 309–339. Anthropological Papers No. 75. Museum of Anthropology, University of Michigan, Ann Arbor.

1992 Early Plant Cultivation in the Desert Borderlands of the American West. In *The Origins of Agriculture: An International Perspective*, edited by C. W. Cowan and Patty Jo Watson, pp. 121–141. Smithsonian Institution Press, Washington, D.C.

Minnis, Paul E., and Steven A. LeBlanc
1979 The Destruction of Three Sites in Southwestern New Mexico. In *Vandalism of Cultural Resources: The Growing Threat to Our Nation's Heritage*, edited by Dee F. Green and Steven A. LeBlanc, pp. 69–78. Southwest Region Cultural Resources Report No. 28. USDA Forest Service, Albuquerque.

Minnis, Paul E., and Alan J. Wormser
1984 Late Pithouse Period Occupation in the Deming Region: Preliminary Report of Excavations at the Florida Mountain Site (LA 18839). In *Recent Research in Mogollon Archaeology*, edited by Steadman Upham, Fred Plog, David G. Batcho, and Barbara E. Kauffman, pp. 229–249. New Mexico State University Occasional Papers No. 10. Las Cruces, New Mexico.

Montgomery, Barbara K.
1994 Ceramic Variability and Households at Chodistaas Pueblo. In *Mogollon VII*, edited by Patrick Beckett, pp. 43–52. COAS Publishing, Las Cruces, New Mexico.

Moore, Bruce M.
1978 Are Pueblo Field Houses a Function of Urbanization? In *Limited Activity and Occupation Sites: A Collection of Conference Papers*, edited by Albert E. Ward, pp. 9–16. Contributions to Anthropological Studies No. 1. Center for Anthropological Studies, Albuquerque.

Moran, Emilio F.
1984 The Ecosystem Concept in Anthropology. In *Historical Origins of the Ecosystem Concept in Biology*, by Emilio F. Moran. Westview Press, Boulder.

Morgan, Lewis H.
1877 *Ancient Society, or Researches in the Lines of Human Progress from Savagery through Barbarism to Civilization.* Charles H. Kerr & Company, Chicago.

Morrison, Michael J.
2002 A Report on Turkey Remains Recovered from Elk Ridge Ruin. In *Mogollon Archaeology: Collected Papers from the Eleventh Mogollon Conference, 20th Anniversary 1980–2000*, edited by Patrick H. Beckett, pp. 137–164. COAS Publishing, Las Cruces, New Mexico.

Morrow, Carol A., and Richard W. Jeffries
1989 Trade or Embedded Procurement? A Test Case from Southern Illinois. In *Time, Energy, and Stone Tools*, edited by Robin Torrence, pp. 27–33. Cambridge University Press, London.

Munson, Marit K.
2000 Sex, Gender, and Status: Human Images from the Classic Mimbres. *American Antiquity* 65:127–144.

Murdock, George P.
1960 Cognatic Forms of Social Organization. In *Social Structure of Southeast Asia*, edited by George P. Murdock, pp. 1–14. Viking Fund Publications in Anthropology No. 29, New York.

Naroll, Raoul
1962 Population Estimates Based on Floor Area. *American Antiquity* 27:587–588.

Nelson, Ben A., and Roger Anyon
1998 Fallow Valleys: Asynchronous Occupations in Southwestern New Mexico. *Kiva* 61:275–294.

Nelson, Ben A., and Steven A. LeBlanc
1986 *Short-Term Sedentism in the American Southwest: The Mimbres Valley Salado.* Maxwell Museum of Anthropology and the University of New Mexico Press, Albuquerque.

Nelson, Ben A., Margaret C. Rugge, and Steven A. LeBlanc
1977 LA 12109: A Small Classic Mimbres Ruin, Mimbres Valley. In *Limited Activity and Occupational Sites: A Collection of Conference Papers*, edited by Albert E. Ward, pp. 191–206. Contributions to Anthropological Studies No. 1. Center for Anthropological Studies, Albuquerque.

Nelson, Margaret C.
1981 Paleo-Indian. In *An Archaeological Synthesis of Southwestern and South-Central New Mexico*, edited by Steven A. LeBlanc and Michael E. Whalen, pp. 38–62.

Office of Contract Archaeology, University of New Mexico, Albuquerque.
1984 Food Selection at Galaz: Inferences from Chipped Stone Analysis. In *The Galaz Ruin, A Prehistoric Mimbres Village in Southwestern New Mexico*, edited by Roger Anyon and Steven A. LeBlanc, pp. 225–246. University of New Mexico Press, Albuquerque.
1991 The Study of Technological Organization. In *Archaeological Method and Theory, Vol. 3*, edited by Michael B. Schiffer, pp. 57–99. University of Arizona Press, Tucson.

1993a Classic Mimbres Land Use in the Eastern Mimbres Region, Southwestern New Mexico. *Kiva* 59:27–48.

1993b Changing Occupational Patterns Among Prehistoric Horticulturalists in SW New Mexico. *Journal of Field Archaeology* 20(1):43–57.

1999 *Mimbres During the Twelfth Century: Abandonment, Continuity, and Reorganization*. University of Arizona Press, Tucson.

Nelson, Margaret C., and Michelle Hegmon
2001 Abandonment is Not What it Seems: An Approach to the Relationship between Site and Regional Abandonment. *American Antiquity* 66:213–236.

Nesbitt, Paul H.
1931 *The Ancient Mimbrenos, Based on the Investigations at the Mattocks Ruin, Mimbres Valley, New Mexico*. Logan Museum Bulletin No. 4. Beloit College, Beloit, Wisconsin.

Netting, Robert
1977 *Cultural Ecology*. Cummings Publishing, Menlo Park, California.

Nisengard, Jennifer E.
2000 Faunal Analysis at LA 5841. In *Late Mimbres Pueblos in Peripheral Areas: Final Report on Test Excavations at LA 5841 (Cooney Ranch #1), Middle Fork of the Mimbres River, Southwestern New Mexico, August 7–19, 1999*, by Robert J. Stokes, pp. 69–81. Report submitted to the Laboratory of Anthropology, Santa Fe, and the Arizona Archaeological and Historical Society, Tucson.

O'Bagy Davis, Carolyn
1995 *Treasured Earth: Hattie Cosgrove's Mimbres Archaeology in the American Southwest*. Sanpete Publications and Old Pueblo Archaeology Center, Tucson.

O'Brien, Michael J., and R. L. Lyman
2000 *Applying Evolutionary Archaeology: A Systematic Approach*. Kluwer Academic/Plenum Press, New York.

Oakes, Yvonne R.
1999 Evaluating Placement of Mogollon Sites. In *Sixty Years of Mogollon Archaeology: Papers from the Ninth Mogollon Conference, Silver City, New Mexico, 1996*, edited by Stephanie M. Whittlesey, pp. 163–172. SRI Press, Tucson.

Orcutt, Janet D., Eric Blinman, and Timothy A. Kohler
1990 Explanations of Population Aggregation in the Mesa Verde Region Prior to A.D. 900. In *Perspectives on Southwest Prehistory*, edited by Paul E. Minnis and Charles Redman, pp. 196–212. Westview Press, Boulder, Colorado.

Orians, G. H. and N. E. Pearson
1979 On the Theory of Central Place Foraging. In *Analysis of Ecological Systems*, edited by D. J. Horn, G. Stairs, and R. D. Mitchell, pp. 155–177. Ohio State University Press, Columbus.

Orlove, Benjamin S.
1980 Ecological Anthropology. *Annual Review of Anthropology* 9:235–273.

Ortiz, Alfonso
1969 *The Tewa World: Space, Time, Being, and Becoming in a Pueblo Society.* University of Chicago Press, Chicago.

Ortner, Sherry B.
1984 Theory in Anthropology since the Sixties. *Comparative Studies in Society and History* 26:126–166.

Parham, Tommie Lee, Ronald Paetzold, and Charles E. Souders
1983 *Soil Survey of Grant County, New Mexico, Central and Southern Parts*. New Mexico Agricultural Experiment Station, New Mexico State University, Las Cruces.

Parsons, Francis B.
1955 A Small Mimbres Ruin Near Silver City, New Mexico. *El Palacio* 62(10):283–289.

Peebles, C. S., and S. M. Kus
1977 Some Archaeological Correlates of Ranked Societies. *American Antiquity* 42:421–447.

Peterson, John A.
1988 Settlement and Subsistence Patterns in the Reserve Phase and Mountain Mogollon: A Test Case in Devil's Park, New Mexico. *The Kiva* 53:113–127.

Pierce, G. J., and J. G. Ollason
1987 Eight Reasons Why Optimal Foraging Theory is a Complete Waste of Time.

Oikos 49(1):111–117.

Plog, Fred
1975 Systems Theory in Archeological Research. *Annual Review of Anthropology* 4:207–224.

Plog, Fred, George J. Gumerman, Robert C. Euler, Jeffrey S. Dean, R. H. Hevly, and T.V.N. Karlstrom
1988 Anasazi Adaptive Strategies: The Model, Predictions, and Results. In *The Anasazi in a Changing Environment*, edited by George Gumerman, pp. 230–276. Cambridge University Press, Cambridge.

Pool, Michael D.
1994 The Early Pithouse Period Settlement System. Paper presented at the Eighth Mogollon Conference, El Paso, Texas.

Powell, Valli Sue
2000 *Iconography and Group Formation During the Late Pithouse and Classic Periods of the Mimbres Society, A.D. 970–1140.* Unpublished Ph.D. dissertation, Department of Anthropology, University of Oklahoma, Norman.

Price, Peter
1996 Chapter 3: Biological Evolution. In *The Revised Theory of Evolution* by Peter Price. Saunder's College Publishing, Fort Worth, Texas.

Prudden, T. Mitchell
1903 The Prehistoric Ruins of the San Juan Watershed in Utah, Arizona, Colorado, and New Mexico. *American Anthropologist* 51:224–288.

Rappaport, Roy A.
1971a The Flow of Energy in an Agricultural Society. *Scientific American* 225(3):116–132.

1971b The Sacred in Human Evolution. *Annual Review of Ecology and Systematics* 2:4016–4044.

1978 Maladaptation in Social Systems. In *The Evolution of Social Systems*, edited by J. Friedman and M. J. Rowlands, pp. 49–87. University of Pittsburgh Press, Pittsburgh.

Ravesloot, John
1979 *The Animas Phase: The Post-Classic Occupation of the Mimbres Valley, New Mexico.* Unpublished M.A. Thesis, Department of Anthropology, Southern Illinois University, Carbondale.

Reed, Lori Stephens
1995 Ceramic Analysis. In *Archaeological Data Recovery Investigations at LA 100548, The Lake Valley Site, A Mogollon Limited Habitation in the Mimbres Uplands, Grant County, New Mexico*, edited by Gary M. Brown, pp. 55–61. Report No. WCRM(F)076. Western Cultural Resource Management, Farmington, New Mexico.

Reeves, Nicholas, and Richard H. Wilkinson
1996 *The Complete Valley of the Kings: Tombs and Treasures of Egypt's Greatest Pharaohs*. Thames and Hudson, London.

Reid, J. Jefferson, Barbara Klie Montgomery, and Maria Nieves Zedeno
1995 Refinements in Dating Late Cibola White Ware. *Kiva* 61:31–44.

Rice, Glen
1998 War and Water: An Ecological Perspective on Hohokam Irrigation. *Kiva* 63:263–302.

Richardson, A.
1982 The Control of Productive Resources on the Northwest Coast of North America. In *Resource Managers: North American and Australian Hunter-Gatherers*, edited by N. M. Williams and E. S. Hunn, pp. 93–112. Westview Press, Boulder, Colorado.

Rinaldo, John B., and Elaine A. Bluhm
1956 *Late Mogollon Pottery Types of the Reserve Area*. Fieldiana: Anthropology 36(7). Chicago Natural History Museum, Chicago.

Rindos, David
1980 Symbiosis, Instability, and the Origins and Spread of Agriculture: A New Model. *Current Anthropology* 21(6):751–772.

1989 Undirected Variation and the Darwinian Explanation of Cultural Change. In *Archaeological Method and Theory,* Vol. 1, edited by Michael B. Schiffer, pp. 1–44. University of Arizona Press, Tucson.

Roper, Donna C.
1979 The Method and Theory of Site Catchment Analysis: A Review. In *Advances in Archaeological Method and Theory,* Vol. 2, edited by Michael B. Schiffer, pp. 119–140. Academic Press, New York.

Roth, Barbara J.
1992 Sedentary Agriculturalists or Mobile Hunter-Gatherers? Evidence on the Late Archaic Occupation of the Northern Tucson Basin. *Kiva* 57:291–314.

Roth, Barbara J., Kate Sloan, and Robert J. Stokes
2001 Modeling the Pithouse Period Occupation of the Sapillo Valley, Southwestern New Mexico. Paper presented at the 66th Annual Meeting of the Society for American Archaeology, New Orleans.

Sahlins, Marshall
1963 Poor Man, Rich Man, Big-Man, Chief: Political Types in Melanesia and Polynesia. *Comparative Studies in Society and History* 5:285–303.

1969 Land Use and the Extended Family in Maola, Fiji. In *Environment and Cultural Behavior: Ecological Studies in Cultural Anthropology*, edited by Andrew P. Vayda, pp. 395–415. Natural History Press, Garden City, New York.

Sahlins, Marshall, and Elman Service
1960 *Evolution and Culture*. University of Michigan Press, Ann Arbor.

Said, Rushdi, and Bahay Issawy
1966 Preliminary Results of a Geological Expedition to Lower Nubia and to Kurkur and Dungul Oases, Egypt. In *Contributions to the Prehistory of Nubia*, assembled by Fred Wendorf, pp. 1–28. Fort Burgwin Research Center and Southern Methodist University Press, Dallas, Texas.

Sanchez, Julia L. J.
1993 *Mimbres Faunal Subsistence, A.D. 250–1100, Grant and Luna Counties, New Mexico*. Unpublished Master's thesis, Department of Anthropology, Texas A&M University, College Station.

1996 A Re-evaluation of Mimbres Faunal Subsistence. *Kiva* 61:295–307.

Sandor, Jonathan A.
1983 *Soils at Prehistoric Agricultural Terracing Sites in New Mexico*. Unpublished Ph.D. dissertation, Department of Soil Sciences, University of California, Berkeley.

Sandstrom, Alan R.
1991 *Corn is Our Blood: Culture and Ethnic Identity in a Contemporary Aztec Indian Village*. University of Oklahoma Press, Norman.

Sauer, Carl, and Donald Brand
1930 *Pueblo Sites in Southeastern Arizona*. Publications in Geography 3(7). University of California, Berkeley.

Sayles, Edwin B.
1983 *The Cochise Cultural Sequence in Southeastern Arizona*. Anthropological Papers No. 42. University of Arizona Press, Tucson.

Sayles, Edwin B., and Ernst Antevs
1941 *The Cochise Culture*. Medallion Papers No. 29. Gila Pueblo, Globe, Arizona.

Schiffer, Michael B.
1980 *Behavioral Archaeology*. Academic Press, New York.

Schlanger, Sarah H.
1990 Artifact Assemblage Composition and Site Occupation Duration. In *Perspectives on Southwestern Prehistory*, edited by Paul E. Minnis and Charles L. Redman, pp. 103–121. Westview Press, Boulder.

Schriever, Bernard A., II
2002 *Mimbres-Mogollon Mobility: The Late Pithouse Period and the Florida Mountain Site, Luna County, New Mexico*. Unpublished Master's thesis, Department of Anthropology, University of Oklahoma, Norman.

Scott, Catherine J.
1983 The Evolution of Mimbres Pottery. In *Mimbres Pottery: Ancient Art of the American Southwest*, edited by J. J. Brody, pp. 38–67. Hudson Hills Press, New York.

Sebastian, Lynne
1992 *The Chaco Anasazi: Sociopolitical Evolution in the Prehistoric Southwest*. Cambridge University Press, Cambridge, England.

Shackley, M. Steven
1995 Sources of Archaeological Obsidian in the Greater American Southwest: An Update and Quantitative Analysis. *American Antiquity* 60:531–551.

Shafer, Harry J.
1982 Prehistoric Agricultural Climax in Southwestern New Mexico: The Classic Mimbres Phase. In *Southwestern Agriculture: Precolumbian to Modern*, edited by H. Dethloff and I. May, pp. 1–23. Texas A&M University Press, College Station.

1986 *The NAN Ranch Archaeology Project, 1985 Interim Report*. Special Report No. 7, Anthropology Laboratory, Department of Anthropology, Texas A&M University, College Station.

1991 Life among the Mimbres: Excavating the NAN Ruin. *Archaeology* Nov/Dec:48–51.

1995 Architecture and Symbolism in Transitional Pueblo Development in the Mimbres Valley, SW New Mexico. *Journal of Field Archaeology* 22:23–47.

1999a The Mimbres Classic and Postclassic: A Case for Discontinuity. In *The Casas*

Grandes World, edited by Curtis F. Schaafsma and Carroll L. Riley, pp. 121–133. University of Utah Press, Salt Lake City.

1999b The Classic Mimbres Phenomenon and Some New Interpretations. In *Sixty Years of Mogollon Archaeology: Papers from the Ninth Mogollon Conference, Silver City, New Mexico, 1996*, edited by Stephanie M. Whittlesey, pp. 95–106. SRI Press, Tucson.

Shafer, Harry J., and Anna J. Taylor
1986 Mimbres Mogollon Pueblo Dynamics and Ceramic Style Change. *Journal of Field Archaeology* 13:33–68.

Shafer, Harry J., and Robbie Brewington
1995 Microstylistic Changes in Mimbres Black-on-White Pottery: Examples from the NAN Ruin, Grant County, New Mexico. *Kiva* 61:6–27.

Shafer, Harry J., and Constance K. Judkins
1997 *Archaeological Investigations at the NAN Ruin, 1996 Season*. Special Report 11, Anthropology Laboratory, Department of Anthropology, Texas A&M University, College Station.

Shafer, Harry J., and Darrell Creel
1999 Large Sites and Small Site Outliers: A New Look at Classic Mimbres Settlement Patterns. Poster presented at the 64th Annual Meeting of the Society for American Archaeology, Chicago.

Shaffer, Brian S., and Karen M. Gardner
1995 The Rabbit Drive Through Time: Analysis of the North American Ethnographic and Prehistoric Evidence. *Utah Archaeology* 8(1):13–25.

Shaffer, Brian S., and Christopher P. Schick
1995 Environment and Animal Procurement by the Mogollon of the Southwest. *North American Archaeologist* 16:117–132.

Shaffer, Brian S., Holly A. Nicholson, and Karen M. Gardner
1995 Possible Mimbres Documentation of Pueblo Snake Ceremonies in the Eleventh Century. *North American Archaeologist* 16(1):17–32.

Shaw, Ian
2000 Introduction: Chronologies and Culture Change in Egypt. In *The Oxford History of Ancient Egypt*, edited by Ian Shaw, pp. 1–16. Oxford University Press, New York.

Simmons, Marc
1977 *New Mexico: An Interpretive History*. University of New Mexico Press, Albuquerque.

Sliva, R. Jane
1999 Cienega Points and Late Archaic Period Chronology in the Southern Southwest. *Kiva* 64:339–368.

Smith, Eric Alden
1987 Optimization Theory in Anthropology: Applications and Critiques. In *The Latest and Best Essays on Evolution and Optimality*, edited by J. Dupré, pp. 201–249. MIT Press, Cambridge, Massachusetts.

1989 Risk and Uncertainty in the "Original Affluent Society": Evolutionary Ecology and Resource-Sharing and Land Tenure. In *Hunters and Gatherers 1: History, Evolution, and Social Change*, edited by Timothy Ingold, D. Riches, and J. Woodburn, pp. 222–302. Berg, Oxford.

Spencer, A. J.
1993 *Early Egypt: The Rise of Civilisation in the Nile Valley*. University of Oklahoma Press, Norman.

Speth, John D., and Susan L. Scott
1990 Horticulture and Large-Mammal Hunting: The Role of Resource Depletion and the Constraints of Time and Labor. In *Farmers as Hunters: The Implications of Sedentism*, edited by Susan Kent, pp. 71–79. Cambridge University Press, Cambridge.

Stark, Barbara L., and D. L. Young
1981 Linear Nearest Neighbor Analysis. *American Antiquity* 46:284–300.

Stephens, D. W., and J. R. Krebs
1986 Average-Rate Maximizing: The Prey and Patch Models. In *Foraging Spectrum* by D. W. Stephens and J. R. Krebs, pp. 13–37. Princeton University Press, New Jersey.

Stevens, Michelle N., and R. Jane Sliva
2002 Empire Points: An Addition to the San Pedro Phase Lithic Assemblage. *Kiva* 67:297–326.

Steward, Julian H.
1938 *Socio-Politcal Aboriginal Groups of the Basin-Plateau*. Bureau of American Ethnology Bulletin No. 120. Washington, D.C.

1955 *Theory of Culture Change*. University of Illinois Press, Urbana.

Stokes, Robert J.
1995 *Prehistoric Settlement Patterns in the Sapillo Creek Valley, Gila National Forest, New Mexico*. Unpublished Master's thesis, Department of Anthropology, Eastern

New Mexico University, Portales.

1996 The McDermott Ranch Archaeological Project: Progress Report on the 1996 Test Excavations of Three Classic Mimbres Pueblos on the McDermott Ranch, Noonday Canyon, New Mexico. Ms. on file with the author and the Laboratory of Anthropology, Santa Fe, New Mexico.

1997 The Development of Interactive Mimbres Communities: Strategies for Resource Control in Peripheral Areas. Ms. on file, Laboratory of Anthropology, Santa Fe, New Mexico.

1998 The Development of Classic Period Mimbres Communities in Peripheral Areas, Southwestern New Mexico. Paper presented at the 10th Mogollon Conference, Silver City, New Mexico.

1999a The Development of Classic Period Mimbres Communities in Peripheral Areas, Southwestern New Mexico. Paper prepared for the poster session "Mimbres Archaeology," 64th Annual Meeting of the Society for American Archaeology, Chicago.

1999b Dating Fill Deposits and Pithouses in the Mimbres Area through Ceramic Seriation Techniques: An Example from the Lake Roberts Vista Site. Ms. on file, Gila National Forest, Supervisor's Office, Silver City, New Mexico.

2000a Late Mimbres Pueblos in Peripheral Areas: Final Report on Test Excavations at LA 5841 (Cooney Ranch #1), Middle Fork of the Mimbres River, Southwestern New Mexico, August 7–19, 1999. Report submitted to Laboratory of Anthropology, Santa Fe, New Mexico and Arizona Archaeological and Historical Society, Tucson.

2000b Dating Fill Deposits and Pithouses in the Mimbres Area through Two Ceramic Seriation Techniques: An Example from the Lake Roberts Vista Site. *Kiva* 65:235–251.

Stokes, Robert J., and Barbara J. Roth
1999 Mobility, Sedentism, and Settlement Patterns in Transition: The Late Pithouse Period in the Sapillo Valley, New Mexico. *Journal of Field Archaeology* 26:423–434.

Stone, Tammy
1993 Small Site Function and Duration of Occupation in the Hohokam Northern Periphery. *Kiva* 59:65–82.

Szuter, Christine R., and Frank E. Bayham
1989 Sedentism and Animal Procurement among Desert Horticulturalists of the North American Southwest. In *Farmers and Hunters: The Implications of Sedentism*,

edited Susan Kent, pp. 80–95. Cambridge University Press, Cambridge.

Szuter, Christine R., and William B. Gillespie
1994 Interpreting Use of Animal Resources at Prehistoric American Southwest Communities. In *The Ancient Southwestern Community: Models and Methods for the Study of Prehistoric Social Organization*, edited by W. H. Wills and Robert D. Leonard, pp. 67–78. University of New Mexico Press, Albuquerque.

Tainter, Joseph A., and Bonnie Bagley Tainter (editors)
1999 *Evolving Complexity and Environmental Risk in the Prehistoric Southwest.* Addison-Wesley Publishing, Reading, Massachusetts.

Thomas, David Hurst
1986 *Refiguring Anthropology: First Principles of Probability and Statistics*. Waveland Press, Prospect Heights, Illinois.

Thornberry, William D.
1967 *Regional Geomorphology of the United States*. John Wiley & Sons, New York.

Trauger, F. D.
1965 Geologic Structure Pattern of Grant County, New Mexico. In *New Mexico Geological Society Guidebook, 16th Field Conference, Southwestern New Mexico II, 1965*, edited by J. Paul Fitzsimmons and Christina Lochman-Balk, pp. 184–187. Socorro, New Mexico.

1972 *Water Resources and General Geology of Grant County, New Mexico.* Hydrologic Report No. 2, New Mexico State Bureau of Mines and Mineral Resources, Socorro.

Trigger, Bruce G.
1968 The Determinants of Settlement Patterns. In *Settlement Archaeology*, edited by K. C. Chang, pp. 53–78. National Press Books, Palo Alto, California.

Turnbow, Christopher A. (editor)
2000 *A Highway Through Time: Archaeological Investigations along NM 90, in Grant and Hidalgo Counties, New Mexico*. U.S. Forest Service Report No. 03-06-98-005b and New Mexico State Highway and Transportation Department Technical Series Report 2000-3. TRC Solutions, Albuquerque.

Varien, Mark D.
1999 *Sedentism and Mobility in a Social Landscape: Mesa Verde and Beyond.* University of Arizona Press, Tucson.

Vayda, Andrew P., and Roy A. Rappaport
1968 Ecology, Cultural and Noncultural. In *Introduction to Cultural Anthropology*, edited by J. Clifton, pp. 477–497. Houghton-Mifflin, Boston.

Vierra, Bradley J. (editor)
1994 *Archaic Hunter-Gatherer Archaeology in the American Southwest.* Contributions in Anthropology 13(1). Eastern New Mexico University, Portales.

Vita-Finzi, C. and E. S. Higgs
1970 Prehistoric Economy in the Mt. Carmel Area of Palestine: Site Catchment Analysis. *Proceedings of the Prehistoric Society* 36:1–37.

Watanabe, Hitoshi
1977 The Human Activity System and Its Spatiotemporal Structure. In *Human Activity Systems*, edited by Hitoshi Watanabe, pp. 3–20. Tokyo Press, Tokyo.

Watson, Patty Jo, Steven A. LeBlanc, and Charles Redman
1971 *Explanation in Archaeology: An Explicitly Scientific Approach.* Columbia University Press, New York.

Webley, D.
1972 Soils and Site Location in Prehistoric Palestine. In *Papers in Economic Prehistory*, edited by E. S. Higgs, pp. 169–180. Cambridge University Press, London.

Welch, Paul D, and C. Margaret Scarry
1995 Status-Related Variation in Foodways in the Moundville Chiefdom. *American Antiquity* 60:397–418.

Wenke, Robert J.
1999 *Patterns in Prehistory: Humankind's First Three Million Years,* Fourth Edition. Oxford University Press, London.

Whalen, Michael E.
1994 *Turquoise Ridge and Late Prehistoric Residential Mobility in the Desert Mogollon Region.* Anthropological Papers No. 118. University of Utah Press, Salt Lake City.

Whalen, Michael E., and Paul E. Minnis
2001 *Casas Grandes and Its Hinterland: Prehistoric Regional Organization in Northwest Mexico.* University of Arizona Press, Tucson.

Wheat, Joe Ben
1955 *Mogollon Culture Prior to A.D. 1000.* Memoirs of the Society for American Archaeology 10, Memoirs of the American Anthropological Association 82.

White, Leslie A.
1959 The Concept of Evolution in Cultural Anthropology. In *Evolution and Anthropology: A Centennial Appraisal*, edited by Betty Meggars, pp. 106–125.

Anthropological Association of Washington, Washington, D. C.

Wilcox, David R.
1978 The Theoretical Significance of Field Houses. In *Limited Activity and Occupational Sites: A Collection of Conference Papers*, edited by Albert E. Ward, pp. 25–34. Contributions to Anthropological Studies No. 1. Center for Anthropological Studies, Albuquerque.

1979 The Hohokam Regional System. In *An Archaeological Test of Sites in the Gila Butte-Santan Region, South-central Arizona*, edited by Glen Rice, David Wilcox, Kevin Rafferty, and James Schoenwetter, pp. 77–116. Arizona State University Anthropological Research Papers No. 18, Tempe.

Wills, Wirt H.
1988 *Early Prehistoric Agriculture in the American Southwest.* School of American Research Press, Santa Fe, New Mexico.

Wills, W. H., and Robert D. Leonard (editors)
1994 *The Ancient Southwestern Community: Models and Methods for the Study of Prehistoric Social Organization.* University of New Mexico Press, Albuquerque.

Winterhalder, Bruce
1981 Optimal Foraging Strategies and Hunter-Gatherer Research in Anthropology: Theory and Models. In *Hunter-Gatherer Foraging Strategies: Ethnographic and Archaeological Analyses*, edited Eric A. Smith and Bruce Winterhalder, pp. 13–35. University of Chicago Press, Chicago.

1994 Concepts in Historical Ecology: The View from Evolutionary Theory. In *Historical Ecology: Cultural Knowledge and Changing Landscapes*, edited by Carole L. Crumley, pp. 17–42. School of American Research Press, Santa Fe.

Wittfogel, Karl
1957 *Oriental Despotism.* Yale University Press, New Haven.

Wolf, Eric R.
1982 *Europe and the People Without History.* University of California Press, Berkeley.

Wood, John J.
1978 Optimal Location in Settlement Space: A Model for Describing Location Strategies. *American Antiquity* 43:258–270.

Woosley, Anne I., and Allan J. McIntyre
2000 *Mimbres Mogollon Archaeology: Charles Di Peso's Excavations at Wind Mountain.* Amerind Foundation, Dragoon, Arizona, and University of New Mexico Press, Albuquerque.

Wylie, Alison
1985 The Reaction Against Analogy. In *Advances in Archaeological Method and Theory,* Vol. 8, edited by Michael B. Schiffer, pp. 63–111. Academic Press, New York.

Zedeño, Maria Nieves
1997 Landscapes, Land Use, and the History of Territory Formation: An Example from the Puebloan Southwest. *Journal of Archaeological Method and Theory* 4(1):67–103.